Encouraging the Scientific Study of Musical Experience & Communication

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1st UC MERCI Colloquium
UCSD Faculty Club
March 17, 2015
The UC Music Experience
Research Community Initiative
UC MERCI

- 24-month Planning Grant (2015-16)
- Proposed activities
  - 6 Colloquia (multi-campus, webcast)
  - 2 Workshops (Workshop I @ UCLA, July)
  - Web portal (music research @ UC and beyond)
  - Multi-campus research (student opportunities!)

Sponsor
UC Multicampus Research Programs and Initiatives (MRPI)
President's Research Catalyst Award

University of California
Office of the President

For the multichain collaborative research project:

Network for Research on Music Experience and Communication

Scott Makie, Ph.D.
Lead Investigator
UC San Diego

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Dean Napolitano, President

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Anne Derr, Provost
Executive Vice President for Academic Affairs
The UC Music Experience Research Community Initiative

merci.ucsd.edu
The UC Music Experience
Research Community Initiative
UC MERCI

Aim

“To develop a multi-campus University of California initiative for collaborative research on human musical experience and communication using new tools for brain/body imaging and data mining.”

- Musical experience
- Musical communication
In the present work an attempt will be made to connect the boundaries of two sciences, which, although drawn towards each other by many natural affinities, have hitherto remained practically distinct — I mean the boundaries of physical and physiological acoustics on the one side, and of musical science and aesthetics on the other. The class of readers addressed will, consequently, have had very different cultivation, and will be affected by very different interests.

- Helmholtz (1862)

*On the Sensations of Tone*
INDIVIDUAL DIFFERENCES IN LISTENING TO MUSIC

BY CHARLES S. MYERS. (1922)

(From the Cambridge Psychological Laboratory.)

1. Plan of the Investigation
2. Comparison with the results of the writer’s previous investigation
3. Comparison with the results of Bullough’s previous investigation
4. The objective aspect in the technical. His suppression of other
5. The nature of associations in the mind of musical
6. The occurrence of associations among the musical
7. The relation of the character to the intra-subjective aspect
8. Symbolization of the art materials
9. The aesthetic value of the pragmatic and objective aspects
10. The aesthetic value of the intra-subjective aspect
11. The aesthetic value of the meaning of music
12. The importance of ‘distance’
13. The importance of the ‘mystic’ feeling
Not only humans like music …
But nearly all humans love music ...
Why Do We Love Music?

... The love of music is essentially an unanalyzed feeling. Countless people fell the esthetic appeal in music without understanding anything about it. It may be like the notorious puppy love, which is frequently blind, but nevertheless a deep love.

Carl Seashore (1941)
*Why We Love Music*
… Why then do we love music? Among other things, we love it because:

- It creates a physiological well-being in our organism.
- It is built from materials that are beautiful objects in themselves.
- It carries us through the realms of creative imagination, thought, actions and feelings in limitless art forms.
- It is self-propelling through natural impulses such as rhythm.
- It is the language of emotion.
- It is a generator of social fellowship.
- It takes us out of the humdrum of life and makes us live in play with the ideal.
- It satisfies our cravings for intellectual conquest, for isolation in the artistic attitude of emotion, and for self-expression for the joy of expression.

Carl Seashore (1941)

*Why We Love Music*
Music Experience as Embodied Experience
Music as Emotional Communication

The successful performance comes in an inspirational attitude, the semi-ecstatic feeling of the beauty one seeks to convey, a state of forgetfulness of self and concrete facts. Thus music is a language of emotion. Through it the composer and the performer convey their own emotions to the listener. It is a message and a means of communication [that] enables the performer and the listener to live, for moments, in the same tonal world of pleasure.

Carl Seashore (1941)
Why We Love Music
Cultural communication …
Cultural communication ...
Theory of Mind Heart

To discern & experience (empathically) the feelings of another (and, thereby, know their motivation to act and interact), we typically must use quite subtle cues…
How & what does music communicate?

