

European Science Foundation  
Standing Committee for the Humanities (SCH)

**ESF SCH EXPLORATORY WORKSHOP**

**Music, Language and Human  
Evolution**

Black Horse House Conference Centre  
University of Reading,  
United Kingdom,  
28 September - 1 October 2004

**With additional support from the British Academy**

Convened by:

**Steven Mithen**

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**Scientific Report**  
**26 November 2004**

## 1. Executive summary

The Workshop fulfilled the aims identified in the original submission, involving a cross section of researchers from a variety of disciplines and locations in contributing to discussion of the theme of *Music, Language and Human Evolution*. As such this was a unique event that has received considerable academic acclaim from the delegates and the wider academic community. Twenty-four delegates attended the meeting coming from seven countries and including five designated ‘young researchers’. One scientific journalist was also present. This was a slightly reduced number of delegates owing to three late withdrawals – archaeology Francesco d’Errico (CNRS, France), psychologist Patrik Juslin (Uppsala, Sweden) and musicologist Klaus Scherer (Geneva, Switzerland). Two of these were for illness and one for unexpected government-related business in France.

These absences created difficulties in maintaining the balance of national and disciplinary representation we had aimed for. This problem was discussed with Valerie Allspach-Kiechel, the ESF contact, who agreed that the meeting could proceed. We were partially successful in replacing participants unable to attend with suitable speakers and discussants, who made a valuable contribution. We were fortunate to be able to involve Elizabeth Tolbert, an American ethnomusicologist from John Hopkins University currently on sabbatical in Cambridge, UK (who covered all of her own costs), and an additional discussant – Illona Roth (Open University, Belgium). Co-host of the workshop Prof. Steven Mithen, who had originally been timetabled to lead the contribution of the discussants, provided instead a fuller concluding paper.

The workshop was run within its budget. A grant from the British Academy supported the travel and accommodation costs of two key participants from Canada to attend, Isabelle Peretz and Sandra Trehub. Both of their presentations – Peretz’s and Trehub’s research reports on the neurology of music and on mother-infant communication, and the two practical sessions – were widely remarked on as making a significant contribution to the themes of the workshop explored in the other sessions.

An overview of the sessions in the order in which they were presented sets out the concerns of the event and allows some impressions of interaction between participants. The opening talk on the European Science Foundation was provided Nicholas Bannan, standing in for Jan Bakós, the ESF representative who was unable to attend at extremely short notice, and incorporating a useful Powerpoint presentation emailed in advance. Robert Foley, who is involved in a current *Eurocores* project, provided some detail regarding its potential for a research agenda such as that being addressed in this workshop.

Foley went on to give the opening paper, an archaeological overview of the topic incorporating recent discoveries in the fossil record and human genetics that help provide a framework for understanding the key issues. Thereafter, a pattern was established for the workshop that mixed contributions from different disciplines and varied between reports of specific research and presentations that modelled the agenda or argued for new cross-disciplinary developments. Foley was followed by neurologist Isabelle Peretz, who argued that there are differences in brain processing between the production and perception of music and language. This scientific position was well represented in the following practical session, in which Tran Quang Hai performed in a

variety of languages and vocal styles. While little of what participants heard would have had much meaning on a verbal level, his persuasive singing had a clear emotional impact, as well as eliciting considerable curiosity about how some of the sounds could come from a human larynx.

Ian Cross defined an approach to music as a means of exchanging representations that is, in origin, holistic, bodily, emotional and in many respects as capable of referential meaning as language. Tecumseh Fitch examined aural-oral communication in a variety of existing species, providing new research evidence about the anatomy and neurology involved. Margaret Clegg, by contrast, provided a detailed examination of the fossil record and what it reveals about vocalisation. She focused especially on the dimensions of the naso-pharynx and the hyoid bone. Elizabeth Tolbert considered the role of singing in ritual, especially in relation to beliefs related to death and the spirit world, drawing on the funerary laments of the Sami culture in which she conducted fieldwork.

Johan Sundberg employed computer analysis to convey interpretative features of musical performance that may have meaning because they relate to changes in locomotion and metabolic rates. The evolutionary underpinning of these related to the following paper by Sandra Trehub, who has examined the nature of mother-infant communication with special reference to singing and infant-directed speech. These performance- and perception-related issues provided fertile ground for the experimental approach taken in a practical session by Pedro Espi-Sanchis that involved participants in the enactment of Southern African panpipe rituals.

