



The E-Newsletter of the Institute of Acoustics Musical Acoustics Group

Issue 1 June 2013



'Musical acoustics or music acoustics is the branch of acoustics concerned with researching and describing the physics of music – how sounds employed as music work. Examples of areas of study are the function of musical instruments, the human voice (the physics of speech and singing), computer analysis of melody, and in the clinical use of music in music therapy.' Wikipedia

The Institute of Acoustics came into existence in 1974 and many founder members were from the Acoustics Group of the Institute of Physics and/or members of the British Acoustical Society (BAS). On formation of the Institute of Acoustics, the Musical Acoustics Group (MAG) were already up and running and was the first specialist group within the Institute. Dr Peter Dobbins was the previous Chair of the MAG and for many years kept the group alive. Some members will recall the newsletter the MAG called *Notes*. Rumour has it that this was prepared using the Atari ST computer! Peter's work commitments, the fact that he now chairs the Underwater Acoustics Group and the delay in finding a successor has meant that activity in the MAG declined. At the most recent AGM held on 10th April 2008, Peter Dobbins reported that the Musical Acoustics group had been fairly dormant in recent years. The plight of the group came to my attention several fairly soon after then but with other heavy commitments (and work overloads) that accompany acoustic consultants, there was little scope for me to give the MAG any assistance despite my long-standing interest in music. However, with 'retirement' from full-time consultancy in late 2011, I felt determined to do what was possible to kick-start life into this important group. I have always been aware that many acousticians have an 'above average' interest in a variety of musical tastes and indeed, the membership includes a number of competent performers, singers and instrument makers.

Because the MAG had become somewhat moribund for almost 5 years, I realised that there was some challenge ahead and a number of initiatives needed to be made. Attempts to hold an AGM last year met with no success as did the proposed one-day meeting in Cardiff which came as a disappointment to those who were prepared to present some really interesting papers and hear a magnificent 18th century organ that has recently been rebuilt. Hindsight told me that the timing was out, being close to Acoustics 2012 held at Nantes, the location in Cardiff not ideal, the cost of the one-day meeting (and associated travel etc) too high to encourage unsponsored attendees including those in the academic sector.

It became clear that more effort was needed to get the MAG kick-started. There was no doubt that interest would not really resume until members were really aware that the MAG group was more than a distant memory. A newsletter was essential and the production of an e-newsletter involves no postage costs as was associated with 'Notes'. MAG-MAG is intended to go out every three months with the next issue scheduled for September.

The trial webinar that was held at the Senior Members Group AGM in March 2013 and half day meeting included a fairly informal paper I presented 'What is the right note interval, pitch, or temperament in music?' This was well attended at St Albans and by a fair number on-line. Perhaps MAG meetings such as this will address cost and travel issues? More about temperament below!!!!

The one-day meeting described below tackled the cost issues and offers concessionary rates.

Mike Wright (Chair MAG)

IOA MUSICAL ACOUSTICS DRAFT MISSION STATEMENT (FOR COMMENT)

'The MAG has a very important part to play in the understanding and research of many aspects of acoustics. The obvious connections between music and acoustics include the design of opera, concert and recital performance venues, studio and practice room acoustics and design. However, aspects such as musical instrument design, music technology, music therapy, musical perception, the singing voice, the use of electronics in musical performance and reproduction also encompass a wide field of acoustical knowledge.

The mission of the MAG is as follows:

- *encourage closer working with professionals in related disciplines such as architects, musical instrument designers and builders, sound engineers, performing musicians and composers, musical education, music in health and wellbeing.*
- *To be a forum for members and other professionals with an interest in all aspects of musical acoustics.*
- *To promote a wider understanding of musical acoustics to academics, professionals in all related fields and increase public awareness.*
- *To hold regular meetings (with access available to related professional disciplines) for the interchange of information and experiences.'*

Please send all comments and suggestions to Mike Wright - mike@isaamnet.org by the end of July 2013.

