Music AI at the Metacreation Lab

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AI is (becoming) ubiquitous
Creative AI

- Creative tasks are those for which there is no clear “optimal” outcome.
  - No such thing as the best graphic design, music composition, drawing, painting, animation, narrative, poetry, joke, recipe, ...

- At the Metacreation Lab, we are studying the partial or complete automation of creative tasks.
Creative AI

• We develop and apply our Creative AI algorithms in two broad contexts:
  – **Computer Assisted Creativity** (Interactive Generation, co-creation): embedding creative AI in creative software.
  – **Embedded Generative Systems** (Embedded Generation): Games, interactive systems, installations, artworks
Central to creative AI are **Generative systems** (often using Machine Learning)

A typical approach is **Style imitation**: Given a corpus $C = \{C_1, \ldots, C_n\}$ representative of style $S$, generate new instances that would be classified as belonging to $S$ by an unbiased observer.

We produce corpus-based **style machines**:
- style imitation,
- style interpolation,
- style combination,
- style transformation,
- style extrapolation,
- style transfer, ...
Computer-Assisted Creativity (Co-Creativity)
Computer Assisted Composition
Taxonomy of CAC Systems

Composition Type
- Multi-Instru. Complete Track
- Multi-Instru. Pattern Track
- Harmonization
- Chord Progression
- Melody Generation
- Rhythm Generation
- Interpolation
- Orchestration
- Interpretation

Generative Algorithm
- Evolutionary Computing
- Cellular Automata
- Artificial Neural Networks
- Search-based Approaches
- Cognitive Architectures
- Markov Models
- Other Machine Learning
- Not Available

Data Representation
- Midi
- Pixoo Roll
- Digital Score
- Audio Format

Deployment Platform
- Desktop
- Web
- Mobile
- Hardware and DIY

Open Source
- Yes
- No

Authoring Community
- Academia
- Industry
- Artists

Available?
- Yes
- No

Audience
- For Lay Users
- Demonstrators
- Collaboration

Human-Computer Interface
- User Interface
  - Direct Manipulation
  - Dialogic
- Programmatic
- Menu Selection
- Anthropomorphic
- Generation

User Interaction
- Data
- Algorithm
- Training

Evaluated?
- Informal
- Empirical
- Analytical
- Not Evaluated

License
- Public Domain
- Open Source
- Copyleft
- Proprietary

Musical Scope
- Specific
- Generic
# Taxonomy of CAC systems (70+)

<table>
<thead>
<tr>
<th>CAC Systems</th>
<th>Year</th>
<th>Composition Task</th>
<th>Data Representation</th>
<th>Algorithm</th>
<th>Audience</th>
<th>Deployment Platform</th>
<th>Evaluation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magenta Studio</td>
<td>2019</td>
<td>Melody, Chords, Rhythm</td>
<td>MIDI</td>
<td>Deep Learning</td>
<td>Amateurs</td>
<td>Desktop / Ableton</td>
<td>Formal</td>
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<td>MuseNet</td>
<td>2019</td>
<td>Multi-Track</td>
<td>MIDI</td>
<td>Deep Learning</td>
<td>Amateurs</td>
<td>Web Demo</td>
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<td>MMM4Live</td>
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<td>MIDI</td>
<td>Transformer</td>
<td>Pro</td>
<td>Ableton</td>
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<td>Apollo</td>
<td>2018</td>
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<td>MIDI</td>
<td>Machine Learning</td>
<td>Amateurs + Pro</td>
<td>Web</td>
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<td>FolkRNN</td>
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<td>RNN</td>
<td>Amateurs + Pro</td>
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<td>Informal</td>
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<td>Melody</td>
<td>MIDI</td>
<td>Markov Models</td>
<td>Pro</td>
<td>iPad / Mac VST</td>
<td>Formal</td>
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<td>Audio</td>
<td>Proprietary</td>
<td>Amateurs</td>
<td>Web</td>
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<td>Spliqs</td>
<td>2016</td>
<td>Multi-Track</td>
<td>MIDI</td>
<td>Proprietary</td>
<td>Lay users</td>
<td>iPad</td>
<td>-</td>
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<tr>
<td>Jukedeck</td>
<td>2012</td>
<td>-</td>
<td>-</td>
<td>Proprietary</td>
<td>-</td>
<td>Web</td>
<td>-</td>
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<tr>
<td>Amper Music</td>
<td>2014</td>
<td>Multi-Track</td>
<td>Audio</td>
<td>Proprietary</td>
<td>Content creators</td>
<td>Web</td>
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<tr>
<td>Melody Sauce</td>
<td>2019</td>
<td>Melody</td>
<td>MIDI</td>
<td>Proprietary</td>
<td>Amateur, Pro</td>
<td>VST</td>
<td>-</td>
</tr>
</tbody>
</table>
MetaMIDI Dataset

