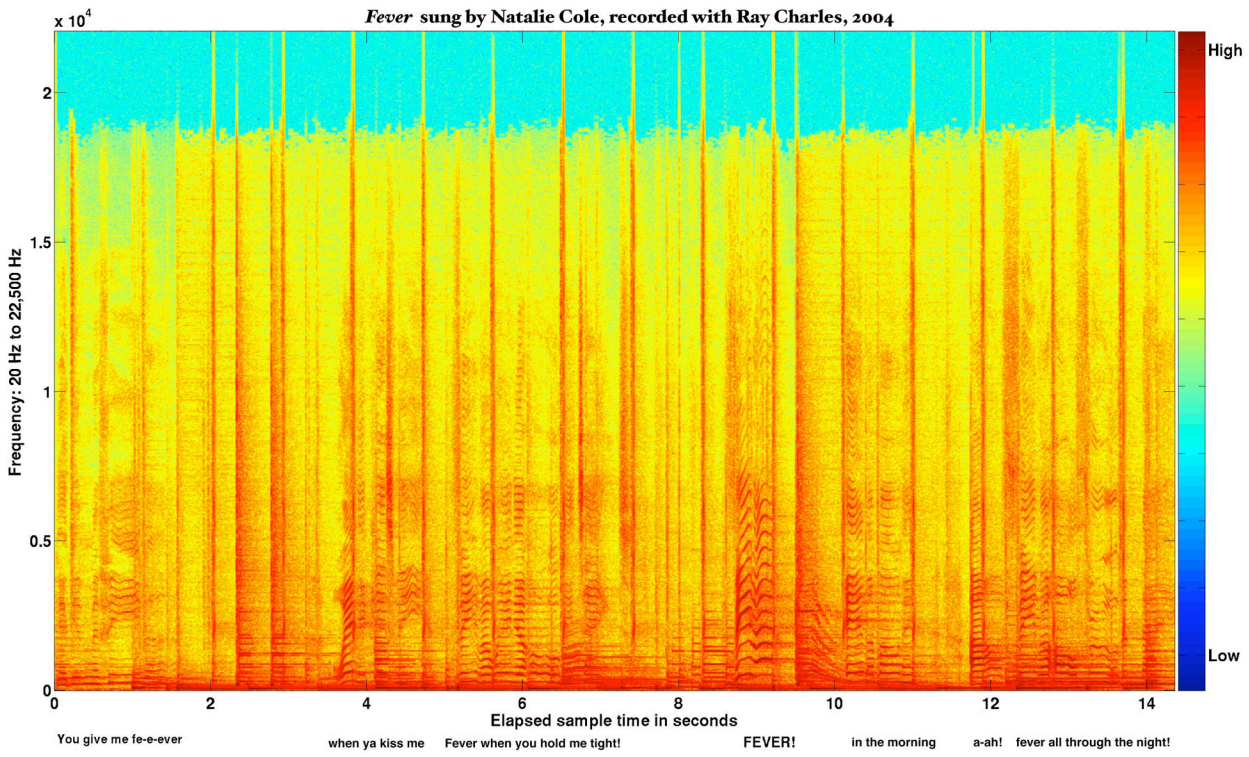
BOOK MINI PROPOSAL

What Does Music Look Like?

Volume 1: The Many Faces of Swing



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Book Overview

1. Audience: Professionals and lay people who enjoy music, computer graphics and information science, e.g. people who bought *Chaos, Fractal Geometry of Nature,* or *A Brief History of Time*. Also, DJs, serious amateur and semi-professional pop musicians, classically trained musicians intrigued by Swing style but unable to play it authentically.

2. Technical Level: Introductory.

3. Book Type: General trade.

   Book Category: Science of Music

   Book Series: I see at least three books in a related series:

   (1) *Swing Rhythm.* This book, extending my thesis research, analyzing Swing rhythm using technical details previously unreported in any great breadth or depth.

