Music in the Time of COVID

Coping Mechanisms for Network Performance

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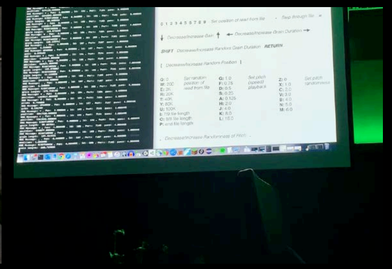
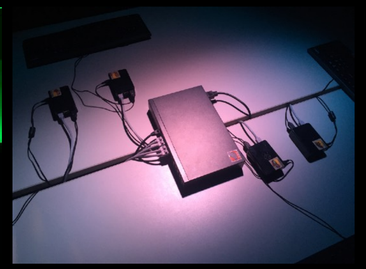
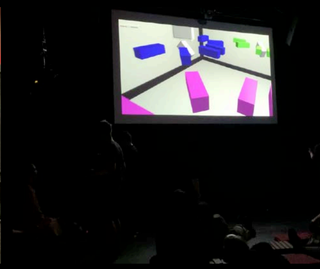
NPAPWS '21 April 28, 2021

Ensemble Nonlinear @ Rensselaer Polytechnic Institute



- Electronic performing ensemble/seminar
- Multi-channel real-time performance
- Client-Server configurations
- Raspberry Pi hardware
- ChucK, Pure Data, Processing, XR software

2021 - WHERE WE WANTED TO BE…

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CORETET virtual instruments for the 21st century

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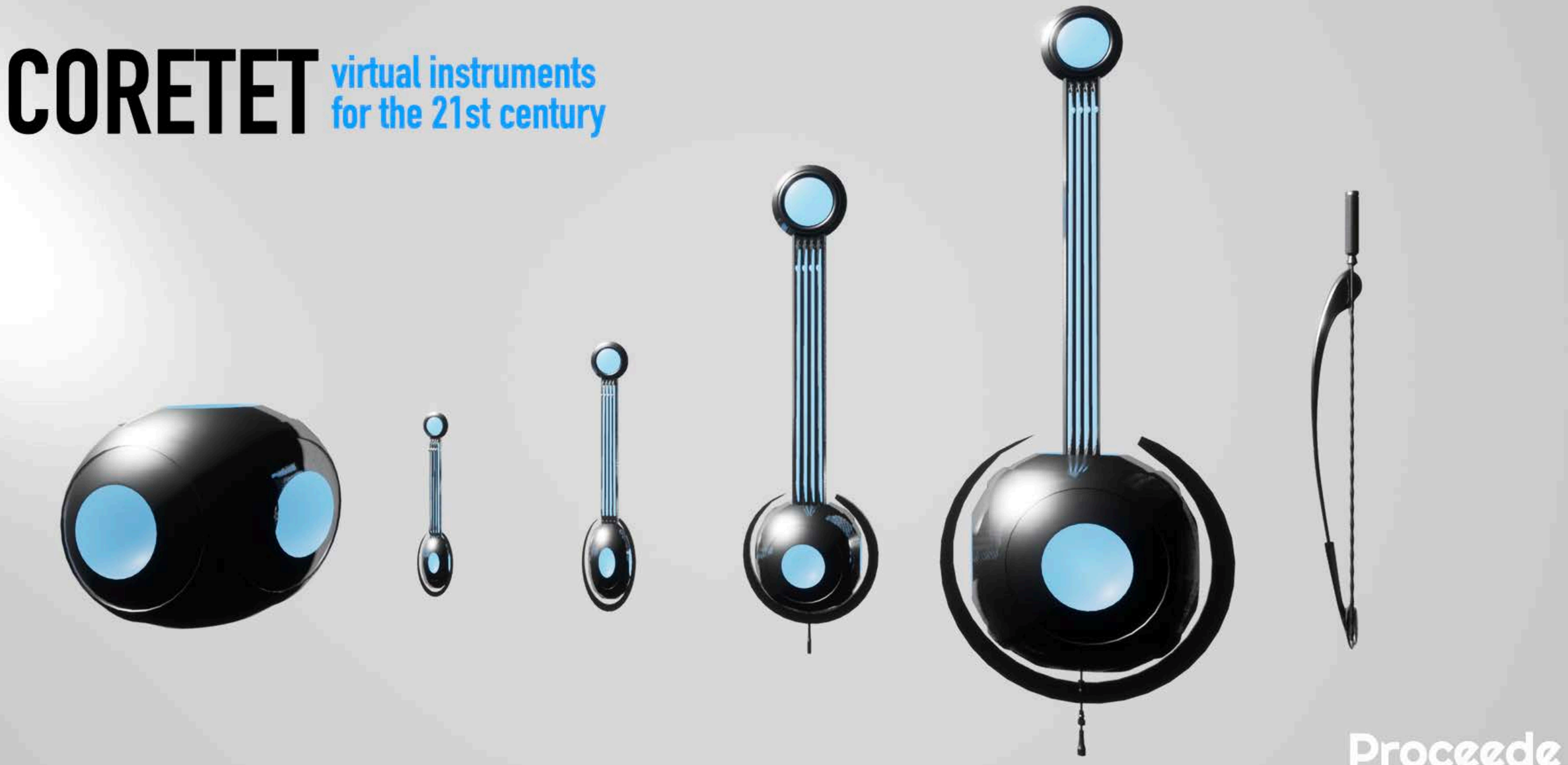
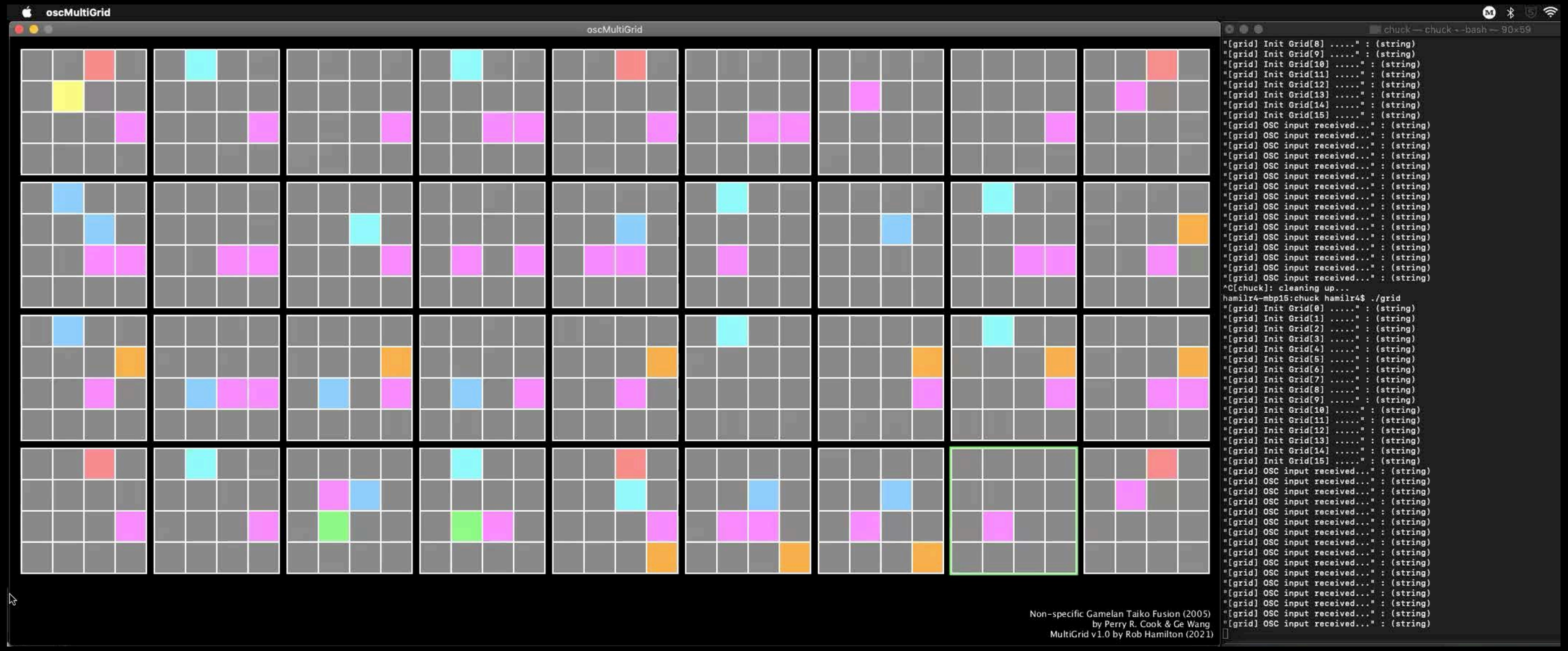
2021 - WHERE WE WANTED TO BE…



