

Introduction to DMI Design

Andrés Pérez

Digital Lutherie
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Outline

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Precursors

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Digital Lutherie

- ▶ Digital: related to computers
- ▶ Lutherie: musical instrument design and construction

DMI: Digital Musical Instrument

Introduction

But... what is a musical instrument?

"...a music instrument is any device used to play and to produce any music, transforming in real-time (i.e. by being played) the actions of one or more performers into sound events".¹

¹Jordà, S. (2004). Digital Instruments and Players : Part II – Diversity, Freedom and Control, (January 2004).

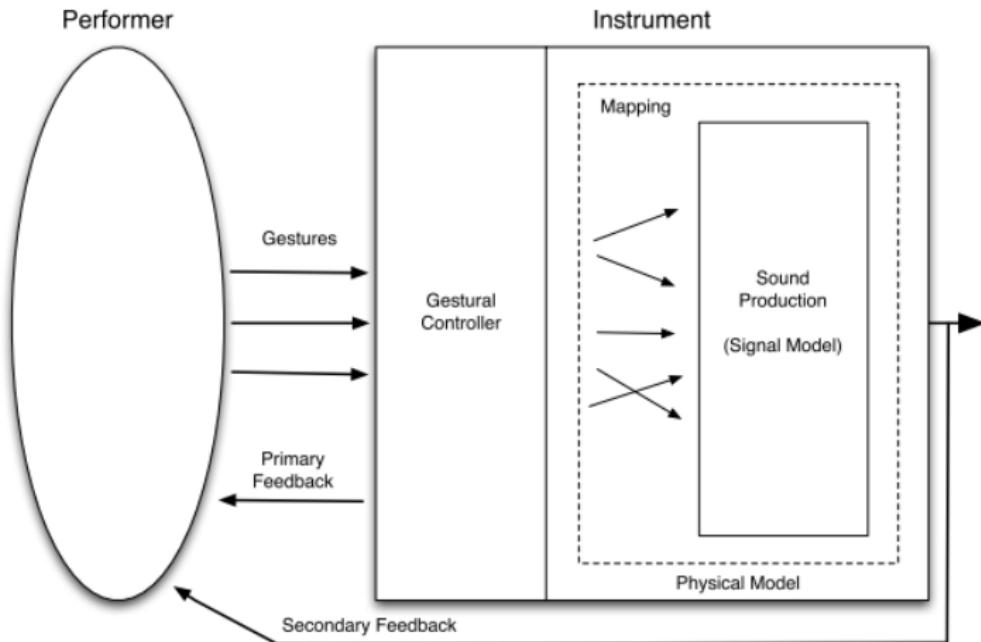
Introduction

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Wanderley, M. M. (2001). Performer-Instrument Interaction: Applications to Gestural Control of Sound Synthesis. PhD thesis, University Paris 6.

Introduction

We consider two types of instruments:

- ▶ Acoustic (traditional)
- ▶ Digital

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"[...] Perhaps the most fundamental of these differences arises from the separation of the control system from the sound synthesis synthesis in a digital musical instrument (DMI). [...] For acoustic instruments these [control systems] are integrated with the sound creation systems. The performer creates sound on an acoustic instrument by acting directly on the sound production mechanisms"³.

³Marshall, M. T. (2008). Physical Interface Design for Digital Musical Instruments

Introduction

Some consequences for DMI:

- ▶ The interface shape (and thus the way of playing the instrument) is not constrained by the sound production method.
- ▶ The sound produced by the instrument is not constrained by mechanic/acoustic principles.
- ▶ The relationship between control system and sound synthesis (*mapping*) is not fixed.

Introduction

In short: DMI design presents a high degree of freedom.

So... how should we do???

*"... Digital instruments, on their side, are only limited by the imagination and know how of their constructors; a substantial distinction with both positive and negative consequences."*⁴

⁴Jordà, S. (2007). Interactivity and live computer music. Computer Music Journal.

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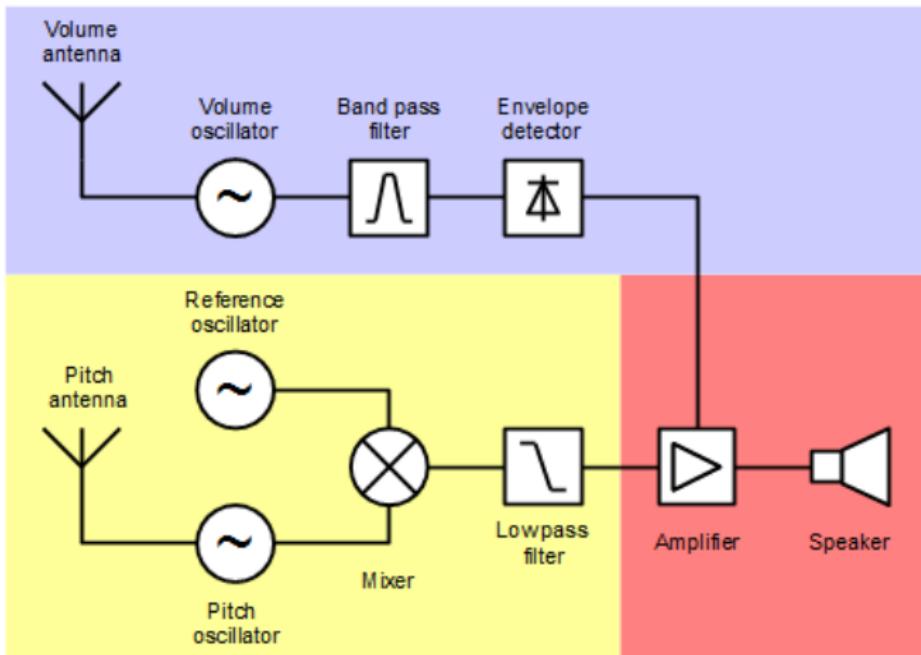
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Precursors

Theremin

- ▶ Invented in 1920 by russian engineer Lev Termen
- ▶ First successful non-acoustic instrument.
- ▶ Still commercialized and used nowadays.
- ▶ Transforms hand gestures into variations of pitch and volume.
- ▶ Based on electric resonators and the heterodyne principle.

Precursors



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Precursors

Ondes Martenot

- ▶ Invented in 1928 by french cellist Maurice Martenot
- ▶ Electrical synthesizer.
- ▶ Pitch is controlled by right hand, volume and timbre with left hand.
- ▶ Popularized by Radiohead in the 2000's.

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Trautonium

- ▶ Invented in 1929 by german electrical engineer Friedrich Trautwein.
- ▶ Player gestures change resistivity of a metal plate, transforming into pitch and volume changes.
- ▶ Extensely played and improved by Oskar Sala (Mixturtrautonium).
- ▶ Innovative introduction of formant filters for timbral control.

Precursors



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Electronic Sackbut

- ▶ Invented in 1945 by canadian physicist Hugh Le Caine.
- ▶ Predecessor of voltage-controlled synths
- ▶ 2D continuous control of volume, attack and pitch

Precursors

Some thoughts...

- ▶ All instrument designers were primarily scientists!
- ▶ Huge bias towards "improving the piano"
- ▶ Huge bias towards continuous (pitch) control
- ▶ These are not exactly DMIs...

Many other bizarre creations at [120 Years of Electronic Music](#)