USC IMSC
A NATIONAL SCIENCE FOUNDATION ENGINEERING RESEARCH CENTER

# E S P

sensory interfaces

# Expression Synthesis Project


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## Research Goal:
## Performing music ~ driving a car.

To create an easy to use, car-like driving interface to allow non-experts to create expressive performances of music.

## Accomplishments:

**Prototype I:** smooth control of dynamics and tempo.
**Prototype II:** real-time visualization of "path" of piece.

*Demonstration* at 2004 USC Undergraduate Symposium.
*Presentation* at 2003, 2004 IMSC Student Conferences.

Aaron Yang received the **Best Presentation Award** at the 2003 and 2004 IMSC Student Conferences.

## Uniqueness & Related Work:

**Uniqueness** – Use of a driving interface for driving control. The ability to create a smooth control for expressive performance. The harmonic music information to terrain mapping is also unique.

**Interfaces** – *Radio Baton* by Max Matthews, manipulates tempo by conductor gestures. *Digital Baton* by Teresa Marrin, creates expressive performances from conducting gestures. *Tactile instruments* by Gil, hand manipulated to create performances.

**Rule based methods** – *Director Musices* by Anders Friberg and Roberto Bresin, rule-based manipulation of musical tempo and dynamics. *Rubato* software by Guerino Mazzola and Jorg Garbers, piece-wise control of tempo and dynamics. *POCO* by Henkjian Honing, environment for analyzing, modifying and synthesizing expression.

**Learning expressive methods** - *Performance Worm* by Werner Goebl, visualization of tempo-loudness space to discover principles of expressive performance. Roberto Bresin has used neural networks to learn a professional pianist's expressive gestures

## 5-Year Plan:

| | |
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| **2004-2005** | Physics models for speed control and force feedback. Develop autopilot and other terrain models. Proof of concept tests. |
| **2006-2007** | Volume control for separate voices and automatic voice separation. Incorporate meter induction. User tests. |
| **2008** | Create a interactive public exhibit. |

May 2004

**Role in IMSC:** This is an interdisciplinary project combining research in human computer interaction and music performance. This research furthers IMSC's goal in creating human-centric immersive technologies.

## Research Approach:

**Terrain:** The road is a representation of the tonal patterns of the music. The curves along the road represent tonal changes. A sharper curve indicates a more significant tonal change. Path generated using computational music analysis. Users can use visuals to make informed expressive performance decisions.

**Steering Wheel:** The user can navigate the turns and control the view of the road.

**Pedals:** These control acceleration and deceleration of the car. The velocity of the car is linked to the tempo of the music. The acceleration of the car is linked to the dynamics(volume levels) of the piece.

**Software:** Implemented in MFSM (Modular Flow Scheduling Framework), an open source implementation of IMSC's SAI (Software Architecture for Immersipresence), using C++ and OpenGL graphics. MIDI (Musical Instrument Digital Interface) files are used for the music. The application graph is shown below.