Björn Merker presented a carefully argued comparison of models for the evolution of music and language based on the essential component of vocal learning. Iain Morley reviewed in detail the anatomical prerequisites for the evolution of vocality and musical behaviour that are traceable in the fossil record. Clive Gamble provided a complementary examination of the environmental features of 'performance space' that may be deductible in the placement of artefacts and their distribution relative to one another. Nicholas Bannan followed up the demonstration of Tran Quang Hai in arguing for an approach to language based on discerning the features of production and perception that remain musical in origin, especially the harmonic properties of timbre. Steven Mithen presented an overview of the entire topic that proposed a possible musical origin for human communication while retaining a place for 'pleasure' as argued by Pinker.

The three discussants helped evaluate the impact of the workshop. David Burrows felt that the debate needed widening to include game-playing; Ilona Roth felt similarly that dance and other expressive arts need to be considered. Robin Dunbar illustrated how experiments with living humans can help resolve matters of conjecture in evaluating the impact of group music-making on feelings of well-being.

Concluding discussion confirmed a commitment towards producing an edited book and retaining contact in order to facilitate collaborative research.

## 2. Scientific content of the event

Invited speakers were all made aware of the purpose of the workshop in advance: that it represented an attempt to define a research agenda; that it permitted explanation on an interdisciplinary basis of the latest research that influences the development of such an agenda; that it might give rise to potential research collaboration; and that an edited book is planned as an outcome.

Participants at the workshop represented three broad categories: invited speakers who had prepared papers in advance; discussants, who brought their own views to evaluating the themes of the workshop; and observers, who made contributions to discussion both in sessions and in valuable social time. The presenters comprised two categories: those dealing with principle themes, who were allotted 90 minutes, of which 30 minutes were to be for discussion; and those presenting research reports, who had 45 minutes, of which 15 minutes were for questions. The timetable of the workshop thus involved: presentations by the invited speakers; generous discussion time, including a concluding plenary session led by Steven Mithen; and two 90-minute musical presentations that included opportunities for musical participation and response.

Robert Foley presented the opening paper, setting the research context in relation to the historical debate that emerged from the work of Darwin. He presented models of the descent of man based on the most recent finds and their interpretation, reminding us that most of the fossil evidence has only been discovered during the last century, and some key components only in the last 10 years. Foley included examination of the means by which evolution proceeds, concluding that human descent represents a 'complex history'. Subsequent discussion arose from considering the potential for music as a vehicle for 'theory of mind' in the early stages of the human evolutionary process. Foley proposed a 'cricket test' for distinguishing between universal behaviours carried by natural selection and those manifested as cultural responses to underlying anatomical or psychological universals. Music's role would be defined by evidence for its place in a continuum between these positions.

Isabelle Peretz addressed the significant issue of brain modularity, and evidence for whether music is processed in a manner distinct from language. She presented case studies of subjects with amusia but not aphasia. Subsequent discussion proposed that attention should also be paid to the opposite case: aphasics who have musical ability. The question arose as to whether the experimental procedures adopted tended to test for a specifically Western view of musicality – i.e. one associated with categorical pitch perception as opposed to, for instance, the capacity to move in time or participate instrumentally or vocally according to conventions existing in non-Western societies in which there may be no concept of the 'unmusical'.

Tran Quang Hai presented the first of the two lecture-recitals of the workshop. He employed real-time digital spectrographic software to display on a screen the waveforms of the enormous variety of vocal styles he has learnt to imitate. As a well-travelled and vocally fearless ethnomusicologist-performer, Hai demonstrated that, while the human respiratory and laryngeal anatomy is universal, its employment in different modes of vocalisation is culturally-determined. He illustrated how some of these differences related to environment and belief. His performance of European *bel*

*canto*, Chinese opera, Mongolian and Tuvan overtone singing, Tibetan chant and other examples provided ample evidence for the common feature of *timbre modification* that underpins these techniques and that has been insufficiently studied as a component of vocal performance.

