

The Role of Technology in Expanding Conducting Practice and its Aesthetic Implications

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SCIC UNIVERSITY
COLLEGE

**UNIARTS
HELSINKI**

Image: Samband Íslenskra Myndlistarmanna Exhibition, 2024

Sonic Sculpture and photo by Majella Clarke



Overview

- Overview
- Context, Purpose and Significance
- Presentation of Research Questions:
 - What does expansion of practice mean for conductors in the 21st century?
 - How can we ensure technology enhances artistic practice?
- Traditional vs. Innovative Practice (Framework developed in my MMus thesis)
- Industrial Revolutions and the Expansion of Musical Practice
- The Role of Technology and Interdisciplinarity in Expansion of Conducting Practice
- Demonstration Performance / Review of Performance Experiments (5 minutes)
- Implications for Aesthetics:
 - Ensemble and musical aesthetics
 - Scoring, composition and performer agency
 - Gesture aesthetics
- Implications for inclusivity, agency, performance, programming and the future of practice

Historical Context

CONDUCTING IS AN EVOLVING PRACTICE

2600 B.C.

CHIRONOMY

Ancient ensembles were led with hand gestures

1033- A.D

GUIDONIAN HAND

The Guidonian Hand was designed to help singers in solmization and unify plainchant.

1500-

TACTUS AND "LE BÂTON"

Polyphony required a new way to unify musicians

1808-

THE CONDUCTOR

Beethoven's 5th Symphony – required professional conductor to unify musicians.

1913-

THE CONTEMPORARY CONDUCTOR

Rite of Spring onwards tests the conductor's technical limits requiring technical mastery & artistic leadership.

1980-

THE IMPROVISING CONDUCTOR

Conduction, VOPA and Sound Painting emerge as conductors lead improvisation

2012-

CONDUCTING WITH TECHNOLOGY

Sonic batons, interactive audio-visual installations, and AI



New technologies are being applied to conducting

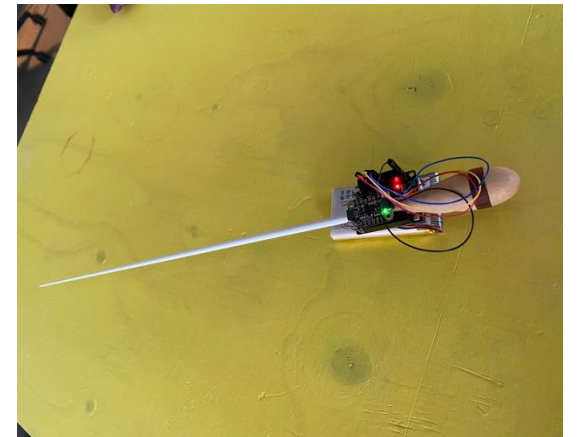
1997 - Mathews Radio Baton and Improvised Nodes

2012 – Joseph Young *Conducting Noise*

2014 – *Leap Motion* gesture software with score control parameters (*Effectorium* installation)

2018 - Video installations with time-stretch algorithms to control tempo with movement (Haus der Musik Vienna *Virtual Conductor* installation)

