

# A NIME Primer

Michael Lyons  
Ritsumeikan University  
Kyoto, Japan  
michael.lyons@gmail.com

Sidney Fels  
University of British Columbia  
Vancouver, BC, Canada  
ssfels@ece.ubc.ca

## ABSTRACT

Attending NIME for the first time can be an overwhelming experience. Beginners may find it difficult to make sense of the vast array of topics presented during the busy program of talks and posters, or appreciate the significance of the wide variety of demos and concerts. This half-day tutorial is intended to provide a general and gentle introduction to the theory and practice of the design of interactive systems for music creation and performance. Our target audience consists of newcomers to the field who would like to start research projects, as well as interested students, people from other fields and members of the public with a general interest in the potential of NIME. We aim to give our audience an entry point to the theory and practice of musical interface design by drawing on case studies from previous years of the conference. Past attendees of the tutorial have told us that they gained a helpful perspective that helped them to increase their understanding and appreciation of their first NIME.

## Keywords

New interfaces for musical expression, musical instrument design, human computer interaction, expressive interfaces, multimodal interaction, digital musical instruments

## 1. INTRODUCTION

Advances in digital audio technologies have led to a situation where computers play a role in most music production and performance. Digital technologies offer unprecedented opportunities for the creation and manipulation of sound, however the flexibility of these new technologies implies a confusing array of choices for musical composers and performers. Some artists have faced this challenge by using computers directly to create music and leading to an explosion of new musical forms. However, most would agree that the computer is not a musical instrument, in the same sense as traditional instruments, and it is natural to ask 'how to play the computer' using interface technology appropriate for human brains and bodies. Over a decade ago we held the first workshop on New Interfaces for Musical Expression (NIME) [3] with the aim of answering this question by exploring connections with the better established field of human-computer interaction. This tutorial summarizes

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

NIME'14, June 30 – July 03, 2014, Goldsmiths, University of London, UK.  
Copyright remains with the author(s).

some of the major lessons that have been learned at NIME since that first workshop. We begin with an overview of the theory and practice of new musical interface design, asking what makes a good musical interface and whether there are any useful design principles or guidelines available. We also discuss topics such as the mapping from human action to musical output, and control intimacy. Practical information about the tools for creating musical interfaces will be given, including an overview of sensors and microcontrollers, audio synthesis techniques, and communication protocols such as Open Sound Control and MIDI. The remainder of the time will be devoted to several specific case studies representative of the major broad themes of the NIME conference, including augmented and sensor based instruments, mobile and networked music, and NIME pedagogy.

## 2. INTENDED AUDIENCE

Our primary objective in presenting this tutorial is to bring potential new members of the NIME community up-to-speed on the application of interactive techniques to music technology. No specific technical background is required, though some familiarity with interactive systems may be helpful. In particular, we do not assume any prior knowledge of sensors microcontrollers, audio synthesis methods, but rather aim to provide participants with an introduction to these areas, as well as pointers to resources for further study. As such, the tutorial should be well suited to beginning graduate students or advanced undergraduates who are interested in this area of research; composers and performers who wish to expand their repertoire of methods and tools; member of the general public curious about recent developments and ongoing research in music technology. A further key message of the tutorial is that the demands of performance make music an interesting and challenging domain for research on real-time interactive multimodal systems. Hence the tutorial may also interest those involved in research on human computer interaction, or the design of interactive systems, who would like to incorporate audio and music into their work. The tutorial has already been presented successfully to general audiences at SIGGRAPH [2] and SIGGRAPH ASIA[?], and other conferences [4], as well as at NIME. For NIME'14, we are updating the material to include new additions to the repertoire of NIMEs including the impact of mobile music making and additional material on recently available devices such as the Leap Motion 3D Controller. One further objective our tutorial is to stimulate the interest of educators in the area of NIME research: music technology projects are found by many to be a powerful means to motivate students at all levels to learn about a wide range of technical and artistic topics, from sensor electronics, through programming and audio synthesis, to design theory and live performance. The tutorial can be easily adapted to small or large audiences.

### 3. DIFFICULTY LEVEL

The tutorial is aimed at beginners. Familiarity with basic aspects of interactive media will be helpful, however there are no specific technical prerequisites. No background in music or computer audio is assumed.

### 4. FACILITIES REQUIRED

The proposed tutorial is best suited to a lecture room, of size appropriate to the number of registrants, with a video projector and good quality audio output.