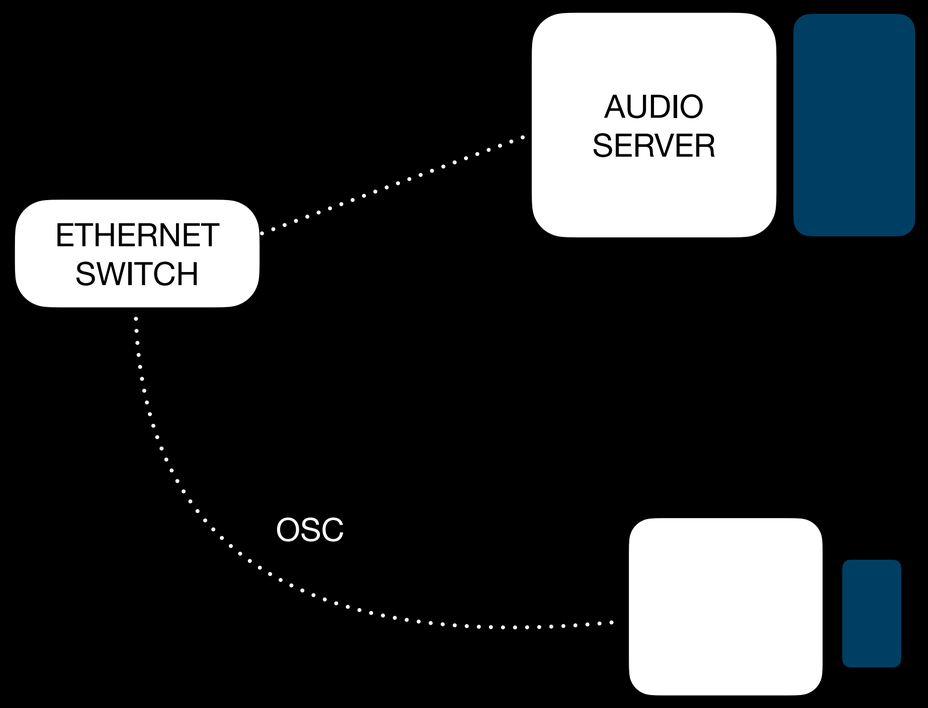
Proceede
music :: games

2021 - WHERE WE ARE…

2021 - WHERE WE ARE...