• **MIDI**: symbolic music representation and communication protocol

• **MetaMIDI Dataset:**
  - 445,631 MIDI files
  - 221,504 MIDIs with Artist/Title metadata
  - 237,236 MIDIs matched to Audio

• Lahk Midi Dataset (existing)
  - 176,581 MIDI files
  - 20,000 MIDIs with Artist/Title metadata
  - 45,129 MIDIs matched to Audio

With Jeff Ens, ISMIR 2021.
MMM Deep Learning Model

- Transformer architecture
- 6 Layers
- +/- 20,000,000 weights
- 1 to 8 bars attention windows.

Figure 1: The Transformer - model architecture.
Tokenized Representation

BAR
- NOTE_ON=60
- TIME_DELTA=2
- NOTE_OFF=60
- NOTE_ON=64
- NOTE_ON=67
- TIME_DELTA=4
- NOTE_OFF=64
- TIME_DELTA=4
- NOTE_OFF=67

TRACK
- INST=30
- DENSITY=5
- BAR_START
- <BAR>
- BAR_END
- BAR_START
- <BAR>
- BAR_END
- BAR_START
- <BAR>
- BAR_END

MULTI-TRACK
- PIECE_START
- TRACK_START
- <TRACK>
- TRACK_END
- TRACK_START
- <TRACK>
- TRACK_END
- TRACK_START
- <TRACK>
- TRACK_END

BAR-FILL
- PIECE_START
- TRACK_START
- INST=30
- DENSITY=5
- BAR_START
- FILL_IN
- BAR_END
- ...
Generate a new track (shown in blue) conditioned on a set of tracks.
Flexible Generation (track in-filling)

RE-Generate a track (shown in blue) conditioned on a set of tracks.
Generation (Bar in-filling)

Re-generate some bars (shown in blue) conditioned the remaining bars.
Flexible Generation

Generation of longer sections

17 bars generated
Flexible Generation (controls)

You can control the note density of a generated track (shown in blue).
**MMM** is the most flexible multitrack model

<table>
<thead>
<tr>
<th>System</th>
<th>Architecture</th>
<th>Dataset</th>
<th>Continuation</th>
<th>Note-Level inpainting</th>
<th>Bar-Level inpainting</th>
<th>Track-Level inpainting</th>
<th>Attribute Control</th>
<th>Num Mon. Tracks</th>
<th>Num Poly. Tracks</th>
<th>Num Instruments</th>
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<tr>
<td>CoCoNet[4]</td>
<td>CNN</td>
<td>Bach Chorales</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>4</td>
<td>0</td>
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<td>MuseGan[2]</td>
<td>GAN</td>
<td>Lakh Midi Dataset</td>
<td>×</td>
<td>×</td>
<td>-</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td></td>
<td></td>
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<tr>
<td>DeepBach[3]</td>
<td>RNN</td>
<td>Bach Chorales</td>
<td>×</td>
<td>×</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td></td>
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<tr>
<td>BachBot[6]</td>
<td>RNN</td>
<td>Bach Chorales</td>
<td>×</td>
<td>×</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td></td>
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<tr>
<td>MuseNet[8]</td>
<td>Transformer</td>
<td>Custom ★</td>
<td>×</td>
<td>×</td>
<td>-</td>
<td>10</td>
<td>10</td>
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<tr>
<td>Music Transformer[5]</td>
<td>Transformer</td>
<td>Maestro Dataset</td>
<td>×</td>
<td>-</td>
<td>1</td>
<td>1</td>
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<td>LahkNES[1]</td>
<td>Transformer</td>
<td>Lakh Midi Dataset NES</td>
<td>×</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MusicVAE[9]</td>
<td>VAE</td>
<td>Custom (1.5 million) ★</td>
<td>×</td>
<td>×</td>
<td>3</td>
<td>0</td>
<td>3</td>
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<td>InpaintNet[7]</td>
<td>VAE</td>
<td>-</td>
<td>×</td>
<td>×</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>MMM[10]</strong></td>
<td>Transformer</td>
<td>Lakh Midi Dataset</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>-</td>
<td>12</td>
<td>128</td>
<td></td>
</tr>
</tbody>
</table>
MMM Generation Control

