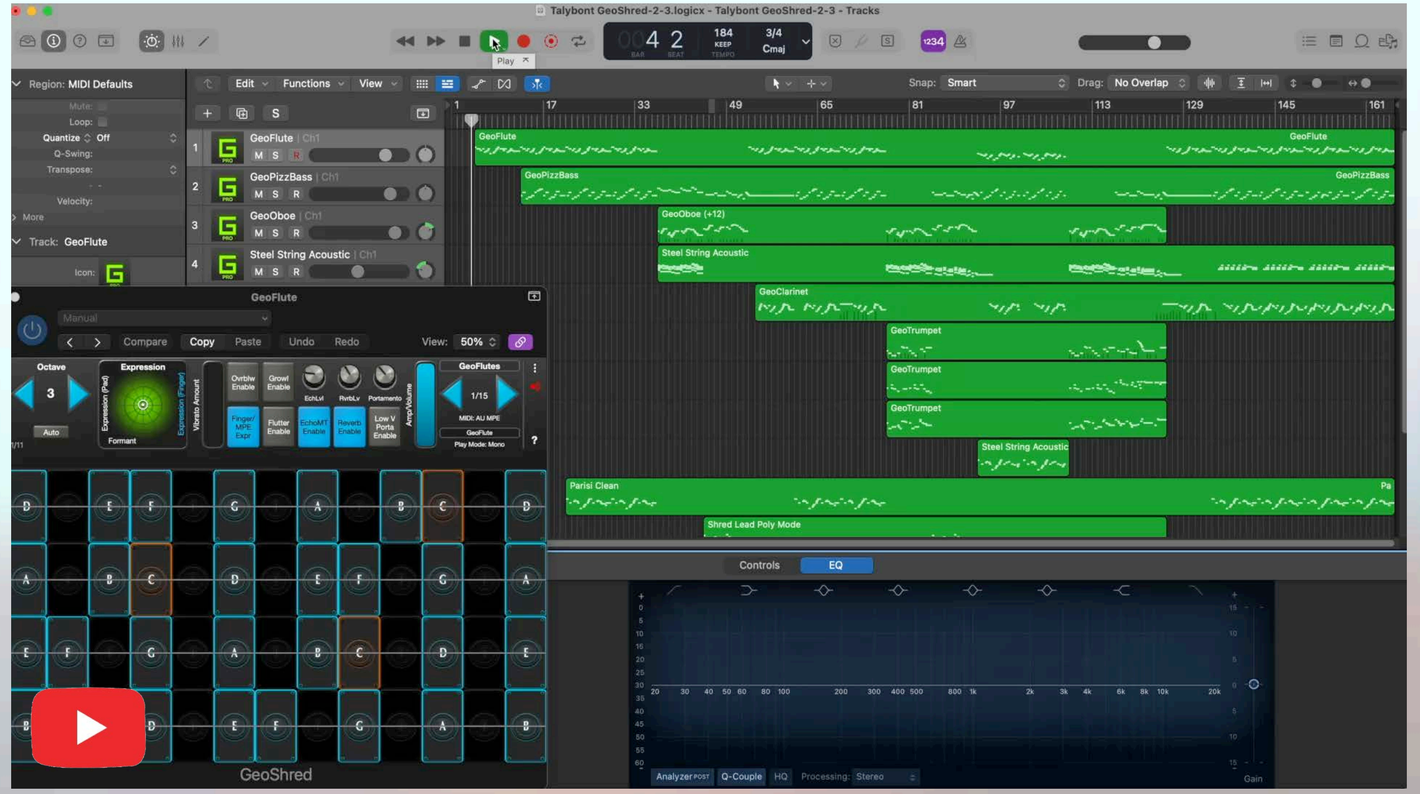
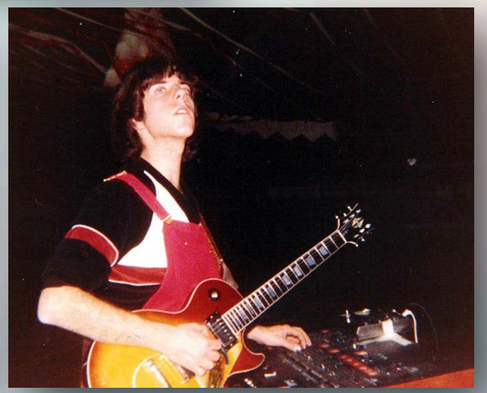
MIDI 2, the Orchestral Articulation Profile and Virtual Performers