Ensemble Nonlinear @ Pre-COVID



CONDUCTOR

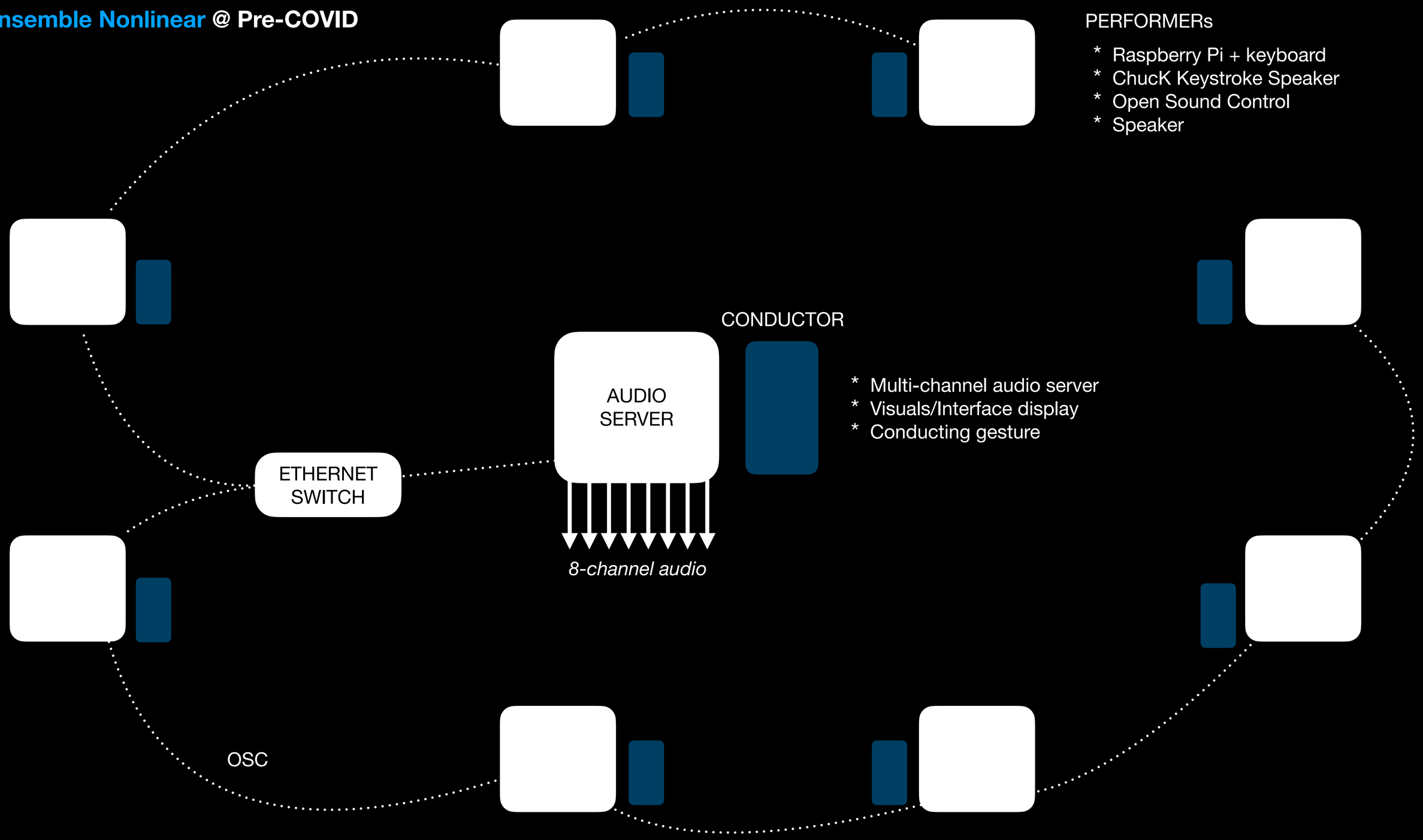
* Multi-channel audio server
* Visuals/Interface display
* Conducting gesture

+

LOCAL PERFORMERs

* Raspberry Pi + keyboard
* ChucK Keystroke Speaker
* Open Sound Control
* Speaker