• Increased controls:
  – Time signature
  – Note density (track relative)
  – Note duration (range)
  – Amount of silence
  – Min polyphony / Max polyphony
  – With/without interpretation (velocity)
  – Musical style control (reggae, pop, disco, Bach, Zappa, Metallica, …)
  – Spotify-like attributes: Danceability, …
  – Affective control: Valence / Arousal / Tension
Integrating MMM in existing interfaces
Integrating to Synthesizers
Apollo

https://metacreation.net/apollo/
Apollo: HCI for MMM

- A web interface
- Corpus manager,
- Multiple models (Magenta music VAE, VOMM, FO, MMM, …)
- MIDI streaming, …
- Batch generation,
- Ranking,
MMM4Live
Onboarding MMM4Live

• Works with Ableton Live 10 and 11
• Onboarding form: https://docs.google.com/forms/d/e/1FAIpQLSdtpc-P8KCIUIDKEQVOiCVRPbUPEaQ_O-B4o8t6XjJRt-sgYQ/viewform
• Site and documentation:
  – https://metacreation.net/mmm4live/
  – Password is at the end of the onboarding form.
User experience and acceptability

• Working with composers:
  – Ourselves
  – 5 North American artists (58k$CAD, Canada Council for the Arts grant on using MMM) preparing an album (to be released next year)
  – Selected beta-testers:
    • Jackson and his Computer Band
    • Matthieu Champagne
    • Pia Balthazar
    • Philip Tremble
Evaluation of the Usability and Acceptability

- **Competence (quality):** Is the system perceived as reliable and competent at its task? Does the system produce original and valuable outputs (always, often, or sometimes)? Does the system allow its user to complete the task with an outcome or similar, different, worse or better, than without the system?
- **Efficiency:** Does the system allow the user to carry the task more or less efficiently? Does the system allow saving time or effort?
- **Agency (control, expressivity):** Does the user have enough control to steer the system’s generation in ways that allow for the above? Does the user feel authorship over the output of the co-creative process?
- **Phenomenology (trust):** Besides the surface-level experience, what are the felt and affective, subjective, impacts of using such systems? Was there an “aha” moment? Was there any awe or fear?
Metacreation Lab

LISTEN AND EVALUATE
A song about the weekend (and you can do whatever you want)

AI Song Contest 2021 / participants
TEAM / Metacreation Lab
SONG / A song about the weekend
(and you can do whatever you want)
TEAM MEMBERS / Cale Plut, Philippe Pasquier, Jeff Ens, Renaud Bougeng, Tara Jadidi, and Dimitar Zlatkov
Computer Assisted Sound Design
Audio Metaphor

• **Soundscape generation engine**

• **Approach:**
  – User input: an expression + desired affect (pleasantness, eventfulness) + duration
  – **Sounds retrieval** from tagged db (WSP, freesound)
  – Segmentation and classification of background and foreground sounds
  – **Pleasantness and eventfulness** classification
  – Mixing and audio rendering

With Dr. Miles Thorogood, and Dr. Jianyu Fan
- Sound and Music Computing, 2012
- Computational Creativity, 2013
- Sound and Music Computing, 2014
- Audio Mostly, 2015
- Journal of New Music Research, 2018

www.AudioMetaphor.ca
AuMe

Kids are playing in the park on a windy afternoon

Duration: 79s

Value

Time (s)

Generate Tracks

Valance

Arousal

Create Mix

Time (s)
Audio Metaphor

A waterfall in Thailand
Audio Metaphor

A city in the bush
A quenching rain drenched my burning head
Generate App

• Real-time style transfer (for pics and video)
• Using Deep Learning:
  – Publicly released
  – 400k downloads
  – 20k regular users
Realtime / Online / Embedded
Generative Systems
Why?