2023 – Intelligent sonic baton with neural audio synthesis



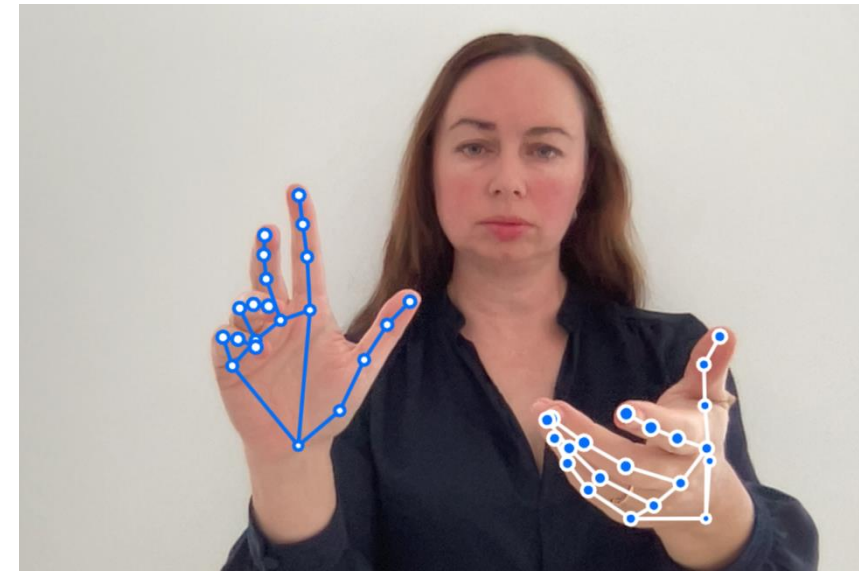
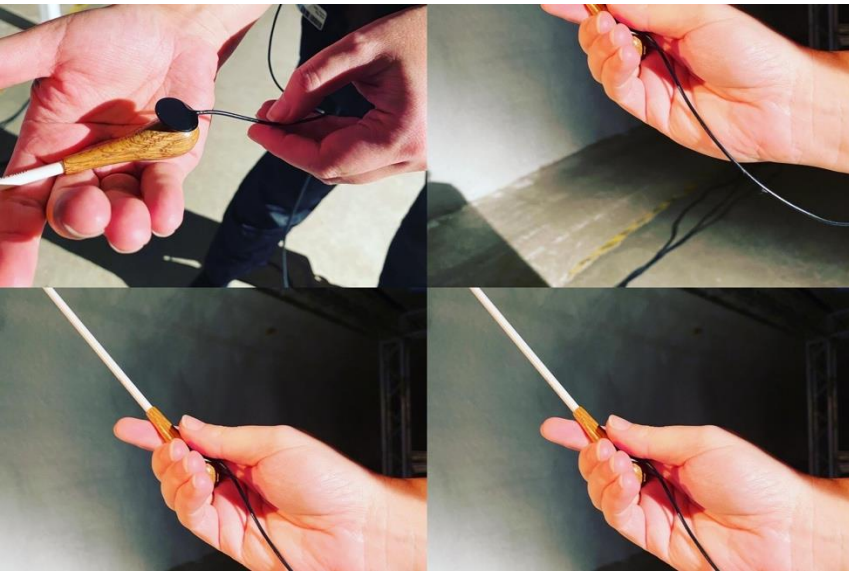
FROM LEFT TO RIGHT: JOSEPH YOUNG CONDUCTING NOISE; EFFECTORIUM MENDELSSOHN HAUS MUSEUM LEIPZIG; HAUS DER MUSIC WIEN VIRTUAL CONDUCTING INSTALLATION; INTELLIGENT SONIC BATON PROJECT

Significance

Expansion of practice for conductors

New ensemble sonics and performance formats

New ways to notate technology integration into performance BUT there are limits...

