CIM10

Conference on Interdisciplinary Musicology

Nature versus Culture

23rd July 2010 – 24th July 2010

Programme and Proceedings

CIM10 is presented in collaboration with:

sempre:

European Seminar in Musicology

International Musicological Society
Internationale Gesellschaft für Musikwissenschaft
Sociedad Internacional de Musicología
Società Internazionale di Musicologia
Société Internationale de Musicologie
Welcome to all CIM10 attendees

We would like to welcome you to the Conference of Interdisciplinary Musicology 2010. Please find below the program and proceedings of the conference. Most contributions consist of an extended abstract, although a number of full papers are also included. In addition to the conference program, there is an optional social program on Saturday evening (dinner) and an excursion to the Peak District on Sunday.

We hope you will enjoy the conference and your stay in Sheffield and we would like to thank you very much for your participation and contribution, which undoubtedly is the most essential part of a conference. Our thanks also go in particular to Richard Parncutt, initiator and mentor of CIM, to Jane Davidson who initiated CIM10 with Nicola Dibben, to the members of the review committee who generously provided feedback on the abstract submissions, to Ruth Feather for her excellent organisation of the registrations, to Stephanie Bramley for realising this Proceedings, to Stephanie Pitts for her help throughout and to Lorna Carter, Yuko Morimoto, and Theresa Veltri for their assistance during the conference.

The conference organisation has been slightly complicated, but especially much enlivened through the birth of Ava Dibben. Therefore, a final gratitude to daughters Ava and Lidewij and husbands James and Erwin for their understanding and support.

Nicola Dibben & Renee Timmers
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### Overview of Programme Schedule

#### 22nd July 2020
Check-in at conference accommodation from 2pm at Reception, **The Edge, Endcliffe Student Village**, Sheffield, S10 3ED.

**20.00** Lecture-recital by Professor Peter Hill: ‘Messiaen and birdsong’. Ensemble Room 2, **Jessop Building, Department of Music, University of Sheffield**, 34 Leavygreave Road, Sheffield, S3 7RD

#### 23rd July Sharman Room, Halifax Conference Venue, Endcliffe Student Village

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<td><strong>Keynote</strong>&lt;br&gt;David Huron: ‘Cultural and biological aspects of sad music’</td>
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19:00 Optional: informal dinner in the local area

25th July Optional: Excursion to the Peak District.
Lecture Recital: Thursday 22nd of July
[Department of Music, Ensemble Room 2]

P. Hill. Messiaen and birdsong.

Talks Day 1: Friday 23rd of July
[Halifax Conference Venue, Sharman Room]

8.45-10.15: Music in humans and animals [Chair: M. Petrović]
H. Taylor & D. Lestel. Music and “music”: a cross-species comparison
E. McLain & X. Ge. "Music Among the Birds": Olivier Messiaen's Oiseaux exotiques
R. Ambrasevičius & D. Račiūnaitė-Vyčinienė Bird imitations in Lithuanian traditional music: Nature vs culture

10.45-12.45: Embodied cognition [Chair: M. Spitzer]
G. E. Woodruff & I. Cross. Meaning as Use in Music: A Teleosemantic Perspective
T.C. Rabinowitch, I. Cross, & P. Burnard. Empathy Promoting Musical Components in Cognition and Education
M. Woolhouse & D. Tidhar. Exploring dance interaction and person perception using silent disco technology

13.45-14.30: Keynote [Chair: R. Timmers]
L. Stewart. When all songs sound the same: Investigations into congenital amusia.

16.00-18.00: Cognition [Chair: T. Eerola]
O. Lartillot & M. Ayari. Interdependencies between cognitive mechanisms and cultural background in listeners' structural understanding of music, studied with the help of a computational complex model
F. Jurgensen & I. Knopke. "Harmony of the Ears": Applications of tuning in symbolic music analysis of Renaissance music

20.00-21.00: Keynote [Chair: N. J. Dibben]
D. Huron. Describing music, interpreting music, explaining music
CIM10: Nature versus Culture

**Talks Day 2: Saturday 24th of July**
[Halifax Conference Venue, Sharman Room]

**8.45-9.15: Language and Music [Chair: A.C. Lehmann]**

**9.15-10.30: Communicative Competencies in Music and Language. [Symposium Discussant: A.C. Lehmann, Organiser: W. Gruhn]**
M. Musso, A. Schneider, V. Glauche, R. Umarova & C Weiller. Language and music: overlap and difference in their neuronal organisation.
K. Leimbrink. The relevance of pitch for human language acquisition and communication.

**11.00-12.15: Computational and musicological approaches to emotion in music.**
[Symposium Discussant: W. Gruhn, Organiser: M. Spitzer]
E. Coutinho & N. J. Dibben. Music, Speech and Emotion: psycho-physiological and computational investigations
T. Eerola & M. Spitzer. Schubert and the Psychology of Emotion: Music Analysis versus Computational Modelling

**13.30-15.30: Performance and popular culture [Chair: F. Jurgensen]**
M. Molina-Solana & M. Grachten. Recognition of pianists by their relation to the performance norm
K. Kochman, M. Leman & D. Moelants. Respiration as an emotional tool in operatic singing
T. Koozin & J. Mishra. Reading tabs and playing rock: A study of Pop-Rock guitar tablature
K. Döveling & P. M. Coleman. How the continuous fascination of music reality shows can be understood as an emotional and bio-culturally induced phenomenon

**16.00-17.30: Universal and origins of compositional structure [Chair: H. Taylor]**
R. Parncutt & G. Hair. Consonance and dissonance in music theory and music psychology
R. Ambrazevičius & Ž. Pärtilas. Searching for "natural" origins of the symmetrical scales: Traditional multipart Setu songs
P. Podlipniak & E. J. Gorzelańczyk. How should the term 'musical universals' be understood?
CIM10: Nature versus Culture

Posters Day 1: Friday 23rd of July
[Halifax Conference Venue, Sharman Room]

14.30-15.30: Poster session

C. Glennon. The Role of Culture in Music Perception: An Investigation of the Influence of Culturally Internalized Schemas on a Recall Activity of Armenian and Estonian Folk Tunes
D. Kučinskas & R. Ambrazevičius. Is a “national composer” really national?
M. Petrović & N. Ljubinković. Music elements of animal sound patterns in Serbian folk songs and dances.
R. Timmers & H. L. Crook. Influences of perceived emotions on attention to musical streams.
Social Program (Optional)

Friday 23rd July.
Dinner at the Dining Room, The Edge. Bar is open after the final talk of the day.

Saturday 24th July.
Dinner at a local restaurant. Meet at 19:00 at The Edge Conference Centre Reception in the Endcliffe Student Village to walk to Taste - Marco Zerboni Bistro, 655 Eccelsall Road. This small, relaxed bistro serves Italian food and has a "bring your own wine" policy.

Sunday 25th July.
Walk in the Peak District National Park (2 miles):

This gentle 2 mile walk goes through moor and woodland, starting at Longshaw National Trust Park and ending at Grindleford Station Cafe, a popular walkers cafe. Meet 10:30 at The Edge Conference Centre in the Endcliffe Student Village.
Returning by 15:30.

10:30 Meet at The Edge Conference Centre Reception in the Endcliffe Student Village to walk to the bus stop (15 minute walk).

11:05 Bus 215 (heading to Matlock) departs from outside the Hunter House Hotel, near Hunters Bar Roundabout. Disembark at Fox House, Hathersage Road for the Longshaw Estate.

The walk ends at Grindleford Station Cafe where we will stop for refreshments. (Chip butties and/or Parkin (ginger cake) recommended). Bus 215 back to Sheffield (Hunters Bar Roundabout) departs once an hour from opposite the Maynard Arms pub at the top of the station drive (an 8 minute walk uphill from the café). Departures on Sunday back to Hunters Bar are at: 13:37, 14:37, 15:37, or 16:37.

Bring suitable footwear (trainers are fine) and something waterproof!
Session Descriptions and Abstracts

Friday 23rd July 2010

8:15am  Music in humans and animals

10:15am  Music and “music”: a cross-species comparison

Hollis Taylor, University of Western Sydney, Australia
Dominique Lestel, Ecole normale supérieure (Paris), France

Abstract

Aims. This paper aims to extend the range of cultural contexts in which music is explored. In a cross-species comparison with human music, the vocalisations of the Australian pied butcherbird find numerous mutualisms. These cultural artefacts are itemised, interrogated, and contextualised. The paper proposes a methodology and a rationale for the study of birdsong by musicologists that, in addressing both sound and musical behaviour, could contribute novel insights into music’s evolutionary origins and biological basis.

Main contribution. The discipline of zoömusicology is still a pioneer enterprise, one requiring at least passing familiarity in a number of areas as well as real expertise in several others. Pre-existing case study models for such research is absent or at minimum insubstantial. The various tasks at hand include collection of extant recordings, observation and recording of birds in the field, sonographic examination, notation, and musicological analysis. The approach herein applies traditional music theory to birdsong and explores some of the major issues that arise in such research. Methodical quantification employs RavenPro, Finale2006-2010, Amadeus II, Excel, and a trained ear. Specific examples (illustrated via audio, video, transcription, and/or sonograms) from an extensive catalogue of pied butcherbird overlaps with human music are presented (Taylor, 2008a and 2008b). The paper follows Merriam’s suggestion that music be studied on three analytic levels (1964: 32). First, an inventory of sound classes, techniques, and stylistic elements exploited by pied butcherbirds is reviewed. Next, the paper discusses a suite of musical behaviours echoing human musical activities. Finally, the success of the species in creating and renewing a musical culture with compelling and intriguing links to human music provokes epistemological questions that move the antithetical classical debate from “nature versus culture” to “culture versus culture.” Music appears to be a bio-cultural hybrid for both humans and songbirds.

Implications. Eurocentric and anthropocentric musical assumptions and preoccupations have resulted in a paucity of studies of other species’ sonic constructs and concomitant behaviour by musicologists. When sonographic analysis of birdsong recordings became possible, biologists apprehended the subject, although not with a trained ear so much as a trained eye. Much focus has been on the functional significance of birdsong, but function and aesthetics are not mutually exclusive. Songbirds learn their songs; their song traditions constitute complex traditions and are regularly referred to in the literature as cultural (Mundinger, 1980: 183; Slater, 1986: 94; Lestel, 2001). Results to date of our systematic exploration suggest that the divide between pied butcherbird song and human music is narrow, and that while some musical elements might be species-specific, many others
appear to be transpecific. This paper examines the implications of this view of shared culture for musicology as well as the sciences. For example, birdsong may be relevant to inquiries by musicologists, linguists, and cognitive neuroscientists into the origins of music and the comparison of the faculties of music and language. Animal abilities are largely unstudied and underestimated—what Lestel terms the "terra incognita" of animal intelligence (2007: 9)—and "efforts to single out distinctly human capacities have rarely held up to scientific scrutiny" (De Waal, 2009: 175). There is a rich future for the study of birdsong by musicologists, both in the study of individual species and in interspecific comparative investigations. Any claims of human uniqueness in music (or other domains) must be considered provisional without animal research, and we expect such research to yield substantial surprises.

References

Dr. Hollis Taylor received her PhD. from the University of Western Sydney (Australia). Her dissertation, Towards a species songbook: Illuminating the vocalisations of the Australian pied butcherbird (Cracticus nigrogularis), straddles the fields of musicology, ornithology, zoömusicology, and composition. In 2008, she participated in the First International Conference on Zoömusicology, "Nightingala," in Finland. She is a member of the birdsong research group "Meter, Rhythm, and Emotion" at the Institute of Biology, Freie Universität, Berlin and a superb lyrebird research group in Australia. Her award-winning compositions based on birdsong have been performed in Europe, Australia, and the United States. She authored a book/DVD set, Post Impressions: A Travel Book for Tragic Intellectuals, about bowing fences in Australia with fellow violinist, Jon Rose; the project is currently being toured by Kronos Quartet. She lectures worldwide on "The Music of Nature and the Nature of Music.”

Dr. Dominique Lestel is a French philosopher and ethologist. Associate Professor at Ecole normale supérieure (Paris) since 1994, he is a founding member of the Department of Cognitive Science. He is also a Senior Research Fellow at the Museum National d’Histoire Naturelle, where he is head of the Eco-ethology and Cognitive Ethology Research Group. He studied philosophy at the Sorbonne and received a Ph.D. from EHESS in 1986. He has held research positions at the University of California (San Diego), Boston University, MIT, and Bull Corporation. He has been a Visiting Professor in Chicago and Tokyo and delivered over 100 lectures worldwide. He received awards from Académie Vétérinaire de France and the International Biographical Centre (Cambridge). He has published in numerous academic journals and books (including Les Origines Animales de la Culture, Animalité, and Les animaux sont-ils intelligents?), as well as several books on shared life in humans/animals/machines.
8:15am  
Music in humans and animals

10:15am  
“Music Among the Birds”: Olivier Messiaen’s *Oiseaux exotiques*

Abstract

Elizabeth McLain & Xiaomei Ge, Virginia Polytechnic Institute and State University, USA

1. Background in Musicology

In 1955, at the request of conductor Pierre Boulez, Olivier Messiaen replaced traditional scales and harmonies with the colors, rhythms, and shapes of birdsongs to compose *Oiseaux exotiques* or *Exotic Birds*. Incorporating orchestral sections and keyboard cadenzas, the work resembles a piano concerto and was appropriately dedicated to and premiered by virtuoso pianist Yvonne Loriod. In *Oiseaux exotiques*, Messiaen “established that it was possible to create a successful musical work using birdsong.”¹ Within both the orchestral sections and piano cadenzas, Messiaen constructs traditional phrase structures using transcriptions of forty-eight non-European birdsongs. We will concentrate on his use of just four of these songs in that portion of *Exotic Birds* defined by rehearsal marks 4-5 as well as the song of the Virginia Cardinal in the piano cadenza.

2. Background in Biology

Birdsong is broadly defined as the more or less complex vocalizations that play a prominent role in attracting mate or deterring competitors. It is the product of the carefully coordinated activity of the vocal organ, respiratory system, the vocal tract and associated muscles. Even relatively simple songs like that of the northern cardinal require skillful coordination of syringeal and respiratory muscles. There are distinctive patterns of airflow and pressure associated with each syllable type. These patterns reflect the fact that each syllable is produced by coordinating the respiratory and syringeal muscles to produce the particular vocal gesture. Birdsongs consist of specific sounds that function at specific times. However, these units do not necessarily begin at the same pitch every time. Rather, individual birds recognize each unit by its melodic contour.

3. Aims

This study explores the definition and usage of birdsong in nature, anatomical aspects of producing birdsong, the structure of birdsong, and ultimately how Messiaen’s intimate ornithological knowledge led to his transcriptions and usage of birdsong to construct Art Music.

4. Main Contribution

Individual birds recognize each unit by its melodic contour, and the overall contour or shape of the unit becomes the primary feature of Messiaen’s transcriptions. As a result of rejecting traditional limitations, Messiaen adapted natural patterns, such as are found in human speech, and traditional musical structures to bind his new material together in an understandable, relatable way. Likewise, he achieves communication in solo piano sections through the juxtaposition of musical events that convey information through their function within phrase architecture and those elements which communicate sensation and establish a point of repose and meditation within the work. Musicology, history, linguistics, and biology collectively illuminate Messiaen’s compositional techniques and make the work more accessible to the average listener.

5. Implications
Developments in biology, genetics, and ornithology inform audience and performers’ perceptions of Messiaen’s music. Messiaen’s transcriptions are accurate in structure and tone color despite obvious alterations in pitch and layering of geographically separated species. Collaboration between musicologists and scientists can promote Messiaen’s compositional and artistic legacy.

6. References

Short biographies
Elizabeth McLain has studied performance interpretations of Shostakoich’s Lady Macbeth of the Mtsensk District, a project for which she received a research grant and about which she presented at the Virginia Tech Undergraduate Research Conference in the spring of 2007. Ms. McLain’s research on Olivier Messiaen’s Oiseaux exotiques will be published in the spring of 2010 in the journal Philologia. Additionally, McLain received a research grant for her contributions to a forthcoming article on the James MacDowell-Templeton Strong letters. Ongoing projects include editing a biography of James MacDowell, formatting an English language collection of Liszt-d’Agoult letters, and writing an article on the music of Andrei Tarkovsky’s films. In addition to her musical interests, McLain studies Russian and religious history and has acquired a working knowledge of linguistics through her study of Russian, French, Italian, and Spanish. She will receive a BA in Music Performance and a BA in History from Virginia Polytechnic Institute and State University in May 2010.

Xiaomei Ge is currently pursuing her Ph.D. in Animal and Poultry Sciences at Virginia Polytechnic Institute and State University. As a researcher, Ge has uncovered the role of PRL-3 in promoting cancer metastases and detected the signaling pathway through CSK and SRC cascades, been in charge of phenotypic screen and obtained disease models of human type 2 diabetes and hypophosphatemic rickets, and investigated the signaling pathway of GH in bovine skeletal muscle at the organism and cellular level by comparing the expression and phosphorylation levels of GHR downstream proteins before and after the GH treatment
as determined in the primary cultured cell line. Her B.S. in Biology was completed in 2003 at Nanjing Normal University, and she received her M.S. in Biochemistry from Nanjing University in 2006. Ge’s publications include “Phosphatase of Regenerating Liver-3 Promotes Motility and Metastasis of Mouse Melanoma Cells” Am J Pathol 2004, 164:2039-2054.
8:15am

Music in humans and animals

10:15am

Bird imitations in Lithuanian traditional music: Nature vs. Culture

Rytis Ambrazevičius, Kaunas University of Technology, Lithuania
Daiva Račiūnaitė-Vyčinienė, Lithuanian Academy of Music and Theatre, Lithuania

Abstract

1. Background in ethnomusicology
Birdsong imitations in music are found throughout history, as evidenced by Janequin’s Le Chant Des Oiseaux (1555). Vocal and instrumental bird imitations are also common in traditional cultures. Generally, birds are very important in Lithuanian traditional culture, and this is expressed through various aspects. For instance, there is a large number of records of bird imitations. Earlier they were mostly regarded as minor forms of verbal folklore, most probably for two reasons. First, they were usually written down as texts only. Second, the qualities of their musical articulation were overlooked. Nowadays they become the objects of ethnomusicological studies (Račiūnaitė-Vyčinienė 1999, Vaicenavičienė 2001, and others). Also, we can trace links with Lithuanian beliefs and, with magic procedures in shamanic cultures in general (Ojamaa 1997, Novik 1999, Sheikin 1993, etc.). Nevertheless, the study of bird imitations in Lithuanian traditional culture lacks a systematic approach.

2. Background in acoustics
Bird vocalizations, including their acoustic qualities, have been studied quite widely for a long time. It is probable that one of the earliest specific studies was conducted by Thorpe (1954). However, the acoustics of bird imitations in traditional cultures lacked attention. On the other hand, the acoustic domain of vocal imitations of other sounds in traditional (or non-Western) cultures seem to have been considered to some degree. Imitations of musical instruments (Patel & Iversen 2003, Ambrazevičius & Balsienė 2009) can be mentioned.

3. Aims
We aim to classify all types of occurrences of bird imitations in Lithuanian folklore and to reveal their differences in the aspect of nature vs. culture (in terms of acoustic vs. notional preferences).

4. Main contribution
The sample used for ethnomusicological-folkloristic analysis contained ca. 200 items of Lithuanian folklore – separate birdsong or bird call imitations, insertions of the imitations in folk songs, etc. They were collected from different publications. For acoustical analysis, recordings of 10 birdsongs and 10 imitations of these birds were selected (different types of imitations; see below). Systematic analysis led to the revelation of the following four groups of bird imitations (conditional denominations are proposed). 1. Nonverbal-natural, naturalistic. They are hardly distinguishable from the original bird vocalizations; usually the human voice is “masked”, i.e., used in unusual ways (also musical instruments or semi-instruments are applied). Acoustical analysis shows a very high correlation of pitch, time, and timbral parameters between the originals and imitations. 2. Verbal-semantic. Notional texts are applied. For instance, an oriole calls whenever it is thirsty: Lyk! Lyk! Lyk! (“Rain! Rain! Rain!”) The correlation of the acoustical parameters is considerable. 3. Symbolic. Mostly nonsense syllables and words, generally “imprinted” (cuckoo: ku-kū; cock: kakariekū, etc.). The correlation discussed ranges from quite high to almost negligible; often some qualities (timbre, intonation, rhythm) are transferred quite reliably while others are not transferred. 4. Abstract-allusions. These are onomatopoeia-based verbs characteristic, e.g., for descriptions of singing: “toot like swans”, “cackle like hens”, etc.
Only some of these sonorities can be associated with the acoustics of the original bird vocalizations.

5. Implications
Traditional bird imitations can be considered in the domain of “natural” acoustic / “cultural” notional qualities. The findings of the present study could be extended to the research of other traditional sound imitations. A comprehensive account of the phenomena of traditional bird imitations requires expertise in both the humanities (first of all, ethnomusicology) and the sciences (acoustics).

6. References

Short biographies
Rytis Ambrazevičius has a degree in physics from Vilnius University and he received his PhD in Musicology from the Lithuanian Academy of Music and Theatre. He is an Assoc. Prof. at Kaunas University of Technology and the Lithuanian Academy of Music and Theatre. His research interests include music and speech acoustics, ethnomusicology, and music cognition. He has authored or co-authored ca 50 papers and books, and ca 400 entries for the Lithuanian Encyclopedia of Music. He is also active as a folk and folkrock musician.

Daiva Račiūnaitė-Vyčinienė graduated with a degree in musicology from the Lithuanian Academy of Music and Theatre where she also received her PhD and habilitation in Musicology. She is an Assoc. Prof. at the Academy, and head of the Department of Ethnomusicology. Her research interests include traditional polyphony, traditional singing in contemporary culture, vocal performance, its links with mythology and world-view. She has authored or co-authored ca 40 papers and books. She is also active as a folk singer.
10:45am  Embodied cognition

12:45pm  Musical Meaning as Use: A Teleosemantic Perspective

Ghofur Woodruff & Ian Cross, University of Cambridge, UK

Abstract

1. Background: Naturalist Philosophy
Ruth Millikan’s naturalist theory of meaning, teleosemantics, is one of the most comprehensive and robust accounts of intentionality in contemporary philosophy (Millikan, 1984, 1989). Viewed as a cross between Wittgenstein’s meaning-as-use and Darwin’s theory of natural selection, teleosemantics defines the meaning of a sign in terms of its function, more specifically, its adaptive value in mediating its users in relation to their environment. The benefits of the adaptive value account for the signs’ reproduction and in doing so, fix its content.

2. Background: Musicology/Music psychology
Musicologists have long been divided over the question of musical meaning, many claiming that meaning resides in the socio-political outcomes of music’s performance (McCary, 2000) or in the apprehension of musical form (Lerdahl & Jackendoff, 1983). A number of authors have of late attempted to bridge the divide by positioning music in broader philosophical and evolutionary frameworks (Cook, 2001; Cross, 2009-2010). However, notably absent from this interdisciplinary discussion is a flow of information between naturalist philosophy and musicology.

3. Aim
In this theoretical discussion, we attempt to bridge the musicological divide by investigating music from a naturalist perspective, asking the question that many take for granted: how can music have meaning? Millikan’s teleosemantics serves as a point of departure, which initially problematises the notion of musical meaning, before setting out a broad, naturalist solution.

4. Main contribution
If meaning is determined by a sign’s historical adaptive value, applying teleosemantics to music’s socio-political content is unproblematic. Music’s content can be construed as the context-sensitive social and practical outcomes of its performance which account for its reproduction. Applying teleosemantics to music’s low-level content – its cognitive, affective, and perceptual effects – proves more difficult. There appears to be nothing in music’s performance or history which could fix its content: there is nothing in the way listeners’ have historically been adapted to their environment through music which accounts for the reproduction of its low-level signs. To put it more simply, according to teleosemantics, music means too much! We designate this phenomenon music’s content problem.

In forging a solution to music’s content problem, we seek inspiration from the field of vocal communication. Drawing on the ethologists’ view that intentional vocal signs emerge from natural signs, we suggest that the low-level content of music’s signs can be fixed through resonances with existing natural signs outside music to which listeners are already adjusted, a process for which we coin the term ecosemantics. Whereas teleosemantics fixes the content of an intentional sign through its historical use, ecosemantics fixes content through a resonance with pre-existing naturals signs.
5. Implications
The evolutionary approach forces us to address the question how music can have meaning, to which the theory of ecosemantics has been crafted in response. However, ecosemantics is too broad an account to explain how individual subsystems in music can have meaning. Rather, it serves as a guiding principle suggesting that music’s low-level content is not strictly speaking musical, but is to be traced to domains outside of music. Thus, there is scope for future exploration of ecosemantics in relation to areas which are typically regarded as ‘intramusical’, such as of tonality and musical expectation..

6. References

Short biographies
Ian Cross is Reader and Director of the Centre for Music and Science at the University of Cambridge, where he is also a Fellow of Wolfson College. He has published widely in the field of music cognition, evolution, and meaning, and has co-edited three books. His current research focus is on music as a bio-cultural phenomenon, and involves collaborations with psychologists, anthropologists, archaeologists, and neuroscientists. E mail: ic108@cam.ac.uk

Ghoffer Woodruff hails from New Zealand where he earned his Masters with distinction at the University of Canterbury. He is currently a Ph.D. candidate at the Centre for Music and Science, working under the supervision of Dr Ian Cross. Ghoffer’s thesis investigates musical meaning from a naturalist perspective, focusing on how theories of human and non-human vocal communication can elucidate our auditory engagement with music. E mail: gow26@cam.ac.uk
10:45am  Embodied cognition
–
12:45pm  Empathy Promoting Musical Components in Cognition and Education

Tal-Chen Rabinowitch, Ian Cross & Pamela Burnard University of Cambridge, UK

Abstract

1. Background in Music Cognition / Psychology
   Entrainment, the propensity of two or more generators of rhythm to align with each other and synchronise is deeply rooted in our biology, and is a fundamental ingredient in the perception and production of music [e.g. (Large, 2000; Cross, 2008)]. At the same time, entrainment may also have important implications as a strong social and emotional bonding force, whereby attentiveness, involvement and synchronisation could promote positive social interaction through processes of mutual understanding and alignment of affect or empathy. Further key components of musical perception and interaction such as imitation, joint intentionality and intersubjectivity, are also likely to be important for empathy. We therefore postulated that particular types of involvement with music may refine and enhance one’s proficiency in empathy promoting musical components (EPMC), which in turn may strengthen one’s social skills, and in particular one’s capacity for empathy.

2. Background in Music Education
   During child development there is a sensitive window for developing emotional empathy occurring between the ages of 8-10. At this stage the child is highly receptive to new disciplines and skills and has acquired the suitable cognitive tools necessary for engaging in music in a group. We identified this as an excellent opportunity for intervention, whereby an enhanced music programme could be designed and incorporated into the curriculum with the goal of advancing the children’s empathic abilities by augmenting, through music, their skills for EPMC.

3. Aims
   The aim of our study was to examine whether and how various music-related components, such as entrainment and imitation can be enhanced through continuous involvement with music, and whether their strengthening can have a positive effect on empathy in everyday life. In addition, and as part of the study’s methodology, we aimed to design a feasible musical group interaction programme suitable for primary school children with an emphasis on these potential EPMCs.

4. Main Contribution
   Methods
   The study consisted of a 9 month long musical interaction programme carried out on a weekly basis in four Cambridge primary schools (including several control groups). A battery of tests for evaluating empathy was given at the beginning and end of the study and a subsequent experiment which focused on entrainment was carried out at the end of the study.
   Results
   Children who participated in the musical interaction sessions showed a significant improvement in their empathy scores compared to matched children in control conditions.

2 Based on assembled references [e.g. (Eisenberg, et al., 1997)], that assume the development of ‘pre-empathic’ capacities, such as Theory of Mind and Perspective Taking by the age of about 8 or 9.
Moreover, children who took part in the musical programme showed a differential emotional reaction to a sad stimulus, depending on the condition of entrainment in a preceding part of the test. No such selective emotional response was observed in children from control groups, implicating more directly the possible links between music, entrainment and empathy.