- Moving away from linear media: Explosion of the number of assets needed when going interactive
- Adaptive experiences (e.g., level difficulty)

Variation in the flow channel (© 2004, Noah Falstein).
Generative Levels and Generative Music for Video Games
Video Games

Game level generation

With Nathan Sorenson and Steve DiPaola
Computational Creativity 2010,
EvoGame 2010 (Best paper Award),
ACM Transactions on AI and Games, 2012
Generating music according to level tension curve
Music Matters:
An empirical study on the effects of adaptive music on experienced and perceived player affect

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Abstract—Music is an important affective aspect of video games. We present the findings of an empirical study on the affective effects of adaptive uses of music in games. We find that adaptive music can significantly increase a players reported experienced feeling of tension, that players recognize and value music, and that player recognize and value adaptive music over linear music.

Index Terms—Music, games, game music, affect, tension, audio of multifaceted music generation systems rather than isolating the adaptivity of music.

Understanding the affective impact of adaptive game music has a wide array of benefits for game development. In linear media, music is a powerful tool for manipulating an audience’s experienced affect, in part due to empirical study of linear multimedia music [11]. Greater understanding of adaptive music in games leads to more impactful and better games.
PreGLAM: A Predictive, Gameplay-based Layered Affect Model
Cale Plut, Philippe Pasquier, Jeff Ens, and Renaud Bougueng

Abstract—We present the Predictive Gameplay-based Layered Affect Model (PreGLAM), an affective game spectator model. PreGLAM extends affective NPC emotion models to model a passive, biased spectator of gameplay. We implement PreGLAM into a custom game Galactic Defense, which we also describe. We empirically evaluate PreGLAM’s application in Galactic Defense, where we compare PreGLAM annotations with participant-provided ground-truth annotations. PreGLAM’s significantly outperforms a random walk time series in how accurately it matches ground-truth annotations.

Index Terms—Game Emotion, Affect

I. INTRODUCTION AND MOTIVATION

A. Motivation

Gaming is, among other things, an emotional experience. There are many potential benefits to modeling emotional responses to the gameplay of a video game. Most applications of modeling gameplay emotion focus on the player’s perceived or induced emotions. Experience-driven Procedural Content Generation (EDPCG) uses affect models to inform the generation of game content [1]. Affective music generation systems generate adaptive music based on a real-time emotion model [2], [3]. Adaptive serious games use real-time affect models to enhance the learning process and performance [4]. Non-human agents such as Non-Player Characters (NPC) is are modeled to create emotionally informed behaviour [5].

experience of watching a film than by playing a game. Film music’s capability to evoke emotions in a viewing audience is well-established [13], and it is now that watching a video of gameplay may have a similar effect.

Interestingly, sports spectators show emotional responses to games that are stronger than those from spectating non-game entertainment media, and more closely resemble emotional outcomes from personal successes or failures [14]. Holm et al. collect physiological responses from participants playing and watching a First-Person Shooter (FPS), comparing between participants who enjoy the FPS genre and those who don’t [12]. Holm et al. find that among players who enjoy the genre, spectating and playing a game have similar physiological responses. This indicates that while the experiences differ in other ways, the emotional responses of a spectator and player are similar, particularly among those who enjoy and/or are familiar with the genre. Therefore, modeling spectator emotions may also provide insights into player emotions.

B. PreGLAM

We present the Predictive Gameplay-based Layered Affect Model (PreGLAM) — an artificial cognitive agent with privileged game information, that models the real-time perceived affect of a biased game spectator. PreGLAM’s design is based
VAT emotion model
PREGLAM is an agent.
Evaluation study.
PreGLAM-MMM: Application and evaluation of affective adaptive generative music in video games

Cale Plut, Philippe Pasquier, Jeff Ens, and Renaud Bougueng

Abstract—We present and evaluate an application of affective adaptive generative music in a single-player, action-RPG video game. We use the PreGLAM affect model, which models a passive, biased audience member, to influence the adaptivity of music that fills the role of acting as an audience to the gameplay. We use the Multi-track music machine to expand and extend a composed adaptive musical score, and we use industry-standard production techniques to synthesize and perform all of our musical scores. We evaluate our application of generative music in comparison to a composed adaptive score and a composed linear score. Our score is rated as nearly equivalent to a composed linear score in perceptions of emotional congruency, immersion, and preference.