   (2) *The Grateful Dead.* Visualizing the music of the Grateful Dead. Dead heads like to look at cool graphics and many would be interested in new insights into the band's music, especially if it helped them personally play the music more authentically or with greater expression, or insight for comparing cover bands to the original Dead.

   (3) *Emotion, Feeling and Expression.* I have looked at some vocal expression data during my thesis research. The complexity and subtleties in the spectral details are as visually compelling as the many images from the micro world of insects and so on. This is a challenging task which would require development of new visualization techniques and/or major improvements to my current techniques. Books one and two (above) could be produced using visualization techniques that I've already developed. Of course any punch up of the visuals would enhance the attractiveness of the books.

Motivation

The goal of this book is a broadly popular and interesting piece which explores both cultural and technical aspects of Swing rhythm, with some comparison to other rhythmic elements for context. The intention is to raise the level of knowledge and awareness about Swing rhythm to help people better recognize, play and understand a music style whose underlying elements might be considered a purely intuitive or mysterious field of information. So far as I know, there are no directly similar books yet.

One primary technical aspect of Swing rhythm lies in the slight timing variations and patterns of music *as played* compared to music as written – if it is written. Many musical styles which swing are from traditions that do not use written music. In any case, Swing rhythm does not fit well with standard European meter, counting and subdivision models of the underlying musical information. Strangely, some excellent musicians seem unaware of the timing variation aspect of Swing, although they recognize the presence of Swing feeling. Some even deny the timing aspect, apparently believing that Swing lies in more familiar features such as rhythm and accent, or that Swing is truly rooted in some mysterious and non analytical *feeling*. Others focus entirely on analytical subdivision of the beat as the basis for Swing. My research results indicate that in many cases, Swing is rooted in consistent bending of the timing and subdivision of a few rhythmic elements (musical note events) and the relationship of these variations to the more strict framework established by "normal" counting and subdivision of the meter as it would be represented in standard musical tablature or other analytic notation (e.g. MIDI format).

My research into Swing rhythm, and computer analysis of music in general, led me to conclude that, while extensive work has been done in this field, there is a disconnected qual-

ity and a narrow academic focus to much of the work. That being said, there has been much very good work done, but the field is still nascent. I discovered fairly easily some fundamental aspects of Swing which had not been previously reported, or at least not found in my literature search. Most of the literature I surveyed (approximately 800 papers) is technical computer papers that mostly use non musical idioms, like statistical analysis of musical samples. Many of them are purely technical, dealing with such things as pattern recognition and computational neural networks. I also delved into psychological, audiological and musicological areas (in addition to computer analysis, search and classification research), and found similar abstraction and disconnection from actual music data in these research approaches. I believe from discussion with professional musicians and an interview with Daniel Levitin that the features I discovered are fairly widely known and accepted by some musicians, although as noted above I have found some professional and semi-professional musicians who are not fully informed. Indeed, I know that I am not fully informed, but part of development of the book would include further discussions with musicians who will give me a more complete view, perhaps more complete than any single person's view thus far.

Similar Books

I've found no books that are directly comparable to what I'm proposing. There are several dozen books looking at Science and Music together. Books in the science of music category are mostly in two general categories: Psychology of Music, and Math/Physics of Music. The recent *Brain on Music* book is from a Neuroscience viewpoint of a former professional musician. For the most part, the graphics tend to be simple black and white, if there are any at all. Surprisingly, I saw only a few black and white graphics when I scanned Levitin's *Brain on Music* book despite it being a neuroscience book. Neuroscience has no short-

age of cool graphics but apparently none made it into the book. The only book I've found that seems close to my book concept in the sense of having some "abstract" information graphics is the Harmonograph book, with fairly cool black and white line graphs. Many of the Math/Physics books have simple graphs of sound waveforms and such, but I haven't looked inside all of these (listed on Powells and Amazon) because my library doesn't have them and Amazon doesn't show inside them. Some sample titles include:

This Is Your Brain on Music: The Science of a Human Obsession. (2006) Daniel Levitin. Dutton/Penguin publishers. (bestseller on several lists)

Sweet Anticipation: Music and the Psychology of Expectation. (2006) David Huron. Bradford Books/MIT Press. (bestseller, Barnes & Noble list)

Fundamentals of Musical Acoustics: Second, Revised Edition. (1990) Arthur H. Benade. Dover Publications.