5. Implications
The results provide evidence supporting our initial hypothesis concerning the role that music may play in strengthening particular skills that are also important for social interaction and empathy. These findings shed light on the cognitive mechanisms that are required both for music perception and for empathy and demonstrate how these skills may be transferred between domains. The study may also contribute to the future design of educational programmes, suggesting several additions in the structure of musical education in schools.

6. References

Short biographies
Tal-Chen Rabinowitch is a PhD student at Cambridge University, working on musical interaction and empathy in children. Tal-Chen studied Psychology and Musicology at the Hebrew University of Jerusalem, and Performing Arts at the Jerusalem Academy of Music and Dance (specialisation flute). She has a Master’s degree in Music Cognition (Hebrew University), which focused on developing a theoretical model that describes how music and empathy may be linked. Her current PhD project, supervised by Drs Ian Cross and Pamela Burnard, aims to empirically investigate and expand this model.

Ian Cross is Director of the Centre for Music & Science at Cambridge University, where he is also a fellow of Wolfson College. He has been involved in the experimental study of music perception and cognition for almost thirty years, focusing recently on music and evolutionary theory. He is the author of over a hundred papers and book chapters, and has co-edited "Musical Structure and Cognition" (1985), "Representing Musical Structure" (1991) and the "Oxford Handbook of Music Psychology" (2009). He is presently co-editing "Language and Music as Cognitive Systems" for Oxford University Press. Ian Cross is also a guitarist.

Pamela Burnard (BMus, MMus, MEd, PhD) works at the University of Cambridge, UK where she manages Higher Degree courses in Arts, Culture and Education and in Educational Research. She is Co-Editor of the *British Journal of Music Education*, Associate Editor of *Psychology of Music* and serves on numerous editorial boards. She is section editor of the ‘Creativity Section’ in the *International Handbook of Research in Arts Education* (Springer, 2007), and the ‘Musical Creativity as Practice’ section of the forthcoming *Oxford Handbook of Music Education* (OUP, 2010). She is convenor of British Education Research Association Creativity SIG.
10:45am

Embodyed cognition

12:45pm

Evaluating and Implementing Strategies for Embodied Music Interaction

Alexander Deweppe, Nuno Diniz, Pieter Coussem, Micheline Lesaffre & Marc Leman, Ghent University, Belgium

Abstract

1. Background in Systematic Musicology

Music mediation based on the concept of embodiment can extend and improve music interaction, cognition and appreciation. Technologies based on this paradigm can allow instant access into a musical content using the human body as a natural interface, regardless of the cultural context in which the interaction takes place. The idea behind this is based on the theory of embodied music cognition (Leman, 2008), in which the human body is seen as a natural mediator between sonic forms and cognitive processes. This idea has been adopted by systematic music research and at present, one of the goals pertaining to the field of interdisciplinary musicology is to harness this relation between body and sound to its full extent (Kim & Seifert, 2006) in responsive and interactive music applications that will support this opportunity for natural interaction with musical content.

2. Background in Computer Science

The requirements to create new and more natural ways for people to interact with musical content raised by systematic musicology have to be supported by proper hardware (to register the corporeal articulations that trigger sonic content) and flexible software. Issues like ideal input devices, what is considered an accurate mapping and what constitutes the ideal properties for embodied mediation technologies are currently under investigation. The main strength of this technology is that it can be used in a very flexible way, since the action-sound-couplings it supports are not fixed. On the other hand, this implies a weakness, because strong user-dependent nature of the technology requires it to remain modular and adaptable. This issue is fortified by the fact that ideally the technology should allow for different types users to interact with it and for different modes of interaction. The matter that is therefore prevalent in this development is how the pitfall of arbitrariness and application-specificity (induced by taking into account user-specific traits) can be overcome and how the natural foundations of its theoretical universal applicability can be safeguarded.

3. Aims

As the human body increasingly becomes the actual interface that makes the interaction with the musical content possible (Blaine & Fels, 2003), the action-reaction-couplings that are applicable, decipherable and relevant to these interactive applications need to be investigated and defined. The aim of this project is to facilitate this natural, embodied interaction with sonic/musical content, allow users to exploit this innate corporeal capacity to bodily interact with sound and to apply methodologies adopted from Human Computer Interaction Studies to evaluate and improve this interaction while keeping the user-specific nature of the input in mind throughout the development process. The question at hand is what action-reaction-couplings can be considered functional, intelligible and preferable within a predefined interactive environment, so that they can be incorporated in further technological development. The objective of the experiment was to test what action-reaction-couplings were considered self-explanatory, which motion-to-sound-relations were considered meaningful and how well test-subjects could discern between different types and levels of sonic output. Each participant was placed in a space equipped with a motion
capture system. Using the two rigid bodies attached to the hands, the test subject could activate sound objects on one or multiple sonic string-objects represented on a screen through their body movement. After an exploration period, the test subjects were asked to perform a set of predefined tests. In these tests, we aimed to evaluate the accuracy and speed at which the subjects could operate the system and the responsiveness of the platform. Afterwards, the test subjects were posed some questions concerning how they evaluated the usability and affordance of the used technology.

4. Main Contribution
This experiment allowed us to evaluate a methodology that investigated both the action-reaction-couplings used within a flexible framework as well as the corresponding software framework itself. Furthermore we examined what action to sound mappings were experienced as natural and functional during task performance, to investigate what elements could be improved in terms of user-friendliness and flexibility to meet future user-specific requirements.

5. Implications for Musicological Interdisciplinarity
The described method aims at formulating an elementary, yet feasible strategy of finding and evaluating appropriate action-reaction-couplings between actuated (musical) gestures and proposed mappings. The outcome of the experiment can inspire further progress in the field of systematic interdisciplinary musicology, especially related to field of embodied music cognition. This line of research is indispensable to eventually achieve ecological validity and cultural implementation of embodied music mediation technologies. The paradigm of embodiment offers opportunities to achieve relatively new and flexible ways of interaction with musical content. This is only feasible when an effective collaboration between researchers from the sciences, the humanities and the arts are closely working together. The used interdisciplinary and user-oriented development-strategy may well effect improvements in other applications that implement these action-reaction-couplings and entail progress in the interactivity of individual and collaborative gesture-based music controllers.

6. References


Short biographies
Alexander Deweppe graduated as a master in Art History at Ghent University in 2006,
and in 2008 started a PhD research in sociomusicology at the Institute of Psychoacoustics and Electronic Music of Ghent University.

Nuno Diniz graduated as a master in Informatics and computer engineering at Instituto Superior Técnico in Lisboa in 2004, and started a PhD research in Auditory Display and Multimodal Interaction at the IPEM in 2008.

Pieter Coussement graduated as a master of Arts at the Royal Academy for Fine Arts in Ghent in 2003 and started his PhD research on the position of the body in interactive art at the IPEM in 2008.
10:45am  
Embodied cognition

12:45pm  
Exploring dance interaction and person perception using silent disco technology

Matthew Woolhouse, University of Cambridge, UK.  
Dan Tidhar, Queen Mary University of London, UK.

Abstract

1. Background in experimental psychology  
Previous research (Macrae et al., 2008; Miles, et al., 2009) has found that synchronised limb movements assist social memory, i.e. people who move their hands in time with each other, remember more about each other.

2. Background in dance  
We explored the above finding in the context of dance and music.

3. Aims  
We hypothesized that music-induced motor coordination between individuals (as in dance) leads to increased person perception (i.e. people who dance in time with each other, remember more about each other), and thus may facilitate social bonding.

4. Main Contribution  
In this experiment we used radio headphones, a marked-up dance floor, two types of music, and memory identifiers (sash colours and symbols). Each dancer wore radio headphones, and a different coloured sash and symbol. Ten dancers were split into two groups, A and B. Using silent disco technology, one type of music was transmitted to group A while at the same time another type of music was transmitted to group B. The types of music were distinguished by tempo and mood. Each dancer was allocated a specific position on dance floor such that (s)he was equidistant from identical numbers of dancers in each group. In order to control for physical proximity effects, at regular time intervals the dancers moved to other positions on the dance floor so that all the dancers were adjacent to one other at some point within the experiment.

Pre-experiment, the dancers were photographed. Post-experiment, the dancers were presented with photographs of all the other dancers and asked to recall each dancer’s sash colour and sash symbol. In order to avoid the adoption of conscious memory strategies during the experiment, the participants were ignorant of the existence of this memory task prior to being presented with the photographs of the other dancers.

5. Implications  
The results, to be presented at the conference, were analysed in order to assess whether dancing at the same tempo as other people significantly enhances sash colour and sash symbol memory, and, by implication, thereby facilitates and/or enhances person perception and social bonding.

6. References  
Macrae, C. Neil; Duffy, Oonagh K.; Miles, Lynden K.; Lawrence, Julie. (2008). A case of

**Short biographies**

**Matthew Woolhouse** is a Junior Research Fellow in Music Cognition at Wolfson College, Cambridge, a member of the Faculty of Music in Cambridge and for 2009-10 is the acting Director of the Centre for Music and Science in Cambridge. Current research interests include the cognitive processes underpinning the historical development of Western tonal music, the perception of musical metre, and the connection between music, dance and person perception. His qualifications include a GGSM from the Guildhall School of Music (London), an MPhil in Musicology (Cambridge) and a PhD in Music Cognition (Cambridge).

**Dan Tidhar** is a postdoctoral researcher at the Centre for Digital Music, School of Electronic Engineering and Computer Science, at Queen Mary, University of London. His current work focuses on application of signal processing methods to musicological research in a semantic web environment. Dan studied Mathematics, Philosophy, Computational Linguistics, and Music, while accumulating practical experience in software development and harpsichord performance. His qualifications include an MSc in Computational Linguistics (Edinburgh), a Masters in harpsichord performance (UdK Berlin) and a PhD in Computer Science from the Technical University of Berlin.
13:45pm  
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Keynote:

14:30pm  ‘When all songs sound the same: Investigations into congenital amusia’

Lauren Stewart, Goldsmiths, University of London, UK

Abstract

The ability to make sense of musical sound has been observed in every culture since the beginning of recorded history. In early infancy, it allows us to respond to the sing-song interactions from a primary caregiver and to engage in musical play. In later life it shapes our social and cultural identities and modulates our affective and emotional states. But a few percent of the population fail to develop the ability to make sense of or engage with music. Individuals with congenital amusia (CA) cannot recognize familiar tunes, cannot tell one tune from another, frequently complain that music sounds like a "din" and avoid the many social situations in which music plays a role. In this talk I will present data from perceptual experiments suggesting that individuals with amusia are insensitive to pitch direction and are unable to retain pitch information in memory. In addition, I will discuss ongoing genetic and neuroimaging approaches that we are using to characterize this disorder. The study of disordered musical development sets in sharp relief the perceptual and cognitive abilities which most of us take for granted and give us a unique chance to investigate how musical perceptual ability develops, from the level of the gene to the development of the brain and the emergence of a complex and fundamental human behaviour.

Short biography

Lauren Stewart is Senior Lecturer and director of a new MSc in Music, Mind and Brain at Goldsmiths, University of London (http://www.gold.ac.uk/pg/msc-music-mind-brain/). Her current research interests ranges from studying those with congenital amusia who have an inability to make sense of musical sound to studying the acquisition of perceptual, cognitive and motor skills in trained musicians. Lauren originally studied Physiological Sciences at Balliol College Oxford, but transferred from bodies to brains with an MSc in Neuroscience and doctoral and postdoctoral training at the Institute of Cognitive Neuroscience, the Wellcome Department of Imaging Neuroscience (both UCL) and Harvard Medical School.
16:00pm  Cognition

18:00pm  Interdependencies between cognitive mechanisms and cultural background in listeners’ structural understanding of music, studied with the help of a computational model

Olivier Lartillot, University of Jyväskylä, Finland
Mondher Ayari, Université Marc Bloch-Strasbourg 2, France

Full Paper

This collaboration studies the complex interdependencies between cognitive mechanisms and cultural background in listeners’ structural understanding of music, with the help of a computational model. Listeners of various expertise have been asked to indicate various levels of segmentation when listening to a traditional Tunisian improvisation. A modelling of the segmentation strategies has been constructed, as a complex articulation between purely perceptual rules (discontinuities, parallelism) and cultural knowledge (description of the Arabic modal structure). Whereas a cognitive model purely based on perceptual rules may offer some explanation of listeners’ behaviours, the integration of cultural knowledge enables a deeper but in the same time clearer interpretation of the ways listeners construct a structural understanding of the improvisation. The cultural knowledge that has been added in the computational model is based on a set of general mechanisms (scales, set of notes, numeric “activation” value associated to each different candidate concept, etc.) that might be related not only to the cultural knowledge, but also to some cognitive building blocks that could be reused for the description of other cultures as well.

1. Background in cognitive ethnomusicology

Psychological and cognitive researches have offered new perspectives on music understanding, related in particular to the perception of musical structure and segmentation (for instance, Lerdahl and Jackendoff, 1983). Particular questions relate to the articulation between culture and nature in music understanding and to the importance of temporal apprehension of music (Imberty, 1981). One particular subject of investigation deals with the cognitive processes enabling the recognition of segmentation marks and temporal integration. Ayari’s (2008) study on intercultural perception is based on the idea that patterns are able to activate learnt schemata which themselves may affect, in return, the dynamic process of segmentation through the development of particular expectations. Therefore, there is a complex interaction between the analysis of the input data and the influence of cultural knowledge in the way a given musical sequence is organised. This process needs to be observed from different perspectives including music analysis, cognitive ethnomusicology and computer modelling of musical pattern identification, in order to describe the real-time potential of music understanding.

2. Background in computational music analysis

Methodological developments of motivic analysis (Reti, 1951) undertaken in particular by linguistics and semiotics (Ruget, 1987; Nattiez, 1990) have been hampered by the underlying complexity of possible strategies and structures. Formalised descriptions of segmentation strategies offered by psychological and cognitive studies might be utilised as a means to guide and make explicit discovery processes. In addition, computational models (Cambouropoulou, 2006; Rolland, 1999; Conklin and Anagnostopoulou, 2001; Meredith et al., 2002; Lartillot, 2005) enable exhaustive analyses of sizeable musical pieces, but still struggle to control the combinatory explosion of structures and to offer musically relevant
analyses. It seems necessary in particular to unveil the different factors responsible for such divergence and to build progressively a complex system offering results congruent to listeners’ expectations (Lartillot, 2007). In this respect, listening experiments significantly contribute to a progressive improvement of the model.

3. Aims
Understanding the complex interdependencies between cognitive mechanisms and cultural background in listeners’ structural understanding of music, with the help of a computational complex model.

4. Main Contribution
A Tunisian traditional modal improvisation (Istikhbâr), performed on the Nay flute by the Tunisian master Mohamed Saâda, was analyzed by three classes of musicians: 20 Tunisian traditional musicians, 20 European jazz musicians and 20 European non-jazz musicians. The individual listening strategies followed by those expert musicians from various cultures are explored with the help of an experimental protocol based on identification of musical material, recognition of mode and modulation, three segmentation tasks (two open and one oriented towards modal transitions) and one reduction task. Segmentations were clustered across subjects, according to the underlying heuristics guiding the segmentation, as indicated by the listeners during the interview phase. Figure 1 shows the analysis of the first part of the improvisation, both by the subjects and the computational implementation of the models. The subjects’ responses are displayed above the staves using downward triangles of three colours: black for the first higher-level (top-level) segmentation, white for the second more detailed (low-level) segmentation, and grey for the segmentation based on modes. For each location the number of subjects who segmented at that particular location is indicated, for each class of listeners: Tunisians (t), European jazzmen (j) and non-jazzmen (n). As mentioned, due to the real-time context of the experiment, segmentation points have been relocated based on the listeners’ own justification of their segmentation choices.

A cognitive model of segmentation strategies has been developed, based in a first step on low-level heuristics of local discontinuity and parallelism. Local segmentation is founded on relatively contrastive discontinuities between auditory attributes. Any significant departure, for a given musical parameter, from a domain of values with which a given stream of notes complies – departure such as a pitch leap, a change of timbre, a modification of sound level, of temporal shape of individual events, of rhythmic values, etc. – tends to imply segmentation, in line with the Gestalt theory principles of similarity and proximity (Lerdahl and Jackendoff, 1983). The computational model employed in this study is the Local Boundary Detection Model (LBDM) (Cambouropoulos, 2005). Local segmentation predicted by the LBDM model is displayed below the staves with upward triangles. Strong segmentation points can generally be associated with consensual segmentation points proposed by subjects of all cultures. Weaker segmentation points cannot be easily explained in the same way (Lartillot & Ayari, 2008, 2009).

Particular schemes, such as sequences of pitches, rhythmic values, etc., are perceived as whole entities, usually called patterns, if they are repeated several times, developed throughout the piece, with or without variations. This corresponds to the principle of parallelism (Lerdahl and Jackendoff, 1983). The termination of the archetypical Mhayyer Sikâ motif, indicated by bold lines under the staves showing one vertical mark at their right ends, contributed to listeners’ segmentation. Each termination of this pattern provokes a segmentation decision by listeners, even when local boundary strength is low (Lartillot & Ayari, 2008). Another heuristic for segmentation induction, based on propagation of segmentation expectations, enables to explain interesting segmentation behavior in the
improvisation, especially in the second part (cf. more details in Lartillot & Ayari, 2009).

The impact of cultural knowledge on the segmentation behaviour is studied with the modelling of a new set of rules that takes into account the modal structure of the improvisation. *Mhyyer Sikā*, as any *Maqām* mode, is made up of the juxtaposition of musical genres (or 'Iqd-genres), defined as groups of 3 to 5 notes such that one (or two) of those notes are considered as pivot: melodic lines tends to rest on such pivotal note (figure 2). Going from one 'Iqd-genre to another seems to provoke a segmentation in the musical grammar. Both European and Arab listeners could perceive this composition process produced in Arabic music, but it is expected that the feeling of segmentation is stronger with Arab listeners. A rough equivalent (but not identical) of this phenomenon in Western music would be a transition between degrees, or a modulation.

This description of Arabic modes has been implemented in the form of a set of general rules, with the purpose of expressing this cultural knowledge in terms of general mechanisms that could be applied, with some variations, to the study of other cultures as well.

- Each 'Iqd-genre is modelled as a concept, with which is associated a value, representing more or less a degree of likelihood, or activation, and allowing a comparison between genres and a selection of the most probable one. This score is represented as a value on a numerical scale referenced by a threshold value: score above this threshold indicates that the 'Iqd-genre can be considered as a plausible candidate, whereas score below the threshold negates the significance of that particular genre for the given musical context.

- Each successive note in the improvisation implies an update of the score associated to each 'Iqd-genre. If the pitch value of the note belongs to the scale of the 'Iqd-genre, its score is increased. If the score is below the threshold, the score increase, but remains still below the threshold. Reversely, if the pitch value of the current note does not belong to the scale of the 'Iqd-genre, its score is decreased significantly, back below the threshold.

- If the note currently played corresponds to a pivotal note of the 'Iqd-genre and is actually emphasized with a long duration (or long inter-onset-interval between that particular note and the next one), then the given 'Iqd-genre is confirmed: its score is increased such that it can now exceeds the detection threshold. Reversely, if the long note currently played does not correspond to a pivotal note of the 'Iqd-genre, the score is decreased.

- The most likely 'Iqd-genre will correspond to the genre with the best score (provided that it exceeds the detection threshold).

- A further general mechanism has been added that reduces ornamented sequences in order to reveal the underlying pivotal notes.

The execution of this model of Arabic mode on the improvisation leads to the modal analysis indicated in Figure 1, where the succession of most likely 'Iqd-genres is indicated. Notes belonging to the selected 'Iqd-genre are circled, and pivotal notes are highlighted with grey ovals that encompass the whole underlying ornamentation. The modal analysis leads to three kinds of segmentation decisions: when a new 'Iqd-genre is detected, when the melody stabilizes on a pivotal note, and when the current note does not belong to any prevailing 'Iqd-genre, opening an indeterminate phase (shown by the vertical lines below note circles, at the beginning of stave 2 and at the end of stave 4).
The integration of cultural knowledge allows a clearer understanding of listeners’ segmentation reactions, and the impact of their musical expertise. Strong perceptual discontinuities (large triangles below staves, corresponding to a LBDM value larger than .25) systematically leads to listeners’ segmentation. The impact of culture, here, is that the pitch value of the note preceding the discontinuity helps to distinguish between top- and low-level segmentation: top-level segments end in the tonic of the mode (D) whereas low-level sub-segments terminate on other pitch values (such as A). Weak perceptual discontinuities (small triangles below staves, corresponding to a LBDM value lower than .25) cannot be easily correlated with listeners’ segmentation. Pitch-gap discontinuity does not seem to have a large segmental impact in this style of music, whereas temporal gaps can be better explained by integrated them into the modelling of Arabic mode (as they help to define pivotal notes). Small silences at the tonic of the mode (D) seems to triggers segmentation decisions, and it can even be related to top-level segmentations if the pivotal D note follows the recent occurrence of a pivotal A note, defining therefore the main ‘Iqad-genre that is central to the modal structure of this improvisation (Mhayer Sikâ). Finally, modal ambiguities lead quite strongly to modal segmentations, and the resolution of the ambiguity also triggers a modal segmentation, by Tunisian listeners in particular.

5. Implications
This study of segmentation strategies by listeners of various cultures shows that, whereas a cognitive model purely based on perceptual rules may offer some explanation of listeners’ behaviours, the integration of cultural knowledge enables a deeper but in the same time clearer interpretation of the ways listeners construct a structural understanding of the improvisation. One interesting remark is that the cultural knowledge that has been added in the computational model is based on a set of general mechanisms (scales, set of notes, numeric “activation” value associated to each different candidate concept, etc.) that might be related not only to the cultural knowledge, but also to some cognitive building blocks that could be reused for the description of other cultures as well. In future works, we plan to establish a general model where such cultural knowledge would be implicitly learned through a direct experience of the computational model to a corpus of music. The extensive experimentation of such complex model on real-world music might offer new insights on the complex interaction between cognitive constraints and cultural knowledge.
Transcription, analysis and segmentation of the first part of Mohamed Saâda’s Istikhbâr by Tunisians (t), jazzmen (j) and non-jazzmen (n) European listeners (over the staves) and by computer (on and under the staves). Local segmentation predicted by the LBDM model is displayed below the staves with upward triangles. The termination of the archetypical Mhayer Sikâ motif are indicated by bold lines under the staves showing one vertical mark at their right ends. The succession of most likely ‘Iqd-genres is indicated below the staves. Notes belonging to the selected ‘Iqd-genre are circled, and pivotal notes are highlighted with grey ovals that encompass the whole underlying ornamentation.

Figure 2: The Mhayer Sikâ (a Tunisian musical mode) contains several variants which operate principally within the second ‘Iqd. The ‘Iqd musical genres forming the scale,
changing roots each time (A, G, and F), are: Bûsalik (G), Mazmoum (F), Isbaîn (A), Râst Dhîl (G), and Isbaîn (G). Pivotal notes are circles.

6. References

Short biographies
Olivier Lartillot is an Academy of Finland Research Fellow at the University of Jyväskylä. His research in the areas of computer science, music analysis and music cognition are dedicated to the development of a computational framework for music analysis from symbolic and audio domains. Engineer Degree (computer science, signal processing, AI), Supélec, 1999, Bachelor of Music (musicology), Sorbonne Paris, 1999, Ph.D. (computer science, music analysis), Ircam, Paris 6, 2004.

16:00pm  
Cognition

18:00pm  
"Harmony of the Ears": Applications of tuning in symbolic music analysis of Renaissance music

Frauke Jurgensen, University of Aberdeen, UK  
Ian Knopke, BBC, London, UK

Abstract

1. Background in musicology:  
Renaissance music theory was both theoretically and philosophically indebted to ancient Greek music theory. At the root was the Pythagorean concept of representing perfect consonances by simple ratios, shown through the division of the monochord. Music, closely linked to mathematics, was seen as a reflection of the perfection of numbers thought to hold the entire universe together (Harmony of the Spheres), and a direct connection between music and the natural world. The most practical application of these ratios was in the construction of scales, where the Pythagorean comma proved a constant problem. During the fifteenth century, the dominating Pythagorean tunings based on pure fifths gradually gave way to meantone tunings (constructed to contain more pure thirds). Mark Lindley has used evidence of favoured diads and triads in fifteenth-century music to show what sort of tuning system might have been conceived by the composer of a piece. As pieces are transmitted in other manuscripts, particularly when they are intabulated for keyboard instruments where tuning issues are critical, they often undergo changes, such as re-composed parts.

2. Background in computing:  
Most music information retrieval and computational musicology research is based on equal-temperament tuning, and this is often assumed even for musics where such tunings were not historically used. However, non-equal tempered tunings such as mean-tone or just intonation place greater emphasis on some note and interval combinations at the expense of others, and the application of this tuning knowledge to these sorts of tasks presents unique analytical opportunities. Specifically, we have been exploring two applications of this.

First, with some collections there is some controversy surrounding the particular tunings that may have been used in performance. Our experiments demonstrate that, through the large-scale analysis of the intervallic and melodic characteristics of multiple pieces, it is possible to probabilistically predict a tuning that might have been used for a particular piece.

Secondly, a typical problem in computational musicology is to algorithmically determine which notes of a melody are the most prominent, an important subtask in phrase analysis and melodic comparison. Knowledge of the tuning system provides an additional information feature and can be used as a new type of similarity measure, singularly or in conjunction with other melodic features.

3. Aims:  
Our aims in this study are two-fold: first, to show how pitch-choices in the Buxheim Organ Book (the largest fifteenth-century keyboard manuscript) can be seen to reflect possible keyboard tunings; and second, to study the efficacy of tuning as an indicator of significance of pitches in a melody.
4. Main Contribution:
We use a hand-entered database in Humdrum format, of the Buxheim Organ Book and its concordances (ca. 500 files in total). The ca. 250 pieces in the keyboard manuscript, copied between ca. 1450--1470, have a total of ca. 200 concordances in manuscripts dating from between ca. 1390--1520. This allows us to see how especially those pieces transmitted in many manuscripts have changed over time. In Buxheim, we can find evidence of re-composition that points towards tuning considerations. For example, certain types of cadences have been consistently re-written to avoid a type of voice-leading which would require a D-sharp in the tuning system used.

5. Implications:
Our work has implications for several disciplines. Performers and scholars of early music rely on an understanding of tuning to make important performance decisions or understand compositional practice. A modern performer may have a much better idea not only what tuning system to choose, but also how a piece may be adjusted to work on a particular instrument. Instrument builders can build more accurate reproductions of historical instruments. Also, we provide reasons why computational musicology researchers should consider the use of tunings other than equal temperament. Finally, we show how knowledge of tuning can be an important similarity feature in symbolic music information retrieval.

6. References:

Short biographies
Frauke Jurgensen (f.jurgensen@abdn.ac.uk) is a Lecturer in Music at the University of Aberdeen. Her research interests include history of theory and compositional practice in the Renaissance, historical performance practice, and computational musicology, and she was appointed Secretary of the International Society for Interdisciplinary Musicology. She also performs as a soprano and organist.
Ian Knopke (ian.knopke@gmail.com) is a Canadian composer, theorist, and music technologist. His main area of research is in music search systems, beginning with his thesis on the AROOOGA system for music and audio on the web. He has since been a researcher in music informatics at Indiana University, and more recently at Goldsmiths College in London as part of the OMRAS2 project. He currently works at the British Broadcasting Company on a large-scale, realtime metadata delivery and search system that supports a wide array of systems, including the iPlayer media delivery system.
16:00pm  

Cognition

18:00pm

Cross modal mappings of musical parameters in the congenitally and early blind

Eitan Ornoy, Beit Berl Academic College, Israel  
Zohar Eitan, Tel Aviv University, Israel  
Roni Y. Granot, The Hebrew University of Jerusalem, Israel

Abstract

1. Background -- music cognition.
Musical parameters such as pitch, loudness and tempo interact perceptually and associate cognitively with features in other domains. Higher pitch, for instance, associates with higher spatial position, lighter color, and smaller size (Marks, 1999). Two recent studies, examining cross-domain mapping in musical contexts, serve as a starting point for the present paper. Eitan & Granot (2006) presented participants with melodic stimuli in which pitch direction, loudness change, and tempo change were controlled, and asked them to imagine a human character moving to the music and specify its movement directions and qualities. Results indicate that musical parameters significantly affect multiple dimensions of motion imagery. For instance, pitch direction affected imagined motion along all three spatial axes, speed and energy. Eitan & Timmers (2009) compared listeners' ratings of diverse antonyms as appropriate for high and low pitched music. High pitched music was rated, among other things, as significantly thinner, smaller, more lightweight, sharper, lighter (visually), younger, feminine, faster and happier than low-pitched music.