I. INTRODUCTION

Music is present in some form in almost all video games. Most music in games is composed by one or more humans, and is either performed by human musicians and/or synthesized.

Academic systems most commonly generate for an instrumentation of solo piano, which is often synthesized with General MIDI sounds. These systems mostly use some form of player experience model, commonly affect-oriented, to control the adaptivity of the generative music. These systems produce novel music that can theoretically perfectly match the events of a game, but lack timbral and performative features when compared to contemporary video games.

Systems from the games industry generally use pre-recorded or recorded audio stems, sequenced together with algorithmic methods. These systems generally extend adaptive musical methods of horizontal resequencing and vertical mixing [6]. This approach produces music that has equivalent performative fidelity to linear music, but this approach often reduce the expressive range of the music, as the music must be composed so that the combined arrangements won't clash with each other [7].
Empirical Evaluation Study

Figure 5. Dtw-distance between annotations and PreGLAM+Random Walk by condition

Figure 6. Dtw-distance between annotations and PreGLAM+Random Walk by dimension
Emotion, immersion, and enjoyment

1) In which video do you feel the music most closely matches the events and actions of the gameplay? (gameplay match)
2) In which video do you feel that the music most closely matches the emotion that you perceive from the gameplay? (emotion match)
3) In which video did you feel most immersed in the gameplay? (immersion)
4) Which video’s music did you enjoy the most? (preference)
The IsoVAT corpus: Parameterization of musical features for affective composition

Cale Plut, Philippe Pasquier, Jeff Ens, and Renaud Bougueng,

Abstract
While there is a breadth of research in mapping musical features to perceived emotion within research in music and emotion, a critique of the field is that this breadth of methodologies lacks in inter-communication, which may reduce the generalizability of findings across the field. We consolidate previous research in this area to construct a parameterized composition guide that maps musical features to their associated emotional expression. We then use this guide to create the "IsoVAT" dataset, a collection of symbolic MIDI clips. This dataset contains a total of 90 clips of music, with 30 clips per affective dimension, organized into 10 sets of 3 clips. Each clip within a set is composed to express a low, medium, or high level of an affective dimension when compared to the other clips within the same set. We perform an empirical experiment to evaluate the validity of our affective composition guide, and to establish the ground-truthed emotional expression of the IsoVAT Dataset. The ground-truthing reveals 19 sets that match the composed labels, 8 sets that have ground-truthed labels that disagree with composed labels, and 3 clips that do not have clear agreement across the three study designs.

Keywords: Music, Affect, Emotion, Dataset, VAT
Affective Composition Guide

• Based on all meta-studies we founds (musicology, music perception and cognition, MIR,...)
Table 8: Central comparison of ground truth order by study design

<table>
<thead>
<tr>
<th></th>
<th>Composed labels</th>
<th>2-rank order</th>
<th>1-rank order</th>
<th>Likert Order</th>
<th>Aggregate G-T Order</th>
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</thead>
<tbody>
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<td><strong>Valence</strong></td>
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<td>2</td>
<td>H-M-L.</td>
<td>M-L-H</td>
<td>L-M-H</td>
<td>(L-H)-M</td>
<td>—</td>
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<tr>
<td>5</td>
<td>H-M-L.</td>
<td>M-L-H</td>
<td>Reverse Loop</td>
<td>(M-L)-H</td>
<td>M-L-H.</td>
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<td>8</td>
<td>H-M-L.</td>
<td>L-M-H</td>
<td>H-L-M</td>
<td>(L-M)-H*</td>
<td>L-M-H.</td>
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<tr>
<td>10</td>
<td>H-M-L.</td>
<td>H-L-M</td>
<td>H-L-M</td>
<td>H-(L-M)</td>
<td>H-L-M.</td>
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<td><strong>Arousal</strong></td>
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<td></td>
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<tr>
<td><strong>Tension</strong></td>
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</table>
Realtime / Online / Embedded
Generative Systems
Musical Agent

ARS ELECTRONICA FESTIVAL
für Kunst, Technologie und Gesellschaft
POSTCITY Linz, 7. – 11.9.2017
www.aec.at
MASOM
Musical Agent based on Self-Organized Maps

iOTA
(collaboration with OUCHHH and Audiofil)
MASOM is listening and interacting
Revive
With Kivanc Tatar and Remy Sui
SpireMuse: musical agent

Personalized, goal-oriented, generation

Alumni Nicolas Gonzales and James Maxwell (CEO and CMO of Spliqz)
Generative movement: 3D animation and dance
Expressive Movement Generation

The Valence and Arousal affective model and the 9 variations captured.