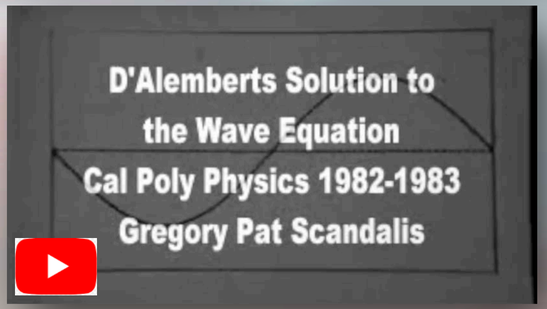
CCRMA Open House, May 15, 2025 - Pat Scandalis



About Pat

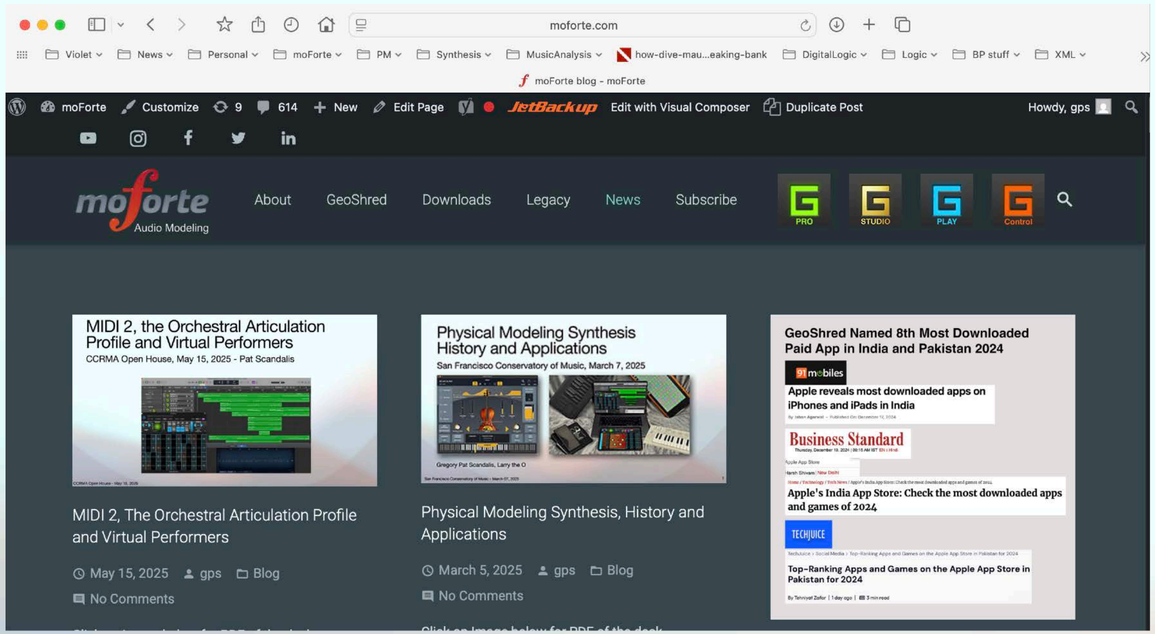
- 42 years in the Silicon Valley as an Engineer
- Built my first monophonic electronic instrument from a Radio Shack P-Box kit in 1970
- Gigged with an Arp Avatar guitar synth (1978)
- Guitar Player for Weird Al Band (1980)
- Computer modeling of vibrating strings and membranes for senior thesis in Physics (1982)
- Researcher in Physical Modeling at Stanford/ CCRMA (1994)
- CEO/CTO of moForte
  Chairman of the MPE Subcommittee MIDI Association