2. Background – CEB Perception.
Perceptual and cognitive capacities relevant to the present study, such as localization, spatial processing, or mental imagery, as well as language and music perception abilities, are largely similar for congenitally or early blind (CEB) and sighted individuals, and sometimes are even enhanced in CEB (Afonso et al., 2007; Gougoux et al., 2004; Hamilton et al., 2004; Lessard et al., 1998; Madsen & Darrow, 1989; Muñnic et al., 1991; Röder et al., 2003; Walker, 1985). There are, however, some noteworthy differences, all concerning spatial perception, cognition and action. CEB, as compared to sighted persons, seem to be less accurate in vertical localization (Lewald, 2002; Zwiers et al., 2001), and are less efficient in processing incomplete spatial information (Thinus-Blanc & Gaunet, 1997), and in dynamic vestibular tasks (Schmid et al., 2007). Most importantly, new evidence shows that vision is critical in early forming of multisensory functions, and that congenital visual deprivation may result in reduced crossmodal interactions (Hötting & Röder, 2009)

3. Aims.
We examine how congenitally and early blind adults map musical parameters like pitch and loudness into features in non-auditory domains, as compared to sighted people. Our study aims to further examine the notion of a common palette of associations to sound, and see how such analogies withstand failures of the visual domain to which they are related. Results may shed light on the interaction of language, culture, and basic multi-modal experience in cross-modal mappings involving music.

4. Main Contribution.
Method. Two experiments replicated, in part, Eitan & Granot (2006) and Eitan & Timmers (2010), described above. Participants were 26 CEB adults (9 musically trained). Results
were compared with those of the above studies.

**Results.** In Exp1 (motion imagery) significant differences between sighted and CEB were found in associating pitch and vertical direction: in contrast to the seeing, for which changes in pitch height map into spatial rise and fall, blind participants do not relate these two domains at all. In Exp2 (pitch metaphors), no significant differences were found between blind and sighted ratings. In both groups, highly significant differences were found between the ratings of all antonyms for high and low music. Importantly, CEB map pitch into visually-based antonyms (e.g., light-dark) in the same way as the seeing.

5. **Implications**

Results suggest that most cross-domain mappings of musical parameters are not dependent on actual audiovisual perception, as they are equally prevalent for the seeing and the congenitally blind. These mappings may stem in part from language use. Paradoxically, however, the pitch-verticallity mapping, prevalent in language yet not associated with hitherto noted naturally occurring audiovisual correlations, seems to be dependent on actual audio-visual experience, as it is completely lacking among CEB. Notably, this is the only spatial axis in which auditory information such as intensity and phase differences is not enough for exact localization. Hence this suggests that spatial height mappings of pitch (observed already at infancy; Walker et al., 2010) are inherently associated with and dependent on sight. We speculate that in sighted infants these mappings are generated by correlations between visually observed spatial height and associated auditory pitch and frequency spectrum.

6. **References**


Röder B., Gelmuth, L. and Rösler, F. (2003). Semantic and morpho-syntactic priming in...


**Short Biographies**

**Eitan Ornoy**
Lecturer of music studies, Beit Berl Academic College.
Education: MA. (violin performance), Rice University, 1993; PhD. (musicology), Hebrew University of Jerusalem, 2002.

**Zohar Eitan**
Associate professor (Music theory and music cognition), School of Music, Tel Aviv University.
Education: MA, Music composition and theory, Tel Aviv University, 1984; PhD, Music theory, University of Pennsylvania, 1990.

**Roni Y. Granot**
Lecturer (music cognition), Musicology Dept., the Hebrew University of Jerusalem.
Education: MA. (music cognition) 1991, the Hebrew University of Jerusalem; PhD. (Musicology) Hebrew University of Jerusalem, 1997 in collaboration with the Cognitive Psychophysiology Lab., Psychology Dept., University of Illinois, Champaign Urbana..
20:00pm   Keynote:

21:00pm   ‘Cultural and biological aspects of sad music’

David Huron, Ohio State University, USA

Abstract

The complex interactions between biology and culture are illustrated by contrasting the sounds of sadness with those of grief. Sadness and grief are related emotions that are nonetheless easily distinguished by their contrasting physiological, behavioral, and phenomenological symptoms. Sadness and grief also exhibit different acoustic characteristics. The acoustic features of sadness are consistent with what ethologists call a "cue," suggesting that the sound-features are entirely learned. By contrast, the acoustic features of grief are consistent with an ethological "signal," suggesting that there is an innate foundation or endogenous predisposition related to the processing of grief-related sounds. Once the sadness/grief distinction is made, it is easier to recognize the cultural elaborations of these two different states in the myriad of lament, cry-song, elegaic, and other traditions evident in many of the world's cultures.

Short biography

David Huron is Arts and Humanities Distinguished Professor in the School of Music and at the Center for Cognitive Science at the Ohio State University. Originally from Canada, Huron completed doctoral studies in musicology at the University of Nottingham in 1989. In addition to laboratory-based research, his activities also involve field studies, principally in Micronesia. He has published some 100 scholarly articles, including three books. His most recent book, "Sweet Anticipation: Music and the Psychology of Expectation" received the Wallace Berry Book Award from the Society for Music Theory.
Saturday 24th July 2010

8:45am
Language and Music

9:15am
Gestural Communication in Music Performance and Speech

Bryony Buck, University of Glasgow, UK
Richard Parncutt, University of Graz, Austria

Abstract

1. Background in Performance Analysis
Musicians’ movements often emphasise aspects of structure and emotion that are somehow immanent in the score (Davidson, 1994). Movements may reflect the physics and physiology of sound production, enhance communication (among ensemble performers and with the audience), and serve as performance memory aids (Esteban, 2007). The ancillary movements of clarinetists reflect tension and structure (Wanderley, 2001). Variations of body movement correlating with phrasing structure, meter and affect (mood/emotion) have also been observed in solo and duet piano performance (Macritchie, 2009; Davidson, 1994).

2. Background in Speech and Communication.
Speech, like music, is a multimodal activity hierarchically organised in structural sequences (Patel, 2003). With much research acknowledging that to fully understand a speaker’s intentions we must integrate the aural and visual elements of speech, we ask whether gestures in music and speech contribute to meaning and understanding in similar ways. Language gestures are suggested to have various roles pertaining to conceptual clarification (Kendon, 1993), narration, topic and context (McNeill, 1992; Kendon, 1997), intention, phrasing structure (Gill, 2008) and syntactic relations (Patel, 2003). Focusing on literature investigating structural and syntactic meanings of gestures, this paper provides a comparative review of existing research into the roles and meaning conveyed in particular physical gestures during verbal communication. If communication and comprehension are enhanced through body movements in both language and music, the connection presumably has both cultural and universal components in both cases. Therefore, musicians’ gestures may be based in part on gestures used in everyday speech.

3. Aims
We compare the literature on gestural features in speech with recent data on gesture in piano performance, focusing on the delineation of structure (phrasing) and effects on aesthetics and meaning.

4. Main Contribution
Using the Vicon® motion capture system, conservatoire pianists were recorded performing Chopin’s A-major and B-minor preludes (Op.28 no. 7&6). The magnitude and direction of displacement (calculated using principle components analysis; see MacRitchie et al 2009), as well as velocity and acceleration of markers at different points on the body (Buck et.al, 2010) were compared with grouping, metrical, harmonic and melodic accents according to Parncutt (2003). Velocity tended to increase just before grouping and harmonic accents, which recalls illustrative gestures that accompany speech; ‘speech-primacy’ motions relating to prosodic elements of speech such as rhythm
or stress, and 'motor-primacy' motions that depend upon the meaning of what is being said (Feyereisen & Lannoy, 1991). Specific motor movements have been noted during speech, demonstrating variations in speed and magnitude of body movements that emphasise the intended meaning being communicated. The current findings, that pianists vary the direction and velocity of non-technical movements with direct relation to grouping structures such as phrasing, suggest a similarity between production & communication of structural organisation and meaning in music performance, to that of speech. Comparisons support proposals of combined 'dual-processing' systems for syntactic integration (Patel, 2003) and key structural sections (Bod, 2002) for music and speech.

5. Implications
Juslin and Laukka, (2003) have indicated strong connections between emotional communication in speech and music, and Juslin and Person (2002) have considered the application of research on emotional communication in post-secondary music education. Our work on the relationship between gesture and musical structure may have similar applications.

6. References
Davidson (1994) What type of information is contained in the body movements of solo musician performers? Jnl Human Movement Studies. 6; 279-301
MacRitchie et.al.(2009) 'Visualising musical structure through performance gesture' ISMIR 2009 proceedings, Kobe, Japan. ISBN
Interaction'. Springer London.

Short biographies

**Bryony Buck**
Doctoral student, Centre for Music Technology, University of Glasgow, Scotland
b.buck@elec.gla.ac.uk

Proceedings contributions:

**Richard Parnas**
Professor of Systematic Musicology, University of Graz, Austria richard.parnas@unigraz.at

Relevant publications:
9:15am  Symposium: Communicative competencies in music and language
10:30am

Language and music: overlap and difference in their neuronal organisation

M. Musso, A. Schneider, V. Glauche, R. Umarova & C. Weiller, University of Freiburg, Germany

Abstract

1. Introduction
In every human society, language as music convert complex acoustic sequences to limited perceptually discrete elements (such as words or notes and chords) organised into hierarchical structures in systems of obligatory dependencies with a finite set of rules that combine them in an infinite way. This propriety distinguishes both faculties from the holistic sound system used by animals, in which each sounds is associated with a particular meaning but sounds are not recombined to form new meaning. However, music and language syntax show important differential factors. It is generally acknowledged that music perception focuses on psychophysically proximate pitches (Scharf, Quigley, Aoki, Peachery, & Reeves, 1987) and that affects not only vertical but also horizontal features of music (Huron 2001). Moreover, language grammar is built from categories (such as nominal and verbal elements) that are absent in music. In music, each pitch is heard in relation to the tonic and to the adjacent pitches at multiple layers of pitch space: the “tonal space”. In this fMRI study linguistic and musical syntactic and psychoacoustic competence were compared to identify the brain network underlying a possible common and specific “conceptual system” within music and language syntax.

2. Subjects and method
We designed an fMRI experiment where eleven German non-musicians had to judge the correctness of some musical phrases and language sentences. The stimuli presented either syntactic or psychoacoustic violations: Correct stimuli followed the principles of language phrase structure or of central tone-relatedness. In the syntactically illegal sequences, the target word or chord had an arbitrary fixed position within the basic elements, so that it did not respect the hierarchical structures and the system of obligatory dependencies, which characterises every “real” grammar. In the control condition, the target word/chord was manipulated in its physic/acoustic features inducing a sense of roughness. In a second study 32 subjects were scanned with DTI sequences. Both experiment were performed on a 3 Tesla scanner. The analysis of the data used SPM5, directed Partial Correlation\(^1\) and DTI-Toolbox\(^2\) in SPM8.

3. Results
Violations of hierarchical rules in language involved a left hemispherical network, including inferior and superior frontal, supramarginalis, parietal and precentral gyrus and thalamus. \(^1\)same processing in music induced a bilateral activation of: the inferior frontal gyrus, insula, superior temporal and periolandic operculum, supramarginal, parietal and precentral gyrus, the right thalamus and the left pallidum. The same activation was involved in the differential contrast between syntactic versus psychoacoustic violations. The conjunction analysis of syntax processing in music and in language as like the
comparison between detection of hierarchical rules versus psychoacoustic violation showed language (blue) and in music (green) a preferential left hemispherical network, involving inferior frontal gyrus (p. opercularis and triangularis), precentral gyrus and insula. DTI and c analysis individuated two functionally and anatomically pathways: a dorsal way between opercularis and supramarginalis/precentral gyrus and a ventral along Capsula extrema between p. triangularis and insula. Only in syntax the ventral pathway reached the girus front superior. The direct comparison of language versus music syntax violations involved a strong activation along the left dorsal pathway. On the other and tonality showed a selective M1 pathways on both hemispheres and on right amygdale.

4. Conclusions
This study supports that the physical propriety of the sound is a “necessary but not sufficient” basis for the feeling of the tonality (Lerdahl, 2001). It confirms the numerous behavioural indications that music and language involved distinct domain-specific networks. Both domains, anyway, showed an important overlap in the neuronal resources underlying hierarchic rule processing, which pivotally engaged Broca’s area and its interaction with temporo-parietal areas through two systems: a “rule-identification” system, which may reassume the function of the ventral network and a “rule-sequencing” system as a possible function of the dorsal pathway. Our study suggests that not a single brain region - Broca’s area - or a single pathway - the dorsal stream (Friederici) - but a dual, well interacting network seems to be the major evolutionary advantage.

5. References
Symposium: Communicative competencies in music and language

The Relevance of Pitch for Human Language Acquisition and Communication

Kerstin Leimbrink, Technische Universität Dortmund, Germany

Abstract

Background
The human ability for speech is a field that has been arousing interdisciplinary interest in the past few years. Linguistic, neurological, and music-educational researchers are investigating the connection between the human disposition, physiological processes, and the environmental influences during the process of language acquisition. Evolutionary psychologists have suggested that music and language evolved from a common ancestor and share the same neural resources (Wallin et al., 2000), which enable humans to speak and sing (Patel, 2008). In the first months of life there is no differentiation between singing and speaking (Gruhn, 2008). Mothers and infants use a variety of preverbal vocalizations to regulate their interaction with each other (Trevatthen, 2003). Infants employ prosodic elements (melody, rhythm, timbre, pitch, phrasing, narratives) to interact and to cooperate with their social environment (Tomasello, 2009). While observing narrations and songs of mothers, one can see how emotions are shared by moving and vocalizing together in time (Malloch &Trevatthen, 2009).

Aims
The present study wants to illustrate the structural and functional role of pitch in intonation phrases. It wants to highlight that a differentiated usage of pitch is fundamental for imitation and cooperative behaviour in the process of language acquisition and also for the acquisition of communicative competencies.

Method
The study is an extended case study that is based on daily video observation of 8 mother-child-pairs between the age of 2 and 9 months of the children. It relates vocal utterances to nonverbal utterances of both mother and infants. The study includes descriptions of situation (location, eye contact, movements, physical touch), interaction (verbal expressions and vocal interactions; criteria for observation: onset time, duration, number of activities) and intonation (pitch, melody, rhythm, ‘pauses’). The audio and video data are analyzed by the computer programs Praat and ELAN.

Results
Results from intonation analysis show the salience for pitch range and pitch movements. The mother adjusts her voice’s pitch to the child’s stage of development, and the prevailing interaction context. In the 2nd month the mother mainly imitates the child’s pitch movements (Figure 1) and the pitch range (Figure 2). The pitches of both – mother and child – adapt. At the same time she initiates an interaction with a rising pitch and embeds an infant’s vocalization with a falling pitch movement in a short communicative phrase (Figure 3). This is the first unit of human communication, which is constituted by the variation of pitch. In the 3rd month the mother imitates the infant’s pitch contour and adds a rising or falling pitch depending on the interactive context (Figure 4). Thus phrasing of short units and alternating narrations are established at the age of 4 months (Figure 5).
characteristic rising intonations, typical of questions, capture the child’s attention and stimulate a new vocalization. The result is a mutual imitation of the rising intonation and then falling intonation. The climax is achieved at the point when the child reacts immediately to the mother’s utterance with a long vocalization.

Figure 1: Imitation of the child’s vocalization at the age of 2 months; the child’s vocalization is marked)

Figure 2: Mutual imitation of pitch range
Conclusion
The video based analysis shows that the imitation of pitch has an influence on the infant’s vocal reactions and support the child’s communicative development. Infants are able to communicate from the very first beginning by the usage of pitch. The mother involves the infant into a communicative interaction by regarding the child as a
competent communicative partner. This happens through imitation of pitch range and pitch movements. Supportive structures of the adult, e.g. imitation und extension of the infant’s vocalisations, help to establish short units and alternating narrations. The results of this study reflect the unique human sociability. They show which strategies humans use in order to synchronize with his/her environment and later to acquire knowledge of others with the help of cooperative alternate behavior. The emergence of preverbal interaction sequences provides an explanation about the relevance of synchronization of pitch in different stages of language acquisition. Imitation, extension and variation of pitch are extremely important for the vocal and communicative development of infants. They are the basis for the acquisition of communicative abilities like turn-taking and the use of deictic expressions in forms of verbal and nonverbal pointing gestures.

References

Short biography
Kerstin Leimbrink, Dr.phil., University of Dortmund, Germany. Diploma in Music Education at the University of Music, Detmold, and State Examination in Music, German Linguistics and Literature, and Pedagogy at the University of Dortmund. Doctoral thesis "Multimodal Communication between Infants and Mothers". She is lecturer at the University of Dortmund and is researching in the field of language and music.
9:15am  Symposium: Communicative competencies in music and language

10:30am  A Naturalist Theory of Musical Pitch: The Effort Code in Music and Speech

Ghofur Eliot Woodruff & Ian Cross, University of Cambridge, UK

Abstract

1. Background
The intersection between music and language has proved a rich and rewarding area of research in recent years. Of particular interest have been the investigations of hierarchic and syntactic structures in music and the musical expression of affect owing to its 'iconic similarity' with vocal expression. However, given these substantial ties, it is surprising that the prosodic function of pitch in speech has not been investigated more fully in relation to music. Indeed, some have sought to define musical prosody in such a way that it necessarily precludes consideration of music in terms of the prosodic functions of pitch in speech. Here we seek to address this issue by exploring a set of prosodic speech codes and their potential relevance to the representation of musical pitch.

2. Main contribution
In The Phonology of Tone and Intonation, Carlos Gussenhoven outlines three prosodic codes to account for certain cross-cultural functions of pitch in speech – frequency, effort and production (Gussenhoven, 2005). Each code describes a relational property of pitch (pitch register, interval and contour) which represents a speaker-related affair owing to a non-accidental correlation between that affair and the pitch’s production. The prosodic codes are thought to be cross-cultural insofar as their meaning is allied with their production, but they are not touted as universals as they are not employed by all communities. After reviewing Gussenhoven’s work, we extend the theory by offering a naturalist explanation of the code’s origins. Building upon the received view in ethology that intentional signs emerge from natural signs in the evolution of vocal communication (Hauser, 1996; Krebs & Dawkins, 1984), we suggest that the principle of transitivity is a key enabling factor in the emergence of the prosodic codes owing to the coupling of natural signs in transitive relation (Millikan, 2004).

Turning to music, we demonstrate how the relational properties of musical pitch could derive their content in part from Gussenhoven’s prosodic speech codes. We review existing evidence in support of this claim before presenting empirical data of our own in relation to the effort code, whereby the representation of effort and related affective states varies as a function of pitch-interval size. The hypothesis is that wide pitch-intervals in music are perceived as conveying more effort than narrow pitch-intervals and vice versa.

3. Method and results
Participants were asked to rate the extent to which consecutive pitch-intervals ranging from 0 to 12 semitones conveyed effort and related affective states. Four variables of interval, affect, direction and register were analysed within a fully crossed, repeated measures, within-subjects ANOVA. Significant main effects were found for interval, affect, direction and register, and two-way interactions between affect and interval, and register and interval. The empirical evidence strongly suggests that listeners employ a low-level mapping function which correlates interval size with the expression of effort and related affective states.
Example 1. Results from the effort code in music perception: perceived effort varies as a function of pitch-interval size.

Acknowledging the limits of this investigation, we attempt to situate the findings within a broader framework. Here we employ the proximal-distal distinction from ethology as a way of reconciling music's biological/cultural divide. Music's proximal level constitutes its perceptual effects, whilst its distal level comprises its context-sensitive social functions. The present experiment only tests the proximal effects of the effort code, but speculations as to some of its distal effects are entertained. For instance, wider intervals are featured in infant play-songs for the purpose of engaging infants’ attention, whilst lullabies use narrower intervals in order to assuage infants. This hypothesis, yet to be tested, is offered here in the spirit of reconciling music's low-level content with its high-level social function.

4. Implications
This research suggests that a tighter coupling is evident between the function of pitch in music and speech than has been previously assumed, particularly with respect to the relational properties of pitch height, interval size, and contour. Furthermore, we propose that evolutionary approaches to the question of representation can be of value in offering a cohesive and comprehensive account of music, reconciling its low-level and high-level content whilst maintaining their functionally distinct identity.

5. References

Short biographies
Ghofur Woodruff hails from New Zealand where he earned his Masters with distinction at the University of Canterbury. He is currently a Ph.D. candidate at the Centre for Music and Science, working under the supervision of Dr Ian Cross. Ghofur’s thesis investigates musical meaning from a naturalist perspective, focusing on how theories of human and non-human vocal communication can elucidate our auditory engagement with music. E mail: gew26@cam.ac.uk
Ian Cross is Reader and Director of the Centre for Music and Science at the University of
CIM10: Nature versus Culture

Cambridge, where he is also a Fellow of Wolfson College. He has published widely in the field of music cognition, evolution, and meaning, and has co-edited three books. His current research focus is on music as a bio-cultural phenomenon, and involves collaborations with psychologists, anthropologists, archaeologists, and neuroscientists. E mail: ic108@cam.ac.uk
11:00am  Symposium: Computational and musicological approaches
to emotion in music.
12:15pm
Music, Speech and Emotion: psycho-physiological and computational
investigations
Eduardo Coutinho & Nicola Dibben, University of Sheffield, UK

Abstract

1. Background in Music Cognition.
There is growing evidence that perception of emotion expressed in vocal prosody and in
music shares certain psychoacoustic attributes (Juslin & Laukka 2003). From the
perspective of musicology these findings are significant because they indicate that listeners’
affective responses to music can be accounted for at least in part by “basic” acoustic cues.

2. Background in Computer Science.
Previous research has shown that a large part of listeners’ affective response to music can
be predicted from a small set of psychoacoustic cues (Coutinho & Cangelosi, 2009), and
physiological variables (Coutinho & Cangelosi, in press).

3. Aims
Our goal is to better understand the way people perceive emotion in music and speech
prosody, i.e. the way people infer the emotional state of others from nonverbal aspects of
speech.

4. Main Contribution
The method involves asking participants to listen to a set of music pieces and speech
excerpts, while reporting their emotional experience using a computer framework interfaced
with a device that controls the movement of the cursor or pointer on a display screen. At
the same time we measure participants’ physiological reactions during listening, namely
heart rate, skin conductance, respiration and blood volume pressure. The data collected
from the mouse position and the physiological readings is used to analyze the participants’
psychological and physiological reactions to the stimuli and to compare them with the
psychoacoustic properties of the music and speech. Each participant also completes a set of
short questionnaires that gather relevant personal information, such as age and gender
(and other demographic variables), exposure to music, years of musical training, personality
traits and mood state. This information is used to test various sub-hypotheses about the
factors influencing perception of emotion in music and speech prosody. This is the first time
that an attempt has been made to study the relationship between expression of emotion in
music and speech prosody in longer excerpts of music and speech.

5. Implications
Evidence that the perception of emotion conveyed by music and speech relies on shared
psychoacoustic characteristics lends credence to the idea that, to some extent at least,
emotion perception relies on ‘basic’ attributes that are adaptive responses to environmental
cues. This emphasises the role of the natural in emotional expression in music, contrary to
the predominance of cultural (semiotic) models of musical expression. Furthermore, the
identification of shared characteristics of emotion expression in music and speech prosody
may contribute to evolutionary perspectives on music and language.
6. References

Short biographies
Dr Eduardo Coutinho is a Postdoctoral Research Fellow at the University of Sheffield, and his research centres on investigating the relationships between the dynamics psychoacoustic features in music and speech and the communication of emotion. In 2008, he completed his doctorate in cognitive sciences at the University of Plymouth with a thesis on the effects of music in human emotions by means of psycho-physiological empirical experiments and computational models.

Dr Nicola Dibben is a Senior Lecturer in Music at the University of Sheffield, and has published over 25 papers and book chapters in musicology and music cognition. She has recently published two books: Björk (Equinox Press, 2009) and Music and Mind in Everyday Life (Oxford University Press, 2010).
11:00am Symposium: Computational and musicological approaches to emotion in music.

12:15pm Schubert and the Psychology of Emotion: Music Analysis versus Computational Modelling

TuomasEEerola, University of Jyvaskyla, Finland
Michael Spitzer, University of Liverpool, UK

Abstract

1. Background
Many studies in music psychology have identified the dominant cues associated with the expression of emotion (reviewed in Gabrielson & Lindstrom, 2010). Basic emotions and affective dimensions have been characterized by specific combinations of dynamics, articulation, tempo, harmony, texture, and timbre (e.g. Schubert, 2004; Ererola et al., 2009), often in connection with the expression of vocal emotion (Juslin & Laukka, 2003). Despite advances in techniques of computational feature extraction, as well as in ways of relating these features to emotion, understanding musical emotion remains at a fairly rudimentary stage. That is, the subtlety of musical emotion, especially in sophisticated art music such as Schubert Lieder, continues to elude music psychology (see Zentner et al., 2008). Insights provided by music analysis could point out ways to improve recognition of emotions in music; likewise, computerized analysis of music may also bring valuable tools for musicological analysis. Furthermore, differences in orientation between analytical and computational approaches may point to a more dynamic, process-driven, model of musical emotion, orientated as much to ‘action tendency’ (the goal-driven unfolding of emotion in time) as designative expression (semiotic snap-shots of moments in time).

2. Aims
Two interlinked studies compare musicological and computational analysis of musical emotions as embodied in the structural features of a single song: Schubert’s Erlkönig. The work unfolded in the following stages:
1) Expert analysis of the song, focusing on how its structural features express and unfold basic emotional categories.
2) Comparison of the analytical annotations with computational features extracted from the samples.
3) Comparison of the effectiveness of two models, based respectively on film soundtracks and expressive piano performance.

The project has several objectives. We can assess the style-specificity of Schubert’s emotions by comparing the three analytical strategies applied to the song: (a) Expert annotation; (b) Audio-based model trained on a corpus of film music (Eerola et al., 2009); (c) Audio-based model trained on a selection of expressive piano performances (based on materials by Resnicow et al., 2004). The two latter analytical models will provide direct insights into the style-specific aspects of the emotions as well as novel information about the feasibility of such models in non-synthetic and non-manipulated musical material.

3. Method
An expert analyst segments and annotates Schubert’s Erlkönig according to its main emotional categories, on the basis of the song’s structural features. Using a recorded performance, the song’s acoustical features are extracted, focusing on the five segments
identified by the analyst. Next, the emotional character of the song's segments are predicted, utilising (a) a film soundtrack model; and (b) an expressive piano performance model. Finally, the results of these two models are related back to musical intuitions of the song by the analyst.

4. Results
Analysis of the music suggested that Schubert's song expresses five basic emotions, while the song as a whole projects the overriding emotion of Fear. Feature extraction reveals that both models (film soundtrack and piano performance) support the analyst's intuitions in complementary ways. The film soundtrack model, while appearing less sensitive to the song's passing details, nevertheless effectively brings out the song's overall character of Fear. It thereby suggests the role both of 'blended' and 'background' emotions in complex art music. On the other hand, the piano performance model revealed sharper distinctions between the affective character of the song's various segments.

5. Conclusions
We provide two contrasting approaches to analysing expressed emotion in Schubert songs. On the one hand, by drawing on the informed intuitions of the expert analyst, we expose the limits of automatic descriptions – even those employing state-of-the-art audio-based emotion models. The two chief limits are insensitivity to (a) compositional strategy; and (b) the temporal aspects of emotion. On the other hand, expert analysis also provides much evidence corroborating the power of automatic computational modelling. We conclude that both approaches offer vital and complementary techniques to understanding expressed emotion in complex art music. Emotion research would benefit hugely from a continued dialogue between them.