Harmonograph: A Visual Guide to the Mathematics of Music. (2003) Anthony Ashton. Wooden Books, Walker & Company.

Science and Music. (1968) Sir James H. Jeans. Dover Publications.

Music, Physics and Engineering. (1967) Harry F. Olson. Dover Publications.

A comment by a reader from A K Peters publishers on my sample chapter:

> The conclusions he draws regarding the over-simplicity/inappropriateness of the "swing ratio" and the complexity of rhythmic expression across styles/cultures are both sound and interesting. I think this is a good example of using computers to analyze something in music about which intuition and musical traditions have a lot to say, but nobody has bothered to collect actual data.

In this case, the actual data clarifies intuition and, I think, increases appreciation of the music. This is cool.

Mission Plan

I have always really liked pop music of various sorts: Rock 'n Roll, Motown, Ragtime, Reggae, Gospel, Soul etc. My thesis research led me to realize that one of the key information features linking the types of music that appeal to me is the presence of Swing in various forms. Indeed, Swing style (not necessarily Swing genre) is associated with many popular forms of 20th century music.

I grew up baffled by the overwhelming complexity of the music from my 45's or on the radio, difficult for me to understand partly because lack of immersion in live music left my brain/mind empty of many of the information mappings that such immersion generally gives people growing up in a culture like Brazil. I began such immersion in 1996 when I started to study and play Samba batucada with various groups in the San Francisco Bay Area. Like learning advanced math, the initial few years were difficult and bewildering for me, but the open and tolerant attitude of most Brazilians to neophyte drummers gave me the chance to develop in an atmosphere that didn't put me down because of my lack of talent, skill and knowledge. Eventually things began to make sense to me as my neural circuitry and motor skills improved. I went from being inept, tense and unhappy to having a sensible mental framework where I could put my expanding collection of intellectual and physical knowledge, making learning increasingly easy and productive. I even started to have fun with it, which after all is the main purpose of music in the lives of most Brazilians. I think this fun over ego aspect is unique to Brazilian music. Now, due to the combination of my information science analytical approach and real world music performance, I am in a unique posi-

tion to help other aspiring musicians make sense of things. I have gotten a surprising amount of positive feedback from my one 15 minute presentation at the ASA/ASJ conference in November 2006, including a news feature in *Discover* magazine and initial work developing a feature for *Inside Science Television* (American Institute of Physics). These positive strokes, many coming randomly as chat or by email from people who stumbled on my paper, convince me that there is a great deal of interest in my information visualization approach to Swing and that a book like this is very timely and will quite likely become a bestseller.

Platform, PR and Marketing

I have given at least a half dozen multimedia presentations of my Swing rhythm research. I have engaged in live or email conversations with another couple of dozen people about it. You can look at some short (3 to 4 minutes) Quicktime and web format examples on my website (www.tlafx.com/WhatDoesMusicLookLike). I enjoy live presentations quite a bit, and would plan to give such demos as part of a rollicking tour to promote this book. I am going to push for giving a keynote address to the ASA conference in New Orleans in November 2007 (headline: *Computer Scientist tells New Orleans what Swing means)*. Many people enjoy both music and computer graphics, and even the ones who don't care much for Swing *per se* sometimes come up and ask if my techniques can be applied to other types of music. Penn Gillette got notice of my ASA/ASJ talk and, a few days after the conference, he spent about ten minutes on his radio show talking about the short AIP report about my work. I think it would be easy to set up a radio blitz in the various cities where I tour due to the combination of music's popularity and the general interest people have in Science which can directly touch their lives. When I worked at NASA Ames on the Intelligent Flight Control program, most times when I engaged in chat with random people (especially on airplanes),

they were generally very interested in the research. This did not end with my description of landing damaged airplanes safely, but they often wanted me to explain some of the basic science, design and engineering behind the work. Since I had had a lot of practice doing briefings, my explanations were easily understood by most people, ranging from ordinary folks to exceptional, well educated and intelligent people, whether in Technology, Business, Arts etc.