Ian Cross presented a view of the emergence of music within human culture as a means of representing and communicating thought. Drawing on ethnomusicological case studies as well as the analysis of responses to film music, he illustrated how music, with or without related bodily movement, can have referential meanings independent of language. He underlined the feature that needs to be considered regarding universalist theories of music: that comparisons are difficult because many cultures do not possess ways of verbalising music as distinct from other behaviours; or, to put this another way, Western concepts of music may bias attempts to understand the biological foundations of musical response that we might seek to trace in pre-modern-human societies.

Tecumseh Fitch provided a scaffold of models of vocal communication in several species resulting from research that has extended and questioned existing assumptions about the nature of sound-producing mechanisms (such as the position of the larynx). From the perspective of animal communication Fitch presented, he argued that the fact that both language and music are human universals, have phrase structure, and entail learning and cultural transmission, suggests that any theory of the evolution of language will have implications for the evolution of music, and vice versa.

Margaret Clegg provided a useful close investigation of the anatomical proportions of the upper vocal tract of a variety of *Homo* subjects. She argued persuasively that much of the modelling previously attempted has been exclusively based on male specimens, whereas female proportions have been relatively ignored. Given the sexual dimorphism of modern humans with respect to vocal pitch, this needs to be addressed, not least as it affects vocal learning. Clegg also considered the cost-benefit balance whereby the relative fragility of the modern human larynx associated with fully upright posture has been seen as increasing the risk of choking. While choking may not present a lethal danger, it is interesting that the body places protection of the airway above maintenance of the capacity to vocalise, whereby even a mild choking episode can cause temporary loss of voice.

Sadly, Klaus Scherer was unable to attend to give his planned presentation on displays of emotion in speech and music. This was a major disappointment, and participants, many of whom cited Scherer's work in their own presentations, were asked to try to absorb this loss into their coverage of the workshop theme. Tecumseh Fitch responded to this with additional material he had brought in the form of video and audio recordings, and further material on these lines was provided in recorded form by Björn Merker and Nicholas Bannan as well as in the concluding theoretical overview provided by Steven Mithen. Organisers and participants all hoped to see Prof. Scherer recover soon, and that he could remain involved in the project represented by the workshop. A resumé of the event was sent to Prof Scherer, who replied as follows:

There are many points in your summary to which I resonate very much and which fit in beautifully with our current work. The important role of the human voice for the neural activation of a centre in the STS concerns us greatly (and I will ask Didier Granjean to send you a copy of a submitted

paper on this). Here and in other study the central role of timbre and voice quality cries out for further research. We are also looking at the role of timbre (energy distribution in the spectrum) to distinguish real from faked stress. So there are many commonalities, and I hope that the workshop will have an effect of bringing researchers together into research constia over a longer period of time.

Johan Sundberg provided an excellent illustration of the elements of expressivity in musical performance, and why this is heightened by departure from metronomic pulse even though it depends on it. He illustrated the use of computer analysis and synthesis to track musical features such as intensity, suggesting that there are elements of 'performance prosody' in both music and language that represent the influence of underlying neural mechanisms responsive to movement memory and variations in levels of arousal. This analysis of musical output on these lines helped clarify issues of similarity and difference in the production and perception of spoken and musical communication, and provided a reminder of means informed by evolutionary psychology to investigate these properties in living subjects.

Elizabeth Tolbert took an alternative approach to understanding performance strategies based on the semiotic principles of C. S. Peirce. This required some explanation due to differences in terminology in this philosophical tradition as it has influenced literary criticism and musicology, compared to conventions in psychology and the social sciences. Nevertheless, a fascinating account emerged of the role of sung lament in conveying the beliefs and ritual practice of the Sami people Tolbert had studied, especially with regard to the capacity of song in such a society to convey an embodiment of the spirit world outside our own and beyond death. While such ideas may no longer be widespread in modern scientific societies, it is essential to consider their likely place in the music-making, social behaviour and beliefs of early humans.

The presentation by Sandra Trehub provided an insight into the world of early childhood experience and the way this interacts with the vocal responses of carers. 'Motherese', or 'infant-directed speech', contains many of the properties of song; and communication with infants may be seen as a stimulus towards music-like behaviour in adults who (at least in Western society) would not see themselves as musical or as having singing voices. However, lullabies are a human universal. Preferential-looking studies and others based on monitoring head-turning have revealed a sophisticated level of innate musicality in infants, consistent with discoveries of aural development and response in the womb. The foundations of musical response and behaviour would appear therefore to be hard-wired in a manner that may be unique to our species.