Short biography
Tuomas Eerola has graduated from the University of Jyväskylä, Finland with PhD dissertation (2003) that concerned the dynamical aspects and cross-cultural correlates of melodic expectancies. He currently acts as a Senior Researcher at the Finnish Centre of Excellence in Interdisciplinary Music Research within the University of Jyväskylä, Finland. He holds a position (associate professor) at the Department of Music at the University of Jyväskylä and has acted as a substitute professor at the same Department between 2006-2008. His research interest lies within the field of music cognition and music psychology, currently mainly in perception and induction of emotions in music. The approaches to these topics consist of combining computational modelling and empirical (behavioural) experimentation. Eerola has published in a variety of international journals (e.g., Cognition, Music Perception, Musicae Scientiae, Journal of Acoustical Society of America, Psychology of Music). More information http://users.lyu.fi/~ptee/

Michael Spitzer is Professor of Music at the University of Liverpool, having taught for many years at Durham University. He is author of Metaphor and Musical Thought (University of Chicago Press, 2004), and Music as Philosophy: Adorno and Beethoven's Late Style (Indiana University Press, 2006). He organised the International Conference on Music and Emotion (Durham 2009), and is editor of Music Analysis's forthcoming Special Issue on Music & Emotion (2011). He is currently writing a book on emotion and musical structure. Michael Spitzer has been President of the Society for Music Analysis since 2007. He directs the annual SMA Music Analysis Summer School.
13:30pm  Performance and popular culture

15:00pm  Nature versus Culture in ritardando performances

Miguel Molina-Solana, University of Granada, Spain
Maarten Grachten, Ghent University, Belgium

Full Paper

1. Background in Music Performance.
The first empirical studies on music performance date back to the beginning of the 20th century, mainly focusing on timing in performance. In the last decades, performance studies have earned recognition as a discipline in its own right.

2. Background in Computing.
Machine learning and data mining techniques have been widely applied to expressive music performance, focusing on finding general principles underlying expressive 'deviations' from the musical score in terms of timing, dynamics and phrasing. These principles aim to model aspects of renditions in a formal quantitative and predictive way (Widmer & Goebl, 2004). Modelling of performances has also been used for identify the performer of a musical work (Molina-Solana et al., 2008; Saunders et al., 2008).

3. Aims.
The main aim of this work is presenting a particular face of the nature vs. culture debate, applying it to music performance. Nature and culture are matched respectively with the structure of the piece and the intentions of the performer. We focus on ritardando performance as it is a commonly studied resource in music performance research.

4. Main contribution.
We present in this work the two traditional visions for the role of performers in music performance. These two alternatives can be seen as a particular case of the nature versus culture debate. The first vision considers that performances are shaped by the structure of the piece, with the performer being a mere transmitter. The second one claims that performers do have a more active role, with the obligation of shaping the music according to their own will. We offer a brief review of several ideas and works, supporting both sides, about the issue. Besides this discussion, we describe our own experimentation.

5. Implications.
Several works dealing with performer and piece identification using expressivity on the performance come to the conclusion that both the performer and the piece are important for a given performance. Obviously, this importance varies depending on the style and the performer. Our own experimentation on ritardandi shows that, despite the fact that ritardandi are mainly piece-dependent, there are clear evidences of performer signatures on them.

Music might be viewed as a communication process in which composers code musical ideas in notation, performers recode from the notation to musical signal, and listeners recode from the signal to ideas (Kendall & Carterette, 1990). Henceforth, the role of performers in this system is a central one; without them, the composer’s message could hardly reach the listeners. Of course, the relative importance of performance in music differs depending on
the structure of the piece, genre, and performers themselves. An immediate question researches has asked is why performers play in certain ways.

The first empirical studies on Music Performance dated back to the beginning of the 20th century, mainly focusing on timing in performance. In the last decades, performance studies have earned recognition as a discipline in its own right.

We present in this paper a study of how this relationship has been addressed in the performance of ritardando. The central question would be: Are performances shaped by the performer or by the piece?

For our work, we will take advantage of the fact that studies on measurement of performances are, with difference, the most numerous within the empirical research on music performance.

We will constrain our study to Western classical music, as it is by far the most studied domain in the existing literature. We will also concentrate on timing, especially in ritardando (the slowing down toward the end of a performance). However, many other aspects (such as dynamics, articulation or vibrato) could be object of study, and included in this nature vs. culture debate.

We argue here, that the nature-culture distinction can also be made in the context of expressive music performance. As said above common view on the process of musical performance is that the purpose of musical interpretation is to express intentions to the listener. Although there may not be a single unambiguous way to express such intentions, there are definitely constraints on the way this communication takes place. In part, the performance is constrained by purely natural phenomena, such as the motoric and perceptual characteristics (and limits) of the performer and listener as human beings. For example, in order for a listener to be able to grasp the rhythmic and metrical structure of the music, a performer should keep tempo fluctuations within certain limits (Honing, 2005). Another natural constraint, that nevertheless appears to have a cultural taste, concerns the expression of phrase structure. Musical phrases seem to be universally marked by arch-like forms of timing and dynamics (Clarke, 1988; Todd, 1985). This practice of demarcating temporal structure might be explained by a reference to Gestalt-theory, but it can also be regarded as a cultural convention.

Further constraints in expressive music performance are unequivocally cultural, for instance the performance conventions that belong to particular historical genres, such as baroque music.

In spite of the many levels of constraints natural and cultural constraints in music performance, there is apparently still enough freedom for performers to develop their own personal style.

Although natural and cultural factors do not need to be framed necessarily as being opposed, the above examples suggest a gradual ordering of factors influencing performance, ranging from purely natural (biological constraints) to increasingly cultural, and ending in individual or personal factors. This ordering can also be seen as ranging from necessity (in a physical sense) to contingency.

Our approach to investigating the individual style of music performers has been to separate the individual component of expression in performances from the common component.
across performers. Thereby we effectively divide the natural-cultural range into that which is individual (one could say ‘hyper-cultural’) and that which is not, assuming that everything which is not individual is roughly constant across performers, and can therefore be indexed by piece rather than by performer. Although this is admittedly a huge simplification, we believe it is methodologically useful in the study of such complex phenomena.

7. Music Performance

The process of performing has been traditionally little investigated. According to the idea of music as a communication system, performers are in charge of carrying the composer’s message to the listener. Providing that it is commonly assumed that performances transmit emotions, many studies have focused on discovering if such emotions are due to the performer intention, or the melody itself (the structure of the piece).

Some studies in music performance are related with either performer identification or piece identification. The objective in performer identification is to discover the personal touch - that we will call culture- that is responsible of distinguishing one rendition from another even if they both are of the same piece. Several studies support the existence of this component (Molina-Solana et al., 2008; Saunders et al., 2008).

Opposed to performer identification (where performers are supposed to have distinctive ways of performing) is piece identification --which requires the structure of the piece to imply a particular expressive behaviour, regardless of the performer. In other words, the existence of a norm to perform a given piece is supposed on this approach. It also assumes that all performers will follow these universal principles. In the context of this work, those common principles will be called nature.

Persson (2001) claimed that performers are influenced by both ‘internal’ (e.g. emotions, wanting to express something personal) and ‘external’ factors (e.g. musical style, the structure of the piece, the composer’s intentions).

According to Juslin (2003), some examples of piece-related factors that might influence a performance are the structure of the piece itself, its genre and style, the notation, and comments from the composer. Some performer-related factors could be performers’ technical skills, their mood while playing, their expressive intentions, and interaction with co-performers and with the public.

Of course, there seem to be other aspects that affect music performance that are not directly controlled by the piece or the performer. We can include here acoustics, condition of the instruments, and even performer’s random variations and motor capabilities.

Two traditional points of view about the role of performers with respect to a musical interpretation can then be identified depending on whether performers take a passive or active role. We will see both aspects in the following sections.

8. The piece (nature)

The first one considers the performer as a mere transmitter. Hence, performances are mainly determined by the original expressive intentions of the composer. This approach implies a careful study of the score and the composer by the performer, allowing no creativity.

One of the clearest examples of this vision is the work by the scholar and pianist Roy Howat (1995). He indicates that the performer cannot follow his will; rather he should express the music as the author devised it. This way, he makes a critic to those performances that he
CIM10: Nature versus Culture

considers to be non-scholarly styles of playing.

Performers analyse the structure of the piece according to the current aesthetic norm, and then they express it following those principles. Other factors such as the style and historical context of the piece also help to prescribe how performers should interpret the piece. It is reasonable to think that pieces from contemporary authors share several compositional and interpretative resources.

The structure of the piece, its genre, its author... they all conform the nature of the piece. Several researchers have proposed models of performance. The fact that they have been proposed in itself may suggest the hypothesis that some performance principles do exist and are common to several pieces and performers. These principles might summarize and explain given phenomena.

Examples of such models are the ones proposed by Widmer and coworkers (Widmer & Goebl, 2004) -obtained automatically from measurements by machine learning; the one by Mazzola and Beran (1998) -supporting that performance depend only on the score; and the GERMS model (Juslin, 2003) -which takes into account several sources for expressivity.

The GERMS model is of special relevance as it is, to the best of our knowledge, the first model including both aspects from the nature of the piece, and from the culture of the performer (next section).

9. The Performer (culture)
On the other hand, we can find authors that support that the ’intuitive feeling of music’ precedes the logical analysis. They consider that performers should have much more freedom, playing a bigger role than just being a mere transmitter. This view encourages performers to play according to their own aesthetical judgements, which can even come from simple intuition. The performer can shape the piece in order to express a different emotion than the one the composer initially devised.

This is possible because music sheets are far from being complete descriptions of the music, despite the fact that they are the most reliable reference of our classical repertoire. This gap allows the musical sense of the performer –apparently not very scientific- to exist and have a key role in the process. This way, performances are not just a monotonous and mechanical transcription of the written notation.

Several studies have proved that a given piece allow different valid performances by just modifying some acoustic parameters (i.e., the same notated structure can be performed in several different ways). Each of those performances generally leads to the expression of a different emotion.

Expressive abilities differ according to individual levels of expertise and may also differ among individuals because of gender and idiosyncratic cultural preferences in coding the expressive identity and musical location of sonic qualities (Sloboda, 1996). This claim indicates that performer can shape the expressivity of a given work.

The standard paradigm in studies of emotional expression in music performance relies on this. This paradigm is as follows: performers are asked to play a number of melodies expressing different emotions and those recordings are later analysed to study which acoustic means were used to shape the melodies. Those experiments point out the fact that several emotional performances can be done over the same melody. Hence, all these researches rely on the hypothesis that emotional performances do not depend solely on the piece, as there are several valid performances; rather, it is the performer who decide how to finally shape the melody.
According to Davidson (2002), some of the factors that may influence the development of a solo performer are early strong experiences of music, frequent exposure to music and support from others, motivation and personality.

10. Nature vs. Culture in Ritardandi
According to Gabrielsson (2003), the majority of research on music performance is focused on measurements, especially on timing as it is used in performances on all instruments. But what is timing? The term timing refers -within this context- to how the duration of notes differs during a performance from what is actually written on the score (the so-called 'mechanical performance').

Penel and Drake (1998) discussed three alternative explanations for expressive timing in music performance. They also conclude that all of them may contribute in different combinations. These explanations are: a) use of timing to highlight and communicate the musical structure to the listener; b) use of timing to compensate perceptual biases in time perception; and c) timing as an effect of biomechanical and instrument-related constraints. As the reader can see, the latter two explanations are more or less involuntary, whereas the first is completely under control of the performer, who uses timing to express certain emotions.

Even more, those timing variations have in practice been proved to contain little noise, as performers are able to replicate them with a high accuracy. How and when those variations are made make listeners appraise different emotions. This fact suggest that some patterns exist which produce different feelings. In fact, analysis of recorded performances revealed that almost every performance variable was affected in ways specific to each emotion.

In a study by Johnson (2000), experts performed a section of Beethoven’s Symphony No. 5 in three versions: mechanical, interpreted and exaggerated. By analysing these performances, Johnson came to the conclusion that the versions differed considerably more in timing than in dynamics.

This fact may suggest that timing is more affected by the performer’s expressive intention, while dynamics are more stable among performances. In other words, it may suggest that a musical score admit several timings (which depend on the performer), while dynamics are more constrained (depending more on the piece).

Of course this is not a rigid claim, but summarizes in the context of our present discussion between culture and nature, the results by Johnson.

A particular case of timing is ritardando. It is the slowing down toward the end of a performance to conclude it gracefully. Even though, ritardando is a tiny part of a whole musical work and can hardly represent a musical performance, we feel that it is representative of what we want to illustrate in this paper: the trade-off between piece (nature) and performer (culture). Johnson’s results would suggest that ritardandi are more prone to be performer-dependent. However, intuitively that dependency is not clear. Studies on analysis and computational modelling of ritardandi show that evidences supporting both visions do exist. In the following lines, we will describe our own experiment to support that claim.

We employed Friberg and Sundberg’s (1999) kinematic rubato model as a means of studying the performed ritardandi. The original data consisted in measurements of timing data of musical performances taken form commercial CD recordings of Chopin’s Nocturnes. We represented these data by the model parameters obtained by fitting the model to the
data. That representation was proved (Grachten & Widmer, 2009) to be mostly piece-dependant. However, we investigate whether the model parameters, when normalize per piece, reveal the performer's identity more clearly. To test this hypothesis, we carry out a set of experiments using machine learning classifiers with leave-one-out cross-validation. A more detailed description is found in Molina-Solana et al. (2010, submitted).

The results indicated that in spite of the extremely reduced data representation we use, pianists can often be identified with accuracy significantly above baseline. Also, they point out that performer's signature exist in music interpretation regardless of the particular piece being played.

11. Conclusions
Music performance research is a very active area of research, with studies on measurement of performances being by far the most numerous. These studies are increasing the knowledge about why performers play in a way or another.

We have presented here the two views on the role of performers. These two alternatives can be seen as a particular case of the nature versus culture debate. The first vision considers that performances are shaped by the structure of the piece, with the performer being a mere transmitter. The second one claims that performers do have a more active role, with the task of shaping the music according to their own will.

In our opinion, there is something to be said for both views: the performance of a musical piece contains both nature and culture aspects. Our work offers a brief review of several ideas and works, supporting both sides, about the issue. In this context, we have also summarized work-in-progress, in which we investigate the balance of performer and piece specific aspects of expressive timing in ritardandi.

12. Acknowledgments. M. Molina-Solana is funded by FPU grant AP2007-02119. Authors want to thank the support of the Department of Computational Perception at the Johannes Kepler University.

13. References


**Short biographies**

**Maarten Grachten** is postdoctoral researcher at the Department of Computational Perception, JKU. His qualifications include PhD in Computer Science and Digital Communication, Pompeu Fabra University (ES). Contact: maarten.grachten@jku.at

**Miguel Molina-Solana** is predoctoral researcher at the Department of Computer Science and Artificial Intelligence, University of Granada, Spain. His qualifications include a M.Sc. in Soft Computing and Intelligent Systems from the University of Granada, Spain and Piano Intermediate Studies at Conservatory of Granada. Contact: miguelmolina@ugr.es
13:30pm  
Performance and popular culture

15:00pm  
Respiration as an Emotional Tool in Operatic Singing

Katty Kochman, Marc Leman & Dirk Moelants, Ghent University, Belgium.

Abstract

1. Background: Performance
Respiration is an essential element in operatic singing performance, providing the singer support for the proper production of tone. However, respiration can also serve as an expressive element in the communication of dramatic ideas, creating an emotional subtext to the expressive intentionality of the piece. Previous research supports the relationship between respiration and dramatic intention in classical singing. Foulds-Elliot (2004) identified a significant difference in the sound pressure level, as well as time taken on inhalation and exhalation in the rehearsal and performance environments for classical singers.

2. Background: Systematic Musicology
Vocal performance provides a unique viewpoint in the application of the ideas related to embodied music cognition, as the body functions as the primary mediator and performance medium. The singer's use of respiration is used as a measure to examine the role of embodiment when communicating emotional and musical intention. Respiration was found to be an accurate reflection of corporeal intention and was used to quantify the establishment of mutual adaptive behavioral resonances between musicians and audiences when articulated through the expressive intention of the singer. (Leman, 2008)

3. Aims
The central research question of this study was to examine the correlation between respiration and the intention to communicate emotional content in operatic vocal performance. Research generated preliminary data regarding potential changes in dramatic intention and emotional expression. Researchers sought to investigate how respiration in singing could be utilized by the artist to enhance the emotional intensity of the music and communicate dramatic intention to the audience. This data was used as a method of elucidating the relationship between expressivity, respiration, and embodiment as a means of artistic communication between singer and audience.

4. Main Contribution
The study provides insight in learned behaviors and meaning construction through social interaction in musical performance. This research should assist in the development of research models that provide information about the effect of communication of musical and emotional meaning on the physical aspects of singing.

4.1 Methodology Two experimental conditions were utilized; rehearsal without audience and performance with audience interaction. Subjects performed the same operatic repertoire in both settings and data was collected through the use of inductive plethysmography, which consist of inductance bands interwoven with fiber optic cable worn.

4.2 Results Data measured in the course of the study included inspiration/expiration phases, respiratory rhythm and amplitude, and abdominal and inter-costal expansion. Preliminary results indicate a significant difference in the respiration phases for the two experimental settings, demonstrating the impact of the changing expressive intention of participant. While the values reported were relative to a particular participant, significant statistical
difference was found in inhalation expansion values and exhalation values for both the lungs and abdomen between the experimental conditions.

5. Implications
This study investigates the role of embodied communication in singing performance, using theories of corporeal intention and performer interaction. In classical singing, respiration functions as a corporeal articulation that allows researchers to quantify the impact of joint attention and the action – reaction cycle in musical communication between performer and audience. Furthermore, respiration, as a key variable, significantly affects the expressive intention of a classical singer. The study’s findings demonstrate the role of nonverbal communication in cultural transmission, within the context of musical performance. Respiration is not only a natural function supporting the vocal instrument, but also serves in the mutual construction of meaning and emotional attunement.

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Foulds-Elliott, Susannah (2004). Respiration in operatic singing: intention to communicate, PhD Dissertation, School of Communication Science and Disorder, University of Sydney, 2004

Short biographies
Katy Kochman is a Ph.D. researcher at the Institute of Psychoacoustic and Electronic Music (IPEM). Her research incorporates the development ecological models for the study of performance and embodied cognition in music. She has an M.A. in Music and is experienced in performing operatic repertoire. She has also earned an M.S. in Education, with a background in behavioral analysis and therapy.

Marc Leman is the Director of the Institute of Psychoacoustic and Electronic Music (IPEM) and a Professor in Systematic Musicology within the Department of Musicology at the University of Gent, Belgium. He has a background in philosophy and his current research activities include cognitive/emotive, and social/cultural approaches to music analysis.

Dirk Moelants studied musicology at Ghent University (Belgium) and viola da gamba with Wieland Kuijken at the Royal Conservatoire of the Hague (the Netherlands). He is currently working as assistant professor at Ghent University where he teaches music theory and ethnomusicology. His research focusses on rhythm and timing in the performance and perception of music. As a musician he performs early music as well as contemporary classical music and traditional music of different cultures. He performed throughout Europe, as well as in Japan, Korea, Taiwan and Morocco.
13:30pm  Performance and popular culture
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15:00pm  Reading Tabs and Playing Rock: A Study of Pop-Rock Guitar Tablature

Timothy Koozin & Jennifer Mishra, University of Houston, USA

Abstract

1. Background in Music Theory
Tablatures have been used to preserve and transmit musical performance information since ancient times. Guitar “tabs” can now be found online for most any popular song. Tablatures provide mappings of physical action rather than detailed representations of musical sound. While tablatures lack the status of musical scores, they offer a conceptual model for musical action that cannot be fully inferred from musical scores or from music listening alone. The topography of the guitar fretboard and the rhythmic actions of guitar playing are significant performative elements that have not been fully considered in studies of harmony and rhythm in pop-rock music. Guitar tablature provides a starting point in creating a visual model for basic musical actions in pop-rock guitar playing.

2. Background in Education and Psychology
In recent years, there has been a movement in music education to include popular music learning practices in school music classrooms. Lucy Green’s work in this area is particularly notable (Green, 2002; 2006). An authentic learning approach to popular music includes students not normally involved in school music while encouraging them to interact with musical materials in ways that popular musicians do, which for guitarists, may include using tablature rather than traditional Western notation. Reading tablature is a qualitatively different experience than reading traditional notation. Investigating the way children interact with this alternate visual representation may have widespread implications for music education.

Because tablature informs action and sound perhaps differently from traditional Western notation, exploring tablature may provide insights into the cognitive processing of music, including memory, Gestalt pattern recognition, and cross-domain mapping (Lakoff and Johnson, 1980; Zbikowski, 2002).

3. Aims
The aim of this study is to explore how musical practices documented in guitar tabs can inform our understanding of theory, practice, and the communication of meaning in pop-rock music. A focus on patterns of physical motion in guitar playing will show that chords and figurations characteristic of pop-rock music can be understood as instances of more generalized hand position shapes and motions indexed to intervallic distances on the fretboard. The presentation interrelates idiomatic actions of guitar playing to chord patterning, riff structure, more complex chords, and alternate tuning.

4. Main Contributions
The study will show how physical constraints inherent in guitar playing may shape musical materials and compositional processes evident in pop-rock music. The guitar fretboard will be explicated as a model of pitch space, showing how harmonic, melodic, and rhythmic patterning in analyzed pop-rock songs are directly related to fundamental patterns of human movement idiomatically suited to the guitar. Further, the study will investigate how musical
understanding is socially constructed by musicians through the informal online discussion of guitar tablature.

5. Implications
As a study of musical behavior in guitar playing and its visualization in popular music guitar tablature, this project reaches into many areas, including perception and cognition, performance and analysis, structure and compositional process in popular music, pedagogy of music reading, music memorization, the study of musical online communities, and the legal issues arising in the digital transmission of intellectual property. A deeper understanding of guitar idioms will aid in the analysis of more complex and soloistic playing and varying style traits found in different genres of popular music. As a component of emergent online culture, guitar tabs are a part of the meaning and cultural knowledge associated with songs. Musical tablatures are a widely popular mode of visual symbolic representation that has yet to be fully explored either by music theorists or educators.

References

Short biographies
Timothy Koozin
Current position: Associate Professor of Music Theory, University of Houston, USA
Main research discipline: Music Theory
Main research areas: Music theory and analysis, aural skills, post-tonal music, popular music, instructional technology
Relevant qualifications: Ph.D. in Music Theory, University of Cincinnati, 1989; M.M. in piano, Ohio University, 1982
Published in journals: Perspectives of New Music, Contemporary Music Review, Music Theory Online, College Music Symposium, Notes, Computers in Music Research
Editorial advisory boards: Music Theory Online (editor 2001-2008), Journal of Interdisciplinary Music Studies (currently)
CIM10: Nature versus Culture

Contact: tkoozin@uh.edu

Jennifer Mishra
Current position: Associate Professor of Music Education, University of Houston
Main research discipline: Music Education
Main research areas: Pre-service teacher education, string education, musical memorization, non-Western music
Relevant qualifications: Ph.D. (major: music education; minor: psychology), Kent State University, 1999; M.M.E. Kent State University, 1994; B.M.E. University of Northern Colorado, 1991
Published in journals: Psychology of Music, Psychomusicology, Asia Pacific Journal for Arts Education, Bulletin of the Council for Research in Music Education
Contact: jmishra@uh.edu
13:30pm  Performance and popular culture

15:00pm  How the continuous fascination of Music Reality Shows can be understood as an Emotional and Bio-Culturally Induced Phenomenon

Katrin Döveling, Free University Berlin, Germany
Paul Michael Coleman, University of Westminster, UK

Abstract

1. Aims
To present the case that music, art and culture are the natural mystical manifestations of the human condition to expressing its biological/emotional needs, and how this phenomenon can be processed for exerting a powerful influence on how we behave culturally: what we term ‘bio-cultural behaviour’ designating MRTV as a case study.

2. Main Contribution: Abstract

Using this case study, the essay will make a connection between our natural instinctive behaviour towards collective cultural participation and the wide emotional appeal of MRTV shows for mass audiences. Research evidence (Döveling 2007, 2008) highlights that the internationally produced programmes like “The X-Factor”, “American Idol” and “Popstars” etc. have engineered audiences into becoming an integral and highly emotionalized function within the televised plot. This paper explores the basis for the emotional involvement of audiences with these music talent shows in respect not only of the motivational studies of Maslow (1976, 1987, 1999) and the ‘hierarchy of needs’ but equally ‘uses and gratification’ research of Palmgreen (1980, 1981). The analysis will focus on the role of the dramaturgic staging of emotions as well as emotional motives and outcomes of music talent shows within the television audience.

The contention is that it is not simply the diversity and drama within its emotional spectrum that leads to a continuous demand on the side of the recipient, as well as within the media production, but also the underlying opportunity for ‘emotional management’ (Döveling 2007, 2008) in front of and behind the television screen. We reveal that the success of these shows originates from a dynamic bio-cultural process that incorporates inherent emotionalized needs in a mediated society and engenders a reception process that discloses highly relevant socio-cultural developments in respect of our basic biological drives to advance our own position within society. Therefore, it will be efficacious to analyse the structures that are in place around the domain of musical cultural dissemination and to scrutinize if these methods are being used for the greater good of artists and the overall music business (and society) and thereby maintaining a healthy environment or simply for the short-term gains for those who create such programming. The paper will examine the roots of socio-evolutionally based needs and behaviours as manifesting itself via MRTV in ‘Emotional Management’ and how it appeals to a fundamental need of ‘belongingness’ and if there are basic biological agendas (conscious or sub-conscious) being followed by all the protagonists involved.

3. Implications for Musical Practice
The ensuing research paper will promote a more enlightened contextualisation of how we express our emotions and individual biological agendas via cultural engagement and
performance.

4. Implications for Musicological Interdisciplinarity
The new perspective on the importance of bio-emotional expression in music and enactment will establish the significance of a multi-disciplinary perspective on the analysis of musical/cultural interpretation and annotation.

5. References

Short biographies
Katrin Döveling, Dr. M.A. earned her Doctorate at the University of Erfurt, Germany in 2004. Her thesis focuses on an analysis of the community building functions of emotions in mass media. She was awarded a Doctoral Research Scholarship at the Dept. of Sociology, UC Berkeley, U.S.A. She received her M.A. in Sociology, Psychology, and Communications Studies at the Heinrich-Heine-University Duesseldorf, Germany. She has lectured in the US, France, England, France and she is also visiting Professor at the University Val de Marne Paris. She is Assistant Professor at the Department of Communications at the Free University Berlin.

Her research interests include the analysis of emotions in media psychology, media sociology, communication studies, Reality TV, infotainment, identity and religion and the mass media, mass media entertainment, visual communication, intercultural communication. She teaches media psychology and media analysis with a focus on emotional media reception, interpersonal communication and media entertainment. Publications include: Emotions- Media- Community, VS Verlag, 2005. She is co-editor of „Im Namen des Fernsehvolkes“ [In the Name of the TV Audience. New formats for orientation and evaluation]: UVK, 2007 (together with Mikos/Nieland) and upcoming „Handbook of Emotions and the Mass Media“(Routledge, 2009, with v. Scheve)
She is reviewer for “International Communication Association” (ICA), Mass Communication Division, Popular Communication Division,, Visual Communication Division, “German Communication Association (DGfU)

Paul Michael Coleman is a final year PhD candidate at the the Centre for Research and Education in Arts and Media (CREAM) in the University of Westminster, Harrow, London, which is one of the UK’s leading centres for research in visual and media arts, design and music. He started his career as a music and TV professional in his native Ireland where he managed Blackhorse Studios and the associated record label in Dublin, releasing a number
of nationally successful records, worked in the studio with a number of very successful international and Irish artists and also on a number of TV shows and movies in his native Ireland as well as the world renowned Olympia Theatre. In 2003 He returned to College to complete a HND B/TEC Higher Diploma in Music & Media Management, at Ballyfermot College, Dublin. In 2005 he completed his B.A. Hons Degree in Music Management & Studio Production. In 2006 he also completed a Masters Degree in Audio Production at the University of Westminster.