Promotional Plans

I will approach people who have written popular works on the science of music to review and comment on my book for blurbs and such. This includes Daniel Levitin (*This is Your Brain on Music*), David Huron (*Sweet Anticipation: Music and the Psychology of Expectation*), Chris McGowan and Ricardo Pessanha (*The Brazilian Sound: Samba, Bossa Nova, and the Popular Music of Brazil*). I will also try to get comments/reviews from serious acoustical scientists like Reiner Plomp (*The Intelligent Ear*), and professional musicians and producers (anybody I can successfully contact, the more famous the better) plus people in radio and TV like Penn Gillette and Oprah. Fortunately I have unlimited long distance on my home phone so I will expect to spend many hours/days pursuing these connections (for no extra cost). Of course, direct contact with local and national bookstores would be essential, and I would expect some help from publisher/agent getting contacts in this area.

I like road trips and expect to go on tour as long as it's fun and productive. Indeed even if it started to be less fun (which I don't expect), as long as books are selling, I'd be giving my demos, talking to people and signing books. Once the word got out, then I would hope to do an international tour as well.

The individual analyses of various tunes are quite modular and would easily be put in a form suitable for a series of magazine or journal articles. Additionally, I have posted several

examples on my website (www.tlafx.com/WhatDoesMusicLookLike), essentially the main examples from my thesis. These articles would be viable both in technical journals such as *Computer Music Journal* and music magazines like *Mix* magazine or *Electronic Musician*. A technical article will be appearing in *Acoustics Today* July 2007 issue.

Resources needed to finish the book

The time I would need to produce this book is in the six month to one year range. This estimate is based on the time it took for me to write the sample chapter, and the number of musical samples that I expect to analyze in order to properly fill up the chapters listed in the sample TOC listed later in this document.

The majority of research and development of the rhythm/music analysis process is already mature. Thus, the time needed to process all the musical samples to fulfill the plan in the sample TOC can be computed based on expected book length. I now think the TOC that I initially produced may be overly ambitious, not from a cultural and musical perspective, but from a labor perspective, possibly also from a book length and print cost perspective. Two possibilities occur to me: 1) abbreviate the ambition in the TOC, or 2) make this into two books, volume one and two of *Many Faces of Swing*.

The computer graphics in this proposal and in the sample chapter are typical of the analysis process as it now stands. The graphics were produced using a student copy of MATLAB, licensed "not for commercial use" which the book probably would be considered. Thus one of two things would need to happen: 1) purchase commercial license for MATLAB (approximately $2500), or 2) develop custom software, which I plan to do anyway. The pro's of MATLAB are temporary expediency. The con's are: 1) visuals may be limited to the style which I have presented, 2) expense, 3) some software development would be

needed to expedite the analysis process which is currently very labor intensive and has some logistical limitations for extracting complex rhythms.

The pro's of software development are: 1) no monetary expense, 2) enhancing the visuals would be part of development, 3) processing of musical samples would probably be quite a lot quicker than with MATLAB, 4) notoriety gained by new, innovative software, and 5) possible commercial sale of software. The con's of software development are 1) one to two month R & D timeframe, 2) possible schedule slippage, 3) feature creep in software design.