### 5. ORGANIZER'S BIOGRAPHIES

**Dr. Michael Lyons**, Professor, Image Arts and Sciences, Ritsumeikan University. Ph.D. Physics, University of British Columbia. Michael has worked in computational neuroscience, pattern recognition, cognitive science, and interactive arts. He was a Research Fellow at Caltech (1992/3), and a Lecturer and Research Assistant Professor at the University of Southern California (1994/96). From 1996-2007 he worked as a Senior Research Scientist at the Advanced Telecommunications Research International Labs in Kyoto, Japan. He joined the newly established College of Image Arts and Sciences, Ritsumeikan University, as a Full Professor, in April 2007. Michael co-founded the New Interfaces for Musical Expression conference.

**Dr. Sidney Fels**, Professor, Electrical & Computer Engineering. Ph.D., Toronto. Sid has worked in HCI, neural networks, intelligent agents and interactive arts for over ten years. He was visiting researcher at ATR Media Integration & Communications Research Laboratories (1996/7). His multimedia interactive artwork, the Iamascope, was exhibited world-wide. He worked at Virtual Technologies Inc. in Palo Alto developing the GesturePlusTM system and the CyberServerTM in 1995. Sid created Glove-TalkII that maps hand gestures to speech. He was co-chair of Graphics Interface 2000; chair of alt.chi at CHI'05, co-chair of ICEC'11 and co-chair of Interactivity at CHI'11. He leads the Human Communications Technology Laboratory and is Director of the Media and Graphics Interdisciplinary Centre. Sid co-founded the New Interfaces for Musical Expression conference.

### 6. FORMAT OF THE TUTORIAL

The tutorial will be conducted as a tutorial lasting a total of three (3) hours, include one break and two discussion periods. Several modules on a wide spectrum of topics will be presented alternately by the two lecturers, with many video examples drawn from past NIME conferences. A detailed list of topics follows.

### 7. REFERENCES

- [1] Frederic Bevilacqua, Sidney Fels, Alexander R Jensenius, Michael J Lyons, Norbert Schnell, and Atau Tanaka. Sig nime: music, technology, and human-computer interaction. In *Extended Abstracts CHI'13*, pages 2529–2532. ACM, 2013.
  - [2] S. Fels and M. Lyons. Creating new interfaces for musical expression: introduction to NIME. In *SIGGRAPH 2009 Courses*. ACM Press, 2009.
  - [3] Michael Lyons and Sidney Fels. Creating new interfaces for musical expression. In *SIGGRAPH Asia 2013 Courses*, page 17. ACM, 2013.
  - [4] I. Poupyrev, M.J. Lyons, S. Fels, and T. Blaine. New interfaces for musical expression. In *Extended Abstracts CHI'01*, pages 491–492. ACM Press, 2001.
  - [5] George Tzanetakis, Sidney Fels, and Michael Lyons. Blending the physical and the virtual in music technology: from interface design to multi-modal signal processing. In *Proceedings of the 21st ACM international conference on Multimedia*, pages 1119–1120. ACM, 2013.
- ### 8. TUTORIAL OUTLINE
1. **Module A : Introduction, Tools, Design**
    - (a) Introduction
      - i. Why NIME
      - ii. A Brief History
      - iii. What it is All About
      - iv. How to Play the Computer
      - v. Introduction to Major Themes
    - (b) Practical Guide to Building Musical Interfaces
      - i. A Six-step Procedure
      - ii. Overview of Sensors
      - iii. Mapping
      - iv. Sound Synthesis
    - (c) Video-based Interfaces
      - i. Video Input Only
      - ii. Video Input and Graphical Output
      - iii. Video and Gestural Input
      - iv. Video and Haptics
    - (d) Design and Aesthetics
      - i. Technological Expressionism
      - ii. NIME and Music Making
      - iii. The Challenge of Performance
      - iv. Aesthetics of Failure
      - v. Mapping and the Audience: Transparency
      - vi. Interaction Metaphors
      - vii. Design Guidelines
  2. Question and Discussion Period (15 minutes)
  3. Break (10 minutes)
  4. **Module B : Case studies, Theory, and Education**
    - (a) Case studies
      - i. Pure NIMEs
      - ii. Augmented Instruments
      - iii. Alternative Instruments
      - iv. Mobile Instruments
      - v. Collaborative Instruments
      - vi. NIMEs for Novices
    - (b) Theory
      - i. Generic Model of a Musical Interface
      - ii. Role of Feedback from the Interface
      - iii. The Mapping Problem
      - iv. Managing System Complexity
      - v. Playability
    - (c) Education
      - i. Education Programs Related to NIME
      - ii. Learning Resources
      - iii. Project-based Curricula
    - (d) Conclusion
      - i. Summary
      - ii. Outlook
      - iii. How to Get Involved
  5. Question and Discussion Period (15 minutes)