His Research Project deals with the issue of how the dissemination of popular music culture via the vehicle of Music Reality Television (henceforth MRTV) is impacting on the overall music business ecosystem in UK and Ireland. This study has drawn him towards the debate on how biology impacts on culture and how this phenomenon leads to what he terms ‘bio-cultural behavioral patterns’.
16:00pm  Universals and origins of compositional structure
-
17:30pm  Consonance and dissonance in music theory and music psychology

Richard Parnsworth, University of Graz, Austria
Graham Hair, University of Glasgow, UK

Abstract

1. Background in music theory and composition
Theorists and composers agree that consonance and dissonance (like tension and relaxation) depend strongly on temporal and historical context, style/genre, and the listener's experience, expertise and preferences. Composer James Tenney (1988) identified five different consonance-dissonance concepts in Western music history. CDC-1 applies to melodic relationships – the simple ratios of octaves, fifths and fourths. CDC-2 and CDC-3 apply to harmonic dyads in two-part counterpoint. CDC-4 applies to early major-minor tonality and refers to tones relative to roots (e.g. a dissonant seventh). CDC-5 (19th Century) refers to whole sonorities, timbres and intensities. Tenney's concept (like his music) focused on harmonic (vertical) relationships. But C&D perception also depends on the melodic (horizontal, linear, voice-leading, contrapuntal) context. Various theories have addressed interactions between C&D and similarity, proximity and primacy-subsidiarity; Rameau and Riemann focused on vertical aspects, Schenker on horizontal.

2. Background in music psychology
Tenney explained CDC-1 by tunability (string-length ratios), CDC-2 by Stumpf's fusion, CDC-3 by the clarity of the lower voice, CDC-4 by Rameau's basse fondamentale, and CDC-5 by Helmholtz's roughness. Similarly, Terhardt (1974) analysed C&D into roughness and "harmony", the latter involving his virtual pitch, Stumpf's fusion, and Riemann's harmonic function. Roughness and fusion can explain the dissonance of the perfect fourth in CDC-3 (Tenney), as well as the central role of major and minor triads in tonal-harmonic music - rendering other theories (e.g. harmonic dualism) obsolete (Parnsworth, in preparation).

Music preferences depend on arousal, pleasantness, and familiarity (Ritossa & Rickard, 2004); in particular, C&D depends on familiarity (Cazden, 1980; Schoenberg, Harmonielehre). With increasing exposure, listeners become more sensitive to tonal microstructures and perceive them differently. New musical styles and C&Ds emerge as performers, improvisers and composers experiment within cultural and psychological constraints.

Krumhansl (1990) quantified the stability of chromatic scale steps and investigated perceived relationships between successive sounds in tonal contexts. Correlations between tone profiles of successive sounds, passages or keys are quantifications of C&D. Parnsworth (1989) analysed linear relationships into perceived pitch commonality and pitch distance. Perceived pitch includes pitches at missing fundamentals (e.g. a C major triad implies pitches at F and A). Variations in pitch salience are included in mathematical formulations of pitch commonality and pitch distance.

3. Aims
We extend Tenney's CDCs to include linear relationships and cover more styles and theoretical approaches. We clarify distinctions between nature (roughness? fusion? distance?) and culture (familiarity, social function, history of ideas) in accounts of the
historical development and modern perception of C&D. We strive for a new synergy between relevant humanities (history of music, history of music theory) and sciences (acoustics, psychology, psychoacoustics).

4. Main contribution

Tenney’s idea of tunability as a basis for CDC-1 is consistent with Wolfe and Schubert (2008). But similarity ratings of successive tones suggest that CDC-1 also involves pitch commonality and the pitch ambiguity of isolated harmonic complex tones (Parnucutt, 1989; Terhardt, 1974).

When music theoretic common-tone concepts are extended to include implied pitches and pitch salience, new light can be shed on old music-theoretic problems. In diatonic chord progressions, for example, harmonic roots often fall through fifths and thirds. A possible explanation is that implied pitches in the first chord are realised in the second.

Tenney did not directly address 20th-Century tonal styles such as impressionism (cf. Väisälä, 2002) or bepop. Differences among tonal-harmonic styles may in part be explicable by variations in the relative importance of roughness and fusion. As harmonic styles became increasingly complex in the late 19th and early 20th Centuries, roughness may have become increasingly irrelevant.

Little recent literature addresses C&D in non-Western music, but the cross-cultural perceptibility of Western C&D invites comparison between psychological and political explanations (cf. Agawu, 2003).

5. Implications

A synergetic combination of CDCs from humanities and sciences can improve communication between music theory/analysis/composition and music psychology/psychoacoustics, helping music psychologists to pose more musically relevant and legitimate questions and music analysts to apply more sophisticated tools.

References


Parnucutt (in preparation). The tonic as triad: Key profiles as pitch salience profiles of tonic triads.


Wolfe, J., & Schubert, E. (2008). They were playing our song: A psycho-acoustic explanation of why non-vocal musical instruments determined how we sing. Talk at ICMPC 10 (Sapporo, Japan).
CIM10: Nature versus Culture

Short biographies

Richard Parncutt is Professor of Systematic Musicology at the University of Graz, Austria. His publications address musical structure (pitch, consonance, harmony, tonality, tension, rhythm, meter, accent), music performance (psychology, piano, applications), and the origins of tonality and of music.

Graham Hair is Professor Emeritus (Music, Centre for Music Technology), University of Glasgow. He composes chamber music for (especially) women's voices (in which he often directs "Scottish Voices") and orchestral, chamber and solo music. His research includes 20th-century musicology, including microtonality.
16:00pm  Universals and origins of compositional structure

17:30pm  Searching for the “natural” origins of the symmetrical scales: Traditional multipart Setu songs

Rytis Ambrazevičius, Kaunas University of Technology, Lithuania
Žanna Pärtlas, Estonian Academy of Music and Theatre, Estonia

Full Paper

Abstract
The older layer of the multipart songs of the Setu (southeastern Estonia) is based on the unusual “one-three-semitone mode”, i.e., consisting of the intervals close to one and three semitones. The structure of this scale can be expressed in semitones as the succession 1-3-1-3-1 and realized by notes such as D-Eb-F-G-A♯-B.

For the analysis, one typical Setu multipart song was chosen. Acoustical measurements of the pitches were carried out. The statistical generalization of the results led to the conclusion that the requirements for (“vertical”) sonorities prevail in the formation of the scale patterns. The influence of “natural” psychoacoustical roughness on the sizes of the “mistuned” intervals (e.g., very wide major thirds) is revealed, suggesting that the origins of the symmetrical scales can possibly be linked to “natural” psychoacoustical phenomena.

1. Background in ethnomusicology and music theory
The Setu multipart songs. The Setu is a small ethnic group of Estonians living in the South-East of Estonia and within the adjoining border territories of Russia (the Pskov region). With regard to music, the greatest peculiarity of the Setu culture is the ancient multipart singing style, which has been preserved in active use until today. Multipart singing is characteristic to almost all genres of Setu traditional songs. The song performers are predominantly women.

The texture of Setu songs is comprised of two functionally different parts – the lower main part (torrõ in folk terminology), which is sung heterophonically by a chorus, and the upper subsidiary part (killõ), which is sung by a solo voice. The torrõ part repeats, usually with extensions and alternations, the leader's melody. The killõ part moves along the two or three upper degrees of the scale.

The one-three-semitone mode. In the Setu multipart songs one can find three types of scale structure: the one-three-semitone scale (for example, D-Eb-F♯-G-A♯-B), the anhemitonic-diatomic (E-G-A-B-C), and the pure diatomic (D-E-F♯-G-A-B-C) (Pärtlas 2006). The last scale is characteristic of the songs of newer style; the first two are presumably of very ancient origin.

The one-three-semitone mode is the most peculiar feature of the Setu song tradition and it is very unusual even on a global scale. This mode consists of intervals close to one and three semitones and has a symmetrical structure, which can be expressed in semitones in the succession of the numbers 1-3-1-3-1 (this is the largest range of the scale). The intervallic structure of this mode was theoretically recognized only in the last decades of the 20th century (Sarv, 1980; Pärtlas, 1997) when the first multitrack recordings of the Setu songs were made. However, a certain disbelief regarding the real existence of such a mode persists among (Estonian) ethnomusicologists even at the present time, so that acoustical investigations of the Setu multipart songs are very topical today, either to support, specify in more detail, or contest the results of empirical analysis.

“Symmetrical modes” in professional and traditional music. One of the reasons
why the one-three-semitone mode seems so unusual in the context of traditional music is its symmetrical structure. Although some examples of the usage of symmetrical scales (especially fragments of the whole tone and octatonic scale) are known in traditional music, in music theory such modes are associated mostly with the compositional techniques of the 20\textsuperscript{th} century, which are often based on mathematical calculations and the deliberate invention of new expressive means. Interestingly, the Setu one-three-semitone mode is similar to one of the "modes of limited transposition" (also known as "symmetrical modes") by Olivier Messiaen (1944). Messiaen’s modes are often considered as artificially constructed, in contrast with "natural" diatonic, pentatonic, etc. scales (Kholopov 1990a, 1990b), thus raising the question as to how such scales could evolve "naturally" in the ancient song tradition.

2. Background in acoustics and psychoacoustics

There is a not inconsiderable number of (ethno)musicological studies dealing with acoustical measurements of musical scales. For this investigation, the studies on vertical (harmonic) sonorities seem to be the most relevant, especially those including microtonal measurements and their interpretations. On the one hand, it is argued that "good harmonic intonation is achieved by reducing the beating between partials, a particularly important feature in barbershop singing (Hagerman & Sundberg, 1980). This intonation corresponds roughly to a just tuning relative to the current chord" (Friberg, Bresin, & Sundberg, 2006). On the other hand, for instance, Muszkalska measured "out-of-tune" thirds and other intervals in Portuguese multipart singing (2000, 2002). Ambrazievicius (2008, etc.) found the dyad-intervals in Sutartinës (a Lithuanian type of Schwebungsdiaphonie) slightly less than 12ET-whole tone. Collation of the results with the findings relating to psychoacoustical roughness (e.g., Kameoka & Kuriyagawa, 1969) led to the conclusion that the musical phenomenon (musical scale) is determined by a "natural" (universal) psychoacoustical domain. The same tendency can be seen in the Portuguese case described by Muszkalska. The Setu one-three-semitone mode has not been analyzed acoustically.

3. Aims

We aim to reveal the regularities in the sizes and usage of the harmonic intervals in the Setu songs with the one-three-semitone mode and their possible origins.

4. Main Contribution

Some assumptions about the nature of the Setu “one-three-semitone mode”. Harmonic thinking is characteristic of the Setu multipart song tradition. The harmonic system is based on the binary opposition of two harmonic complexes, which contain every second scale note. Under conditions of the one-three-semitone mode it results in monointervallic harmony, where all structural verticals are (approximately) four-semitone intervals (major thirds) – G-B, F#-A#, Eb-G, and D-F#. The monointervallic harmony determines the peculiar sound of the Setu songs and suggests the assumption that the one-three-semitone mode could be caused by a preference for the major third as a harmonic sound.

This assumption is also supported by the fact that the four-semitone sonorities also enjoy special status in the songs based on the diatonic and anhemitonic-diatonic scales. The major thirds are often emphasized rhythmically; they are located at the important points of the tune form and are also accented dynamically by the singers. One more argument in favour of the harmonic nature of the one-three-semitone mode is the circumstance that sometimes the structure of this scale gets its specific form only in the chorus part, while the lead singer uses the diatonic scale (see Figure 1a).

The song examined. The Setu singers vary the pitch of scale notes extensively; furthermore the scales often have mixed or transitional forms (Pártlas, 1997). Thus the
selection of material for analysis can influence the results to a considerable extent. The sound recording under consideration (Figure 1a) is the work-game song “The Grinding Stone” (Käsiikivi). The performer is an outstanding Setu singer, Anne Vabarna (1877–1964), who was especially famous for her long epic songs. Anne Vabarna lived in Northern Setumaa, where the older song style and the one-three-semitone mode were better preserved. She used to sing with her family choir (3-5 singers), but in this case there are only two performers – the lead singer, who sings the torrō in the chorus part, and the killō. The performance as a duet is not a very traditional situation, but it eliminates the problem of the wide unisons in the torrō part. This recording is one of the few recordings of Anne Vabarna made with a tape-recorder and is, therefore, of relatively good technical quality.

**Figure 1.** a) Schematic transcription of the song examined. The pitches are transposed to the standard range so that the tonal centre is G4. Numbering of notes used in the succeeding analysis is supplemented. b) Averaged pitch tracks (bold lines); only multipart segment is shown. The pitches are transposed so that the averaged tonal centre is zero.
The horizontal dashes mark maximum deviations. Long dyads are highlighted. Thin lines correspond to the transcription (Figure 1a). c) Roughness of dyads, in arbitrary units, see text for details.

**Measurements.** For the pitch measurements, Praat software was applied. The spectra of the vocal dyads were analyzed and the fundamental frequencies of both voices were calculated, mostly from the measurements of the upper (clearly standing out) harmonics. For monophonic – solo and unison (quasi-unison) – parts, direct pitch measurements from pitch tracks were also applied. The first five melostrophes of the song were examined. The performance features quite significant intratral pitch changes. For instance, in the prolonged dyads even some break-up into short notes is perceived. Average pitches were measured in this case. Some dyads actually start from a single pitch and then digress to target pitches. Here only the target pitches (as "true" ones) were considered.

**Intertonal pitch change and scale considerations.** Averaged pitch tracks based on the measurements of the five melostrophes were designed (Figure 1b; here and hereafter only the segment of multipart performance is presented). It was held that each succeeding melostrophe features a certain increment or decrement (microtransposition; see Ambrazevičius, 2005-2006 for details of the procedure).

It is obvious that the succeeding occurrences of certain scale degrees differ significantly in pitch. Moreover, some degrees (most notably, the highest two – A# and B in the transcription) are hardly separable: their zones of intonation overlap. These findings show that, from the scalar point of view, the performance comprises two conjunct bichords (transcribed as Eb-G and G-B) realized most distinctly by the (short) vocal dyads with intervals of thirds in between, plus additional anchor dyads formed by the prolonged dyads (transcribed as F#-A#). The relation of the latter to the two-bichord-structure is quite peculiar: while in some cases the prolonged dyads are clearly perceived as moving downwards from the preceding upper bichords, in other cases (mostly for the upper voice), this motion is hardly noticeable. (Seemingly, this faint movement of killō is characteristic of the song examined and not necessarily as faint in Setu songs in general.) All the occurrences fall into the same category as there are intermediate cases. The resulting scale intervals (averages, in ascending order of pitch) are: 357, 84, 312, and 42 cents. Once again, the highest interval actually covers a wide range, roughly from minor second to prime. These findings lead to the conclusion that the scale in the transcription (Figure 1a) should be somewhat reconsidered, as well as the general findings on Setu scales and their changeability.

**Aspect of psychoacoustical roughness.** Importantly, in the performance analyzed vertical (harmonic) intervals are more stable than horizontal (melodic) ones. This holds especially for the intervals realized by the prolonged dyads: compare the standard deviation of 24 cents for the prolonged dyads with 33 cents for the horizontal intervals (averages). This means that the structure of the scale rests, first of all, on vertical thinking. Therefore it would be interesting to try to reveal the origins of the sizes of the vertical intervals. Here we do not pretend to clarify all the aspects responsible for the issue, but only to propose a couple of possible explanations. First of all, we mean roughness as a psychoacoustical phenomenon, thus as a “natural” or, more specifically, biological (i.e., universal, not cultural) phenomenon resulting from the periphery of hearing – the action of the inner ear. For an analysis of roughness, let us apply the mathematical procedure proposed by Vassilakis, 2001 and based on earlier findings (Plomp & Levelt, 1965; Kameoka & Kuriyagawa, 1969; Sethares, 1998). Say, the lower pitch of dyad is G#3 minus 40 cents (which corresponds to the averaged lowest pitch of the dyads in the performance analyzed, Eb in the transcription) whereas the higher one
is increased gradually by 10 cents. Then the harmonics of the two sounds are calculated and the total roughness resulting from the interaction of all the harmonic pairs is evaluated. Harmonics up to 2 kHz are considered, since higher harmonics decrease rapidly in intensity, roughly from that frequency (as seen in the spectra of the performance). For the sake of a simplified evaluation, the amplitudes of the harmonics are assumed to be equal since, first, according to Vassilakis, the influence of amplitude is small, and, second, maximum roughness is sought (which corresponds to the equal amplitudes in the harmonic pair). The same procedure is repeated with pitch B3 plus 40 cents (roughly the averaged lower pitch of the two upper dyads – pooled F# and G in the transcription). Figure 1c shows the results. In the neighbourhood of the major third, roughness for the upper dyads has one minimum whereas there are two minima for the lower dyads. These minima correspond to 5:4 (natural major third) and 9:7 (“large” major third) ratios. The 9:7 minimum for the lower dyad is even lower than the 5:4 minimum. Possibly this could explain the tendency to use the “large” major third in the lower dyads (measured 442 cents, on average) and the tendency to use the natural major third in the upper dyads (measured 389 cents, on average). Of course, actual values often deviate noticeably from these averages. Moreover, the procedure for evaluating roughness is crudely simplified and the 9:7-dip probably does not appear for the upper dyads because of the cutoff at 2 kHz. Nevertheless, this dip seems to be less pronounced for the higher pitches.

These findings mean that the singers try unconsciously to avoid rough sonorities; interval sizes are thus governed by a psychoacoustical phenomenon. This result is quite unexpected because just the opposite has been stated with reference to Lithuanian polyphonic vocal Sutartinės, where the dyad intervals appear to be based on the principle of maximum roughness (Ambrazavičius, 2008). The conclusion is based only on findings in one single Setu song and should be verified by examination of more examples.

Intervals in the song examined decrease when going up (if one considers the bichords or, separately, seconds and thirds). This leads to the assumption that another phenomenon is possibly also at work: the so-called “proportional” scales (Alexeyev, 1976, p. 80–108) or “arithmetic” scales, i.e., scale structures based on frequency intervals instead of pitch intervals (Ellis, 1965, etc.).

5. Implications
The origins of the symmetrical scales can be linked to “natural” psychoacoustical phenomena. The present study provides a basis for further ethnomusicological discussion on the development of symmetrical scales in other multipart song traditions (for example, the scales with the structures 2-2-2, 3-1-3, and 1-3-1 found in the southern regions of Russia).
A comprehensive account of the phenomena of symmetrical scales requires expertise in both the humanities (ethnomusicology, music theory, etc.) and the sciences (acoustics, statistics).

6. References


**Short biographies**

**Rytis Ambrazavičius** graduated as a physicist from Vilnius University and he received his PhD in Musicology from the Lithuanian Academy of Music and Theatre. He is Assoc. Prof. at Kaunas University of Technology and the Lithuanian Academy of Music and Theatre. His research interests include music and speech acoustics, ethnomusicology, and music cognition. He has authored or co-authored ca 50 papers and books, and ca 400 entries for the Lithuanian Encyclopedia of Music. He is also active as a folk and folkrock musician.

**Žanna Pärtlas** is currently Senior Researcher at the Estonian Academy of Music and Theatre, Tallinn. She studied musicology at the Rimski-Korsakov State Conservatory, St. Petersburg. In 1992 she received her PhD from the same institution. Her research interests include Estonian and Russian folk song tradition, analytical approaches to traditional music, and general theoretical questions of traditional multipart singing. Since 1981 she has carried out field work in Russia (Pskov, Smolensk, Tver regions), Belarus (Vitebsk, Gomel regions), and Estonia.
16:00pm  Universals and origins of compositional structure

17:30pm  How should the term 'musical universals' be understood?

Piotr Podlipniak, Adam Mickiewicz University, Poland
Edward Jacek Gorzelańczyk, Kazimierz Wielki University, Poland

Abstract

1. Background in music theory
Musical universals are traditionally understood as musical features present in every musical expression (Hood, 1977). From this point of view, they are the necessary condition of musicality. Of course, it has been extremely challenging to indicate such traits in the variety of world music now and in history (Nettl, 2005). Therefore, scholars have often differentiated between absolute and statistical universals (ibid.), the majority of which belong to the latter category. Importantly, despite of the long history of research, the scholars have not developed a shared understanding of what musical universals are and which musical features belong to the category.

2. Background in biology
Since the works of Ch. R. Darwin human beings have been recognized as significantly shaped by the process of natural selection (Darwin, 1871). Moreover, research conducted in the past decades suggests that there are a lot of human mental capacities which are the results of this process (Sperber and Hirschfeld, 1999). Such capacities are biological adaptations which are present among all healthy people independently of culture and race. The presence of the shared mental traits results in similarities ubiquitous in human activities. Most probably music represents one of the biological adaptations (Gray et al., 2001). Therefore, if music is an evolutionary adaptation, there must be some human musical abilities which influence every musical culture.

3. Aims
In the study a new understanding of musical universals is suggested. The understanding is founded upon the relations between human musical proclivities and musical features observed in the majority of musical cultures around the world. The notion of musical universals proposed in this paper is derived from contemporary knowledge of genetics, human evolution, psychology of musical abilities and music anthropology.

4. Main contribution
So far the major criterion of universality has been the ubiquity of a trait. This method of identifying universals does not, however, discriminate between features which are the result of the musical 'instinct' and the features which are widely disseminated today because of the exchange and storage of cultural information. According to the authors, only the former case is an example of universality. Therefore, establishing whether a certain musical feature is universal or not cannot be restricted to the comparison between different types of music. The presence of musical universals is produced by means of certain innate cognitive strategies linked to the processing of specific elements of music (Harwood, 1976). Therefore, researchers should also investigate the relations between human neurobiological traits and the presence of some regularities in music. For example, the occurrence of musical scales with more or less precise discrete categories of musical pitch, often given as an example of a musical universal (Nettl, 2000), has its cause in the principles of the functioning of the cerebral module analysing intervallic relations (Peretz and Coltheart,
The most important question is, however, the heredity of this module.
List of Posters and Poster Abstracts


C. Glennon. The Role of Culture in Music Perception: An Investigation of the Influence of Culturally Internalized Schemas on a Recall Activity of Armenian and Estonian Folk Tunes


D. Kučinskas & R. Ambrazevičius. Is a “national composer” really national?


M. Petrović & N. Ljubinković. Music elements of animal sound patterns in Serbian folk songs and dances.


R. Timmers & H. L. Crook. Influences of perceived emotions on attention to musical streams.

Sounding Sustainable: Stradivari, Nature, and Culture

Aaron S. Allen, University of North Carolina at Greensboro, USA.

Abstract

1-2. Background in disciplines

Allen has degrees in musicology and environmental studies. His interest in ecomusicology led to his co-founding the American Musicological Society’s Ecocriticism Study Group, which he currently chairs.

3. Aims

As a craft in which trees are made to sound, lutherie creates a discernable connection between nature and culture: wood is fundamental to an instrument’s resonance, and instruments are central to making music. The luthiers of Cremona, Italy, knew this well, and their ability to meld nature and art has contributed to their lasting and near mythological reputation. Craftsmen such as Antonio Stradivari (1644/49?-1737) imported quality wood from northern Italy, specifically the Val di Fiemme’s Paneveggio Forest, also known as “La foresta dei violini” because its red fir is prized as resonant wood. The Cremonesi luthiers and the Fiemmesi foresters share an intertwined story of cultural and ecological sustainability.

This case study on wood for violins focuses on the ecological practices (sustainable and unsustainable) that provide material for musical instruments; doing so brings to the fore questions about the cultural values accorded to such creations. Furthermore, this poster demonstrates the synthesis of the approaches of music history / musicology and sustainability studies / ecocriticism in a critically engaged ecomusicology that highlights what Simon Schama (1995) referred to as the “necessary union of culture and nature.”

4. Main Contribution

Conservation is not the norm in histories of lutherie, and numerous case studies could show the destructive impacts of harvesting wood for instrument making. To take but one example, pernambuco (pau brasil) is used for professional quality violin bows; the tree is endemic to one area of Brasil, and other bow-making materials are poor substitutes. A history of misuse and deforestation, due to demand and destructive farming practices, have endangered the tree. The result is a precarious situation for bow makers and string instrument players.

While this and other stories of musical instrument woods may be typical (e.g. with rosewood, ebony, grenadilla, jakwood, etc.), lutherie has also played a role in, and can continue to help with, the preservation of forests. The story of the Fiemmesi and Cremonesi is a case in point. Despite the Venetian navy’s demand for Paneveggian lumber to build their war and merchant ships, the Fiemmesi instead were able to practice sustainable forestry for centuries — in part because of long-standing cultural institutions, and in part due to the Cremonesi luthiers’ use of the unique resonance wood of the Paneveggio and the reputation of the resulting instruments. This poster presents a positive story of ecological and cultural sustainability in instrument making: how craftsmanship and music played a role in conserving forests and ways of life.

In considering the wood used to make a quality Cremonese violin, this research engages with the debate about what makes the sound of a Stradivarius so special (e.g., was it the varnish or wood treatment, or was it the design or the craftsmanship?). Stradivari has long been associated with the Paneveggio, and some of his spruce soundboards did come from the area. Such wood, while unique and valuable, is but one aspect that makes a Strad the gold standard for lutherie. Ultimately, physical and ecological factors, i.e. the characteristics of the instrument and its materials, must be considered alongside cultural
ones. These instruments are cultural commodities (Appadurai 1986); the thing itself has value, but its process of becoming — from forest to wood to instrument to sound — increases that culturally determined appraisal. In considering this nexus of ecological and cultural values, we are able to understand better the musical instrument as a union of culture and nature.

5. Implications
This research has implications for scholars and practitioners regarding both method and action. For scholars, it offers a multi-disciplinary approach to questions of sustainability, which although usually involving multiple science disciplines, rarely includes the arts and humanities; relevant disciplines include ecology, forest/environmental history, music history, and instrument making. Furthermore, it offers a new path in ecomusicology: sustainability studies, which differ from more traditional conceptions and influences of nature as related to musical works. For practitioners (performers and luthiers), this research offers insights into the usually negative ecological impact of harvesting wood for musical instrument manufacture and provides a case study of one historical situation in which cultural sustainability has mediated such ecological impacts. Such knowledge can inform luthiers’ and performers’ activities and choices.

6. References

Short biography
Aaron S. Allen earned a B.S. in environmental studies and a B.A. in music from Tulane University, then a Ph.D. in music from Harvard University with a dissertation on Beethoven reception in 19th-century Italy. His passion for synergies of art and science led to his co-founding the American Musicological Society’s Ecocriticism Study Group, which he currently chairs. Allen has published and presented papers on campus environmental issues, Beethoven, and ecomusicology.

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The Role of Culture in Music Perception: An Investigation of the Influence of Culturally Internalized Schemas on a Recall Activity of Armenian and Estonian Folk Tunes

Catherine Glennon, Ross Institute Academy in East Hampton, USA

Abstract

1. Background
Perception is not simply a passive registering of elements existing in our immediate or extended reality, but an active and inactive construction of extracted elements. The involuntarily selective process is guided by previously established frameworks, which on a broad level are rooted in our cultural backgrounds. Therefore, what we perceive and attend to in music will be somewhat dependent on our previous experiences with music in our culture. This study investigates the culturally selective element in the process of music perception; it looks at the role culture plays in framing perception of foreign musical material.

In 1920, British psychologist Frederick Bartlett published a compelling experiment he conducted involving memory, perception, and cultural schemas. The experiment revealed much about the influence of familiarity and culture on the perception of the foreign folk tales; Bartlett noticed that when prompted to recall the foreign tale, his subjects inserted schemata typical of folk-stories from their culture [1].