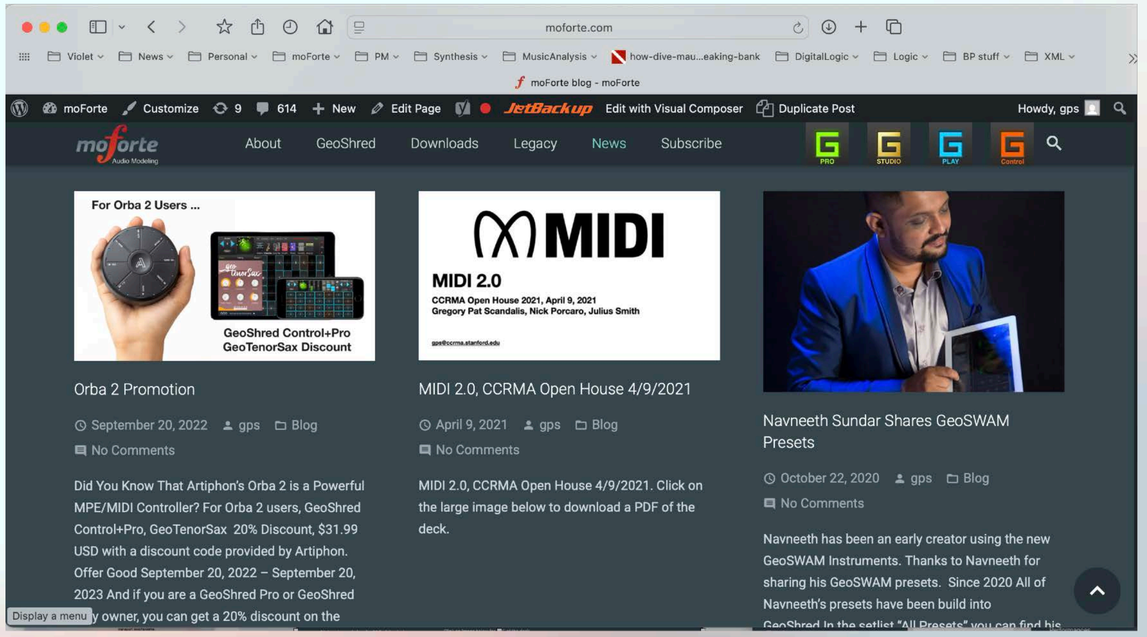


Presentations

http://www.moforte.com/news



This Presentation

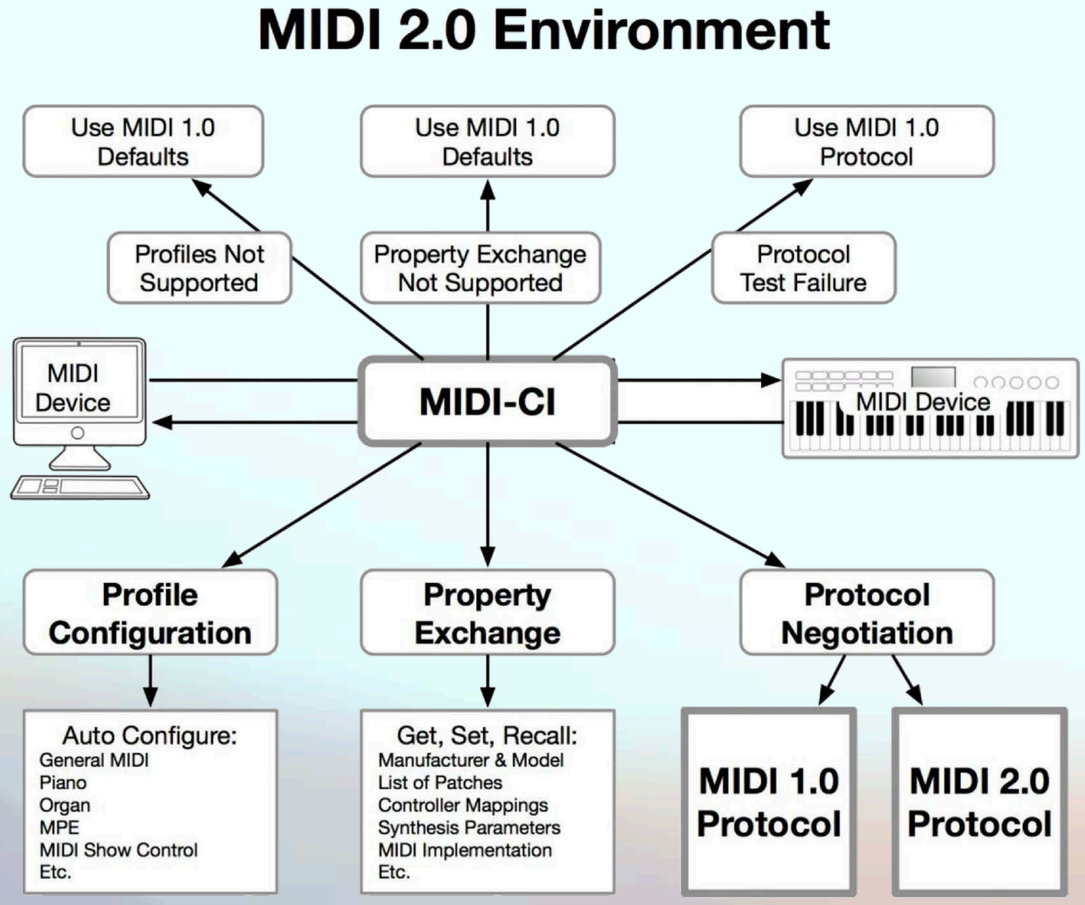


MIDI 2.0 Presentation From CCRMA Open House 2021

Outline of Topics

- Brief MIDI 2 Overview
- Orchestral Sample Libraries and Key Switches
- MIDI 2 Orchestral Articulation Profile
- What does this mean for Live Performance, Film/Game Scoring and Virtual Performers
- Questions

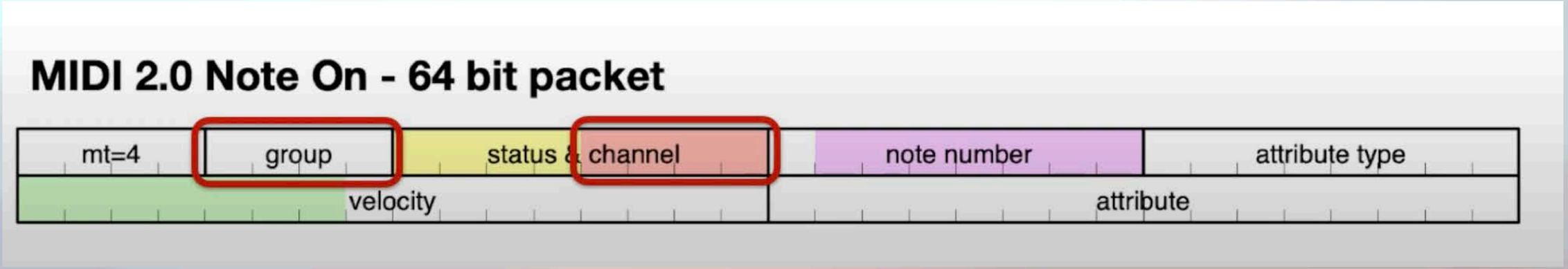
MIDI 2



- MIDI 2.0 is bidirectional. It changes MIDI from a monolog to a dialog
- MIDI 2.0 Protocol mirrors and extends the MIDI 1.0 Protocol.There is a new Universal MIDI Packet (UMP) which offers higher resolution performance controllers (32 bit), more controllers (32k) and 16 channel groups for 256 channels.
- MIDI-CI (Capability Inquiry) supports profile and property exchange which can be used to configure devices for specific applications.
- Compatible with MIDI 1.0
- Future Proofing, UMP is transport agnostic and can be implemented on USB, Ethernet, Bluetooth and future transport mechanisms.