A 'Linked in' discussion on tuning and temperament

The following interesting discussion came about following efforts to publicise IOA MAG. This was on the same theme as my presentation at the Senior Members Group AGM in March 2013.

Richard Hill-Jowett - CEO at Audio Visual Designs (Pty) Ltd Johannesburg Area, South Africa *'...as a classical guitarist musical acoustics are everything just short of tuning'*.

Mike Wright: *'Tuning and temperament are most important and abhor the way we are all being brainwashed with the Western European convention of equal temperament'*.

Richard Hill-Jowett: *'Indeed - It is interesting to explore various scales (pentatonic) etc. What about 'six-note Blues. Even changing the starting note can alter the musicality - Start on the harmonic minor 5th Note gives a distinctly East European Gypsy feel.*

Even more exotic are the middle eastern scales moving away from the 12 pitch per octave to one that includes an augmented step - distinctive in the Jewish tune "Hava Nagila" etc.

However this relates purely to the interrelationship between one note and another and less to do with timbre and tonal quality that modifies or shapes the sound. This is confusing with regard to pure physics and can be described as almost an art form. e.g. What makes a Stradivarius Violin sound so unique and why can we not simply mass produce the same 'sound'.

Finally what about totally unrelated issues such as mood, setting, occasion? Why would Jazz seem to touch the soul more in the surroundings of a small club filled with a passionate and appreciative audience. The instruments are the same - it can be argued that the acoustical character of the venue could be replicated but emotion makes a huge difference. Why watching the game on a large screen at home just is not quite the same as opposed to 'being there'.

Mike Wright: *Interesting discussion on blues scales! A hexatonic blues scale consists of a minor pentatonic scale plus the #4th or \flat 5th. However we have some who talk about the heptatonic (7-note)"blues scale". This is a diatonic major scale with lowered 3rd, 5th and 7th and sometimes described as a combination of 'African scales' and diatonic western scales. However, is it a scale!? Look in Benward & Saker (2003): Music: In Theory and Practice, Vol. I, p.39 where it also describes a 9-note blues scale featuring a flat 3rd & 7th alternating with normal 3rd s and 7th s giving 'blue notes'. Of course, if all things were equal we would have equi-pentatonic systems = 240 cents, equi-heptatonic = 171 cents....*

You touch on Middle Eastern culture and one of my personal favourites is one from Iran - Miquam Rast taking it from from C with $\frac{1}{2}$ flat 3rd and $\frac{1}{2}$ flat 7th. Now we are moving away from 12 tone and indeed, thoughts can now turn to music with 17 tones / octave which can be a real delight!! However, guitarists would need new instruments! Would you mind me me reproducing an edited view of this thread in the my newsletter, It could certainly spark interest by others!

Richard Hill-Jowett: *'I would have no objection at all.*

In South Africa we have a unique "Township" sound that inspired many western and local artists like Ladysmith Black Mambazo. Interestingly this involves "Open Tuning" on a fretless guitar. This evolved from the use in the townships of a 5 litre cooking oil can, a plank and some guitar strings to create a Township Guitar with a particularly unique sound.

Practically Frets were not possible and open tuning made chords very simple by simply Barre up and down the 'fret board' (I suppose without frets it is no longer a fret board?)

An example <http://www.silveryrecords.com/fretless-guitar/>

This opens up endless variety and combinations otherwise impossible with the standard EADGBE fixed fret setup.

Last month I was in Botswana and attended a function at a school in the middle of the African bush. The kids put on a marimba concert with 18 marimbas built out of Gourds strips of leather thong and Mopanie wood. Here too the sound was very interesting and I would have loved to have had the time to explore the relationship between the notes - certainly not the traditionally accepted major scale - I think there was an augmented note in the scale and some of the tuning was a few cents away from the standard. Making it difficult to define was the variance from one instrument to the next with a tiny 2-foot long instrument being played by a pre-school kid to a huge bass instrument being played by two huge Batswana kids in their late teens'.