Organization of Book

The book will present historical and cultural background of Swing music and its development in American Jazz and popular music. This will include material to show that Swing is not merely a phenomenon of Jazz, but is present as a performance style in a wide range of music in several parts of the world. Swing will be contrasted with Straight Time performance and other forms of *rhythmic expression*, which is the parent category of Swing, as seen from a musicological and cultural point of view. The history will of course look at major figures like Louis Armstrong, Duke Ellington and Benny Goodman, and also touch on Ragtime, Gospel and other traditions that are part of the foundations of Swing. Ragtime provided breakthrough developments in rhythm that helped separate American music from the rules of European Classical traditions, and together with Gospel and Blues, led to the development of Boogie-Woogie, Swing, Soul and other popular modern forms.

I will explain my research process: how, looking directly at recordings of Swing tunes of various styles, I discovered informational features which appear in the music performances but not typically in the academic or "official" view, i.e. music as written, conceptualized and analyzed in terms of conventional meter and subdivision. I will include supporting

information from other researchers as well as my own. I will also provide anecdotes and interviews with professional musicians and musicologists of various genres of music. These would discuss, interpret and validate (or contradict) the different viewpoints of the research results, and explain how the scientific findings relate to the experiences and opinions of those in the music profession. The goal is to show how experts can arrive at different interpretations of the same information (or find consensus). I will attempt to produce the most cogent and accurate framework to date for understanding the nature of Swing.

I will describe the *technical* aspects of my research, explaining the basics of sound in terms of time and frequency, and the visual analysis tools I've used (and developed) to help understand the reality of the recordings as compared to the frameworks of written music and standard schooling. Explanations will avoid difficult or scary mathematical details, instead casting the techniques in more intuitive terms such as explaining the parallels between water waves and sound waves to elucidate details like frequency, amplitude and wavelength. Simple examples of Fourier analysis will be given showing how complex waveforms can be created using simpler waveforms, and visually relating these to real world waveforms of musical instruments and vocals. This is a gentle introduction to the science of sound which will inform non-technical people, and possibly encourage them to look more deeply at the scientific and mathematical approach.

Finally, I will give detailed analysis of a fairly large collection of actual recordings of Swing tunes from various sources and styles. These tunes would be the collection included on the CD (purchased separately for a reasonable price). Brief mention will be made of other features of music (besides rhythm) that can be analyzed using the same techniques. This would include comparison of instruments and how their sound (timbre) relates to the

visual details of the spectrograms, and how emotion in vocals can be seen in a similar way. While there have been some published papers in this area, those that I've looked at are visually unimpressive: black and white graphics, with murky details. I intend to extensively explore the time/frequency information in a visually spectacular way similar to Mandelbrot's classic *Fractal Geometry of Nature*. This part is intended to be a teaser to the third book in the series exploring the complex nature of real world sound. The focus of the third book is the technical elements behind emotionally expressive vocals and instrumentals, including identifying different singers and instrumentalists by the spectral details of their sound.

A sample chapter and TOC of *The Many Faces of Swing* (8 MB) is available online:

http://www.tlafx.com/Papers/

I can provide hardcopy of this on request.

My thesis paper is also available on the website. It is a very large file due to many high resolution graphics, intended for print quality. I've put up some of the sections individually for more practical downloading. The appendix on audiology was originally intended to be a short (four or five pages) summary of how the human hearing system works, but it became a 20 to 30 page research paper and summary of the field. This is an indication of my working style: I couldn't stop while the piece was just a few rickety bones and scraps of flesh. Fortunately my advisor reigned me in before I wrote two thesis papers.

Figure 1 shows Bob Marley singing Stir it up (1973) "Quench me darling, when I'm thirsty. Cool me down, when I'm hot" in his signature plaintive sensitive style. Contrast the complexity of this spectrogram with Natalie Cole's strong punchy vocals from Fever on the title page. Information such as will be explored (using substantially improved visualization techniques) in the *Emotion, Feelings and Expressions* title (book 3).