UMP - Universal MIDI Packet

- Uses existing MIDI 1.0 semantics and mechanisms
- New Universal MIDI Packet (UMP) which offers higher resolution performance controllers (32 bit), more controllers (32k) and 16 channel groups for 256 channels, better NRPNs and full 8 bit SysEx.
- Based on 32bit words. There are 32,64,96,128 bit UMPs



Profiles

- Profiles represent a semantic contract between senders and receivers.
- Piano
- MPE
- Drawbar Organ
- **Orchestral Articulation**
- …

M2-123-UM **Note On Orchestral Articulation Profile v1.0** 2024-03-28

MIDI-CI Profile for Note On Selection of Orchestral Articulation

Using MIDI 2.0 Protocol

MIDI Association Document: M2-123-UM

Document Version 1.0
Draft Date 2024-03-28

Published 2024-04-05

Developed and Published By
The MIDI Association
and
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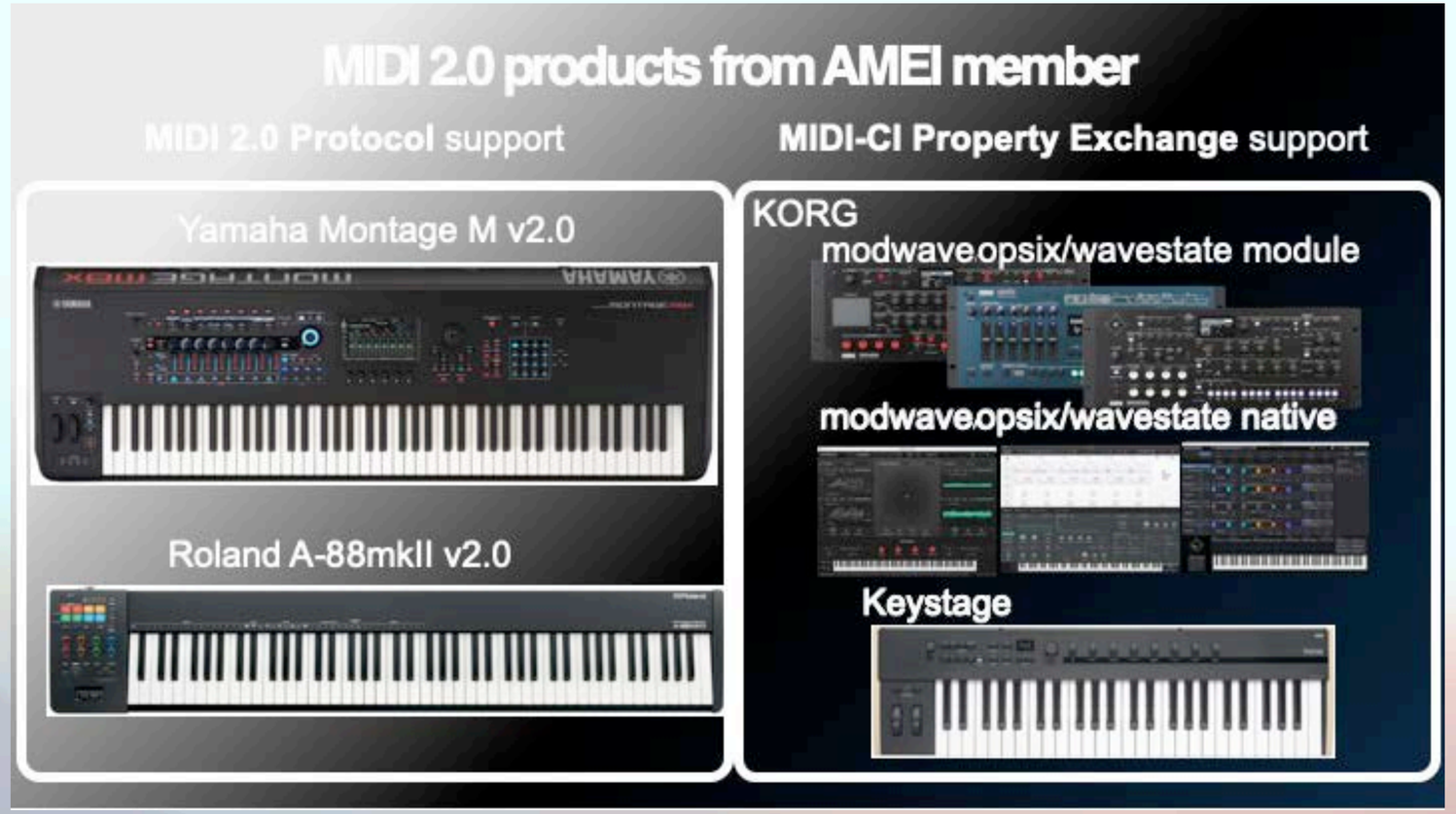
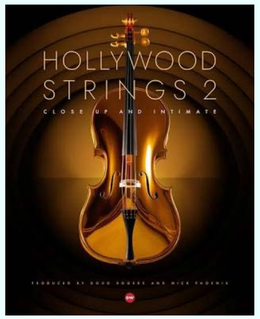
MIDI 2 Status