This led me to recall my paper described above was modified from one I gave back in 1999 at the University of Pittsburgh at a conference primarily aimed for composers and ethnomusicologists. However, in the updating process to aim it for acousticians for the IOA SMG meeting in March, I had been in contact with several composers and ethnomusicologists whom I have known over the years. This was to get further information regarding specific aspects of African music which I have had interest for many years. With regard to mbira music (also known as likembe, mbila, thumb piano, mbira huru, mbira njari, mbira nyunga nyunga, sansu, zanzu, karimbao, kalimba) an interesting response came from South African composer and musicologist Martin Scherzinger, whom I met at Pittsburgh in 1999. He referred me to his recent paper: *Negotiating the Music-Theory/African-Music Nexus: A Political Critique of Ethnomusicological Anti-Formalism and a Strategic Analysis of the Harmonic Patterning of the Shona Mbira Song Nyamaropa*, Martin Scherzinger, *Perspectives of New Music*, Vol. 39, No. 1 (Winter, 2001), pp. 5-117 which makes very interesting reading. With regard to mbira tuning the following variants were illustrated as examples with intervals shown in cents.

Mujuru's gandanga	131	216	164	246	140	197	193
Shigamba's gandanga	130	188	170	210	133	188	189
Majuru's dambatsoko	178	147	157	219	199	184	129
Majura's nyamaropa	160	198	115	230	128	161	219



He pointed out that 'the question of tuning is not central to the article contained in the above, but elaborated from pp. 49-51. The analysis of the mbira tuning patterns was made in the following way: I digitally recorded differently tuned mbiras in a recording studio at Columbia University, New York. The samples were edited using a Silicon Graphics workstation. After making a sonogram analysis of each key, the partials were tracked using Audiosculpt. The results of the partial tracking were averaged giving a single frequency in Herz for the fundamental and the prominent harmonics of each key. The data was then converted from Herz to "octave point pitch class" notation using a Silicon Graphics station running CMIX. This data format gives both the pitch and the deviation there from in cents. Finally, the distances between keys were measured in cents.'

IOA MAG ONE DAY MEETING

Acoustic Challenges in Quires and Places Where They Sing

Friends House, 173 Euston Road, London NW1 2BJ - Tuesday 2 July 2013

Conservatoires – acoustics and music working together

Stephen Dance, London South Bank University

Interaction between music, acoustics, and architecture in renaissance churches in Venice

Raf Orłowski, Ramboll Acoustics

Learning modern acoustical design from traditional choir venues

John O'Keefe, Aercoustics Engineering, Canada

Singing and space – a study of choral singers and perceptions of auditorium acoustics

Shane Sugrue, London South Bank University

Investigating singing performance in different acoustic environments in the virtual singing studio -

Jude Brereton, University of York

Intonation drift in a capella SATB quartet singing

David M Howard , Audio Lab, University of York, Heslington, York YO10 5DD, UK

When an SATB quartet sings a capella their pitch centre can drift since they perform in non-equal temperament. When the music modulates away from the starting key and back again later in the piece, the starting and ending keys (usually the same) will not be in tune with each other if the overall pitch has shifted. This effect is explored in terms of how it can be measured and predictions of tuning shifts in items from the a cappella repertoire will be explored along with the results from an experiment to measure pitch drift from a semi-professional quartet. The fundamental frequencies for each singer of a quartet were derived from an electrolyngograph. It is suggested that conductors and choral leaders need to be aware of this effect and have a strategy for dealing with it in rehearsal and performance.

21st Century Organ Technology: The King is Dead - Long Live the King!

Christopher Stanbury AIOA, University of West London

This paper investigates the growth in popularity of 'hybrid' instruments – traditional pipe organs incorporating into their specification an enlarged, digital system termed a 'virtual organ'.