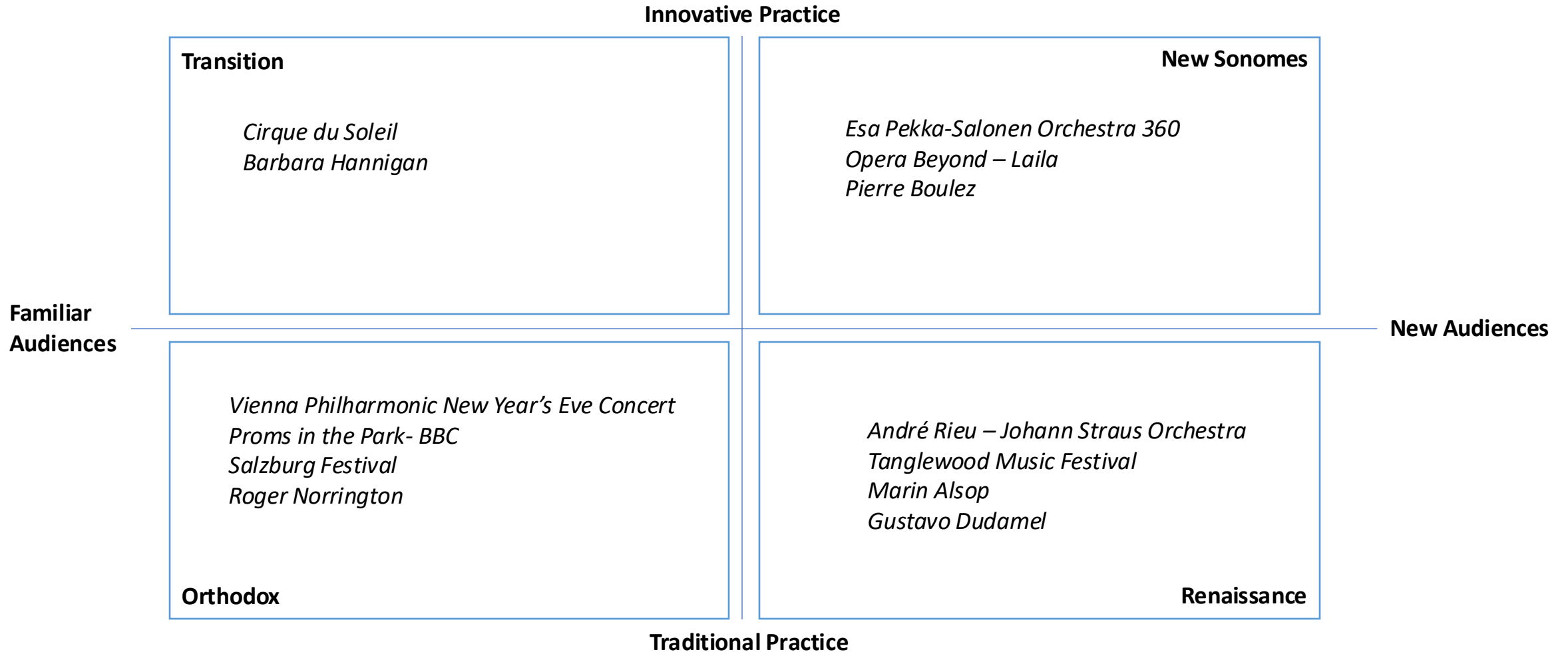




Research Questions

- What does expansion of practice mean for conductors in the 21st century?
 - How can we ensure technology enhances artistic practice?
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Traditional Versus Innovative Practice Framework (Clarke 2024)



What drives the need to expand practice?

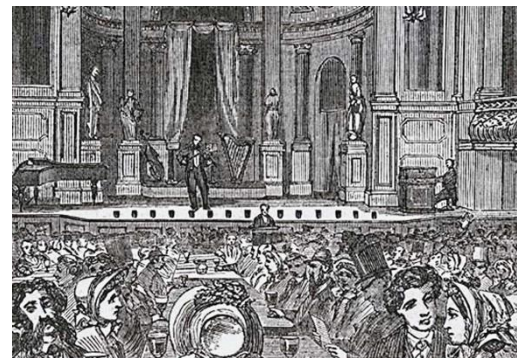


1st Industrial Revolution

Mechanization provides more tonal instrumental complexity for wind instruments.

Division of labor leads to specialization, and instrumental virtuosi

Large production systems in factories → large productions in music too



2nd Industrial Revolution

Urbanisation increases access to musical entertainment, musical instruction, publishing

Mechanical improvements of instruments

Electricity and science produce the first electric instruments (Telharmonium)
Expanding symphony orchestra.



3rd Industrial Revolution

Shift from mechanical to **digital electronics created new instruments**
Recording studios scale music.
Compositions use acoustic with digital technologies.
Conductor needs expanded skills e.g. read spectrograms, perfect tempo



4th Industrial Revolution

Undefined and evolving
Convergence between the physical, digital, and biological spheres.
Artificial intelligence, Cybernetics, Human-Machine interface
What does this mean for orchestras and conductors