Ensemble Nonlinear @ Pre-COVID



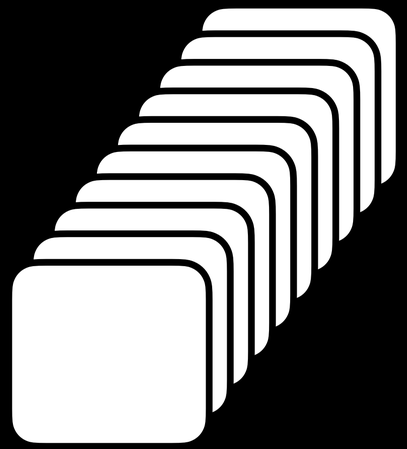
Ensemble Nonlinear @ During-COVID

CONDUCTOR

AUDIO SERVERs

* ChucK/Pure Data
* Multi-port Input

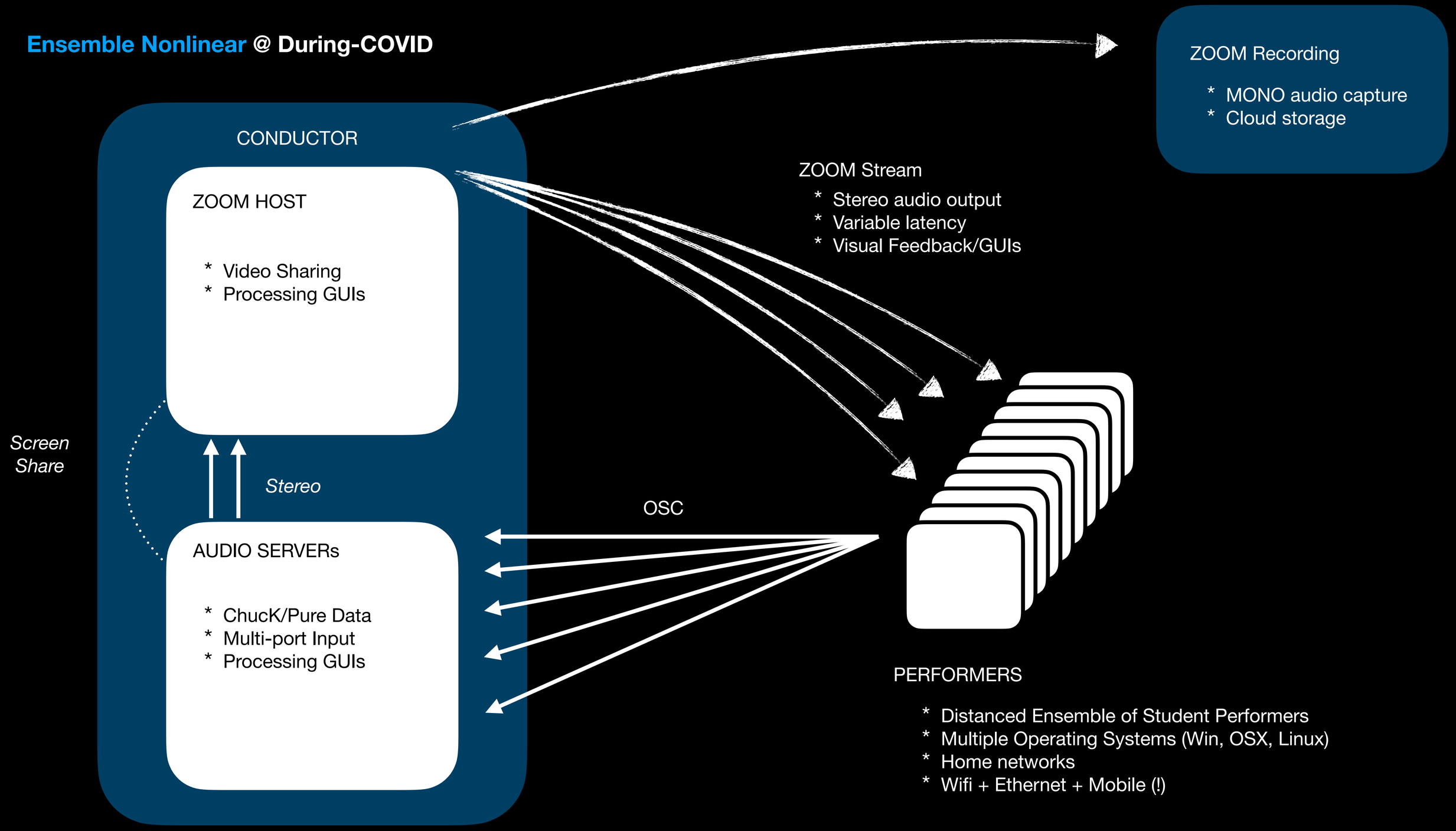
+



PERFORMERS

* Distanced Ensemble of Student Performers
* Multiple Operating Systems (Win, OSX, Linux)
* Home networks
* Wifi + Ethernet + Mobile (!)

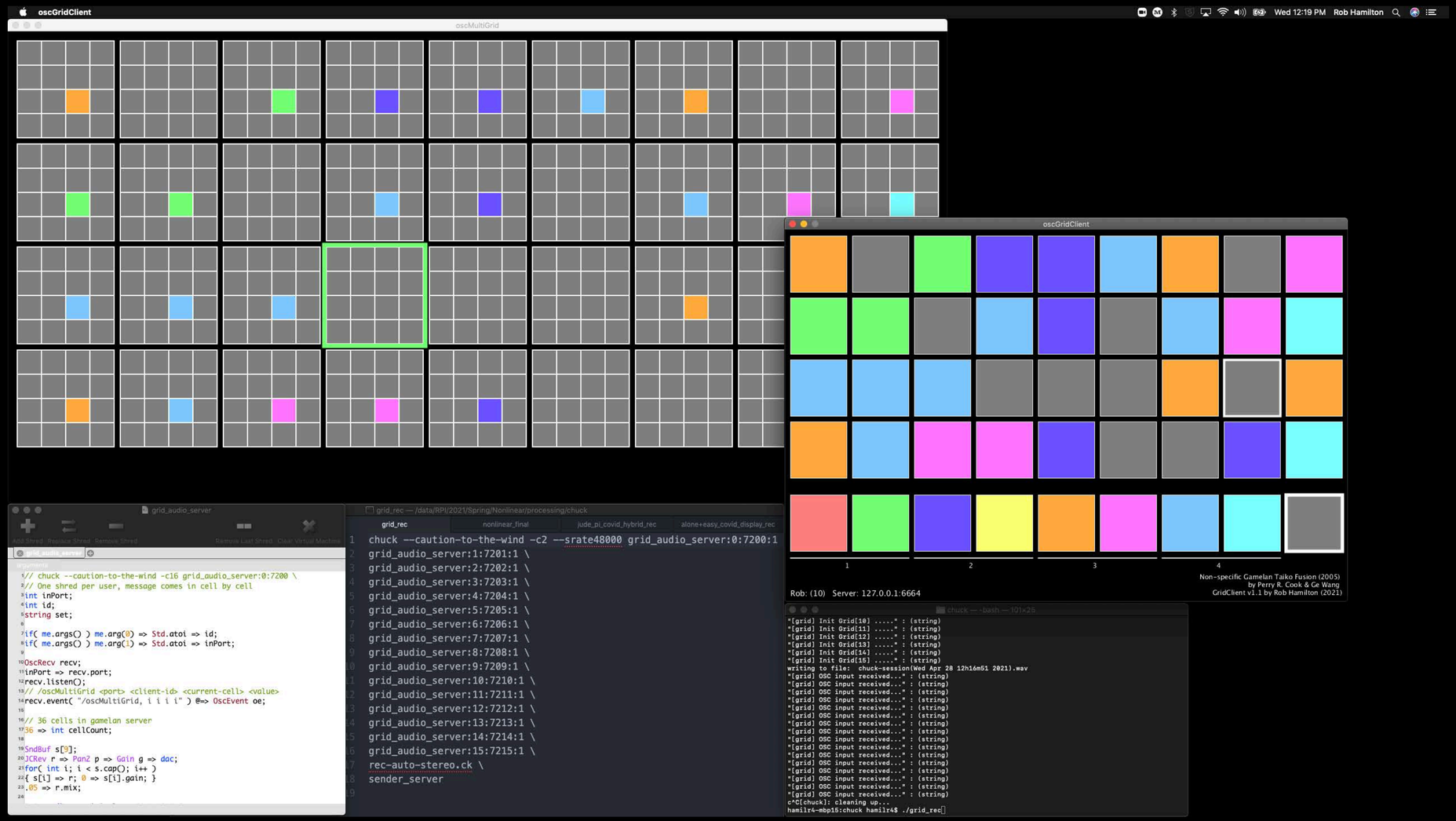
Ensemble Nonlinear @ During-COVID



Non-Specific Taiko Gamelan Fusion

By Ge Wang and Perry Cook (arr. R. Hamilton)