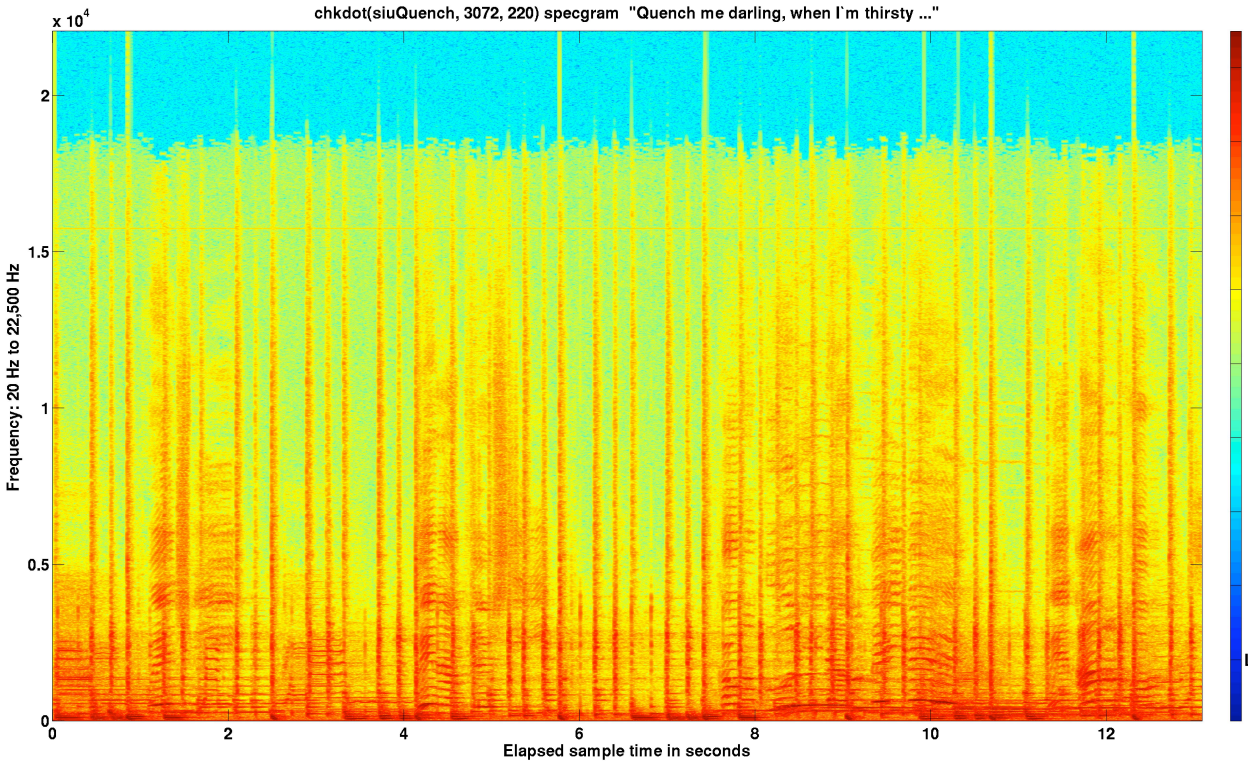

Figure 1: Example of complex vocal patterns

Author Bio

Ken Lindsay is an Information Scientist with tlafx in Ashland, Oregon, and a specialist in information visualization. His current work includes extracting previously unseen information from music and biophysical signals. Previously he worked 8 years at NASA Ames Research Center in the Neuro Engineering Lab, developing realtime 3D flight simulators for the Intelligent Flight Control program which researched and created software to help pilots safely land severely damaged aircraft. In other incarnations he has worked in hardware and software engineering, Theatre, Film and Radio. A serious student of Brazilian music for over 10 years, he has performed in the San Francisco Bay Area, New Orleans, and Rio de Janeiro. He holds an MS in Math and Computer Science from Southern Oregon University.

Published articles about his research include an abstract in *Journal of the Acoustical Society of America* 2006, various www news items based on the JASA abstract and the attention derived from it, a news feature in *Discover* magazine April 2007 issue and an upcoming technical article in *Acoustics Today* July 2007.