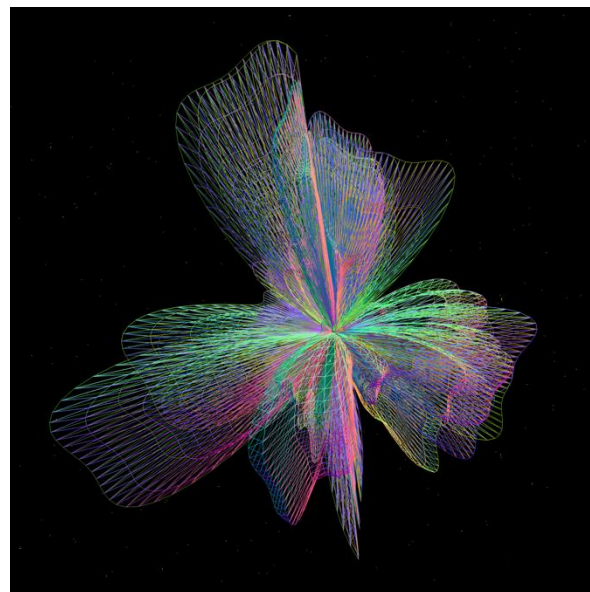
Experiments in Expansion of Conducting Practice: traditional audio synthesis vs neural audio synthesis

Sonic Baton Project – same baton but very different performance outcomes



Spherical Harmonics by Majella Clarke and Peter J. Østergaard

- The conductor has little control over the sonic outcome – all movements generate random, exploratory signals
- Without something more – it is just a magic wand...
- The conductor traces the gesture score of the spherical harmonics with their baton.
- The gesture movements are synthesised in Max and provide a sonic accompaniment to the electric guitar or chosen amplified instrument.
- The gesture scores are also able to be made as 3D printed gesture sculptures.
- Compositional materiality is important for expansion of practice.



Spherical Harmonics by Majella Clarke and Peter J. Østergaard



In Stillness I Found Death for Sonic Baton and String Orchestra by Juan David Bermúdez

Through Stillness I Found death. (2023)

Sonic baton
very slow (the swaying of the mountains)
♩ 250

① Japan
PP MF G.P.

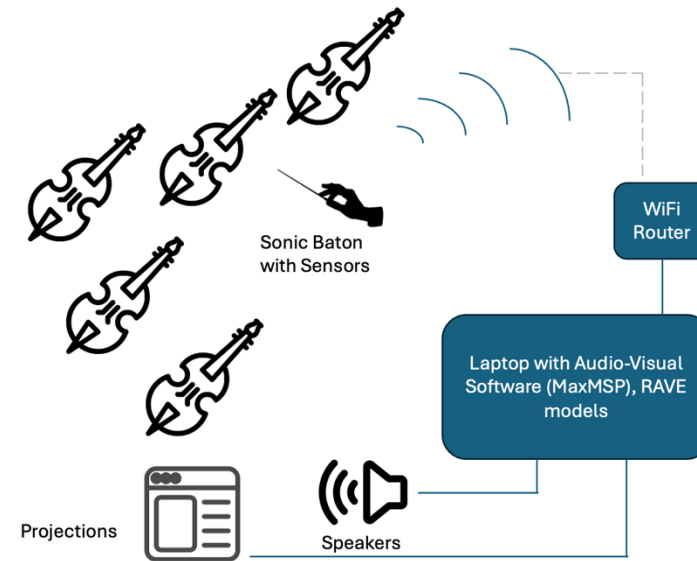
② Popocatepetl
G.P.

③ San Francisco
FP FP G.P.

④ Iceland
Rit..... G.P.