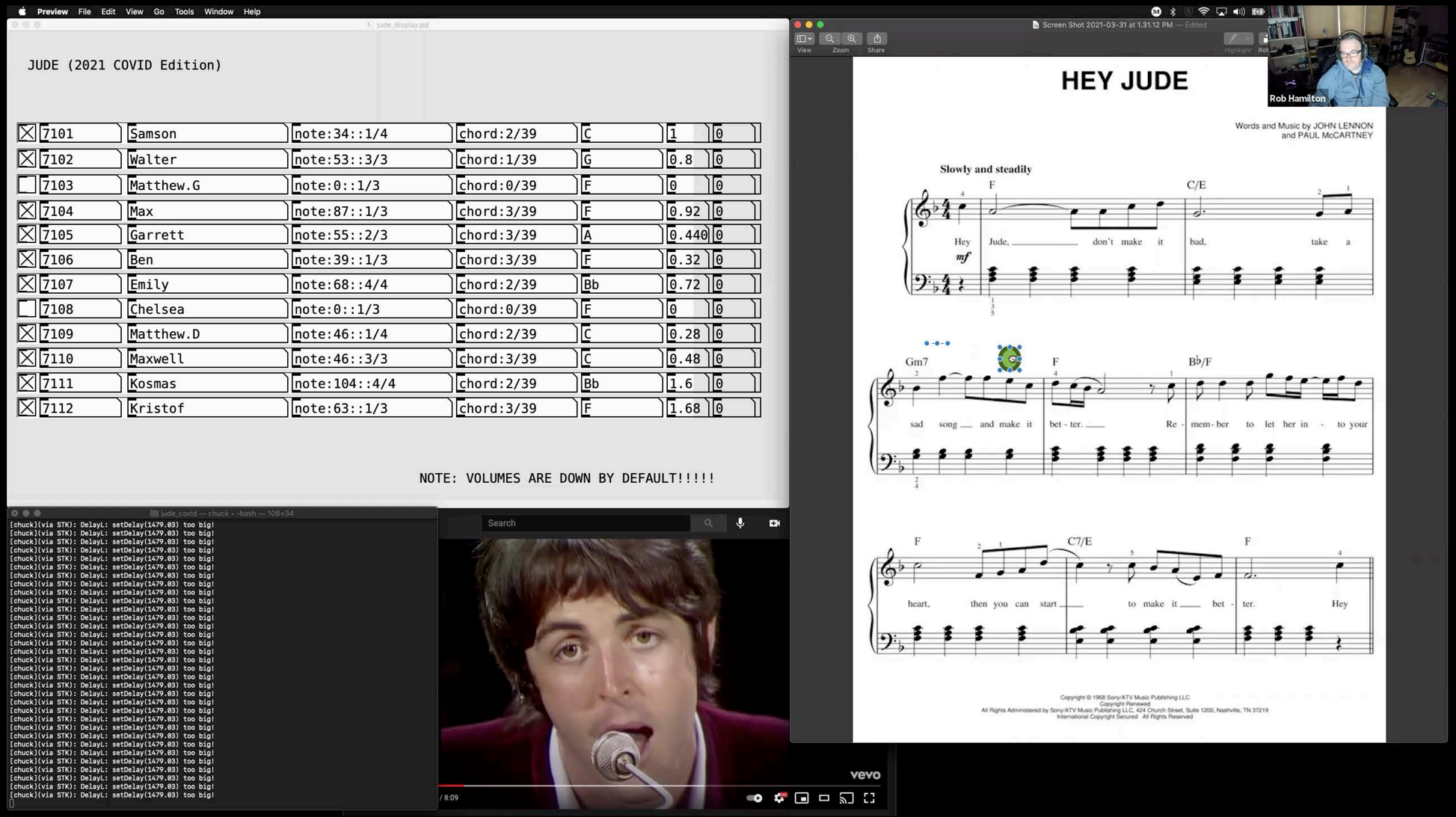
ChucK + Processing



Jude

By Lennon and McCartney (arr. R. Hamilton)

ChucK + Pure Data



Preview File Edit View Go Tools Window Help

alone_easy

Name	Port	Gain (0-6)	Width (ms)	Position (samp)	Pitch/ Speed	Pitch (rand)	Width (rand)	Position (rand)	Key Value	Pan (-1 - 1)
Kosmas	7111	0.285	28.028	0.000	1.000	0.000	5.000	0	Up (1082)	0.300
Kris	7112	0.314	89.888	0.000	1.000	0.000	5.000	0	Up (1082)	-0.300
maxk	7104	0.000	80.000	0.000	4.000	0.000	5.000	0	j (74)	0.000
Dennem	7109	0.418	80.000	0.000	1.000	0.000	3.846	0	Up (1082)	0.700
Maxim	7106	0.556	84.800	0.000	1.000	0.000	5.000	0	Up (1082)	0.500
Ben	7110	0.000	143.268	0.000	0.250	2.000	2.959	4584455	Test (8)	-0.700
Walter	7102	1.586	89.888	0.000	1.000	0.000	5.000	0	Right (1079)	-0.500
Garrett	7105	0.133	80.000	0.000	1.000	0.000	5.000	0	Up (1082)	0.250
Samson	7101	0.345	80.000	0.000	1.000	0.000	5.000	0	Up (1082)	-0.800
Emily	7107	0.000	53.205	0.000	0.250	0.000	3.846	0	s (83)	0.800