William Li, Omid Alemi, Jianyu Fan, Philippe Pasquier, Ranking-based Affect Estimation of Motion Capture Data in the Valence and Arousal, MOCO, 2018
Groovenet
Generative Music Video
Autolume

With Jonas Kraasch, and robonom. Exhibited 2021
The Evaluation Problem

How good are these systems?
How are they perceived?
Evaluation of metacreation

Metacreations can be evaluated by:

1. Their authors: artists, designers, computer scientists,...
2. Users, peers and experts: composers, musicians, sound designers,...
3. The audience: popularity, concert and album sales,...
4. Media: critics, journalists,...
5. Peer reviewers, curators and jury: papers, concerts, festivals, grants, ...
6. Theoretical and analytic measures: of the process, of the input/output relationship, ...
7. Empirical studies: qualitative or quantitative user/audience study, ...
Evaluation of Musical Metacreation

- **Evaluating** creative systems is a difficult task:
  - **Theoretical reasons:**
    - No notion of optimality
    - Subjective/cultural impressions/judgments are involved
    - It is multidimensional and framing can play a role: humans seem biased against computational creativity (Moffat and Kelly, Comp. Crea., 2006)
  - **Practical reasons:**
    - Choice of the corpus
    - Choice of the parameters (user study)
    - Choice of a sample output: generative systems can create ad infinitum
    - Choice of creative process: The various uses of the system needs to be taken into account
    - Choice of interface (user experience, usability studies)
The Bias Against Metacreation

• The bias against computational creativity is the hypothesis that computationally-generated artifacts are often judged to be less interesting, valuable, and less creative than human generated ones.

• Anecdotal evidence include David Cope’s Experience in Musical Intelligence (EMI, 1981), an early style imitation system that was received with controversy.
The bias against computational creativity?

• Empirical study of the bias against computational creativity:
  1. David Moffat and Martin Kelly (ICCC 2006)
  4. Hong, J. and Curran, N.M. (ACM Trans, 2020)
Metacreation – Creative AI

Why does it matter?
1. It is scientific research (on creative processes)
2. It is applied research (has applications):
   1. **Computer assisted creativity** to enhance the creative workflow: expressivity, flexibility, authorship, control, ...
   2. **Embedded generative systems** to enhance interactive experiences: gaming, health and wellbeing,
3. It is a major development in (generative) art influencing every fields, and creating new ones (AI art, live coding,...).
Creative AI

Scientific Research

Artistic practice

Embedded generative systems

Amper Music®

Metacreative

EVA BEAT

Jukedeck

HALO

magenta

spliqs

Spotify

melodrive

augmented creativity

adaptive music generation
Luddites were English rioters in favor of destructing machinery.
The Fear of Technologic Unemployment

Advertisement from the American Federation of Musicians, Syracuse Herald, September 2, 1930.

IS ART TO HAVE A TYRANT?
Fear of Technologic Unemployment

A robot grinding up musical instruments, Syracuse Herald, November 3, 1930.
Creative tasks in practice
Conclusion

• Technology has continually shaped us.
• Away from the fears of AI taking over, we believe in the humanist tradition of anthropocentric instrumentalism.
• The computerization of society and the rise of autonomous machines has deep implications.
• The future is generative, and we should harness the power of machines to expand and support our creativity.
Metacreation Lab, colleagues, and team!
Generative Art and Computational Creativity

Simon Fraser University
Philippe Pasquier with special guest Arne Eigenfeldt

Advanced Generative Art and Computational Creativity

Simon Fraser University
Philippe Pasquier
• **AIMC**: https://aimusiccreativity.org/
• Special Issue on Music AI of the *Journal for the Simulation of Music Creativity*.
• Music AI Tutorial at IJCAI
• ACM Movement and Computation (MOCO): https://www.movementcomputing.org/