- Available in Linux, macOS, iOS/iPadOS, Windows, Android.
- Yamaha, Korg, Roland have MIDI 2 products available.
- There is a technical issue with how to do MIDI-CI with DAW plugins. The solution for this will be announced at SuperBooth

Orchestral Sample Library Key Switches

- Key Switches are used to select alternate articulated samples
- Articulation is sometimes done in post editing
- Note that Physical Models generally use MPE and CCs so that the articulated behavior can be performed directly



	Spitfire	EastWest	Berlin Strings	Cinematic Studio	Vienna
C0	Long (Sustained)	Sustain	Sustain	Legato	Sustain
C#0	Legato	Legato Slur	Legato	Sustain	Legato
D0	Staccato	Legato Bow	Staccato	Staccato	Staccato
D#0	Spiccato (Bouncing Stroke)	Porato	Spiccato	Spiccato	Spiccato
E0	Pizzicato	Staccato	Pizzicato	Pizzicato	Pizzicato
F0	Col Legno (with the wood)	Spiccato	Tremolo	Conlegno	Tremoo
F#0	Tremolo	Pizzicato	Trill m2	Tremolo	Trill m2
G0	Trill m2	Tremolo	Trill M2	Trill m2	Trill M2
G#0	Trill M2		Marcato	Trill M2	Sul Ponticello
A0	Harmonics		Sul Ponticello (near the bridge)	Harmonics	Harmonics
A#0	Sul Tasto (near the fingerboard)			Con Soridino	Detaché
B0	Con Sordina (with mute)				

MIDI 2 Orchestral Articulation Profile

- Released April 2024
- Provides a MIDI 2 standard for selecting articulations.
- Several hundred articulations across all families of instruments are defined
- Attribute tags in the UMP are defined for various articulations

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What Does the Orchestral Profile Mean for Live performance

- MPE controllers and Physical Models will most likely support the Orchestral Articulation Profile
- New classes of controllers to support direct manipulation of articulation parameters
- Many different sensors: touch, pressure, sliding, breath, spatial motion… all expressive opportunities

What Does the Orchestral Profile Mean for Scoring

- A standard way to articulate orchestral scores
- Much more comprehensive than current key switches
- The profile supports articulation equivalence so that scores can be re-orchestrated with different instruments and the instruments respond with analogous articulations.

What Does the Orchestral Profile Mean for Virtual Performers

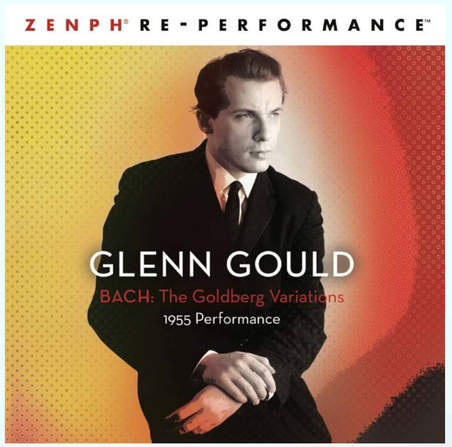
- Sometime in the moderately near future there will be a corpus of MIDI 2 articulated instrument performances.
- These performances may be used as training data for Virtual Performers.
- Note that currently, there are unresolved ownership and ethical issues around creating AI tools using training data.