Virtual organs, such as Hauptwerk by Milan Digital Audio, have become increasingly common in concert halls, places of worship and theatres worldwide during the last decade. This is primarily because such a system offers significant cost savings over more traditional methods of organ building whilst offering great flexibility in tonal design. There is evidence to suggest that, instead of merely replacing pipe organs with electronic substitutes, many venues choose to build a Hauptwerk computer system into the extant instrument.

But does a virtual organ offer the same artistic and aesthetic qualities as a traditional pipe organ and can the two technologies be successfully amalgamated? This paper outlines the process of augmenting the specification of a pre-existing pipe organ with the use of a Hauptwerk computer-based virtual organ, referring to case studies of recent installations in Sussex.

The process of converting an organ console to a suitable MIDI system, the required tonal balancing between 'real' and virtual stops, use of virtual 'convolution' reverb systems, the requirements of a suitable audio reproduction system and other acoustic considerations are explored and the resultant expansion of musical potential demonstrated by means of live organ performance and/or DVD recording. Issues of artistic authenticity, any limitations of such a system and whether this does indeed represent the future of classical organ design are also discussed.

REMINDER - Musical Acoustics Group AGM 15:00 hrs 2nd July 2013

Also at Friends House, 173 Euston Road, London NW1 2BJ

Agenda

- 1) Acting Chair's report on the progress in the rejuvenation of the IOA Musical Acoustics Group
- 2) Continuation of an association / co-existence with the Musical Acoustics Network (MAN).
- 3) Representation at Music Research Consortium UK formal inauguration meeting on 25 October 2013 at Senate House, Malet Street, London WC1E 7HU
- 4) Election of Committee: The following posts will be elected:
 - Chair;
 - Secretary;
 - Young Persons Representative;
 - Subject to item 2) IOA MAG / MAN coordinator.
- 5) Future Activities:
 - a) Group Meetings
 - b) Programme of one-day meetings for late 2013 and into 2014 inc Spring Conference theme
 - c) Possibility of combining initiatives with other IOA specialist groups – particularly the Electroacoustics and Building Acoustics groups.

Message Board

IOA 40th

Have just reviewed the MAG AGM agenda, please be aware that plans for the IOA 40th in 2014 mean that there is unlikely to be a spring conference next year and all groups will be asked to participate in the 40th anniversary conference in Autumn 2014. Chris Turner

A new bowed string acoustics site

Prior to his recent death earlier this year, the former double bass music professor, acoustician, and performer Knut Guettler created a website for discussion of bowed string and bow properties and phenomena. It was his wish that this website would turn into a meeting point for string players and acousticians. There is a selection of articles on the subject, links to other websites of interest and there is a question and comment function. <http://knutsacoustics.com>

A letter from Edgar Brown

I fear I've not been keeping up with reading Acoustics Bulletin, but I've just seen your piece about saving the Group. I was one of the founding members of IOA and was in the Group from the time it started. I was its secretary for a period in the 1980s and early 90s and its chairman for a time. It's with some trepidation that I write to you about ideas for reviving the group. With such eminent people as Peter Dobbins and David Sharp having been involved recently, you might rightly say: "Oh, those ideas are old hat; we've tried them and they don't work!"

It's true that Musical Acoustics is a 'fringe interest' for the Institute's membership. Most members make their living from other - perhaps 'down-to-earth' - activities and, while maybe having the inclination, have not the time to devote to it. There were - and still are - some of us who 'made our living' from musical acoustics in academic research. But our number has shrunk gradually. David Sharp's group and a few others are fortunately still active, but my 'one man band' disappeared with retirement as did other groups with a rather fuller orchestration!