alone+easy_covid — chuck - -bt

```
keyboard 'Keyboard' ready
port, pan:  7110 -0.700000
keyboard 'Keyboard' ready
port, pan:  7111 0.300000
keyboard 'Keyboard' ready
port, pan:  7112 -0.300000
keyboard 'Keyboard' ready
^C[chuck]: cleaning up...
hamilr4-mbp15:alone+easy_covid hamilr4$ /data/RPI/nonlinear/co
port, pan:  7101 -0.800000
keyboard 'Keyboard' ready
port, pan:  7102 -0.500000
keyboard 'Keyboard' ready
port, pan:  7103 -0.250000
keyboard 'Keyboard' ready
port, pan:  7104 0.000000
keyboard 'Keyboard' ready
port, pan:  7105 0.250000
keyboard 'Keyboard' ready
port, pan:  7106 0.500000
keyboard 'Keyboard' ready
port, pan:  7107 0.800000
keyboard 'Keyboard' ready
port, pan:  7108 1.000000
keyboard 'Keyboard' ready
port, pan:  7109 0.700000
keyboard 'Keyboard' ready
port, pan:  7110 -0.700000
keyboard 'Keyboard' ready
port, pan:  7111 0.300000
keyboard 'Keyboard' ready
port, pan:  7112 -0.300000
keyboard 'Keyboard' ready
```

controls (page 1 of 3)

View Zoom Share Highlight Rotate Markup Search

0 1 2 3 4 5 6 7 8 9 *Set position of read from file* **-** *Step through file* **=**

↓ *Decrease/Increase Gain* ↑ ← *Decrease/Increase Grain Duration* →

SHIFT *Decrease/Increase Random Grain Duration* ***RETURN***

[*Decrease/Increase Random Position* **]**

Q: 0
W: 200
E: 2K
R: 20K
T: 40K
Y: 80K
U: 100K
I: 7/9 file length
O: 8/9 file length
P: end file length

Set random position of read from file

G: 1.0
F: 0.75
D: 0.5
S: 0.25
A: 0.125
H: 2.0
J: 4.0
K: 8.0
L: 16.0

Set pitch (speed) playback

Z: 0
X: 1.0
C: 2.0
V: 3.0
B: 4.0
N: 5.0
M: 6.0

Set pitch randomness

, *Decrease/Increase Randomness of Pitch* **.**

alone + easy

By Rob Hamilton

ChucK + Processing

MUSICAL PROBLEMATICS

- Spatialization? What's that…
- Network reliability / variable latencies
- OS issues, remote support/maintenance
- Gain staging

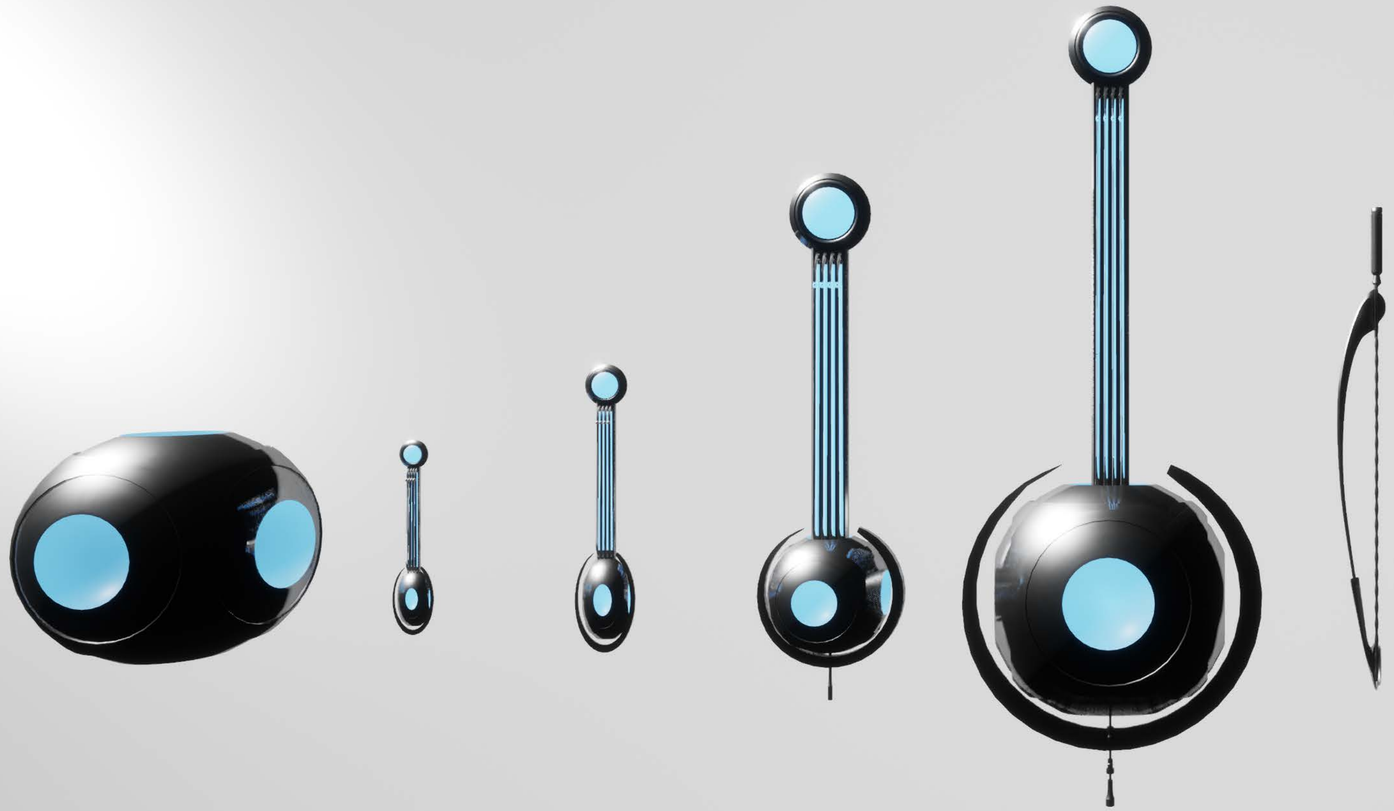
MUSICAL SOLUTIONS

- Stereo streams with GUI feedback (Spatialization? What's that...)
- Flexible compositional timing (Network reliability/variable latencies)
- KISS on the Client-side (OS issues/support/maintenance)
- Prayer (Gain staging)

MUSICAL FUTURES?