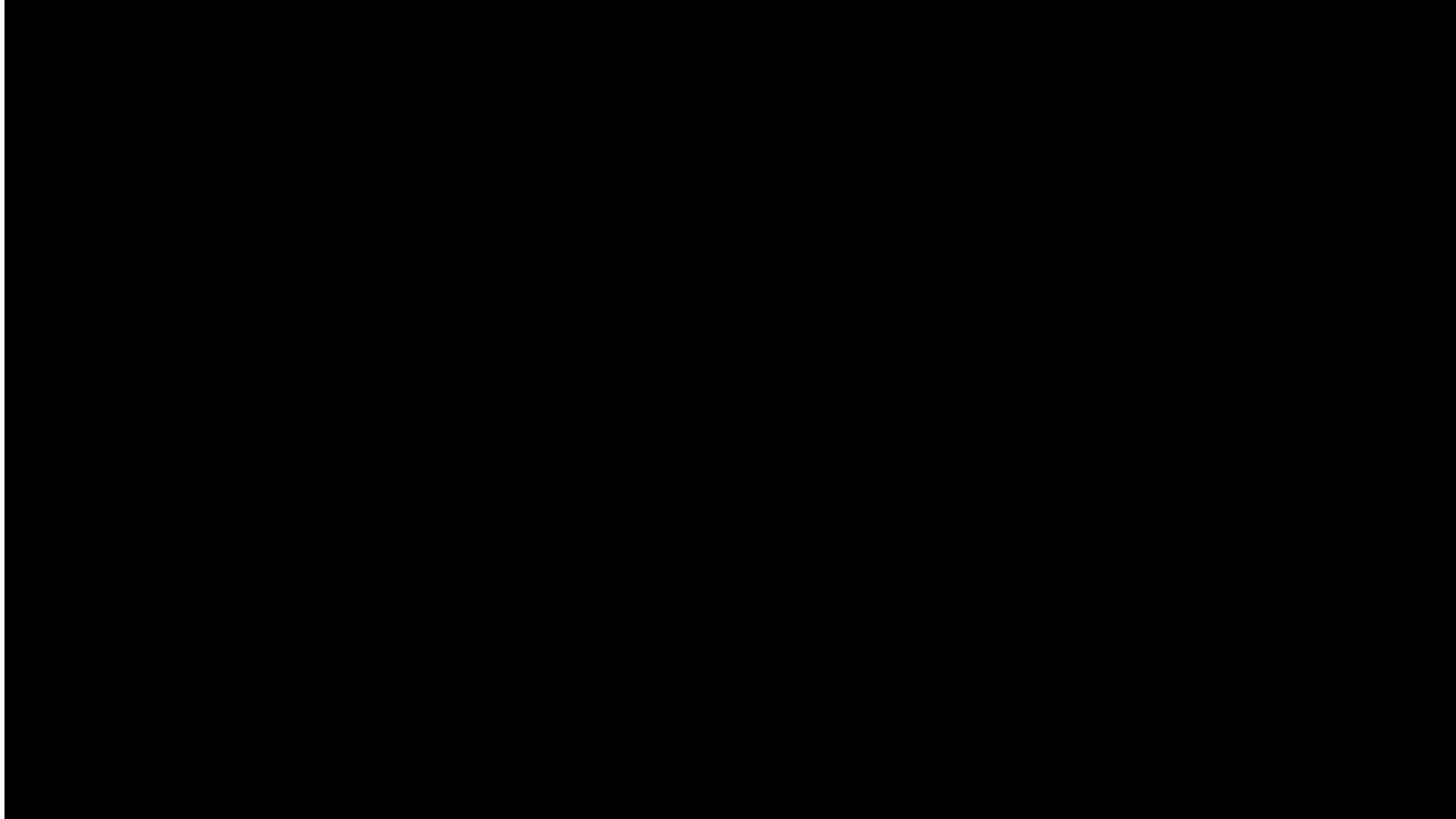
Free From the Ensemble (for reference only)
Slower

Sonic baton
1/4



- Sonic baton using neural audio synthesis
- Realtime audio variational autoencoder (RAVE) model technology
- The score uses musical notation with earthquake data graphical notation and translucent paper
- Modular in structure
- Conductor is a performer with gestures notated

*In Stillness I Found Death for Sonic Baton and
String Orchestra* by Juan David Bermúdez



Two very different performances of *May The Whole Universe* by Bergþóra Ægisdóttir