2. Aims
This study involves a recall activity in which subjects from the United States were presented with children’s folk songs from Armenia and Estonia and asked to sing the tunes back after listening. The objective was to examine how a person of one culture would perceive music of a foreign culture employing musical material unfamiliar to the person. The hypothesis for this study was that a lack of familiarity with music of a particular culture would affect the perception of musical aspects idiosyncratic to that music; it was expected that musical schemas specific to American culture would reshape aspects of the Estonian and Armenian music.

3. Main Contribution
   **Methods.** The stimuli for the experiment consisted of short samples (12 to 30 seconds) of children’s folk tunes from Armenia, Estonia, and the United States [2] [3] [4]. The American song was used as a baseline comparison for the task. The sample size was eight (n=8).

   Each subject was tested individually. Each of the eight sound clips was heard twice followed immediately by a recall of the tune in which the subject was asked to sing back to the moderator what she had heard. Subjects were given the option of not providing a response at all.

   **Results.** Each of the subjects’ responses was recorded and transcribed. The transcribed responses were evaluated based on four defining characteristics: rhythm, contour, harmonic line, and one idiosyncratic aspect. Subjects received full, half, or zero credit for each defining characteristic of each song (1, 0.5, or 0, respectively). These scores were determined through a careful comparative-analysis of the subject’s transcribed responses to transcriptions of the original sound clips played during the experiment.

   Overall, the performance rate on an individual and group level was better for the American song, than on the Armenian and Estonian songs. However, certain aspects of the Estonian and Armenian songs were well perceived; the rhythm and contour were consistently better perceived than the harmony or idiosyncratic aspects. A t-test pair-wise comparison revealed significant differences in some areas between the perception of certain
defining characteristics in the American song and non-American songs.

4. Implications
The results of the experiment suggest the following: The perception of certain musical aspects is dependent on having previously established schema necessary to support those aspects. The specific aspects of Estonian and Armenian songs that were most difficult for the subjects to perceive were the harmonic lines and certain idiosyncratic aspects, specifically rhythmic syncopation. The mistakes made during recall were a result of either complete omission of a certain aspect, or an alteration of an aspect in such ways that better fit American musical schemas. This was most often done with chromatic passages and syncopation. The omission of a certain aspect can be interpreted as either an issue of memory, and/or an issue of not having the proper framework with which to incorporate the material.

The results of this study provide tentative evidence for culturally learned schemas that are involuntarily acting on our perception of music. The system does not work as easily with music that violates aspects of the previously established schemas. During the recall, elements from a person’s own culture were smuggled in, filling in gaps with their most familiar memory of how a tune would go. It is fair to conclude that the schemas particular to music in American culture do not provide a framework for accurately reproducing certain elements of Estonian and Armenian folk music. This experiment also reaffirms the reconstructive nature of memory.

5. References

Short biography
Catherine Glennon has a Master’s degree from the Mind, Brain, and Education program at the Harvard Graduate School of Education. Catherine received a Bachelor of Arts in Music from Rice University under the tutelage of pianist Jon Kimura Parker. Catherine currently has a studio of private piano students and works at the Ross Institute Academy in East Hampton, NY where she functions as Research Assistant to the Associate Director.
Are we making ourselves clear? Singers’ and non-singers’ perceptions of the intelligibility of sung text

Jane Ginsborg, Royal Northern College of Music, Manchester, UK
Philip Fine, University of Buckingham, UK
Chris Barlow, Southampton Solent University, UK
Polly Long, Southampton Solent University, UK
Jasper Brownrigg, Royal Northern College of Music, UK

Abstract

1. Background in music performance
The intelligibility of sung text is an important component of listeners’ enjoyment of vocal music, and a central concern for singers and, for example, choral conductors (Fine & Ginsborg, 2007a). One factor underlying intelligibility, from the point of view of the performer, is the number of singers: it may be easier for one singer to convey the words of a song, and their meaning, than for a group of singers. Another is vocal technique, which relates to the culture of Western classical music: singers learn to project their voices and use clear (if not exaggerated) diction (solo singers: Adams, 1998; Falkner, 1994; choral singers: Fisher, 1991; Emmons & Chase, 2006), but the modification of vowels in the interests of preserving the musical line (Hollien et al., 2000) and consonant confusions (Collister & Huron, 2008) can affect intelligibility, as can the use of vibrato (Sundberg, 1994).

2. Background in psychology
The singer, however, can only do so much to ensure intelligibility (Fine & Ginsborg, 2007b); the perception of sung text depends to a certain extent on the listener. Those who are themselves experienced singers and singing teachers, and are therefore members of the same culture as the performer, are more likely to be attuned to factors affecting singers’ diction, and better than non-singers at resolving the acoustic signal into recognisable words. In a preliminary experiment, listeners with experience of both singing and listening to singing wrote down significantly more of the words of songs – whether sung by a trained soloist or a small group of trained soloists – than did listeners without such experience (Fine, Ginsborg & Barlow, 2009).

3. Aims
The aim of the present study was to replicate and extend Fine et al.’s (2009) study by replacing the small group of trained soloists with an unaccompanied chamber choir, and so test more realistically the difference between assessing the intelligibility of a single trained singer and that of a group of choral singers.

4. Main Contribution
An experiment was conducted, for which two groups of participants were recruited as listeners: 24 trained singers and singing teachers, and 24 non-singers. They were asked to keep a diary for a week in which they recorded their hours of singing, active listening to singing and passive hearing of singing. The stimulus materials consisted of recordings of four songs, with semantically meaningful and non-semantically meaningful texts, recorded by a solo voice and a choir in unison. Each of the participants heard four different recordings played twice. The between-subject independent variable was experience (singer vs. non-singer). The within-subject independent variables were number of singers (solo vs. choir) and nature of text (semantically meaningful vs. non-semantically meaningful); the dependent measure was number of syllables correctly written down. Data collection is
under way and results will be reported when the analysis is completed.

5. Implications
The findings will have direct application for performers and teachers, and will enhance our understanding of the natural and cultural factors underlying the perception of vocal music and the intelligibility of sung text.

6. References


Short biographies

**Jane Ginsborg** is Director of the Centre for Music Performance Research at the Royal Northern College of Music, Manchester. She has published widely on expert musicians’ approaches to practise and memorizing, and won the British Voice Association’s Van Lawrence Award in 2002 for her research on singers’ memorizing strategies. Current research interests include expert musicians’ preparation for performance, collaborative music making and musicians’ health.

**Philip Fine** is Senior Lecturer in Psychology at the University of Buckingham. His main area of research concerns the cognitive processes involved in expert sight-singing. He is currently investigating mental rehearsal in musicians, memory for musical speeds and the factors affecting the understanding of sung lyrics. He is also interested in expert problem solving, specifically cryptic crossword and sudoku solving behaviours.

**Chris Barlow** is Reader in Technology at Southampton Solent University. He has published on voice science, acoustics and learning technologies. He is also an experienced recording engineer and producer specialising in classical – particularly vocal – music, and has released
over 30 CDs on a number of record labels. He is a qualified audiometrist and is a freelance consultant on industrial/occupational noise exposure and control, with a particular interest in the music industry.

Polly Long and Jasper Brownrigg are students at their respective institutions for whose research assistance the first three authors are very grateful.
Multilayered Monophony: Factors Contributing to Stream Segregation in Qin Music

Chiung-Hui Hwang, University of Sheffield, UK

Abstract

1. Background in auditory perception
   Multilayered auditory perception of qin music is a perceptual characteristic of qin music (Yip 1992), but it has never been studied systematically. This research applies the principles of auditory scene analysis to explain how this perceptual characteristic of qin music is caused by stream segregation.

2. Background in music analysis
   By combining the method of music analysis and the perceptual theory of auditory scene analysis on selected qin performance recordings, this research proposes the factors contributing to stream segregation in qin music. It explores how qin music's great range of timbre and wide range of pitch interval influence the acoustic structure of qin monophonic melody and suggest stream segregation for listeners.

3. Aims
   Although the music of the Chinese zither qin has been considered to be formed of a single melody, or in other words to be monophonic, without accompaniment or polyphonic parts, it is not only heard in this way, but also as multiple voices in some contexts. Such listening experience is shared by many listeners, as qin music is commonly described as being produced seemingly from several instruments of an ensemble rather than a solo one. This perceptual phenomenon, though mentioned as multilayered characteristic of qin music, has never been studied systematically.
   
   This research aims to explore the phenomenon of stream segregation in the 'multilayered monophony' of qin music. By applying perceptual theory and analyses of musical excerpts from selected recordings of the qin repertoire, this paper identifies contributory factors to the stream segregation of qin music. Visual illustrations of the suggested perceptual streams show how multiple perceptual streams arise from different contributory factors, and how these factors operate separately and together, opening up a listening experience comprising changing auditory organizations.

4. Main Contribution
   This interdisciplinary research offers a new understanding of qin music. It explores a significant perceptual characteristic of qin music that is commonly experienced by qin listeners, but which has never been explored from the perspective of music structural analysis and perceptual psychology. This research also demonstrates the subtlety and complexity of qin music's sonic structure and of the listener's perceptions. In addition to the contribution to qin studies, this interdisciplinary research contributes to the psychology of music perception. In illustrating perception of a non-Western form of music, it provides evidence that further emphasizes the validity of auditory scene analysis as an essential process of hearing, a principle that could help explain hearing in a wide range of listening experiences but has so far been mostly applied to experiences of Western music.

5. Implications
   In showing how the sonic structure of qin music suggests stream segregation, this research also implies that stream segregation should be related to qin listeners' backgrounds. For instance, qin listeners are traditionally players themselves, and their
playing experiences of the *qin* may be influencing stream segregation in their listening experiences. How does the background of *qin* listeners influence stream segregation? This will need further empirical research.

6. References

Short biography
**Chiung-Hui Hwang** is currently a PhD candidate in the Music Department at the University of Sheffield. She has been working as a freelance lecturer and composer after earning her master’s degree in music theory and composition from National Chiao-Tong University of Taiwan (1992), providing courses of music appreciation for non-music students and courses of music theory and music analysis for music students. Her PhD thesis explores the structure, perception and conceptualisation of *qin* music. Email: xiao_rou2001@yahoo.com
Is a “national composer” really national?

Darius Kučinskas & Rytis Ambrazevičius, Kaunas University of Technology, Lithuania

Abstract

Mikalojus Konstantinas Čiurlionis (1975-1911) is called a priori as a Lithuanian national composer. Lithuanian musicologists describe the style of his music as obviously “Lithuanian”. The tendency to consider oeuvre of composers as obviously national is characteristic of different national composer schools in Eastern Europe. The present study aims to clarify to what degree can Čiurlionis’ music be really designated as Lithuanian, in the domain of rhythm patterns.

For the analysis, the composer’s piano pieces were used, belonging to the early (1896-1903) and late (1904-1909) periods. Also samples of Lithuanian and Polish song notations were compiled. Altogether 3467 measures were examined. The results show that, in comparison with Čiurlionis’ earlier compositions, his later compositions were less influenced by Lithuanian folk music (in the rhythm domain). They show quite small resemblance both to Lithuanian and Polish folk music. Therefore the national aspect of Čiurlionis’ music is questionable.

1. Background in musicology

At the end of the 19th century, national composer schools emerged in Europe. It was believed that national composers should necessarily employ folk music in their oeuvre, one way or another. Usually this meant citations or fragments of folk melodies and applying rhythms or modes of folk music. On the other hand, quite often the musical style of national composers was developing and changing, thus their relationship with folk music was variable and sometimes even questionable.

Mikalojus Konstantinas Čiurlionis (1975-1911) is one of the most important figures in Lithuanian art history. He was the first professional Lithuanian composer and painter. After music composition studies in Warsaw (1894-1899) and Leipzig (1901-1902) he turned to painting and completed studies at the Warsaw Art School (1906). Afterward, he lived and created in Vilnius (1907-1908) and St. Petersburg (1908-1909). During his life time he spent only some years in Lithuania. His first compositions were marked by the obvious influence of Chopin, while his late compositions were full of experiments linked to serialism. However, Čiurlionis is called a priori as a Lithuanian national composer. Possibly, this opinion was indirectly caused by Čiurlionis’ decision to “dedicate all past and present compositions to Lithuania”, which he declared in 1906, a period when the national movement was in ascendency (Čiurlionis, 1960). Čiurlionis also wrote an article titled “On music” (1910) that proposed guidelines for future Lithuanian professional music. Lithuanian musicologists describe the style of his music (especially the scale structures, intonations, rhythmic formulae) as obviously “Lithuanian” (Čiurlionytė, 1966; Bruveris, 1969; Landsbergis, 1971; Ambrazas, 2000). However, the same features are common for the music of other composers of other nationalities as well (Kašponis, 1992). So the question is to what degree can Čiurlionis’ music be really designated as Lithuanian.

2. Background in statistics.

From the numerous music studies applying statistical methods, the most relevant for the present investigation seems to be the work of R. Kašponis (1992), seemingly not well-known even among Lithuanian scholars. In his study, Kašponis analyzed the statistical similarities and differences among four musical (notation) samples: Lithuanian folk songs, music of Lithuanian composers, non-Lithuanian folk songs (various European traditions), and music of non-Lithuanian composers. The criterion of $\chi^2$ test was applied, different sets
of melodic and harmonic elements were considered.

3. Aims
We aim, with the aid of statistical analysis, to investigate the links between Čiurlionis’ piano music and Lithuanian or Polish folk songs (in the domain of rhythm patterns).

4. Main contribution
For the analysis, the composer’s piano pieces were used as they form the largest corpus of his oeuvre and reflect the development of his style most credibly. Two samples of Čiurlionis’ compositions were selected corresponding to the early (1896-1903) and late (1904-1909) periods. The pieces were taken from Kūriniai fortepijonui (Čiurlionis, 2004). Pieces with obvious citations of folk music (arrangements of folk songs for piano) or those presenting specific genres (mazurkas, waltzes, polkas, marches, polonaises) were removed from the analysis. Also later completions of Čiurlionis’ unfinished pieces were not considered. Meters of 4/4 (characteristic of the later period) and 2/4 were pooled: 4/4 were considered as two measures of 2/4.

Seven pieces in 2/4 (489 measures) and nine pieces in 3/4 (308 measures) belonging to the early period as well as ten pieces in 2/4 (523 measures) and thirteen pieces in 3/4 (377 measures) from the late period were examined. Altogether 39 pieces and 1697 measures were used for the analysis.

Samples of Lithuanian song notations (from the Dzūkija region) and Polish song notations (different regions) were compiled, from different publications (Čėtkauskaite’, 1981; Balčikonis, 1972; etc.). Dzūkija is selected because it is the ethnographical region where Čiurlionis came from. Only songs with accented metrorhythms, constant meters, and not containing values less than sixteenths were considered. Thus the set comprised 56 songs from Dzūkija in 2/4 (511 measures), 58 songs from Dzūkija in 3/4 (507 measures), 32 Polish songs in 2/4 (407 measures), and 35 Polish songs in 3/4 (345 measures). Altogether 181 songs (1770 measures) were examined.

A total of eight sets can be specified:
1) Čiurlionis’ early piano music (in 2/4);
2) Čiurlionis’ early piano music (in 3/4);
3) Čiurlionis’ late piano music (in 2/4);
4) Čiurlionis’ late piano music (in 3/4);
5) Dzūkai folk songs (in 2/4);
6) Dzūkai folk songs (in 3/4);
7) Polish folk songs (in 2/4);
8) Polish folk songs (in 3/4).

Sets of rhythm patterns were designed; aspects of different meters and their positions in the measure were taken into account. A method similar to that used by Kašponis (1992) based on the χ² test was applied for comparison of the samples (presented in the form of distributions of rhythm patterns). Collation of the results for Dzūkis songs, in general, and presumably archetypal rhythm patterns in archaic calendar songs from Dzūkis (Austrauskas, 1993) was also performed. Here we present a simplified chart depicting collation of the results for the four samples of 2/4 meter (Figure 1; more results will be presented at the conference).
Figure 1. Percentages of occurrences found in the positions of every sixteenth note. Measures of 2/4 are examined.

The results show that, in comparison with Čiurlionis’ earlier compositions, his later compositions were less influenced by Lithuanian folk music. The later compositions show quite small resemblance both to Lithuanian and Polish folk music.

5. Implications
Rhythm patterns used in Čiurlionis’ later compositions are artificially constructed by the composer. Possibly, they show a conscious turn from folk music to new compositional techniques, explored some decades later by composers of the New Viennese School. Čiurlionis’ music experienced, in a sense, a transformation “from nature to culture”. This seems to be not the traditional approach that was characteristic of most of “national” composers. The result is somewhat unexpected and contrary to the initial hypothesis presuming the transformation “from culture to nature” in Čiurlionis’ oeuvre.

6. References


**Short biographies**

**Darius Kučinskas** graduated with a degree in piano performance from the Lithuanian Academy of Music and Theatre where he also received his PhD in Musicology. He is an Assoc. Prof. at Kaunas University of Technology, and head of the Department of Audiovisual Arts. His research interests include musical semiotics, musical paleography, and the creative legacy of Mikalojus Konstantinas Čiurlionis. He has authored or co-authored ca 20 papers and books.

**Rytis Ambrazevičius** has a degree in physics from Vilnius University and he received his PhD in Musicology from the Lithuanian Academy of Music and Theatre. He is an Assoc. Prof. at Kaunas University of Technology and the Lithuanian Academy of Music and Theatre. His research interests include music and speech acoustics, ethnomusicology, and music cognition. He has authored or co-authored ca 50 papers and books, and ca 400 entries for the Lithuanian Encyclopedia of Music. He is also active as a folk and folkrock musician.
Nature and culture in dialogue: the constitution of musical meaning

Elisa Negretto, University of Padua, Italy
Brooke Wilken, University of Victoria, Canada

Abstract

1. Background in music philosophy
   One of the principal aims of phenomenology is to describe the human experience in the world: the way individual subjects know the environment in which they are immersed, and the structures of consciousness that allow such knowledge. An interdisciplinary approach involving research in music cognition and perception may be of great relevance to the discussion of these topics. Since phenomenology does not describe how meanings are constituted, research in music perception provides empirical evidence for a more complete description of the human experience and knowledge of the world.

2. Background in music cognition and perception
   The study of music cognition and perception is primarily focused on empirical analysis of topics related to music comprehension. Such research utilizes a variety of methods such as statistical analysis, neuroimaging, infant studies, behavioral analysis and computer modeling. Many of these research methods result in specialized data lacking placement in a greater description of the interactions between a perceiver and their environment. One way of addressing this issue is to employ phenomenological terminology and perspectives as a means by which to pose questions and integrate data obtained by music researchers in the cognitive sciences.

3. Aims
   This project will examine the ways in which music perception is influenced by both innate auditory mechanisms and adaptive perceptual strategies based on acquired implicit knowledge of musical trends. A unique approach to this subject will consider empirically-derived findings in the field of music cognition and perception from a phenomenological perspective, with specific reference to the philosophical writings of Husserl, Gallagher and Zahavi.

   Husserl’s account of objective senses acting as points of reference for subjective perception will be compared to empirical research-based accounts of sensory input (sound events) as points of reference for the constitution of meaning in music. Music perception research pertaining to biologically-based auditory grouping strategies compliments Husserl’s account of sensation as experienced rather than perceived by addressing many of the questions of ‘how’ left open in his writing. Additionally, the influence of innate capacities on musical experience may be considered phenomenologically with the assertion that in every perceptual act there is some objective environmental reference which is the essential link to the world and the basis for the constitution and perceptual awareness of music. In this way the subjective perceiver is consciously aware of her auditory experience as having a specific meaning.

   Few writings in the field of music cognition and perception delve into how highly unfamiliar musical styles are recognized by the uncultivated listener as constituting music rather than some other unfamiliar auditory stimulus. From a phenomenological perspective, the problem may be considered in the following way: music has an objective environmental reference because its perception is based on the experience of particular auditory events (nature), while the meaning which it acquires is subjective and based on experience with the style in questions (culture).

   Gallagher and Zahavi describe perception as dynamic, interpretive and context-based. This is in accordance with much cognitive science literature considering musical
meaning as shaped by attention-directedness, ability to form expectations, understanding of
cortical musical employment, acquired emotional associations or level of musical
training. All of these influences have been experimentally examined, with results evidencing
the vastness of individual difference in the constitution of musical meaning; thus indicating
the extent to which meaning truly relies on experience. On the other hand, both the global
employment of music and the ability to recognize highly unfamiliar styles as belonging to
the category of ‘music’ highlight the innate capacity to reference music as an object from
which to constitute meaning.

4. Main Contribution (Poster Presentation)
This interdisciplinary project creates a framework under which several influential
hypotheses related to music perception may be tied together. For example, Clarke’s
ecological concept of ‘resonance’ asserts that all individuals are born with dynamic
perceptual structures intentionally directed toward the environment and its comprehesion
(2005). From the phenomenological perspective presented in this project, music acquires
meaning through these perceptual structures, which resonate and adapt to culture-specific
musical features over time. In order to establish what ‘resonance’ actually entails, we may
turn to the more specific hypotheses related to exposure-based learning such as Huron’s
study of musical expectation (2006) or the analyses of emotion and meaning as presented

5. Implications
By drawing a phenomenological distinction between the experience of music and the
constitution of meaning in music, some specific boundaries are set up for an integrated
definitional approach to musical meaning. This project maintains that musical meaning is
constituted through implicit referral to learned features of musical style and function within
one’s culture. Further studies dealing with music and evolution may consider the perception
of meaningful music versus the experience of certain auditory events as music when
examining both innate capacities for music production and comprehension as well as the
survival value of community-specific tendencies toward similar expectations, emotional
responses and ideas about musical function.

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Short biographies
Elisa Negretto
CIM10: Nature versus Culture

Current position: Ph.D. student, University of Padua (Italy)
Main research disciplines: phenomenology, cognitive psychology of music.
Main research areas: musical expectations, music comprehension and musical meaning, temporal structure of human perception.
Contact: elisa.negretto@virgilio.it

Brooke Wilken
Current position: Master’s student, University of Victoria (Canada)
Main research disciplines: music cognition and perception, ethnomusicology.
Main research areas: oxytocin and social bonding, drum circles of the North American Pacific Coast.
Relevant qualification: Bachelor of Music (B.Mus) in Theory and Composition (2005, University of Saskatchewan); Cognitive Science studies at McGill University, Montreal (2008-2009).
Contact: brooke.wilken@mail.mcgill.ca
Music elements of animal sound patterns in Serbian folk songs and dances

Milena Petrović & Nenad Ljubinković, University of Arts Belgrade, Serbia

Abstract

Close relationship between humans and animals exist since antiquity. There are theories that show human's language developed from imitation of animal sounds. While humans interpret animal sounds differently in individual languages, animal species make the same sounds everywhere. Animals mostly perform sound patterns consisted of small melodic ambitus which is, on the other hand, the evidence of song's antiquity. Animal sounds are incorporated in Serbian ritual songs and dances by direct imitation and famous dances are named according to animals. Bordoun singing principle is typical for old Serbian songs, but we can find it in wolves howling. Cadenza at the second scale degree is emblematic for most Serbian folk songs, but it's also found in dove singing. Non-isochronous meter and the change between isochronous and non-isochronous meter we can find in many Serbian folk songs and dances as well as in dove and peacock song. Dotted rhythm recognizable in rooster singing represents typical rhythmic pattern of some Serbian dances. The interval of augmented fourth which occur in the Balkan and Istrian scales is also the interval recognizable as a crane sound. A gallop rhythm and its inversion could be seen in numerous Serbian folk songs and dances.

1. Background in musicology

There is a theory that the original speech of humans and animals was constituted of affects and screams (Herder 1989, 8). The “ding-dong” hypothesis holds that humans language began when they started to name different objects, actions or phenomena after a recognizable sounds associated with it (Vajda, The Origin of Language). According to this hypothesis the first human words were a type of verbal icon whose form was an exact image of its meaning (crash=thunder, boom=explosion). At the same way the first songs and dances were the onomatopoeia of animal sound patterns. A “bow-wow” hypothesis holding that human vocabulary developed from imitation of animal noises (moo, bark, meow) and that the first human words were a type of index, whose form is, according to Vajda's opinion, naturally connected with its meaning. But, as onomatopoeia presents a limited part of any language's vocabulary, Vajda thinks that it seems unlikely that entire human's vocabulary derived from imitation of animal sounds. As animal language consists of signs which are inborn and natural (Herder, 22), young animals begin to produce them even if they are raised far away from their species (Vajda, Animal systems of communication). But, some think that birdsong is a learnt skill, and if a bird is raised without contact with its own family or even species, it will learn the repertoire of its adoptive parents: birdsong is based on imitation structure which proves that learning process is the most important in animals (Martinelli 2008, 10). Likewise, children will not naturally develop words unless they hear it first and then repeat it, because, according to Vajda's opinion, they are not inborn like in animal language.

Animals show a tendency to perform within a limited interval area, displaying preferences for very small intervals (Martinelli 2005, 15). In Serbian musical tradition a song's small melodic ambitus is very often the evidence of its antiquity (Golemović 2005, 138). Similarly, the interval of third/fourth downward/upward is very frequent interval at many bird species (lark, titmouse, cuckoo). Humans interpret animal sounds differently according to individual languages. For example, the English word “cuckoo” is pronounced with a vowel u which, in some other English words is transformed into vowel a. For example, due to the absence of cuckoos in the area she lived, a Scottish lady pronounced a
cuckoo with the vowel a (Jaspersen 1928, 406). Certainly, the onomatopoeia of the cuckoo sound was more intense than linguistic standards (Guberina 1967, 45) and resulted with a name given to this bird not only in Serbian and other Slovenian languages, but in the most of Indo-European languages (Djordjević II 1958, 3). The human ability for creativeness produced so many other words. Vajda thinks that the changeability of human languages generated that one sign could mark different things. On the other side, in animal language there are five main elements such as organization and form, repetition and variation, intervals and scales, rhythm and tempo, sounds and timbres, while all animal species are capable of producing different range of timbres and dynamic (Martinelli, 2005). In animal behavior we find sounds of sexual connotation, a communication in the form of dialog between young and parents, sounds that individuals make in order to be recognized, alarm sounds and signals related to protection of areas, nest food and offspring. Among these acoustic behavior types which are classified according to their function, we can not find sounds that animal make due to their pleasure (Kosk, Communication and music). But there is the howling that wolves perform celebrating a successful hunt (Martinelli 2008, 3).