A further problem is the horrendous cost of putting on a full-dress meeting - even if only a half-day one. Academic institutions charge an arm and a leg for the hire of facilities. Those of us in employment may most likely charge it up 'on the firm' if the subject is relevant - which unfortunately musical acoustics usually isn't! (I guess this is the reason for the failure of the Cardiff meeting. Taking a deep breath, I was willing to fork out the £160 registration fee personally because I have a great interest in the organ and there was a tantalising promise of 'things organic'. But it would have made a hole in my pension!) Added to this is the understandable thin geographic spread of musically-interested IOA

members. It's well-nigh impossible to get together a group large enough to make a meeting financially viable. Even if a musical meeting is part of a larger conference, the costs of attendance can be intimidating.

What can we do about it? Well here are things we tried in the past: is it worth thinking of something along these lines again?

1. Visits to places of musical interest. Examples: Piano Factory, Organ Builders, Bell Foundry (there are 2 famous ones in Britain), Wind Instrument Makers (woodwind and brass), Welsh Harp Maker (this one tagged on to a major IOA conference in Swansea: fluency in Welsh not essential but helpful!). Advantages are that a small group is viable (in fact a small factory/workshop may specify "not more than 'N' " for space reasons) and there may be minimal cost apart from travel to the venue. Also geographic spread may mitigate the membership spread - we don't all live in London, but neither are all the organ builders (or loudspeaker makers) there!

2. Peter Dobbins, single handed and no doubt with great effort used to send out "Notes" - a delightful Newsletter. Could someone be prevailed upon to keep it going? This would seem to be a way of holding the membership together (and of course it can be electronic nowadays!)

Kindest Regards, Edgar Brown

P.S. Before I retired at the end of 2000 I worked on woodwind acoustics and constructed an experimental bassoon. Now in retirement I'm building a House Organ, a project I started in my student days in the 50s and am now finding the time to make some real progress!

Tympanic acoustic guitars/instruments. Great depth, very loud and responsive, standing wave...

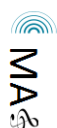
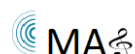
In 1990 I redesigned the loudspeaker diaphragm (spiral tube cone) and its suspension (tangential suspension), both principles were 'borrowed' by UK & JP companies and are currently being used by them in their products today, ah well they do say imitation is the most sincere form of flattery! I just wish they would pay the now meagre royalties they owe me for direct infringement of claim 1 of my patent. A few tens of millions of pounds!

That said, in the past 20 odd years I have developed top not technologies including many speaker designs new components and smart pneumatic audio materials. The latter category as a stick on damping baffle not only makes a drum skin more percussive by means of the air stretching pneumatics of spiral voids, but it also obliterates standing wave resonance and it is this dynamic that makes possible tympanic instruments. These would be un-playable without this technology and of course substantial instrument body reinforcing to take the enormous tension of a drum diaphragm, simply because of standing wave resonance distorting the notes played, in much the same way this is the problem with loudspeakers, so why don't all

Speakers have this type of damping, well attempted patent theft of a trillion dollar market device is why it is also why the futures markets were compromised and it is criminal that technologies so useful should be attacked in this manner. I won a Smart Award to develop it for the hearing aid, so the government diverted funding to digital whereas an analogue device damped correctly would not only vastly outperform a digital device, it would also cost a tenth of the price! Concordia a new type of hearing aid by Phillips Dalesman some months previous.

The upshot is this type of tympanic diaphragm-ed instrument has great depth clarity, percussive response and pneumatic harmonics, will it and yours truly's design be ripped off once again, it is patented but then so were my other designs.

Simon Carrington, Conceptual designer at AEON Acoustics.



Issue 2 will appear at the end of September. Please send all items for possible inclusion to Mike Wright mike@isaamnet.org before 25th September. Feedback following this edition would be much appreciated.

The Institute of Acoustics, authors and contributors reserve their rights in regards to copyright of their work. No part of this work covered by the copyright may be reproduced or copied in any form or by any means without the written consent of the publisher. The Institute of Acoustics, editor and contributors are not responsible in any way for the actions or results taken any person, organisation or any party on basis of reading information or contributions in this newsletter.