COMPOSING FOR AR SPACE : POSSIBILITIES FOR SPATIALIZATION

Amy Brandon (PHD student, Dalhousie University)

amybrandon.ca

INTRODUCTION

- This paper discusses challenges and opportunities encountered in interactive AR scores and installations using headset and smartphone technology, and discusses two current projects in development using spatialization

- *Boundary* (2020): an AR app installation for the Gaudeamus Festival

- A list of the works shown here is included in the PDF handout

INTRODUCTION

- AR (and XR) offers significant opportunities to composers
  - Immersive and interactive possibilities of 3D graphic scores
  - Integration of electronics into scores using hand gestures
  - Creation of extended instruments, which can be played simultaneously in the real and digital worlds
  - Immersive and interactive sound installations for headset and apps

WHY AR?

- VR has been a popular choice for XR composers, but AR also has certain advantages for composing for instruments, and for sound installations

- Much of my work looks at the boundary between the digital and real worlds, and how the body interacts with that and manipulates it.

- There are technological issues to be overcome with both platforms, but recent technological developments have improved the feasibility of AR, particularly in how visuals merge with real-world space

ABOUT 360, VR AND AR (XR)

- 360
  - A 2D image that creates a sphere around the user
  - Non-interactive
- VR
  - An entirely digital environment that is interactive using sensors, controllers and a headset that occludes vision
- AR
  - Digital elements are superimposed over reality, via smartphones or specialized headsets that do not occlude vision
  - Interactive using hand gestures or UI

PAST WORKS WITH HEADSET AND MOBILE AR

- I created a number of works from 2017 - present using 360 scores, HTC Vive, Metavision headset and smartphone AR

  - *Hidden Motive I* (2018)
  - *Hidden Motive II* and *III* (2018)
  - *7 Malaguena Fragments for Augmented Guitar* (2019)
  - *flesh projektor I* and *II (*2019) -
  - *Augmented Percussions* (2019)
  - *WNMF x AR* installation (2019)
  - *WNMF x AR* app (2019)
  - *Boundary* app (2020)

KEY ISSUES WITH AR COMPOSING

- In creating these works from 2017-present, I encountered **three key issues**:
  - How to effectively integrate AR with a performer playing an acoustic instrument
  - How to bring the audience into the immersive 3D experience of AR
  - How to merge digital and real worlds effectively and realistically

METAVISION HEADSET

- METAVision headset has advantages and disadvantages in most of these areas

- Advantages:
  - Clear visor (holographic AR)
  - Widest field-of-view available (90 degrees)
  - Hand and gesture recognition
  - Programmable in Unity
  - Projection of a first-person perspective

METAVISION HEADSET: HAND AND GESTURE DETECTION

- The METAVision hand-detection and gesture-recognition allowed me to make the scores interactive:
  - **Move** elements of the score and trigger sound files
    - *Hidden Motive II* (2018)
  - Create **fields** where hand movements can impact pitch or effects
    - *Hidden Motive III* (2018)
  - **Spatialization**
    - Unity 3D Audio
    - Send positioning information **via OSC** for multi-channel systems and spatialization

METAVISION HEADSET: DISADVANTAGES

- I encountered some difficulties with the gesture recognition systems in METAVision.
- Hand-detection was not **seamless**, leading to some problems in performance
  - *Hidden Motive II* (2018)
- One way I dealt with this issue was creating **sound fields** rather that objects, where the fields were placed in a static position:
  - *Hidden Motive III* (2018)
- Reducing the number of interactive visual objects created a larger question, when does an interactive score simply become a controller?

EXTENDED INSTRUMENTS (2019)

- Another of my particular goals with METAVision was to create **extended instruments**.
- **Extended instruments** are acoustic instruments with playable digital overlay, and are played in the real and digital worlds simultaneously.
- I created two works for guitar, and one for percussion trying to find ways to **merge the instrument with interactive digital elements** using METAVision
  - *7 Malaguena Fragments for Augmented Guitar* (2019)
  - *flesh projector I* and *II* (2019)
  - *Augmented Percussions* (2019)

EXTENDED INSTRUMENTS (2019)

- Advantages:
  - **Occlusion** of digital objects and real instruments partially effective
- Disadvantages:
  - **Positioning** of digital objects is tricky and not an exact science
  - **Occlusion** not consistent, digital and real elements not truly linked

WHAT ABOUT SPATIALIZATION?

- So what do these issues with hand-detection and occlusion have to do with spatialization?
- Spatializing METAVision AR graphic scores and extended instruments is possible in a number of ways
- Unity has on-board **3D audio**, and a number of tools for spatialization
- **Position data** of digital objects (and sound sources) can be sent in real-time via OSC
  - In 2019, I worked with D. Andrew Stewart (University of Lethbridge) on a multi-channel test using OSC
  - The rotation of a cube, or its position in space can influence compositional elements external to the headset

WHAT ABOUT SPATIALIZATION?

- But without effective and seamless hand-detection and gesture recognition, spatialization for an interactive score using METAVision would remain difficult

- Recently released Microsoft **MRTK** toolkit may assist in resolving some issues
  - MRTK toolkit can implement **Leap Motion** into the METAVision for improved hand-tracking and gesture-recognition
  - Additional improvements to spatial mapping of external environment, occlusion and other visual aspects

- I am currently developing a second work for augmented percussion for **Ryan Scott** (2022) to implement these new developments

MOBILE AR SOUND INSTALLATIONS

- Many of the issues I encountered with the METAVision are also now solvable with smartphone AR
  - Easier for audience to experience 3D space
  - Third-party hand and gesture reactivity
  - Significant improvements to how AR objects integrate with the real world
    - AR Foundation 4's occlusion, environmental probes and lighting estimation features
    - ARCore Depth API, Apple's LiDAR sensor for iPhone 12
- *WNMFxAR* (2019) vs. *Boundary* (2020) is an example of improved visuals

ADVANTAGES TO MOBILE AR AND SPATIALIZATION

- Mobile AR also has advantages for spatialized sound installations
- In particular, there are few limitations on sound installation size, and both visuals and sound can be built for a micro or macro level, using Unity 3D Audio
- Installations can be built for a single room, a building or a park.

MICRO / MACRO SOUND INSTALLATIONS IN MOBILE AR

- Micro Level (Indoors)
  - One can zoom in close using the lens of a smart phone
  - Movement of user can influence sound through a small space using phone positioning
  - User gesture control can also influence sound (*Boundary* 2020)

- Macro Level (Building or Outdoors)
  - GPS positioning (*WNMF x AR* 2019)
  - User positioning can influence sound elements

MACRO/MICRO SPACE IN AR: COLLECTION : RECOLLECTION (2022)

- *Collection : Recollection* (2021) is a large-scale outdoor AR sound installation
- Collaboration with visual artist **Despo Sophocleous** and sound artist **Danielle Jakubiak**
- Working with The Quad - a large open space in downtown Halifax, NS
- Our project involves themes of machine memory, or how machines experience visuals and sound differently to humans.

THANK YOU!

- As a self-taught developer, creating these AR pieces was a deep learning experience.
- Thank you for the chance to show my previous work and how I am integrating spatialization into future works for headset and mobile AR.
- Questions? Contact me at amyGbrandon@gmail.com