MuMe and Variation:
Classification, Ontology, and Autonomy

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MUME14 @ NIME
NIME <=> MuMe

• 1980s
  – development of software beyond 1:1 relationship
NIME <=> MuMe

- online
- improvisational
- Lewis’ Voyager

software

- offline
- compositional
- Cope’s EMI
NIME <-> MuMe

- interactive systems
  - reactive ?
  - require input from performer for musical interest and complexity
  - high-level decisions remain with performer or are preset

- generative systems
  - selection/rejection from multiple generations
  - composer can piece together larger work from smaller generations
NIME <=> MuMe

- so where are we now?
  - NIME
    - instrumental builder + performer + composer
    - human interaction
  - MuMe
    - software
    - (autonomous?) creativity
Classification (?)

- proposed taxonomy
  - comparison without regard to
    - perceived musicality
    - complexity
    - (traditional) autonomy
Online vs. Offline

- online
  - improvisational
  - how system reacts to live performer
    - complexity, intelligence, agency, autonomy

- offline
  - no input
  - what extend system produces its own structure and details
    - can it move forward on its own?
Taxonomy of Musical Metacreation

- classification system
- relationship to designer’s control over final musical result
- how much creative decision-making is left to system?
- how much influence is required from human to make system perform musically?
Taxonomy of Musical Metacreation

1. Independence
   • the use of any process on a musical gesture that is beyond the control of the composer

2. Compositionality
   • the use of any process to determine the relationships between pre-defined gestures

3. Generativity
   • the generation of musical gestures

4. Proactivity
   • system/agents that are able to initiate their own musical gestures

5. Adaptability
   • agents behave in different ways over time due to their own internal evolution

6. Versatility
   • agents determine their own content without predefined stylistic limits

7. Volition
   • agents exhibit volition, deciding when, what, and how to compose/perform
1. Independence

• the use of any process on a musical gesture that is beyond the control of the composer
  • delegating some creative responsibility to system

• Examples
  • complex signal processing
  • random playback speed
  • alter volume/onset data in sequencer
2. Compositionality

- the use of any process to determine the relationships between pre-defined musical gestures
  - relationship between two fixed gestures/processes
- Examples
  - initiating multiple layers of pre-generated material
  - triggering pre-recorded material
  - initiating complex signal processing
    - separate from the original (i.e. complex delays)
  - initiating events through score-following
  - live-coding
    - sequences initiated
#1 Independence
Press the Keys,
for Bass Clarinet and Live Electronics -
João Pedro Coimbra
3. Generativity

• the generation of musical gestures
  • any reactive system that requires input to function

• Examples
  • triggering processes containing pitch/rhythm generation algorithms
  • triggering generative gestures in response to performer’s action
  • live systems that use live input
  • feedback systems
  • live-coding
    • sequences initiated that include random/stochastic selection from constrained set
#3 Generativity
Viomax
Gérard Assayag et al.
#3 Generativity
CI Metrical
Andrew Brown, Toby Gifford
4. Proactivity

• system/agents that are able to initiate their own musical gestures
  • agent doesn’t wait for trigger
  • agents not reactive
    • do not require input to function
• Examples
  • interactive systems with independent response to performer
    • Lewis’ Voyager
  • multi-agent systems
#4 Proactivity
Interactive Trio
George Lewis
#4 Proactivity
An Unnatural Selection
Arne Eigenfeldt
5. Adaptability

a) agents behave in different ways over time due to their own internal evolution
  • no triggered preset behaviours
  • agents determine when and how to alter their behaviour proactively

b) agents interact and influence one another
  • social agents
  • Examples
    • generative system that generates its own musical structure
#5 Adaptability
Zamyatin
Ollie Bown
#5 Adaptability
The Indifference Engine
Arne Eigenfeldt
6. Versatility

• agents determine their own content without predefined stylistic limits
  • generate different compositions each time
  • no formal templates
  • potential for transformation of creative space
#6 Versatility perhaps by 2017-19?
7. Volition

- agents exhibit volition, deciding when, what, and how to compose/perform
  - freestanding creative system
  - decides when it wants to create
    - why it would do so...
  - deriving its own conceptual spaces (Gärdenfors)
  - autonomous critical evaluation (Galanter)
7. Volition

• Requirements
  • long-term learning
  • sophisticated feedback mechanisms
    • peers and community
  • form aesthetic judgements
  • derive its own motivations
#7 Volition
perhaps by 2024?
Discussion

• no account for complexity
  • complex system that needs to be nudged
    • #4 proactivity
  • random melody generator changing how melodies are produced using randomly generated form
    • #5 adaptability
• without ability to generate own form
  • computer-assisted composition
Proactivity

• Defining element
  • making musical decisions “on its own”
• extremely difficult to define
• listener
  • serendipity vs. emergence?
  • profound change in system not resulting in musical change?
• no methods to determine if something does something “on its own”
  • our deepest analytical and philosophical challenge
Thinking and Listening

- conceptual minefield?
- input not required
  - thus, no need to listen
- good listening system that cannot rise above echoing input
  - limited to #4 Proactivity
- indifferent system to input that determines proactively when to make musical decisions
  - rise to #5 Adaptability
Usefulness

• how (musically) useful is considered
  • generated material
  • interaction
    • Dean (2003) / Newell et al. (1963)
  • not accounted for here
  • separate issue
Large-scale Structure

• difficult for artist to delegate to system
• a difficult aspect of music
• systems *can* generate short forms
• “what to do next?”
  • current, past, and potential future musical contexts
• computational aesthetics
Conclusion

• complex and useful systems exist at lower levels
• comparing systems independent of their “musical maturity”
• each level as a principle?
  • which level does a system aspire to?
  • does it master that principle?
    • allow us to critically examine how systems may fall short
Questions / Discussion
what level?
Computer Duets
Shlomo Dubnov
Agents and Multi-agent Systems

• agent
  • large field in computer science
• intelligent agents
  • some element of AI
    • learning / reasoning
• autonomous agents
  • modifying the way in which they achieve their objectives
• distributed agents
  • on distinct computers
Agents and Multi-agent Systems

- musical agent
  - independent entity
  - reacts to input in a complex manner
  - operates on its own
    - doesn’t need to be directed/controlled
  - more than an algorithm!
Interactive Trio
George Lewis
Agents and Multi-agent Systems

- multi-agent
  - autonomous
    - no direct user interaction
  - social
    - interact with one another
  - reactive
    - interact with their environment
  - proactive
    - make decisions how and when they should operate