2. Background in folkloristics

Singing and dancing present the oldest forms of artistic expression and one of the most ancient and universal modes of human communication. The first human's ritual songs and dances had original emotional, social and cultural functions. Since the beginning of human history, people have lived in a close contact with animals and the relationship between humans and animals are shown in the old myths and legends. There is a theory of mythical origins of human's language, where mystical languages used to communicate with animals or spirits, such as the language of the bird. In Serbian folklore a frequent motif is an inarticulate animal language which represents the eternal human's aspiration to realize, master and learn the animal language, especially bird's language, believing that knowing animal's language humans will learn how to heal and predict future (Čajkanović 1994, 436). The knowledge of this language is considered as a gift of happiness and those who understands their language can also understand earth and all the animals (Čajkanović, 437). In Serbian ritual and dances the animal sound patterns are incorporated most frequently by direct imitation for ritual purposes. Beside the significant cult of ancestors Serbs maintain the animal cult as well. From the antiquity Serbs posses totem animals which had the role to guard a tribe, to predict a future, to cure illness. According to old Serbian beliefs totem animals had supra-normal power and the incarnated souls of the ancestors (Čajkanović,183). Belief in a rooster power dates since prehistory, especially in Dinaric and mountainous regions (Vasić 2004, 80). Rooster's loud singing resulted in the name given to this animal in many nations (Djordjević II, 66). In ancient Serbian religion it was believed that wolf and snake were totemic animals, they weren't allowed to be killed, they predicted the future and protected tribe (Čajkanović, 68). Serbian people in its practice and beliefs identifies with wolf, so it is believed that wolf is ancient Serbian, pre-christian and tribal totem. The imitation of wolf could be seen in wolf processions where the procession leader starts singing, while the others repeat a refrain (Vasić, 84). In this antiphonal type of singing in wolf processions the melodies are constructed of tree tones, while the structure of these simplified dancing patterns is based on tree-bars. The imitation of wolf wailing can be also seen in bourdon singing as the most common type of singing in which the first voice sings melody, while the following other keeps one and the same tone. This type of singing is typical for mountainous eastern Serbia (Homolje), the area in which wolves live. Wolf howling could be heard very often at the end of musical phrases in guttural glissando technique, which is very old type of singing (Djordjević I, 223). As the dance of wolfers was followed only by the rhythm of steps, in some Serbian dances the steps like the rhythm of horse's trot or gallop could be recognized. The close relationship between human and horse dates from the ancient period. A gallop rhythm is typical for great number of Serbian folk songs and dances. At some fresco paintings in Serbia we can find horses and
riders painted together with dancers. How much the animals were important to Serbs shows the cult of animals, for example the famous holidays are named by the animals such as Džurdjevan (the cattle holiday), Mečkovdan (the bear holiday), Mišidan (the mice holiday) (Čajkanović, 198-199). The dance with the animal's motifs presents one of the five main dancing archetypes (Maletić 1986, 180). The old Serbian dances are named according to the animals, so there is a mouse-dance, rat-dance, goat-dance, snake-dance, rabbit-dance, duck-dance, sparrow-dance, titmouse-dance and so on (Vasić 2003, 44). The famous dances (kolo) are known by the name svinjarac (pig-dance), konjičko (horse-dance) or golubarka (pigeon-dance) (Vasić 2002, 158). folk songs are sung solo and in group, in heterophony or using a bordoun structure. The animals perform more individually, but when they sing in group they build bi-tonics like heterophony, a type of singing which is very common in Serbia and for which some theoreticians believe that it was a performers' effort to sing in unison (Golemović, 152). The well-known characteristic of Serbian oral folk tradition is conveying of songs from generation to generation, and it could be noticed in birds variation of songs and their transmission in other geographical areas (Martinelli 2008, 10).

3. Aims

The basic aim is to show that people since antiquity imitated sounds from their environment and that they incorporated animal sound patterns in the primordial songs and dances by direct imitation in ritual purposes. Imitation is probably more a non-human than human musical issue, showing the crucial role that practice has in all musical activity (Martinelli, 3). Identification of animal sound patterns in Serbian folk songs and dances could provide a base for determination of hierarchy of music patterns according to its origins.

4. Main contribution

The audio comparative method shows similarities between music elements in animal sound patterns and music qualities of Serbian folk songs and dances, as:

1. Howling of wolf can be recognized in Serbian folk singing in the form of so-called singer's howling at vowels at the phrase ending, but also in the old country bordoun singing which is so typical for the mountainous area of Homolje.

2. The singing of dove bespeaks of cadenza at the second scale degree which present the song ending in numerous Serbian folk songs. As birds are known for their sense of a tonal center in singing, this cadenza could be realized as a tonalization of a second degree.

3. Dove sings in non-isochronous meter (5/8) in which many Serbian folk songs are sang. It seems that meter reverted from isochronous (3/4) to non-isochronous (5/8) is due to breathing, i.e. shortening the last tone of the motif in order to inspire. In some Serbian folk songs we can hear the regular change of 3/4 into 5/8.

4. In the peacock's motif we can notice the horizontal metric grouping and non-isochronous meter (2+3+3+2). This type of metrical grouping we can not find in Serbian folk songs, but time signature 5/8 with different metrical grouping inside phrases where we can notice that three-part rhythmic pattern changes its position (2+3 and then 3+2 or vice versa).

5. Dotted rhythm is recognizable in rooster song, but we can also find it in some Serbian folk songs and dances.

6. The sound motif of Istrian crane shows the interval of augmented fourth which is recognizable as the ambitus of downward tetrachord of Balkan scale as well as of Istrian scale.

7. While singing, many bird species build rhythmical and metrical variations of the initial pattern. The repetitions and variations of the main motif from the beginning of a pattern is typical structural tendency in Serbian folk songs and dances.

8. The gallop, as the archetypal rhythmic pattern, presents the fundament of numerous Serbian folk songs and dances. Under the gallop rhythm we understand the gallop inversion,
namely the motif that begins without the up-beat which is so typical for horse gallop.

9. In some Serbian songs we can hear the regular change of 3/4 and 6/8 time signature which presents the metric change typical for cardinal singing. We can just assume that cardinal bird species sometimes used to live on Serbian territory, or that some other bird species sing, building in their song this type of metrical change.

5. Implications

The relationship between humans and animals is aboriginal and the question if humans originally imitated animals or it happened to be vice versa, still remains. Nature and culture are not parts of dualism but two points of the same base (Martinelli 2008, 11). Animal sound patterns are clear and articulated musical motifs incorporated in Serbian folk songs and dances. The future research would refer to studying iambic pattern in animal sounds, its existence seemingly of the expiratory nature. As breathing affects animal sound making and its metrical grouping, iambic pattern could be musically transposed into the up-beat. On the other side, there is a theory that the base of any musical motif is the up-beat (Riemann 1884). It is also tempting to think about the origin of music patterns according to their producing and reproducing in animal vocal apparatus. For example, in a dove singing we can hear the regular change of isochronous and non-isochronous meter and the gentle transformation of isochronous into non-isochronous meter by the usage of their common motif (eighth note – quarter note). Starting with a motif in 3/4 measure, a dove easily conquer the field of non-isochronous pulse after just few repetitions of a motif. Sometimes, this motif could be shortened and transformed into the dotted rhythm, but sometimes the motif could be divided into syncopated rhythm. Music elements of animal sound patterns could be used as the initial educational method for understanding basic musical parameters. Making the list of the entire bird species that live on Serbian territory according to their musical patterns, will be a part of the further research and could be used as the initial pedagogical material in biomusic pedagogy.

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**Short biographies**

**Milena Petrović** is a musicologist and teacher of solfegio at the Faculty of Music, University of Belgrade. Holds MA from the University of Belgrade, specialist in Music Theater from the University of Arts, Belgrade. Actively participates at national and international music conferences (CIM, ESCOM, ICMPC, SEMPRE, CFME). Holds seminars and workshops in the country and abroad. Main interests are music perception and cognition, music-linguistic and zoo-musicology.

**Nenad Ljubinković** graduated from the Filology school Belgrade University, literary department, where he took the MA and PhD. Worked at the Institute of literature and lectured national literature at different schools in Serbia. Now professor emeritus. He was a founder and a leader of the project named Serbian oral tradition in Balkan context at the Institute of literature. During 2004/05, a leader of the international research project named Oral tradition of Serbian ethnic songs, under the UNESCO sponsorship. The author of the large number of papers and the Review of Yugoslav people's literature.
Musical Materials and Compositional Practices at the Intersection of Natural and Cultural Constraints

Tijana Popović Mladenović, Blanka Bogunović & Ivana Perković, University of Arts, Belgrade, Serbia

Abstract

Musical phenomena are part of the vibrant interplay between natural and cultural constraints, understood as rules or conditions that impose limits on what is possible. Materials and compositional practices in music are rooted in particular relationship between cognitive and physical determinants, which are not mutually exclusive. Composing, as a process and activity, has its creative, emotional and cognitive sources, founded in a social psychological context that determines achievement, motivation, and identity of the composer. In our study we aim to determine elements of nature and culture: a) that reflect in musical material related to techniques and strategies of compositional systems and b) that reveal/disclose personal and creative perspective of cognitive, emotional and imaginative processes that are involved in compositional practices. The method of our research is explorative and qualitative. Results show that creative process is inspired by nature and shaped by culture. It refers to the unfolding in the frame of biologically given potentials and is influenced by psychological, social, cultural context. In compositional practices a creative process begins in divergent manners, either from some sentiment, sound, painting, certain musical idea, colour of instrument, text. Then it rises in its complexity (provisional plans, subordinate ideas, flashes of illumination, new insights, trial-and-error search) and has its climax which is followed by tension resolving (final structural shaping, orchestration, hierarchy of micro and macro levels) through convergent problem solving.

1. Background in musicology.
Musical phenomena are part of the vibrant interplay between natural and cultural constraints, understood as rules or conditions that impose limits on what is possible (Leman, 2007). Materials and compositional practices in music are rooted in particular relationship between cognitive and physical determinants, which are not mutually exclusive. The dynamic model of cognitive and physical interaction affects our understanding of musical material and compositional practices as the outcome of evolutionary trajectories which lead to present time of postmodernity (Cross, 2001). Now, incompatible aesthetics and styles coexist in a fluctuating, steady condition. Compositional grammars, techniques and strategies created during the 20th century did not satisfy historical demand for their own creation. This type of lacuna in the 20th century music might be compared to the late 14th century with its isorhythmic technique and complicated rhythmical surface. Will, as in the 15th century – the time of fauxbourdon, Dunstable and Dufy, when complexity opened a new path to euphony and structural diversity (Lerdahl, 1997) – the similar developments happen in the 21st century?

2. Background in music psychology.
Composing, as a process and activity, has its creative, emotional and cognitive sources, founded in a social psychological context that determines achievement, motivation, and identity of the composer (North & Hargreaves, 2008). Creativity is a process that can be observed only in intersection where individual, culture/domain and social/field interact (Csikszentmihalyi, 2004). Systems theory approach (Van Bertalanffy, 1950) could provide a conceptual framework for understanding how intimate and individual world of composers' cognitive strategies, emotional drives, creative impulses, imaginations and compositional
practice, as an open system, can interact with wider, macrosystems of environment, culture and nature.

3. Aims.
The aim of our study is to determine elements of nature and culture: a) that reflect in musical material related to techniques and strategies of compositional systems and b) that reveal/disclose personal and creative perspective of cognitive, emotional and imaginative processes that are involved in compositional practices.

Figure 1. The model of intersection of nature and culture in the context of creative musical processes

4. Main contribution.
The method of our research is explorative and qualitative. It covers 3 areas of interest: musical materials used by composers, individual perspective (personal and creative) and compositional practices in their relation to nature and culture. A questionnaire (21 items) was filled in (written form or interview) by 9 eminent Serbian contemporary composers (professors /former and present/ at the Department of Composition and the Department of Music Theory at the Faculty of Music in Belgrade, as well as those at interdisciplinary doctoral studies at the University of Arts in Belgrade, freelance artists, radio artists, former manager of Electronic Studio of Radio Television of Serbia, former advisor to the Minister of Culture of the Republic of Serbia, as well as 4 students of undergraduate and doctoral studies at the Department of Composition at the Faculty of Music in Belgrade). They all differ in style and musical directions and are aged from 22 to 80, 5 female and 8 male participants. The qualitative content analysis of participants’ answers has been done.

Results. Nature — music — culture. In answers of contemporary Serbian composers to the group of questions referring to the type of relationship between nature and culture in music, its
CIM10: Nature versus Culture

conditionality by nature and/or culture, characteristics of its own nature and culture, its force ‘per se’ and ‘for ourselves’, as well as to types of ‘representation’ of nature and culture which refer to the signification and meaning of music, we re-raise the issue of difference between noetic and aesthetic music, in other words, the difference between philosophy of music and aesthetics of music and the terms musica mundana and musica humana. In fact, it is the issue of nature versus culture when it comes to music in its most general sense, and in that sense composers mainly picked their choices according to latently present subtext of accepting or unaccepting Pythagorean-Platonic assumption that there is one a priori and only nous, and not aisthesis given music which is, as its prerequisite, ahead, beyond and before each historically created music. However, all participants included in their answers the historical dimension and the question of the beginning, or, if not ontological, at least logical Prius: did the nature or culture cause the creation of the first organized sounds?

Five composers think that the first cause cannot be culture, that is, they believe that the nature is to be ‘thanked’ for the start of that particular conditional music, while still in the midst of the formation of culture, nature continues to provide and develop categorical mental conditions: musical ability, complementary capabilities for the realization of intentions and decisions, preferences, while culture offers various models of sound structures and methods of ‘encoding’. That is, only later the transformation of meaning, the conversion of the elementary principles, comes – conversion of the natural-natural (of original state of music: energy and articulation of voice, breath, breathing, inhaling and exhaling, therefore life) into the elaborated-natural (into the new stylized forms: knowledge, techniques, skills, and searching for resources cultivate, which can be referred to as the dimension of culture). Also, two of these five artists point out that the music is more a matter of nature (in its origin and structure), and that it exists through cultural matters. Taking this into account, furthermore, one of these five authors, points out that since the effects of nature and culture are categorial, they cannot be quantitatively or qualitatively compared, while the two of them believe that music is nowadays more a cultural phenomenon than natural (at the same time, one of the answers points out that even then it does not lose its natural property – as long as it has any kind of connection with the unconscious, it is in concert with nature; while the other points out that, as a commodity, music becomes purely a matter of culture).

Four of the participants generally think that the music is mainly/solely a matter of culture (according to what kind of music certain social groups listen to, because the notion of nature is also a matter of culture, because there is nothing in music that is not a matter of culture, and there is just something that is ‘a memory of the nature’, because birds do not recognize their twitter like music, whereas the human culture does), and three authors believe that the music is equally/in the midst/in balance a matter of both nature and culture (the natural in music are the laws of music system, while civilization references and their interpretation are a matter of culture).

Based on the previously presented, composers consider that the nature of music are its general, permanent and necessary features, natural musical system and its clear physical and mathematical laws (frequency, intensity, overtone row...), but also musical material which is, for some of the authors, the exclusive nature of music. Culture of music, for almost all composers, is the organization of the material, the use of certain techniques, as well as the understanding and interpretation. In this regard, almost all authors think that nature and culture of music are two mirrors that reflect each other (culture is the mirror, and the very essence of music is the image that reflects in it; joined containers that are mutually stipulated). Also, for most of the authors both nature and culture of music are real and exact categories (practically and exactly belong to the culture that reveals the reality and exactness in music as its nature). Along with this, one author explicitly rejects the real
and the exact as words that can bind to the nature of music and instead of them (as well as instead of words virtual and fictional) introduces the terms uncatchability, elusiveness, sensitivity, variability, inevitability of its natural self.

According to one of the authors, music must exist 'per se' and 'for ourselves'. The signification of music, according to him, as the relationship between the sign and the signified refers to duration, existence in time, process, infinity, motion, constancy. Nature with no intention 'offers' occurrences which we can 'design' and culture offers occurrences for designing and influences this design. In this regard, another author emphasizes that, when it comes to the sense and meaning of music, the cultural layer is able to take over, absorb, 'eat' the signification, or even to cover up and camouflage the lack of it, and, on the other hand, when the signification is there, inside, in a composition, it is sometimes not known. At the same time, it is pointed out (according to four authors) that the sense of music is in its nature, and that its meaning and interpretation are related to culture. Another group of authors (seven of them) observes that culture 'represents' both the sense and the meaning of music and in line with it, doubts the existence of 'music per se'.

**Nature – musical material – culture.** Most composers primarily state natural sound, tone or human breath (the true nature of music) as a sound environment of their own creating. On the other hand, the culture, as a sound environment of creating, is present in reliance on a musical tradition, words and speech (what comes from culture is an impulse for the tone: archetype, association, word), as well as on techno music and aesthetics (dealing with algorithmic music, sound synthesis, live electronics in a digital reality, sampling, therefore inexhaustible acoustic reality of the entire recorded history of music and non-European musical cultures).

Sounds of nature and culture have equally important role in the process of formation of musical material in the works of our participants. As essential building elements that originate from nature authors state: sounds of wind, waves, birds (I help myself to them as if they were on a platter, I just take them. They are actual musical material that create meaningful formulas, codes, symbols, in context with other elements, or with themselves), images of natural elements and especially universe, human voices, noises and voices of nature in general. The most frequently mentioned sounds in the field of culture result from popular music, as incentives or content (interweaving, overtaking, flirting, analyzing mutual borders of pop and art music) and from the immediate urban environment (each acoustic input represents possible material since my imagination is solely acoustic). In this context, 'absorption of ready-made' cultural goods and meanings ranges from: my music is not capable of absorbing any unmusical meanings to my music absorbs everything. I absorb them like any sample, or I use blues and jazz in order to create a kind of genetic engineering between popular and art music.

In this process of translating the sounds of nature and culture into the musical material, most of the composers state cultural sound pollutants to hinder them from 'hearing' their own music. It is about all artificial sounds, such as: noise of large power plants, unbearable safety car signals and above all torturing strikes of subcultural 'music' called techno; electronic appliances, some radio and TV stations; but also estrade, street, internet, various institutions; music accompanying commercials, in an elevator of a store. Paradoxically, for an author whose primary sound identity is techno music, silence can be frightening. One of the authors points out that we are getting used to those visible or invisible dumps of (sound as well) waste to scandalous proportions, but believes in the subversive endurance of art because of its connection with the unconscious.

**Nature – creative – culture.** In the further course of the research composers gave answers to questions regarding the autopoietic layer of creation (imagination, creation,
compositional process and strategies) in the context of the determinants of nature versus culture, of musical material and the way it is formed. As crucial determinants of nature in the process of musical imagination and creation (one’s own composing intuition and/or irrational creative actions) the participants singled out: hearing, memory, concentration, intelligence and above all talent as a complex competence with the essential characteristic of spontaneous or deliberate moving of sound phantasms, then, the musical substance itself and its design, 'my sound' (sound platitudes, melo-rhythmic models, a specific unit that becomes subject of further manipulation); then, the way in which I 'filter' selected elements of culture, gradual natural processes (change of seasons, days and nights, cyclone and anticyclone – continuous evolutionary processes); acoustic aura, my efforts to shape up the nature of music in my own way, the nature of music which I accepted as an absolute value. As crucial determinants of culture they stated: selection and formulation of an idea/concept; spheres that are of my interest (Balkan folklore, Slavic mythologies, French impressionism); the highest of stairs which the profession has got to till that moment (the motto is: to be synchronous only with your own time); structural design; poetics and dynamics of 'game'; the context of transition from the 20th to the 21st century.

Considering compositional strategies and unfolding of creative process, the most striking thing about our participants was their individuality and idiosyncrasy. Some authors declare that their strategies have already established pattern, but some others point out that they have different strategies depending on a piece, period of professional development, theme and initial inspiration. The authors described the flow of compositional process in the following ways: the beginning of the process of music creation gives in to the non-control and spontaneity – the process starts with an audision and looking for correspondents in audio material; fantasizing, which is on the verge of dreaming, begins with disqualification and this is the beginning of work; there are no strategies, there is a decision making in important moments, where one of them excludes all others and leads to a new crossroads; I look at Klee’s drawings and imagine a motion picture, my music develops if it allows itself something that is visually impossible; I improvise, choose, arrange, analyze; even at the beginning I have an idea of the whole composition (vision of the whole); all compositional processes are subordinate to finding a unique acoustic reality (digital technology is just a tool); idea – work on the thematic material and its formal shaping as an exploration of its possible aspects through the front, middle and back layer – orchestration.

As the primary means of shaping musical materials that potentially contribute to the individual compositional poetic methods, therefore, their own compositional practices, to be aesthetically accessible, that is, as ways of their own adjusting of musical structure to sensory perception (aisthesis) of others, composers stated or emphasized the following: I think that there is nothing I should do for my music to be aesthetically accessible; I write music despite everything, it is enough to access a single being and gain its understanding; I try to follow breath – as a measure of phrase, the rhythm of alternation of inhalation and exhalation, as a natural flow of thoughts, as a natural flow of speech, I deal with the relationships and communication between male and female, of one with oneself even more; I pursue logic through sincerity in expression, and moderateness and congruity resolve the issue of accessibility; repetitiveness is what enables and facilitates the listener to enter my work, it is a ‘conditio sine qua non’ of my work; immanent properties of musical material direct the ways of its formation; I do not have an exact ‘recipe’ for formation of my musical materials and their further shaping – it seems to me that this is what contributes for my compositional poetic method to be aesthetically accessible as well.

**Nature – personal/creative – culture.** With an aim to realize the interconnection between personal contents and creative practices we asked composers about the relationship between story and music, their creative impulses and emotional drives, wondering where the gravity
centre is: in the nature or in the culture. Answers were diverse regarding the question: Is music essential for the story or is it vice versa? Answers ranged from strong exclusive statements (music must not tell the story), through sociocultural perspective of this issue (music becomes more and more a derivate of cultural process and it integrates with other spiritual and artistic domains), to more balanced opinions, which stated that there is no need for relatedness (though Man as a mediator needs a story; story is put into music as a narrative so that it can be understood, talked about, remembered), and reached such case of complete integration of music and story (story inspires music creation). Therefore, music can live without story in its natural shape, but context/people draw music into it and it becomes integrative part of culture.

Creative impulses are mainly positioned in the sphere of nature and then form different layers of perspective. They vary from strong creative needs (a need to explore, shape; to build up, create something that has not been there before; essential creative impulse shakes me as an earthquake), through emotional impulses (love, curiosity, vanity, being intrigued, defiance), through sound and action, creative and critical attitude towards everyday context and utilitarian to spontaneous inspiration and illumination. Emotional drives could be divided into three groups: mystical feelings of self-awareness (a ‘clever’ grain of sand in a desert); inner beginning of ‘blended’ sound and feeling; the most frequent drives were strong, positive, emotional impacts (elation, bliss, joy; self-fulfilment) and relatively rare (two authors) strong, sharp, negative, emotional impact (nervousness, anxiety, impatience; at difficult moments and in tense situations).

**Nature – personal – culture.** We tried to get composers’ personal perspective in relation to biological roots – experience (in sociocultural context), regarding musical creation. Mainly, two personal points of views were possibly different. Creation is mostly seen as a means of exceeding biological constraints: to last longer than biological life; as a sublimation of fear of finality of life; as an incentive for overcoming limitations of a biological being. On the other hand, some of our participants understand music as a meta category, that transcends biological determination and personal experience issues. They think of music as a medium to transcend material status in order to reach an idea; that music is a part of spiritual nature of the Man and biological transiency has nothing to do with it.

When asked how biology and experience direct creative processes, composers tend to see potentials as spiritus movens and experience as a source of enrichment which contributes to personal development, wisdom, knowledge, competence. Therefore, creation is ‘ludus’ and experience is built in it. Biology is also seen as ever present source of inspiration (consciousness, psychological challenge). But, cultural experience may bring some limitations to the development of one’s own ideas and paths, when some models are imposed.

Gender, as a biological determinant, was not taken into account by a group of composers, as one of the key features for creation in music, even though it is not so important. They are aware of indisputable influence of their gender, but it is not clear how and when, and there is no such an interest in this issue. As one of the composers said, “Gender is determined by the level of testosterone and estrogens which affect emotions in Man; in emotional sense, every artist is more or less male and female at the same time, unless he/she is a chauvinist”. It is interesting that almost none of the participants mentioned cultural stereotypes as constraints. It prevails that individuality is ‘older’ than gender.

Key life events, periods and strong personal experiences influenced practice of creation and content, and gave a colour to the music of our participants, but when asked to elaborate their statements, some of them said that there is awareness of complexity, but it is not
accessible to comprehension. However, key experiences could be grouped into three sources: personal experience that brought strong emotional charge, positive or negative (love, nostalgia, death, fears, elation; frustration, rage, injustice; maturation, unexpected reversal), important events (accidental developments and challenges; divorce, children; intensive key musical event; death of a family member; getting to know eminent composer) and social circumstances, either negative social climate in certain periods (as an artistic being, I hardly bear denying a right to communicate) or positive (that rises critical and positive energy, which inspires interest, knowledge, exchange, development, creation).

Nature – compositional practices – culture. The last set of questions refers to attitudes towards music, compositional systems and practices (musical modernism, avant-garde, post avant-garde, postmodernism, post-postmodernism...) in the last sixty years or so. When asked whether and how much the complexity/complicatedness of the mid-20th century music opened the way to euphony and structural richness, the authors pointed out: making musical structure complex is mainly directly proportional with the increase of structural richness, and inversely proportional to the euphony – however, not everything is that symmetrical and linear – in my experience, the degree of cacophony (as opposed to euphony) also depends on the color of the sound source, on the presence of overtones and on intensity; avant-garde of the mid-20th century led to the return to beautiful sound, no matter how strange it may sound; the music of the second half of the 20th century was more cacophonous and it opened new horizons for the aesthetics of beautiful in music – structural richness is much more important.

While, in connection with the assumption that 'arrow of history' lost its way at some point, and the question whether technology (of musical material among the rest) will in that case start (or has already started!) the future of music and decompose poetical-aesthetic gap, that is, which compositional grammars, techniques and strategies have prospects today, the composers answered: I do not think that the course, or tiled flows of 'musical history' digress in any way, that they 'lose their way', get into crisis, but I am very much concerned about artificially steered changes by the sources of power based on profit, 'graying' of culture and the danger that popular subculture will swallow everything; to lose way is an occurrence, not a tragedy – in the near future, fusion will have prospects; managerial strategies will be crucial for the future – combining successful examples of theatrical, multimedia and popular music practices; possibilities of electronics will continue to be explored and improved; technology will not dissolve the gap, as it will not be done by any other technique or strategy in itself; only that which goes back to the roots of music has prospects, and that is primarily something that can be listened to; great potential lies in possibilities of digital technology (computers, acoustic music, live electronics, the whole library of history stored on the internet); all known compositional strategies have prospects if they are in consent with the musical content.

5. Conclusions.
Idiosyncratic private codes and compositional grammar of a compositional system (style, approach, method, etc.) are based on common principles. We tended to define main constraints of postmodern ‘artificial’ grammar (Lerdahl, 1988). It designates (and is designated by) musical material used in compositional systems by combining different strategies in order to be perceived as apprehensible.

We are of the opinion that creative process is inspired by nature and shaped by culture. It refers to the unfolding in the frame of biologically given potentials and is influenced by psychological, social and cultural context. Biological context is more often seen as spiritus movens of creation, while culture has a role of shaping and (re)directing the process and tends towards outcome. As one of the composers pointed out, creative practices have their
final meaning and value when they are performed, listened to and evaluated, because creativity is constructed through interaction between a performer and an audience.

While most of the authors think that musical material has its origin in the domain of nature, the shaping of that musical material is associated with the domain of culture. Most composers primarily state natural sound, tone or human breath as a sound environment of their own creating. In compositional practices, the striking difference was shown between the two kinds of strategies: a phase to phase process where decision making was done at each 'crossing' (bottom-up) and starting from gestalt vision or idea about certain work as a whole (top-down). A creative process begins in divergent manners, either from some sentiment (Phantasie, dreamlike state), or from sound (Audisions), or from painting (Audi-visions) or from certain musical idea, colour of instrument, text. Then it rises in its complexity (provisional plans, subordinate ideas, flashes of illumination, new insights, trial and error search) and has its climax which is followed by tension resolving (final structural shaping, orchestration, hierarchy of micro and macro levels) through convergent problem solving (Enthusiasm-Idea-Problem-Process-Hope). Basically, there are no significant differences considering age and gender. Individual differences can be noticed in cognitive elaboration and professional sharpness of experienced composers who developed theoretical and creative models/path. It seems that individuality is 'older' than gender.

6. Implications.
This study represents a part of triple research chain (Popović Mladjenović et al., 2009; Bogunović et al., 2009) dealing with listening to, performing and composing music where common elements are cognitive, emotional/expressional and imaginative processes. We expect that new data will enable integration of findings and new theoretical conceptualizations in the field of interdisciplinarity.

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ACKNOWLEDGEMENTS

The research for this article was carried out as part of the project "World Chronotopes of Serbian Music", No. 147045D (2006 – 2010), supported by the Serbian Ministry of Science and Environment.

We would like to thank our colleagues composers and students for their mindful and open-minded contributions to this research (in alphabetical order): Andjelković Matija, Brkljačić Ivan, Gnjatović Ana, Maksimović Rajko, Milošević Tatjana, Nikodijević Marko, Radovanović Vladan, Savić Svetlana, Softić Nemanja, Srđić Jelena, Stefanović Ivana, Tošić Vladimir and Zatkalik Miloš.