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Bibliography for the book would include some or all of these, plus other sources as appropriate to guide readers to books and discs that may appeal to them (i.e. that appeal to me). A discography would also be included. Current discography is:

Artist ***Album*** ***Date*** ***Song***

Paul Simon *Graceland* (1986) *Graceland*

Paul Simon *Rhythm of the Saints* (1990) *Obvious Child*

Bob Marley *Legend* (1984) *Stir it up* (1973), *Could you be loved?* (1980)

Putumayo *Carnival* (2001) Martinho da Vila *Canta, Canta minha Gente* (1974)

Putumayo *Swing Around the World* (2002) Ka'au Crater Boys *Opihi Man*

Duke Heitger and his Swing Band *Swing Pan Alley*

Louis Armstrong & Duke Ellington *Louis Armstrong meets Duke Ellington* (1962)

It Don't Mean a Thing (if it ain't got that Swing)

Ray Charles *Genius Loves Company* (2004) Ray Charles & Natalie Cole *Fever*

Grupo Batuque *Samba de Futebol* (2004) Various batucada, pandeiro, tamborim etc.

Various Artists *Batucada por Favor* (1998) Bob Azzam *Batucada por Favor*

Luciano Perrone and Nilo Sergio *Os Ritmistas Brasileiros*: *Batucada Fantastica*

(1963/1998) various tracks.

Virginia Rodrigues *Sol Negro* (1997) *Adeus Batucada*

BIBLIOGRAPHY (FROM MY MASTERS THESIS)

Anemüller, J. & Gramss, T. (1999). ***A Neural Network for Sound Source Separation.*** In (Dau, et al., 1999).

Bekesy, G. von. (1960). ***Experiments in Hearing.*** Translated by E.G. Wever. McGraw-Hill Book Co. New York.

Bengsston, I. (1987) ***Notation, Motion and Perception: Some Aspects of Musical Rhythm.*** in (Gabrielsson, 1987).

Beranek, L. (1954). ***Acoustics.*** McGraw-Hill Book Co. New York.

Birch, Alisdair MacRae. (2003) ***It Don't Mean a Things.*** Available online at www.alisdair.com .

Brigham, O. (1974). ***The Fast Fourier Transform.*** Englewood Cliffs, NJ. Prentice-Hall.

Cholakis, Ernest. (1995) ***Jazz Swing Drummers Groove Analysis.*** Numerical Sound. Available online at www.numericalsound.com .

Cooley, J. W. & Tukey, J. W. (1965) ***An Algorithm for the Machine Calculation of Complex Fourier Series.*** Math. of Computing. 19, 297-301.

Dau, T, Hohman, V & Kollmeister, B. (1999). ***Psychophysics, Physiology and Models of Hearing.*** World Scientific. Singapore, New Jersey.

Deutsch, D. (ed.) (1999). ***The Psychology of Music, 2nd edition.*** San Diego, CA. Academic Press Series in Cognition and Perception.

Dixon, S. (1999). ***A Beat Tracking System for Audio Signals.*** Proceedings of the Conference on Mathematical and Computational Methods in Music, pp. 101-110. Vienna, Austria.

Dowling & Harwood. (1986). ***Music Cognition***. New York. Academic Press.

Elliot, D. F. & Rao, K. R. (1982) ***Fast Transforms: Algorithms, Analyses and Applications.*** Academic Press. Orlando, FL.

Firefly Books. (2004). ***Photographic Atlas of the Human Body.*** Octopus Publishing Group, Ltd. & The Science Photo Library.

Fox, D. (2005 , 24 December.). ***Do the brainwave boogie-woogie.*** New Scientist Magazine issue 2531.

Fraisse, P. (1963). ***The Psychology of Time.*** New York. Harper and Row.