The second practical session was led by the South African ethnomusicologist Pedro Espi-Sanchis. He began by illustrating the potential for musicians from contemporary hunter-gatherer communities to make sophisticated music from what are essentially found-objects made available naturally in their environment. These included the Lekolilo flute, originally a length of seaweed deposited on the coast of Namibia, on which he is able to play music of great sophistication with barely any modification of the object. He accompanied himself with shakers attached to his ankles made from moth chrysalises. In order to illustrate how with a modicum of curiosity and experiment can allow a fit and intelligent human to acquire at least a basic level of musical

achievement with such simple resources, he gave lengths of rubber tubing identical in proportion to his seaweed flute to every participant in the workshop. While it rapidly became clear that mastery of the instrument would require considerable investment of time and effort, several people present made reasonable progress. The point Espi-Sanchis was making at this stage is that the Lekolilo flute is indeed a solo, virtuosic instrument: those of us who found it hard were measuring themselves against the standard he had achieved. By contrast, he then introduced a set of the single-note panpipes that are in widespread use in several Southern African cultures. It was far easier to make a successful sound where the target was thus limited, and we were then able to proceed to play in co-ordination with one another, placing individual notes into a melodic texture dependent on these separate elements. Once this was achieved, the element of movement was introduced, which had two important outcomes: it lent an additional sense of physical animation to the activity that is fully consistent with its African ritual origins; and it permitted the kaleidoscopic interaction of the individual notes to be experienced in different ways as movement around the space brought one into proximity with different contributions. This session was both greatly enjoyed, and provided an important set of experiences against which the modelling of early musical development could be proposed.

Björn Merker presented with great clarity a set of potential models for how the issue of human vocal and communicative evolution may be researched. He felt that developments in the cerebral cortex that permit learning based on mimicry outweigh what we can learn from the ‘-ynxes’ (study of the pharynx and larynx). While both music and language need to be seen as rule-based systems through which human beings acquire the capacity to communicate with others, music allows co-ordination to pulse and contour that confers survival advantages through summative vocal performance.

The paper by Iain Morley comprised a wide-ranging critical analysis of data in several disciplines from which a synthesis could be attempted that places the anatomical and psychological prerequisites for human vocality in a proposed chronological and morphological sequence. This provided a helpful link between the more general overview given by Foley and the synthesis later attempted by Mithen. However, as implied in Merker’s advisory approach (backed up by extraordinarily human-like recordings of animals he played at the concluding plenary session), there are inconsistencies in any sequential model that illustrate the complex, mosaic and partial nature of the evidence available for interpretation on these lines.

Clive Gamble’s paper threw new light on the social aspects of proto-musical behaviour in approaching archaeological evidence in terms of its distribution as a means of proposing the ‘performance space’ in which life might have been led 500,000 years ago. Comparisons between the traces of ritual in a modern hunter-gatherer society, such as the circular impressions left on the ground by dancing around a fire, with indications of where tools may and may not have been used within early sites, gives rise to an innovative concern with social response to the environment. Were evidence to be sought that allowed these ideas to develop, it would reveal more about the purpose of ritual, which may well have involved music as a means of social co-ordination, and the kinds of belief that gave rise to it.

Nicholas Bannan set out to illustrate that there are musical properties to speech that have received little attention, since linguistics has largely focused on the development

of grammar, syntax and vocabulary and ignored the extent to which referential and recursive vocal communication might exist without (and therefore prior to) these features. Using recordings, his own performance and the participation of the group, he proposed especially that, in terms of production and perception, the harmonic features of language (the vowels and voiced consonants) represent categories that are discerned as musical quanta. In turn, such sounds can be 'read' as having both semantic properties (as in the difference in vowel between <bat> and <boot>) and conveying emotion according to the timbral intensities associated with their production.

Steven Mithen's closing presentation led to plenary discussion. Mithen proposed that modern human vocal communication may have had roots in a proto-musical productive ability he labels HMMM: it is Holistic, Multi-Modal, Mimetic. In many respects, this meshes with the idea of music as an emergent exaptation argued by Cross, as well as with Bannan's conclusions in the preceding paper. On this basis, music may have left its traces in language, which has transcended the state of HMMM in its acquisition of higher levels of semanticity that are less dependent on emotional motivation and gross bodily movement. However, Mithen argues the retention of elements of Pinker's 'cheesecake' analogy, since modern humans clearly enjoy music without seeming to depend on it. Perhaps it is in high-intensity vocalisation (shouting, singing, yodelling etc.) that HMMM is still experienced, while the universal, innate capacity for music on which our species may have depended in the past remains present as the foundations for infant learning and the basis for an important social capacity no longer of apparent survival value.