CORETET

virtual instruments
for the 21st century



MUSIC is a universal experience, bringing us together across huge cultural and physical distances. With Coretet, the joy of playing music has been brought to virtual reality, allowing beginners and experts alike to create and share beautiful music together.

CORETET is a virtual reality instrument and networked performance environment allowing users to play music either alone or across the network. Choose from five instrument presets - like cello, bass or violin - or create your own instrument of the future. Record your solo performances and share them online. Or better yet, connect to other users in real-time across the network to form your own string "coretet".

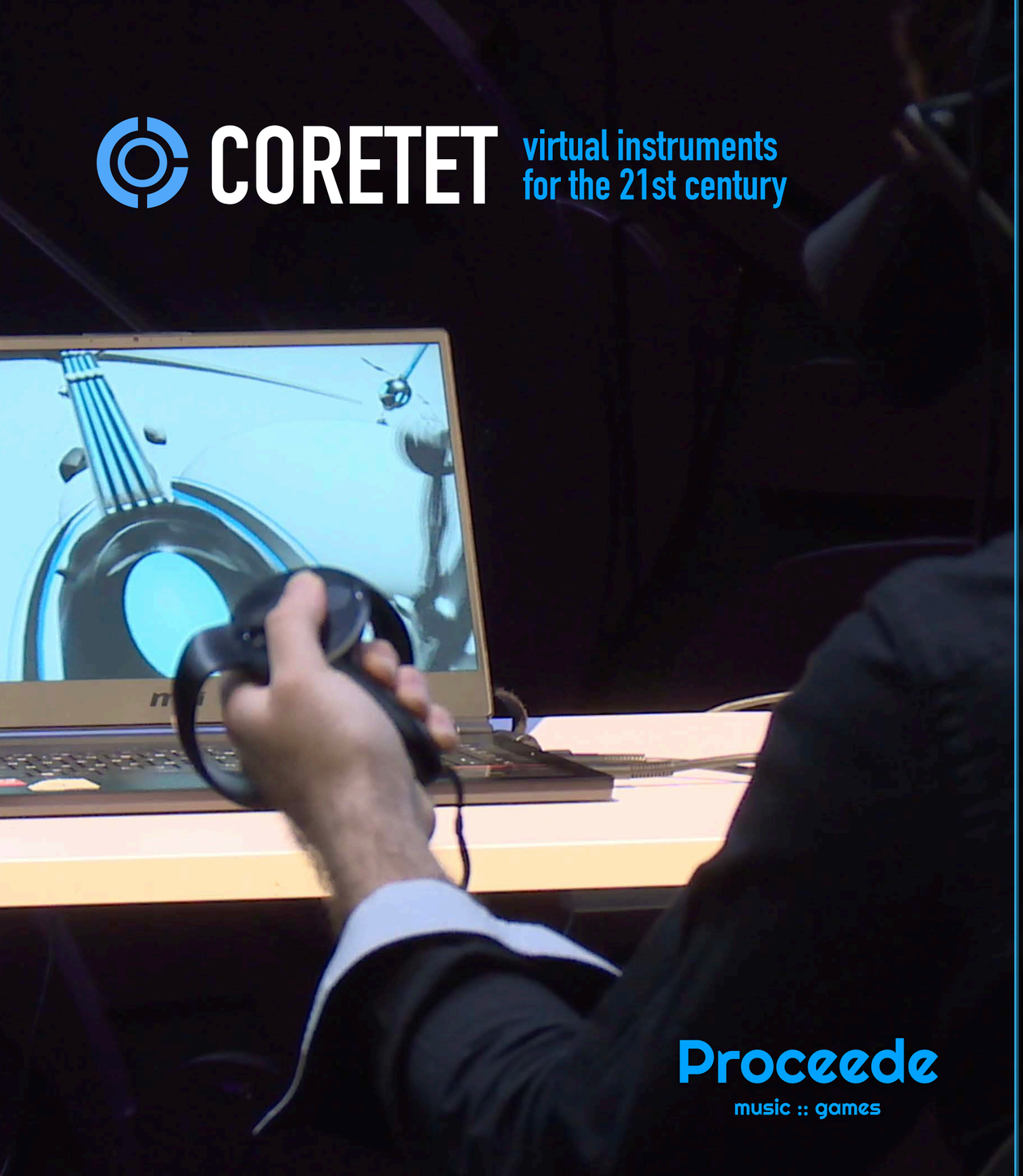
- BUILD your own instrument
- PLAY your favorite music
- SHARE your creations with the world

Coming Christmas 2021 for Oculus Rift and Oculus Quest

oculus

Proceede
music :: games

UNREAL
ENGINE



Proceede

Formed by researchers from Stanford University's Center for Computer Research in Music and Acoustics (CCRMA), **PROCEEDE** combines bleeding-edge audio processing technologies and game design to craft the musical game systems of the future.