- Pitch
- Harmony
- Rhythm
- Melody / Gesture
- Articulation
- Timbre
- Cultural associations

How does music support health?

How does music support learning?

How does music support culture?

What is the best music selection method?
Embodied Musical Experience
1-D Mapping of pitch to location/ effort/ risk
Embodied Musical Experience
1-D Mapping of pitch to distance/ effort/ height / risk

Objective

Slow Rhythm
Low Pitch

Fast Rhythm
High Pitch

Safety
Rest
Home
Low

Spatial/Affective

Safety
Rest
Home
Low

Threat
Effort
Away
High

Scott Makeig, 2015
Harmonics within One Tone

The octave \[\frac{2}{1} = \text{musical 'identity'}\]

The 'perfect' fifth \[\frac{3}{1} \rightarrow \frac{3}{2} \text{ ratio}\]

The 'major' third \[\frac{5}{1} \rightarrow \frac{5}{2} \rightarrow \frac{5}{4} \text{ ratio}\]
The Web of Musical Fifths (3/2) and Thirds (5/4)

S Makeig, 2013
Folding the Enharmonic Tone Group into a 53-note Torus
The Enharmonic Tone Group
(53 notes per octave)

Web of Fifths and Thirds

S Makeig, 1989
Folding the Enharmonic Tone Group into the 12-note torus

S Makeig, 2013
How do composers & musicians use these harmonic relations to communicate affectively through music?
Osgood’s Semantic Differential

Evaluation

Potency

S Makeig, 2013
2-D Mapping: Intervals/Harmonies ↔ Affect

(After Alain Danielou’s Theory of interval affect)

S Makeig, 2013
EEG Dynamics of Emotion Imagination

Suggest the imaginative experience of 15 emotions:

- After Helen Bonny (GIM)
- Preceding relaxation induction
- Alternate pos and neg emotions
- Relax between emotion episodes
- → 1-5 min periods of eyes-closed spontaneous EEG (x 15 emotions)
- ... from 33 subjects

Onton & Makeig, Frontiers in Human Neuroscience ‘09
Changes in distribution of broadband high-frequency EEG power with imagined emotions

Julie Onton & Scott Makeig, *Frontiers in Human Neuroscience*, 2009
Performing a Rhythm Pattern involving Metric Modulation
Source Cluster with Beat-Following ERP

Potential (µV)

Latency (ms)

Source Cluster with Beat-Following ERP

Cls 6 (5 Ss, 9 ICs)

S Makeig, 2015
IC Source Cluster 6
Beat Following
at 25 Hz & 6 Hz

But Little Evidence for
Metric Modulation

3 + 3 + 2
Barlines

S Makeig, 2015
IC Source Cluster 4
Metric Modulation > Metric Repeat

Latency (ms)

Frequency (Hz)

Cls 4 ERSP, 144
Cls 4 ERSP, 244
Cls 4 ERSP, 133
Cls 4 ERSP, 233

S Makeig, 2015
Measuring Musical Engagement Through Expressive Rhythm

How can we measure a listener’s engagement level?

Grace Leslie & S Makeig, 2013
Rhythmic expression task

The Heart is a Lonely Hunter (1968)

Two conditions
- Fully engaged
- Less engaged

The Conducting Experiment (2013)
EEG Result: Full affective engagement

"The TPJ controls representations of the self or of another individual across a variety of low-level (agency discrimination, visual perspective taking, control of imitation) and high-level (mentalizing, empathy), and socio-cognitive processes."

-Santiestaban et al., 2012

The rTPJ is a key cortical structure for both motor and emotional control; rTPJ volume predicts level of emotional awareness of others in autistics; etc. …
• **6 Music Colloquia Webcasts**
  April 24 @ UC Davis

• **2 Music Science Workshops**
  July @ UCLA

• **Multi-campus Music Research Projects**
  Sarah Creel
  John Iversen
  Gert Lanckriet
  Piotr Winkielman

• **UC Music Science Web Portal**
  Scott Makeig & John Iversen

*partial funding available!*