Conductor Trio



X-pitch mimicry

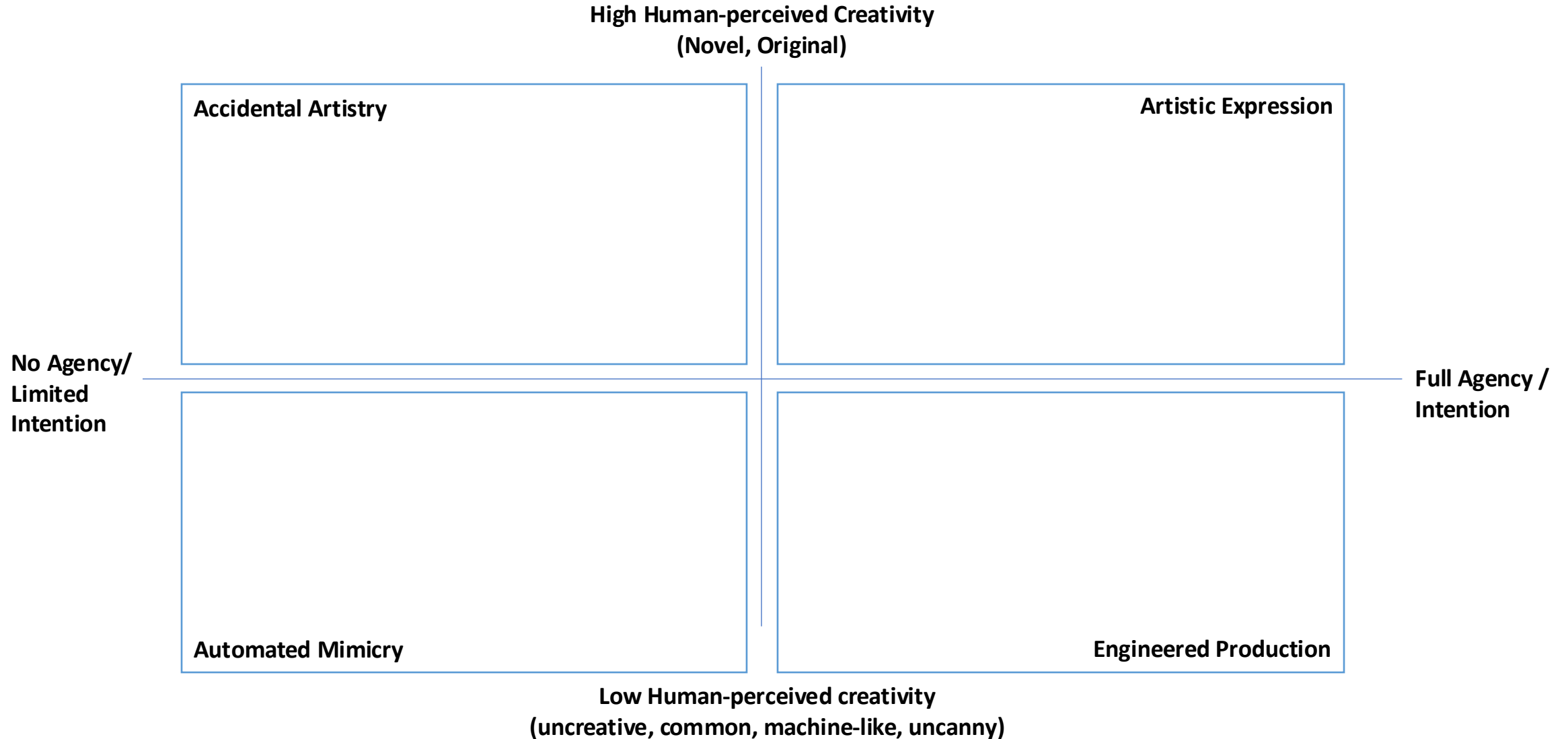


Implications for Aesthetics

	Audio Synthesis	Neural Audio Synthesis
Conductor Gesture Aesthetics	Realtime responsiveness Latency is a variable parameter Exploratory and Random	Realtime responsiveness Latency approx. 200 ms Mapped and Learned → new practice
Agency and Intention	Limited	Improved Agency, intention practiced. Can be part of improvisation ensemble
Ensemble aesthetics	Random, exploratory. Baton = sonic magic wand. Conductor likely follows.	Can be used with traditional conducting and ensembles to direct and provide gestual direction as well as sonic outcomes. Conductor can lead. Temporal cohesion.
Scoring	Requires a score to improve agency and intention	Scores can be graphical, musical but the dataset notated must be the priori consideration.
Musical aesthetics	Stable sounds, expressive limitations, timbral control	Timbral complexity, expressive dynamics, expressive tonality (microtonalities), the dataset becomes the new instrument