Two discussants provided feedback on the workshop as a whole, and all took the opportunity they were given to propose variants on the direction in which the content of the sessions had appeared to lead. Both began by recognising the large amount of ground covered and the potential of the workshop to influence new levels of understanding in the related fields represented.

Illona Roth wanted research to pay attention to special abilities (such as virtuosi and child prodigies) as well as musical universals. She also proposed that attention be paid to links between musical self-expression and other forms or artistic endeavour such as poetry and painting.

Robin Dunbar summed up a number of themes in the workshop through presenting recent research that provides a potential means of linking, for instance, the archaeological concerns of Gamble and Mithen with the performance-based approaches of Espi-Sanchis and Bannan. It was especially exciting to consider the means by which Dunbar advocated research in contemporary human populations that may help explain the phenomenon of group music-making consistent with his theories of group social bonding (the grooming-to-gossip hypothesis). He explained how an ethical means of measuring endorphin release could be employed to differentiate between people who participated in group singing in a church setting and those who did not. This approach has enormous potential for development as a useful instrument for discerning the consequences of participatory music-making in a variety of contexts.

In the concluding discussion, means of taking the debate forward were considered, as well as a commitment towards the eventual production of a book based on this work.



Since the workshop, an article has appeared written by Michael Balter in the November 12<sup>th</sup> issue of *Science* (volume 306). This will be reprinted in French in a subsequent issue of *Le Figaro*. Plans are in hand to distribute a CD containing video of the two practical sessions to all workshop participants. Several email discussions have arisen in relation to potential research projects that may emerge as collaborations between participants at the workshop. Steven Mithen and Nicholas Bannan will further review these developments and proceed with the principle of producing an edited book based on contributions to the workshop and work achieved in its wake.

### **3. Assessment of the results, contribution to the future direction of the field, outcome**

There was a strong feeling amongst participants that the workshop had made a significant contribution to interdisciplinary understanding of issues involved with the topic, and that it had helped determine an agenda for future research.

Some proposals emerged in submitted papers. Bannan's presentation, taking into account what had passed before proposed the following avenues for empirical research:

- **Neurology I:** neural pathways for musical processing and recall (e.g. work with Alzheimers patients who participate in group singing sing but have lost language; and with subjects with autism such as Samantha (El Mogharbel et al, 2003), for whom music rather than language was acquired as their means of representation and communication);
- **Neurology II:** speed of aural/oral response - the 'virtual unison' that allows football chants to be generated almost instantaneously, and through which non-readers are able to participate in choir rehearsals;
- **Psychology I:** continuation of the work of Scherer (1992), Juslin & Laukka (2003) and Cox (2001) exploring the processing of music (both in production and perception) in relation to vocal expression of emotion;
- **Psychology II:** exploration of the emotional regions termed *nostalgia* and *revelation*, and experiment in their elicitation through group and individual music-making;
- **Acoustics:** exploration of the features of intentionality and processing that underpin individual roles in group vocal performance; 'self-to-other ratios' (Ternstrom, 1999; Daugherty, 2000), the achievement of resonances that carry more profitably (on the lines of Merker 2000), and the neurological features of blend and tuning.

A further set of ideas has emerged since the conference in exchanges between Bannan and Clegg that may also involve Fitch and Sundberg. These relate to the virtual modelling for which Sundberg has the appropriate computer software of the kinds of sound that might be perceived were a variety of candidate vocalisations by modern

humans to be modified in terms of the consequences of changes in vocal tract proportions based on the fossil evidence. Results produced on this basis could be compared with those presented by Fitch where modern human sounds were played as if produced in the vocal tract of other species.

Some discussions have also subsequently emerged from the experimental methods reported by Dunbar for measuring endorphin release in group singing. Where it may be possible to replicate these methods with, for instance, clinically deaf musicians, or Alzheimer's patients participating in group singing, it could shed important light on the homeostatic potential of music-making as well as differences between musical participation and other behaviours. There are, however, ethical issues involved in such studies.