Short biographies

Tijana Popović Mladenović
Current position Assistant Professor of Musicology, University of Arts,
Belgrade, Serbia
Main field of research Music history, theory and analysis
Main research areas Fin-de-siècle music
Contemporary music
Processes of musical thinking
Relevant qualifications Ph.D. in Musicology, Department of Musicology,
University of Arts, Belgrade, 2007.
Book publications
– Musical Writing (1996). Belgrade (Serb.)
– E lucevan le stele – Selected Excerpts from Italian and
(Serb.)
– Claude Debussy and His Time (2008). Belgrade (Serb.)
– Processes of Panstylistic Musical Thinking (2009). Belgrade
(Serb.)
Membership of editorial board
Musical Wave, musicological magazine (Belgrade)
Contact mitide@yubc.net

Blanka Bogunović
Current position Assistant Professor of Music Psychology, University of Arts,
Belgrade, Serbia
Main field of research Psychology of Music, Educational Psychology
Main research areas Giftedness in arts, specialized music education, musical
performance.
Relevant qualifications Ph.D. in Psychology, Faculty of Philosophy, University of
MA in Music (flute), University of Arts, Belgrade, Serbia, 1983.
Book publications Musical Talent and Successfulness (2008). Belgrade (Serb.)
Membership of editorial board
Journal of the Institute for Educational Research, Belgrade, Serbia
Contact jubolek@kbcnet.rs

Ivana Perković
<table>
<thead>
<tr>
<th>Current position</th>
<th>Assistant Professor of Musicology, University of Arts, Belgrade, Serbia</th>
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<td>Main field of research</td>
<td>Music history, theory and analysis</td>
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<td>Main research areas</td>
<td>Orthodox music, medieval and contemporary 19\text{th} century Serbian music Classical style</td>
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<td>Relevant qualifications</td>
<td>Ph.D. in Musicology, Department of Musicology, University of Arts in Belgrade, 2005.</td>
</tr>
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<td>Contact</td>
<td><a href="mailto:ivanaper@beocity.net">ivanaper@beocity.net</a></td>
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Brain activation patterns during listening to pleasant and unpleasant music and their connection with extraversion: An fMRI study

Hendrik Saare, Estonian Academy of Music and Theatre, Estonia
Jaan Ross, Estonian Academy of Music and Theatre, Estonia
Peeter Ross, East Tallinn Central Hospital, Estonia
Katrin Kõdar, East Tallinn Central Hospital, Estonia
Thomas Hackländer, HELIOS-Klinikum Wuppertal, Germany

Abstract

1. Background in neuroscience
This research is based on previous studies (Blood et al. 2001, Koelsch et al. 2006) that have sought to discover which parts of the brain are involved in the perception and analysis of music. It has to be noticed, however, that there has been relatively less research on individual differences which may be observed in the brain activity between listeners engaged in music. For the time being, the relationship between one's personality traits and the person's brain activity during engagement with music has not been widely studied.

2. Background in psychology
Personality traits affect our daily interaction with different aspects of our surroundings and are believed to have a biological basis. The five-factor personality model (Costa, McCrae 1992) posits human dispositions into categories of extraversion, neuroticism, openness to experience, agreeableness and conscientiousness. Two personality traits, extraversion and neuroticism, are strongly associated with emotional experience and have been found to moderate brain reactivity to emotional stimuli (Canli et al. 2001). Extraverts can be characterised by the tendency to experience positive emotions which is why we were interested in this personality dimension in relation to pleasant and unpleasant stimuli. How this applies to the musical experience is still a question that hasn't received much attention.

3. Aims
The goal is to study brain activation patterns of people with high and low scores of extraversion while attending pleasant and unpleasant musical stimuli. We expected to see different activations for the pleasant and unpleasant stimuli as well as for different extraversion groups.

4. Main contribution
202 participants were tested with the personality questionnaire EPIP-NEO (Mõttus, 2005), which is the Estonian equivalent of the NEO-PI-R (Costa, McCrae 1992) five-factor personality questionnaire. On the basis of the test results, 28 right-handed people (12 male, 16 female; mean age 26.8 SD 9.2) both with high and low scores of extraversion were included in the fMRI study group on a voluntary basis. 15 of them were professionally related to music and 13 were not. All the subgroups were gender balanced.

For acoustic stimulation, instrumental pieces of music were used in order to exclude possible brain activation by the lyrics. The participants were presented two pieces of music: Clair de Lune by Debussy (pleasant stimulus) and an electronically manipulated dissonant version of J.S.Bach, Rejouissance (BWV 1069) (unpleasant stimulus).
For the functional MRI Philips Achieva 3 Tesla scanner was used. During scanning the volunteers were asked to listen passively to the musical stimuli. After the procedure the volunteers were asked to rate the songs they had heard, on a scale from -5 to +5. The mean ratings for the pleasant and unpleasant stimuli were 2.8 and -1.8, respectively.

The results showed activated areas in the temporal lobes, prefrontal cortex and anterior
cingulate cortex. In conclusion we found lateralization of brain activity, where the pleasant stimulus activated areas in the left hemisphere and unpleasant music stimulated right hemisphere areas. Also we found activity in brain regions that are implicated in language processing. Additionally the low extraverted group showed right frontal lobe activation in response to unpleasant stimulus that wasn't observed in the high extraverted group.

5. Implications
The results of this research provide a better understanding of the different brain activation patterns during engagement with music of positive and negative valence as well as of differences between brain activation patterns of people with high and low extraversion. In relation to the conference theme the research investigates how personality traits with a possible biological basis can influence brain reactivity to music.

6. References

Short biographies
**Hendrik Saare**, Department of Musicology, Estonian Academy of Music and Theatre, Tallinn, Estonia; hsaare@gmail.com

BSc in Psychology from the University of Tartu in 2005. Thesis: “Strong Experiences in Music, Their Categorization and Connection with Personality Traits”

In 2006 I presented a research paper at the 9th International Conference on Music Perception and Cognition in Bologna.

I am currently studying musicology at the Estonian Academy of Music and Theatre. This research is a part of my post-graduate studies.

**Jaan Ross**, Professor, Estonian Academy of Music and Theatre, and University of Tartu, jaan.ross@ut.ee

Main research discipline: musicology, auditory psychology

Main research areas: perception, production and analysis of sounds of speech and music

Relevant qualifications: PhD in musicology, 1988, Lithuanian State Conservatoire, Vilnius; PhD in psychology, 1992, Abo Akademy, Turku


Advisory boards: Musicae Scientiae, Journal of Interdisciplinary Music Studies, Akadeemia (in Estonian), Proceedings of the Estonian Academy of Sciences
Using music classification to study prehistoric human migrations

Patrick Savage, Tom Rzeszutek & Steven Brown, McMaster University, Canada

Abstract

1. Background in comparative musicology
Cross-cultural musical comparison and classification have fascinated scholars dating back at least to the Age of Exploration, but few proposals have been put forth for a universally applicable musical classification system. The only comprehensive proposal, namely Alan Lomax’s (1968) “Cantometrics” coding scheme, was criticized but never followed up or improved upon. Our project proposes a new classification scheme, one that focuses specifically on structural features of choral song. This method builds on Lomax’s conceptual approach but incorporates advances in music cognition, ethnomusicology, and multivariate statistical methods to generate valid measurements of musical similarity between populations that incorporates diversity of song types within populations. A principal objective of this work is to compare our new classification method side-by-side with Lomax’s Cantometric coding scheme using a common data set of choral samples in order to examine the relative strengths of the two coding schemes.

2. Background in genetic anthropology
Various markers have been used to study the history of human evolutionary migrations, most notably genes and languages (Cavalli-Sforza, Menozzi, & Piazza, 1994). Our current project explores the potential use of music to serve as a novel marker to study historical migrations. Musics, like genes and languages, change over time, accumulating stylistic “mutations” as a function of both time and geographic distance. The focus of our project is on the dispersion of the Austronesian-speaking peoples throughout the Pacific region from a proposed birthplace in Taiwan roughly 6000 years ago (Diamond, 2000). This “Out of Taiwan” hypothesis has been predicated principally on linguistic data, and has received serious challenges by some genetic findings (Oppenheimer & Richards, 2001). An analysis of music will provide a novel means of examining the respective migration stories provided by languages and genes. However, music’s potential to serve as a migration marker requires that we have a valid method of musical classification and an ability to analyze the musics of cultures throughout the world in terms of their similarity and difference.

3. Aims
The two major aims of this work are, first, to develop a method of musical classification and cross-cultural music comparison, and second, to apply this method to the study of human migrations. One of the assumptions of our method, which we call “CantoChor” (“canto” = song; “chor” is short for chorus), is that the best-controlled musical sample for cross-cultural musical comparison is choral song, i.e., vocal music with two or more simultaneous singers. We thus exclude vocal solos, instrumental solos, and instrumental ensembles from our sample. Solo forms require no mutual agreement among performers on stylistic features, and hence are too susceptible to idiosyncratic variation, while instrumental music lacks the common physical constraints on vocalization that provide cross-cultural comparability of vocal music.

The final step of this method is the examination of musical variation in relation to both genetic variation and linguistic variation throughout a region. Our method involves the performance of statistical cluster-analyses and correlations using phylogenetic software packages. First, musical classification is performed so as to generate a distance matrix for musical style across cultures. This musical distance matrix is then compared with distance matrices for genes and for languages to look at the extent to which correlations are present.
From these correlations, it should be possible to determine if changes in musical style across cultures more closely match genetic variation, linguistic variation, both, or neither. Intra-musical correlations between stylistic features irrespective of shared cultural history will provide support for the intrinsic, “natural” constraints on those features, while correlations between stylistic features and their shared genetic and/or linguistic histories will provide evidence for “cultural” features of music. Finally, we plan to compare Cantometrics and CantoChor to see if the two methods provide similar results.

4. Main Contribution
Musical classification and comparison has been a highly neglected topic not only in ethnomusicology but cognitive musicology as well. There has not been a serious discussion of musical classification since the work of Lomax in the 1960’s and 70’s. Therefore, we are proposing a revival of this very important topic. Statistical methods allow us to generate distance matrices providing measurements of “musical distance” between cultures based on relative frequencies of songs of different “cantogroups” (clusters of songs classified as having similar features) across multiple cultures, analogous to using haplogroup frequencies to measure genetic distance in migration studies.

There are nine Taiwanese aboriginal tribes for which both musical and genetic samples are available. Preliminary results of applying Cantometrics to 226 choral samples from these tribes showed that musical distance is significantly correlated with genetic distance – as measured using mitochondrial DNA haplotypes ($r^2=0.19, p<0.05$) – but not with geographic distance ($r^2=0.04, p>0.2$). These results suggest that music can be used as a novel marker to study human migrations.

5. Implications
A successful application of these methods to the Austronesian migration could be followed by successively larger studies in order to further test the universality of Cantometrics and CantoChor and add to an understanding of human migrations throughout the world and throughout history. Validation of Cantometrics and/or CantoChor and of music’s use as a migrational marker would provide a powerful new universal methodology for musical study. This would be a significant advance for studies of musical comparison, music evolution, and musical universals.

6. References

Short biographies
Patrick Savage is a graduate student in the Department of Psychology, Neuroscience and Behaviour at McMaster University in Hamilton, Ontario, Canada. He received a B.A. summa cum laude in music composition at Amherst College and studied traditional Japanese music at Doshisha University in Kyoto, Japan as the Amherst-Doshisha Fellow.
Email: savagepe@mcmaster.ca

Steven Brown is an assistant professor in the Department of Psychology, Neuroscience & Behaviour at McMaster University in Hamilton, Ontario, Canada.
Email: stebro@mcmaster.ca
Influences of perceived emotions on perception of musical streams

Renee Timmers & Harriet L. Crook, University of Sheffield, UK

Abstract

1. Background in auditory perception
Stream segregation refers to the phenomenon of perceiving multiple streams or voices even though the presented sound is in fact a single temporal sequence. On the basis of acoustical characteristics such as the timing, pitch and timbre of the tones, tones are perceived as coming from the same source, or, to segregate and appear to come from different sources. In a classical paradigm in which low and high tones alternate sequentially, an interaction between speed of alternation and distance in pitch has been shown: Tones further apart in pitch tend to segregate especially at faster tempi Creating a perception of two simultaneous voices when in fact the auditory stimulus is a single melodic line. (Van Noorden, 1975; Bregman, 1994).

2. Background in music cognition and emotion
Within music cognition research, awareness is growing that perception and experience of emotions are not only a result of listening to music, but also inform and shape music cognition. For example, induced emotions interact with the memory for major and minor melodies (Haddock & Houston, 2007) and influence expectations for upcoming musical events (Timmers, 2009).

3. Aims
A perceptual experiment was designed to investigate the influence of perceived emotions induced through a visual prime on the perception of auditory streams.

4. Main contribution
The perceptual experiment combined an [a visual] emotional prime with a classical stream segregation experiment that varies tempo and pitch interval of a repeating three note pattern (low note followed by a higher note and returning to the low note). Three factors were systematically varied in the experiment: emotion, tempo and interval. The emotion conditions were happy, sad and neutral. Faces expressing these emotions (using Radboud Emotional Faces Database, Langner et al, 2010) were used as emotional prime. Participants saw the faces on a screen and were instructed to imagine the expressed emotion. The tempo conditions included 120, 150 and 180 ms, which refers to the time interval between successive note onsets. The interval conditions included a perfect fourth and an augmented fourth. Previous research has shown that perception of streams is ambiguous under these conditions (e.g. Van Noorden, 1975; Snyder et al 2009; Sussman, Horváth, Winkler, 2007). Finally, three starting pitches were used as random variable to add variation to the experiment and diminish order effects.

The total of 54 trials were presented in random order. Participants listened to a single repeating pattern for 6 sec. After each trial, the perception of streams was assessed using two 7-point rating scales: Participants judged to what extent they perceived the alternating tones as one stream or two streams. And, participants judged to what extent the lower or higher note was perceived in the foreground. The middle of the rating scales indicated an ambiguous situation – the sequence was heard as two streams and as one stream (alternating), and both the high and low note were perceived to be in the foreground.

Preliminary results are reported based on the data of 21 participants with varied musical
backgrounds. A repeated measures ANOVA was run with emotion, tempo and interval as within-subjects factors. Data was averaged over the three trials per condition (presentation of the material at different pitch heights). Separate ANOVAs were run for the two ratings. For the rating of stream segregation (rating 1), the main effects of tempo and interval were significant ($F(2, 40) = 17.4, p < .0001$ for tempo; $F(1, 20) = 7.74, p < .05$ for interval). No effect of emotional priming was found and no interactions were found. For the rating of foreground/background (rating 2), the effect of emotion was marginally significant ($F(2, 40) = 3.08, p = .057$, two-tailed): For the happy condition, the high note was [assigned] relatively more to the foreground compared to the sad condition. Tempo and interval were not significant, nor did any of the interactions reach significance for this type of rating.

One reason for the lack of a significant effect of emotion on the perception of stream segregation could be a large within-subject variability. Perception tends to be highly variable and varies with context and order. To separate variability from the main trends, a principle component analysis was run clustering the data into underlying components. This was done for the two ratings separately. The principle component analysis for the stream segregation rating resulted in eight components with an eigenvalue greater than 1, indicating a large number of trends within the data. The largest component accounted for 26% of the data, and the second component for an additional 13% of the data. A multiple regression analysis was run with emotion, tempo and interval as continuous factors to examine to what extent these principle components are related to these factors. The main component could be accounted for 93% by the linear combination of these three continuous factors. However, the second component could not be accounted for significantly by any of these factors.

For the main component, each factor contributed significantly to the regression analysis (tempo: $F(1, 16) = 156.6, p < .0001$; interval: $F(1, 16) = 12.4, p < .01$; emotion: $F(1,16) = 6.29, p < .05$). These effects were in the expected direction: Longer durations between notes (slower tempi) had less segregation than shorter durations. The augmented fourth had more segregation than the perfect fourth. A sad context led to more segregation than a neutral context, while a happy context led to less segregation.

The principle component analysis of the ratings of foreground/background led to a similar picture of diversity in answers: Nine components were extracted with an eigenvalue larger than 1. The first component accounted for 16% of the data and the second component for 15% of the data. Again a multiple regression analysis was run with emotion, tempo and interval as continuous factors to examine to what extent these principle components are related to these factors. For the first component, emotion was the only significant contributor to the regression analysis ($F(1,16) = 5.16, p < .05$). It accounted for 28% of this component. Interestingly, for the second component, tempo was the only significant contributor to the regression analysis ($F(1,16) = 4.66, p < .05$) accounting for 34% of this component.

**5. Implications**

This investigation has shown two influences of perceived emotions on perception of stream segregation: shifting attention to a relatively high or low pitched stream and increasing stream segregation in a sad context and integration in a happy context. Although quite weak effects, this has nevertheless important consequences for auditory perception research. These effects were seen even with a relatively low level and stimulus driven auditory process and non-auditory emotional priming. There is scope to investigate further effects within specifically musical contexts, for example implied polyphony, which exploit the same mechanisms of auditory grouping.

**6. References**


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**Short biographies**

**Renee Timmers** is lecturer in psychology of music at the Department of Music, University of Sheffield, where she directs the onsite and distance learning MA’s in psychology of music. She has a background in Musicology (MA, University of Amsterdam) and Psychology (PhD, Radboud University Nijmegen) and was postdoctoral researcher at several institutes (among others Northwestern University, Austrian Research Institute for Artificial Intelligence, and King’s College London) before coming to Sheffield. Her main research interests concern psychology of performance, emotional responses to music and music cognition.

**Harriet Crook** is a senior clinical scientist in the department of Audiovestibular Medicine at the Royal Hallamshire Hospital and a Postdoctoral Research Assistant at the Department of Music at the University of Sheffield. After a BA in Music and Philosophy at Cardiff, she studied for a PhD investigating the Neuropsychology of music cognition at the University of Sheffield after which she trained as a Clinical Scientist in Audiology. Dr Crook leads a service for diagnosis & management of Auditory Processing Disorders in Adults and is also currently working on improved clinical methods of programming cochlear implants for music perception. She has interests in Auditory processing and the impacts of hearing impairment on music perception. She has presented at national and international conferences on the topic of music and cochlear implants.
A cognitive approach to the ‘Tristan’ chord

Matthew Woolhouse, Wolfson College, University of Cambridge, UK.

Abstract

1. Background in cognitive musicology
This research uses a cognitive model, designed to predict listeners’ experience of tonal attraction.

2. Background in music theory
The research applies the model to a particular problem from music theory/analysis: the ‘correct’ functional interpretation of chromatic nineteenth-century harmony.

3. Aims
Nineteenth-century chromatic harmony is problematic in that frequently it is functionally ambiguous – chromatic chords, unlike diatonic harmony, often have ill-defined roots which means that their proper functions are difficult to establish. The example par excellence of this is the long-running debate over the correct functional description of the opening sequence of Wagner’s ‘Tristan und Isolde’ (Lerdahl, 2001, pp183-6). This project attempts to circumvent this problem by employing a cognitive/perceptual approach to the analysis of chromatic harmony.

4. Main Contribution
Woolhouse (2007) and Woolhouse & Cross (a, forthcoming) present a formal context-independent model that predicts the level of tonal attraction between temporally adjacent pitches and/or chords. The model is context-independent in that the key or tonal context of the music need not be specified prior to the calculation. The model is based on the notion of ‘interval cycle proximity’, a hypothesized cognitive grouping mechanism responsible for the perception of tonal attraction (Woolhouse & Cross; b, forthcoming). The model has been tested empirically using techniques from experimental psychology and inferential statistics. The talk will be illustrated with an analysis of the opening of Wagner’s ‘Tristan und Isolde’, and will show that the model can predict the opening sequence of ‘Tristan’ in terms of tonal attraction without the chords needing to be functionally specified.

5. Implications
When we listen to functionally ambiguous harmony, such as the opening of ‘Tristan’, is our perception of the music unified or bifurcated? The multiple functional interpretations possible with respect to chromatic harmony suggest that the latter should be the case; that is, that functionally ambiguous music should be perceived as “either this or that”. However, anecdotally at least, this is not the case: chromatic music is experienced holistically, as a unified dynamic percept, in much the same way as diatonic music. This implies that there is a fundamental mismatch between the functional system music theorists use to describe chromatic harmony (which leads to ambiguity) and our perception (which is unified and unambiguous). The paper will explore whether or not this implies that the functional approach should be abandoned with respect to the analysis of chromatic harmony in favour of a perceptual-dynamic approach, for example, such as that offered by models of tonal attraction. The paper will contextualise this issue by briefly reviewing some of the analytical approaches that have been adopted thus far in relation to the ‘Tristan’ chord.

6. References
CIM10: Nature versus Culture


Short biography

Matthew Woolhouse is a Junior Research Fellow in Music Cognition at Wolfson College, Cambridge, a member of the Faculty of Music in Cambridge and for 2009-10 is the acting Director of the Centre for Music and Science in Cambridge. Current research interests include the cognitive processes underpinning the historical development of Western tonal music, the perception of musical metre, and the connection between music, dance and person perception.
CIM10: Nature versus Culture
List of Attendees

Aaron Allen       The University of North Carolina at Greensboro, USA       aaron.s.allen@gmail.com
Rytis Ambrazievicius Kaunas University of technology, Lithuania       rytisam@defi.lt
Mondher Ayari       University of Strasbourg-2, France          mondher.ayari@ircam.fr
Blanka Bogunovic University of Arts, Belgrade, Serbia       jube@kbcnet.rs
June Bonfield-Brown Nottingham Trent University        Junebonfieldbrown@sky.com
Stephanie Bramley University of Sheffield               mup09sb@sheffield.ac.uk
Bryony Buck         University of Glasgow              B.buck@elec.gla.ac.uk
Lorna Carter       University of Sheffield     lornacarter@gmail.com
Paul Coleman University of Westminster        paulmichaelcoleman@yahoo.co.uk
Eduardo Coutinho University of Sheffield                e.coutinho@sheffield.ac.uk
Helen Daynes       Kings College London        helen.daynes@kcl.ac.uk
Alexander Deweppe Ghent University, Belgium               alexander.deweppe@ugent.be
Nikki Dibben       University of Sheffield       n.j.dibben@sheffield.ac.uk
Tuomas Eerola University of Jyvaskyla, Finland        tuomas.eerola@juyu.fi
Zohar Eitan        Tel Aviv University, Israel        zohar44@yahoo.com
Jane Ginsborg Royal Northern College of Music           Jane.Ginsborg@rcm.ac.uk
catherine Glennon Harvard University, USA             cglennon@post.harvard.edu
Wilfried Gruhn University of Freiburg, Germany       mail@wgruh.de
Graham Hair         Glasgow University          ruth0@blueyonder.co.uk
Ruth Herbert       Open University         R.E.Hodges@derby.ac.uk
Richard Hodges     University of Derby          huron.1@osu.edu
David Huron        Ohio State University        xiao_rou2001@yahoo.com
Chiung-Hui Hwang University of Sheffield     f.jurgensen@abdn.ac.uk
Frauke Jurgensen University of Aberdeen     slk34@cam.ac.uk
Sarah Knight       University of Cambridge       ian.knoque@gmail.com
Ian Knophe         BBC                          Catharina.Debouck@UGent.be
timothy Koozin University of Houston, USA            tkoozin@uh.edu
Darius Kucinskas Kaunas University of technology, Lithuania      darius.kucinskas@ktu.lt
oliver Lartillot University of Jyvaskyla, Finland             olartillot@gmail.com
daniel.leech-wilkinson Kings College London        kerstin.leimbrink@tu-dortmund.de
Kerstin Leimbrink University of Dortmund, Germany       emclain@vt.edu
Elisabeth McLain Virginia Polytechnic Institute, USA  miguelmolina@ugr.es
Miguel Molina-Solana University of Granada, Spain       YMorimoto1@sheffield.ac.uk
Yuko Morimoto       University of Sheffield        mariachristina.musso@uniklinik-freiburg.de
Mariachristina Musso University of Freiburg, Germany        Elisa.negretto@virgilio.it
Elisa Negretto       University of Padua, Italy        d.omigie@gmail.com
Diana Omigie       Goldsmiths University of London       k.overy@ed.ac.uk
Katie Overy       IMHSD, University of Edinburgh        Zhanna@ema.edu.ee
Zhanna Partlas Estonian Academy of Music and Theatre, Estonia      p.milena@eunet.rs
Milena Petrovic University of Arts, Belgrade, Serbia       Michelle.phillips@btinternet.com
Michelle Phillips University of Cambridge             s.e.pitts@sheffield.ac.uk
Stephanie Pitts University of Sheffield     podlip@poczta.onet.pl
tai-chien Rabinowitch University of Cambridge     tcnr2@cam.ac.uk

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<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regina Rottner</td>
<td>Austria</td>
<td><a href="mailto:r.rottner@yahoo.co.uk">r.rottner@yahoo.co.uk</a></td>
</tr>
<tr>
<td>Hendrik Saare</td>
<td>Estonian Academy of Music and Theatre, Estonia</td>
<td><a href="mailto:hsaare@gmail.com">hsaare@gmail.com</a></td>
</tr>
<tr>
<td>Pat Savage</td>
<td>McMaster University, Canada</td>
<td><a href="mailto:savagepe@mcmaster.ca">savagepe@mcmaster.ca</a></td>
</tr>
<tr>
<td>Michael Spitzer</td>
<td>University of Liverpool</td>
<td><a href="mailto:michael.spitzer@durham.ac.uk">michael.spitzer@durham.ac.uk</a></td>
</tr>
<tr>
<td>Lauren Stewart</td>
<td>Goldsmiths, University of London</td>
<td><a href="mailto:l.stewart@gold.ac.uk">l.stewart@gold.ac.uk</a></td>
</tr>
<tr>
<td>Hollis Taylor</td>
<td>University of Western Sydney, Australia</td>
<td><a href="mailto:hollistaylor@me.com">hollistaylor@me.com</a></td>
</tr>
<tr>
<td>Dan Tidhar</td>
<td>Queen Mary, University of London</td>
<td><a href="mailto:dan.tidhar@elec.qmul.ac.uk">dan.tidhar@elec.qmul.ac.uk</a></td>
</tr>
<tr>
<td>Renee Timmers</td>
<td>University of Sheffield</td>
<td><a href="mailto:r.timmers@sheffield.ac.uk">r.timmers@sheffield.ac.uk</a></td>
</tr>
<tr>
<td>Theresa Veltri</td>
<td>University of Sheffield</td>
<td><a href="mailto:mup09tmv@sheffield.ac.uk">mup09tmv@sheffield.ac.uk</a></td>
</tr>
<tr>
<td>Duncan Werner</td>
<td>University of Derby</td>
<td><a href="mailto:D.Werner@derby.ac.uk">D.Werner@derby.ac.uk</a></td>
</tr>
<tr>
<td>Brooke Wilken</td>
<td>University of Victoria, Canada</td>
<td><a href="mailto:brooke.wilken@mail.mcgill.ca">brooke.wilken@mail.mcgill.ca</a></td>
</tr>
<tr>
<td>Maria Witek</td>
<td>University of Oxford</td>
<td><a href="mailto:maria.witek@wadh.ox.ac.uk">maria.witek@wadh.ox.ac.uk</a></td>
</tr>
<tr>
<td>Ghofur Eliot Woodruff</td>
<td>University of Cambridge</td>
<td><a href="mailto:gew26@cam.ac.uk">gew26@cam.ac.uk</a></td>
</tr>
<tr>
<td>Matthew Woolhouse</td>
<td>University of Cambridge</td>
<td><a href="mailto:mhw31@cam.ac.uk">mhw31@cam.ac.uk</a></td>
</tr>
<tr>
<td>Roni Yeger-Granot</td>
<td>The Hebrew University of Jerusalem, Israel</td>
<td><a href="mailto:rgranot@huji.013.net.il">rgranot@huji.013.net.il</a></td>
</tr>
</tbody>
</table>
CIM10 Review Committee

Mireille Besson  
CNRS – Marseilles, France
Emilios Cambouropoulos  
Aristotle University of Thessaloniki, Greece
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University of Western Sydney, Australia
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Université de Montréal, Canada
Costas Tsougras  
Aristotle University of Thessaloniki, Greece
Elizabeth West Marvin  
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Aaron Williamson  
Royal College of Music, UK
Lawrence Zbikowski  
University of Chicago, USA
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