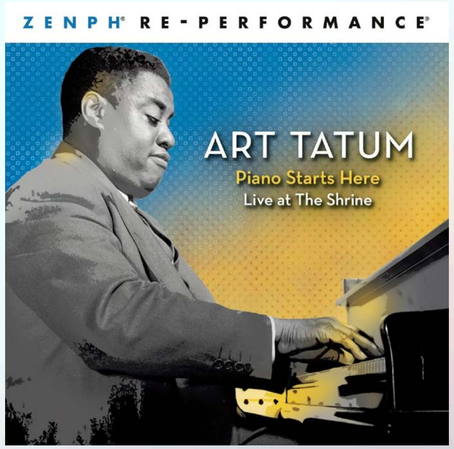
Example: JAM_BOT

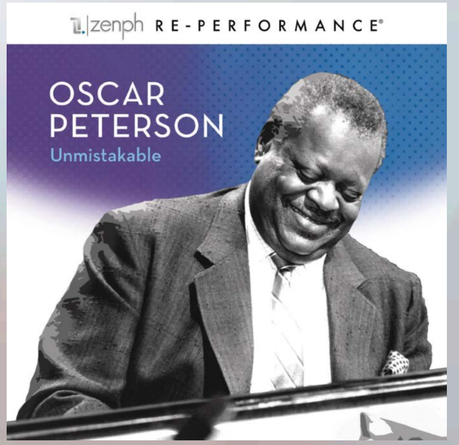
- MIT Media Lab. Realtime Generative AI, trained on a collection of Jordan Rudess' MIDI performances.
- Performance with the JAM_BOT is conversational, with Jordan playing and then the JAM_BOT responding in the same style

Example, Zenph “Re-Performance”

- DSP and ML techniques to extract articulation data from recordings
- Velocity, timing, pedal estimate
- Stored as “10bit” MIDI
- Re-performed on a high resolution Disklavier
- Required intensive manual intervention. Zenph ceased operations in 2012.
- Now, over 10 years later these techniques could be revisited for monophonic instruments to create a corpus of articulated MIDI 2 performances based on real performances







Ethics Statement About Training Virtual Performers Using Orchestral Articulation Data

- The ownership of training data and resulting performances remains unclear
- There are issues of ownership, consent, attribution, labor displacement, authenticity.
- It’s probably inevitable that Virtual Peformers will emerge.
- The entire music eco system must start talking about these issues.

Gratitude

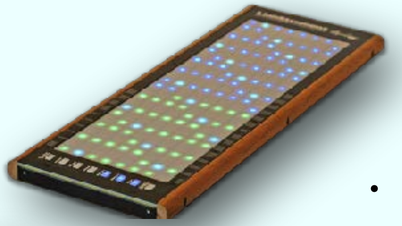
Mary Albertson
Eric Bateman
Athan Billias
Simone Capitani
Chris Chafe
John Chowning
Perry Cook
Jon Dattorro
David Jaffe
Mike Kent
Joe Koepnick
Max Matthews (RIP)
Romain Michon
Denis Labrecque
Scott Levine
Roger Linn
Fernando Lopez-Lezcano
Keith McMillen (RIP)
Yann Orlarey
Stephane Letz
Stefano Lucato
Stanford OTL
Larry the O
Emanuele Parravicini
Danny Petkevich
Nick Porcaro
Bill Putnam
Jordan Rudess
Danielle Rudess
Kent Sandvik
Julius Smith
Tim Stilson
David Van Brink
Scott Van Duyne
Yamaha

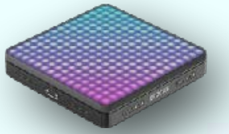
And CCRMA

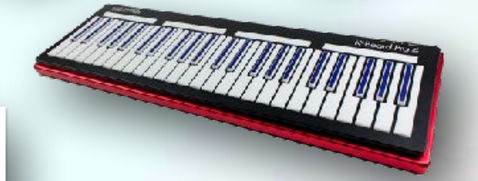
Questions?

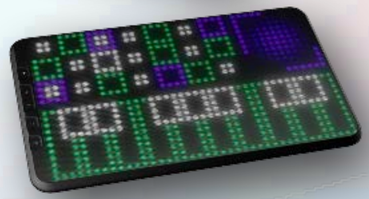
You can reach me at
gps@moforte.com

Some MPE Controllers









- Haken Continuum
- Lumi Keys
- Roli Blocks
- KMI K-Board Pro 4
- Ere Touch
- Ableton Push 2
- Exquis
- Osmose
- Guitar Controllers
- Sensel Morph
- Artiphon INSTRUMENT 1
- Joué
- GeoShred
- Roli Seaboard
- LinnStrument

MPE makes a whole new generation of controllers possible. **Whatever instrument makers dream up!**