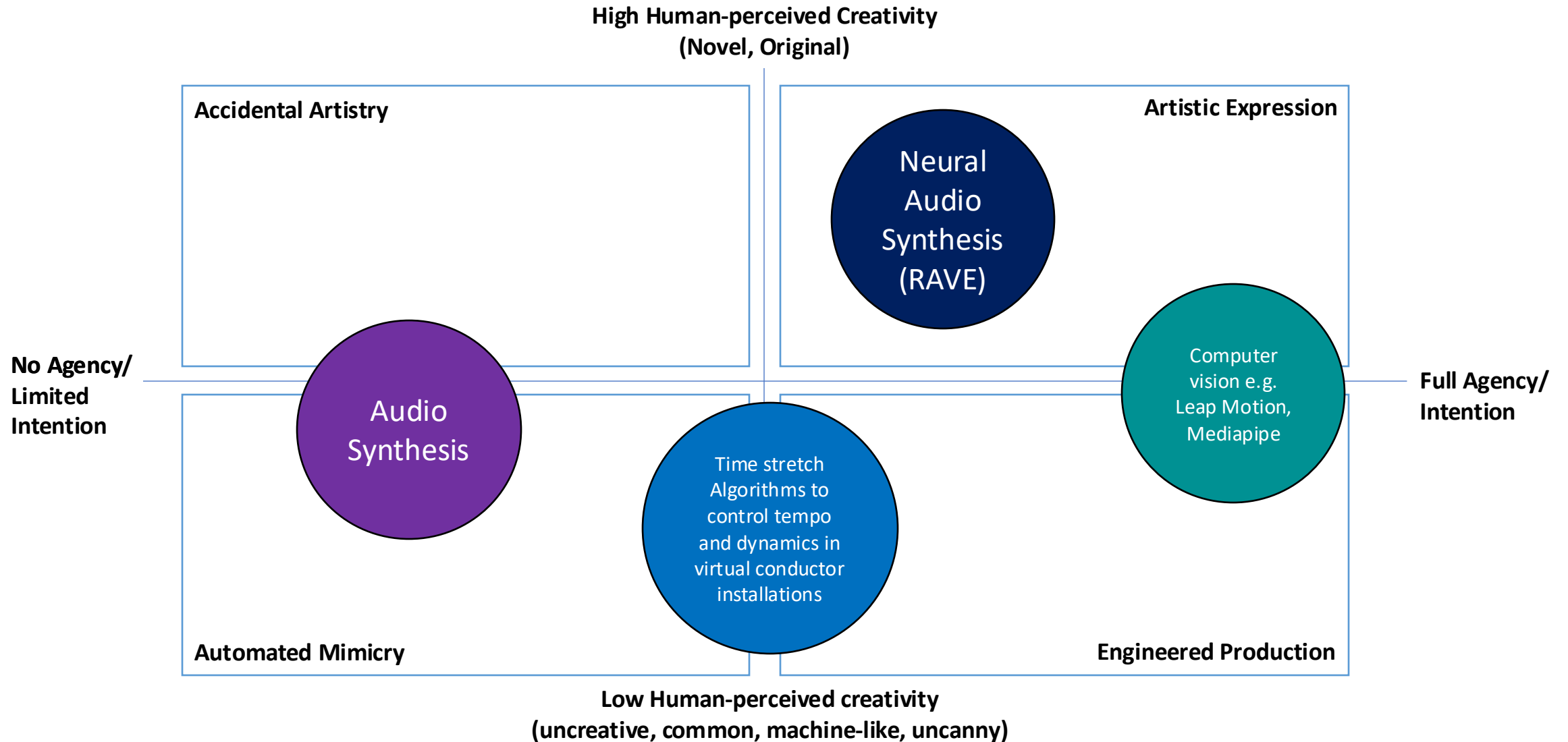
AI Agency-Creativity Framework

By Majella Clarke (2025)



AI Agency-Creativity Framework

By Majella Clarke (2025)