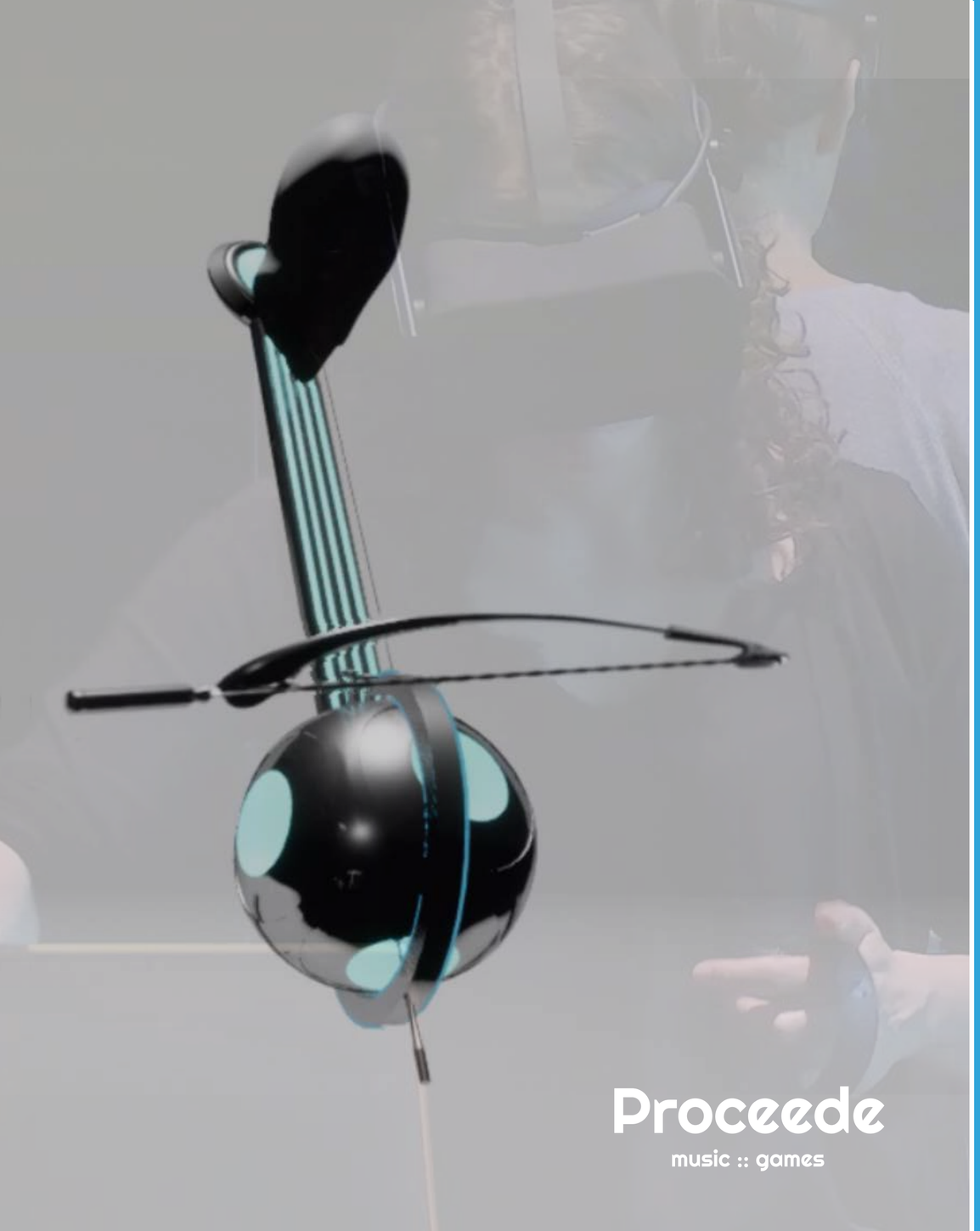
Design and development on **Coretet** is led by Dr. Rob Hamilton (Professor of Music and Media, Rensselaer Polytechnic Institute), an internationally-recognized expert in the field of mobile and VR instrument design. As a member of the team that launched Smule, Inc. Dr. Hamilton designed the core music systems that powered industry leading hit mobile music titles such as Ocarina, I Am T-Pain, Magic Piano, and Sing Karaoke/Smule. Art direction and modeling for **Coretet** is overseen by Chris Platz (Zynga, Smule).

At the heart of **Coretet** lies the **PROCEEDE** Audio Engine, using data from the virtual instrument itself to procedurally generate the sound of a bowed string. Alongside the native synthesis and audio processing capabilities of Epic's UNREAL ENGINE 4, the Proceede Audio Engine uses a process called physical modeling to accurately reproduce the sound and feel of bowed or plucked strings.

TIMELINE

Coretet has already been successfully prototyped and battle-tested in live networked concert performances around the globe (US, Austria, France, Mexico) using a suite of Oculus Rifts. A single player version of **Coretet** is in development currently with plans to ship on the Oculus Store by Christmas, 2020.

A fully-networked version of the software and an accompanying in-app purchase layer for licensed song content are planned for release respectively in Summer and Fall 2021.



QUEST

Coretet was designed and developed using the Oculus Rift. And with the Rift, the core Coretet experience has been validated by professional and amateur musicians around the globe. With an eventual goal to leverage the Oculus Quest's hand-tracking functionality, Coretet running on the Quest using the Oculus Touch controllers already offers an amazing experience, giving users the ability to play freely, without restriction.

Players can sit or stand to play and can interact with their instruments using Oculus Touch controllers or their hands in Quest hand-tracking mode. During networked play, players using Quest can freely turn and face their collaborators without restriction.

MONETIZATION

We plan on charging $5.99 for the initial solo-player launch of Cortet. At that time, Coretet will include a set of free-to-play musical scores firmly in the public domain.

With the multi-player release of Coretet, we anticipate increasing the application cost to $9.99. And with the initial release of downloadable content including new instrument skins and sounds, musical scores to purchase, we plan on introducing both a la carte item purchasing or monthly subscriptions. As we solidify relationships with music publishers, we anticipate the application becoming free-to-play with the primary income stream shifting to subscription to our licensed catalog of hit songs.

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