Beyond these specific outcomes, it is evident that a new network has now been established involving academics in numerous EU and overseas institutions for the exploration of how music evolved. Mithen is drawing on the specific results from the meeting and this network to write a synthesis of current evidence for how music and language evolved, to be published in the spring of 2005, and the participants have agreed to contribute to an edited volume. Oxford University Press have provisionally agreed to publish this and a formal proposal is currently being prepared.

In summary, the meeting was of immense academic value and has made a major contribution to inter-disciplinary research involving both the sciences and humanities on the subject of how music and language evolved.

## **4. Final programme**

### **Music, Language & Human Evolution Conference Programme**

#### **Tuesday 28 September**

- 2.00-2.30pm Arrival & register at Black Horse House, conference centre,  
University of Reading
- 2.30-3.00pm Ján Bakos: (Standing Committee for the Humanities)  
Presentation of the European Science Foundation (ESF)  
Introduction to the conference theme: Nicholas Bannan
- 3.00-4.30pm Robert Foley: *The evolution of human abilities*  
Break
- 5.00-6.30pm Isabelle Peretz: *Modularity of music processing*
- 7.00pm Dinner
- 8.30pm Performance: Tran Quang Hai  
(Archaeology Building)

### **Wednesday 29 September**

- 9.00-10.30am Ian Cross: *Music as an emergent exaptation*  
Break
- 11.00-11.45am Tecumseh Fitch: *The Evolution of Music and Language: A Comparative Perspective*
- 11.45-12.30pm Margaret Clegg: *The evolution of the human vocal tract: specialised for speech?*  
Lunch
- 2.00-2.45pm Elizabeth Tolbert: *The Evolution of Music and the Birth of Representation*
- 2.45-3.30pm Johan Sundberg: *Musicians' performance prosody*  
Break
- 4.00-5.30pm Sandra Trehub: *The Role of Vocal Music in Infancy*  
7.00pm Dinner  
8.30pm Performance: Pedro Espi-Sanchis  
(Archaeology Building)

### **Thursday 30 September**

- 9.00-9.45am Björn Merker: *Vocal learning as key to the origins of music and language*
- 9.45-10.30am Iain Morley: *Hominid physiological evolution and the emergence of musical capacities*  
Break
- 11.00-12.30pm Clive Gamble: *Dances with wolves or a dance to the music of time: the rhythms of social life half a million years ago*  
Lunch
- 2.00-2.45pm Nicholas Bannan: *Language as music: future trends in interdisciplinary research into the origins of human communication.*
- 2.45-3.30pm Steven Mithen: *Overview and an evolutionary story of language and music*  
Break
- 4.00-6.00pm Robin Dunbar & Illona Roth: Discussants' final comments, leading to concluding discussion  
7.00pm Dinner

### **Friday 1 October** **Breakfast & depart**

## **5. Final list of participants (full title, address, tel, fax, email)**

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## 6. Statistical information on participants (age bracket, countries of origin, etc.)

Michael Balter	40-50	France	Male
Nicholas Bannan	40-50	UK	Male
John Bispham	20-30	UK	Male
Jill Bowie	30-40	UK	Female
Margaret Clegg	40-50	UK	Female
Ian Cross	40-50	UK	Male
Robin Dunbar	40-50	UK	Male
Pedro Espi-Sanchis	40-50	South Africa	Male
Tecumseh Fitch	30-40	UK	Male
Robert Foley	40-50	UK	Male
Clive Gamble	40-50	UK	Male
Helen Keenoo	30-40	UK	Female
Anna Machin	20-30	UK	Female
Guy Madison	30-40	Sweden	Male
Björn Merker	50-60	Sweden	Male
Partha Mita	20-30	USA	Male
Steven Mithen	40-50	UK	Male
Iain Morley	20-30	UK	Male
Isabelle Peretz	40-50	Canada	Female
Illona Roth	40-50	Belgium	Female
[Klaus Scherer	Unable to attend	Switzerland]	
Johann Sundberg	60-70	Sweden	Male
Elizabeth Tolbert	30-40	USA	Female
Sandra Trehub	50-60	Canada	Female
Tran Quang Hai	50-60	France	Male