Friberg, A. & Sundstrom, J. (1999). ***Jazz Drummers' Swing Ratio in Relation to Tempo.*** Royal Institute of Technology. Stockholm, Sweden. Journal of the Acoustical Society of America ASA/EAA/DAGA conference, Berlin.

Friberg, A. & Sundstrom, J. (2002). ***Swing ratios and Ensemble Timing in Jazz Performance: Evidence for a Common Rhythmic Pattern.*** Music Perception 19(3), 333-349. http://www.speech.kth.se/music/performance/Texts/ensemble_swing.htm

Gabrielsson, A., ed. (1987). ***Action and Perception in Rhythm and Music. Papers Given at a Symposium in the Third International Conference on Event Perception and Action.*** Royal Swedish Academy of Music, #55. Stockholm.

Gabrielsson, A. (2000). ***Timing in Music Performance and its Relation to Music Experience.*** In (Sloboda ed., 2000).

Giguere, C. & Smoorenburg, G. F. (1999). ***Computational Modeling of Outer Hair Cell Damage: Implications for Hearing Aid Signal Processing.*** In (Dau, et al., 1999).

Goto, M. & Muraoka, Y. (1994). ***A Beat Tracking System for Acoustic Signals of Music*** San Francisco ACM Multimedia 0-89791 -686-7/94/0010.

Guoyon, F. (2005). ***A Computational Approach to Rhythm Description.*** PhD Thesis. University of Barcelona, Spain.

Hamer, M. (2000, 23 December.). ***It don't mean a thing if it ain't got that swing. But what is swing?*** New Scientist Magazine, 2270, p.48.

Hamming, R. W. (1983). ***Numerical Methods for Scientists and Engineers, 2nd ed.*** McGraw-Hill Book Company, New York.

Haykin, S.(1999). ***Neural Nets: A Comprehensive Introduction.*** Englewood Cliffs, NJ. Prentice-Hall.

Klapuri, A. (2004). ***Signal Processing Methods for the Automatic Transcription of Music*** PhD Thesis. Tampere University of Technology Publications 460. Tampere, Finland.

Møller, A. (2000). ***Hearing: Its Physiology and Pathophysiology.*** Academic Press. San Diego.

Neto, J.S. ((2005). ***BRJazzBook: 20 Brasilian Jazz Tunes.*** Retrieved from www.jovisan.net. October 2005.

Plomp, R. (2002). ***The Intelligent Ear: On the Nature of Sound Perception.*** Lawrence Erlbaum Associates, Publishers. Mahwah, New Jersey. London.

Press, W H., Teukolsky, S. A, Vetterling, W, T. & Flannery, B. P. (1988, 1992, 2002). ***Numerical Recipes in C++, 2nd Edition.*** Cambridge, UK. Cambridge University Press.

Sloboda, J. A.(ed.). ***Generative Process in Music.*** (2000). Oxford, UK. Clarendon Press.

Schwartz, A., Mertsching, B., Brucke, M., Nebel, W., Hansen, M. & Kollmeier, B. (1999) ***Silicon Cochlea: A Digital VLSI Implementation of a Psychoacoustical and Physiologically Motivated Speech Preprocessor.*** In (Dau, et al., 1999).

Schulze, H., Scheich, H. & Langner, G. (1999) ***Periodicity Coding in the Auditory Cortex: What Can We Learn From Learning Experiments?*** In (Dau, et al., 1999).

Seashore, C. E. (1938/1967) ***Psychology of Music.*** Dover Publications, Inc. New York.

Tzanetakis, G. & Cook, P. (2002) ***Human Perception and Computer Extraction of Musical Beat Strength.*** Proc. of the 5th Int. Conference on Digital Audio Effects (DAFx-02).

Young, R. M. (2001) ***An Introduction to Nonharmonic Fourier Series, revised 1st edition.*** Academic Press. San Diego, CA.

Waadelund, C. H. (2004) ***Spectral Properties of Rhythm Performance.*** Norwegian University of Science and Technology. Trondheim, Norway.