Implications for inclusivity, agency, performance and programming

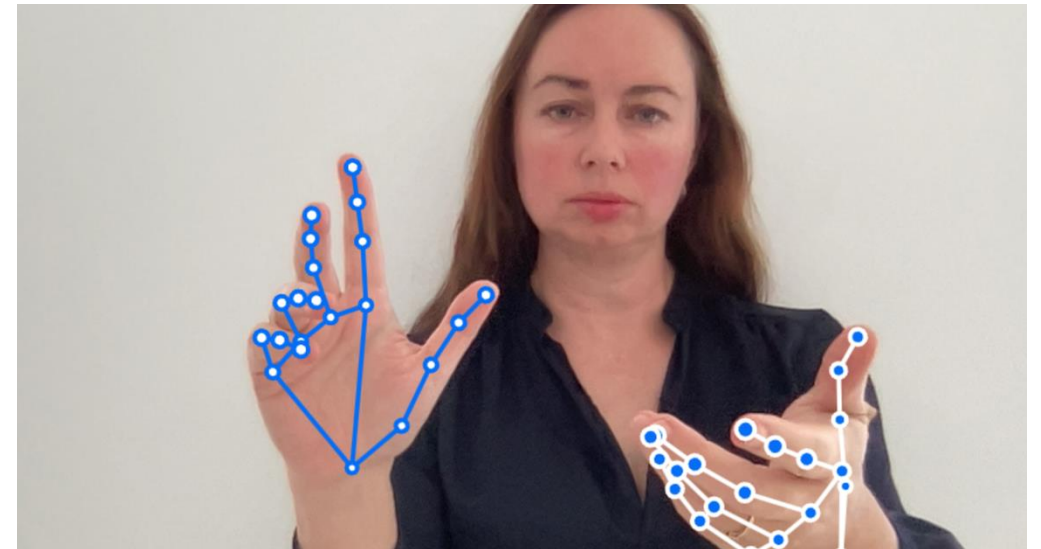
- Performance experiments reveal that expanding conducting practice requires:
 1. Innovative compositions;
 2. Diverse performance formats; and
 3. Meaningful engagement with musicians.
- What are the limits? Can anyone conduct with a sonic baton?
- When we lose intention/agency in the gesture sonic response – the baton becomes a magic wand - and does not expand practice.
- The essence of conducting lies in its ability to unify and guide musical expression, pointing towards new possibilities in orchestral performance and composition.
- Agency and intention are the foundations of conducting practice.

Future of Practice

Dematerialisation is a technology trend – do we need sensors on a baton to do what we do?

Computer vision is now being used for gesture (landmark) mapping with sound

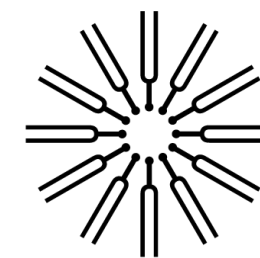
Will this expand the conductor's practice?



Collaborations To Date



Intelligent Instruments Lab
Iceland University of the Arts
The Living Art Museum, Iceland (NYLO)
Sibelius Academy, Uniarts Helsinki
SIM Residency
Towards Sound
Harpa Concert Hall



HARPA

Acknowledgements and Collaborators

Three personnel of the Intelligent Instruments Lab, Iceland, were part of the team that collaborated in the second experiment and performance demo. **Nicola Privato** provided technical expertise in the set-up using Max MSP, **Victor Shepard** produced sound files with RAV models with PyTorch and **Sean Patrick O'brien** placed the sensors and batteries on the baton. Nicola and Victor were also part of the performance demonstration at the Towards Sound Finissage at the Living Art Museum in Reykjavik.

Charles Quivillion facilitated the Open University Course Symbolic Sound Producing Gesture Course through the Sibelius Academy in November 2022. Charles was involved in the set-up of the first experiment with using a contact microphone on the baton and produce sound through Ableton PUSH. Charles also organised the final performance from the course for which Majella first used the sonic baton in performance.

Thomas Pausz Head of the Masters in Design Program at the Iceland University of Arts, is advising on the design of the sonic baton.

Composers **Juan David Bermondez**, **Bergþóra Ægisdóttir** and **Santiago Rueda Garcia** composed scores for the sonic baton and ensemble. The compositions were premiered at the Earth Day Concert in Reykjavik.

Curated by composer **Ruth Wiesenfeld** and visual artist **Gunnhildur Hauksdóttir**, the sonic baton was used to demo and perform in the Towards Sound Exhibition at the Living Art Museum, Reykjavik.