



SIGGRAPH 2024

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THE PREMIER CONFERENCE
& EXHIBITION ON
COMPUTER GRAPHICS &
INTERACTIVE TECHNIQUES

METAHUMAN THEATRE

TEACHING PHOTOGRAMMETRY AND
MOCAP AS A PERFORMING ARTS PROCESS

TOPHER MARAFFI, NC STATE UNIVERSITY





Metahuman Theatre:

Teaching Photogrammetry and Mocap as a Performing Arts Process

SIGGRAPH 2024 Educator's Forum

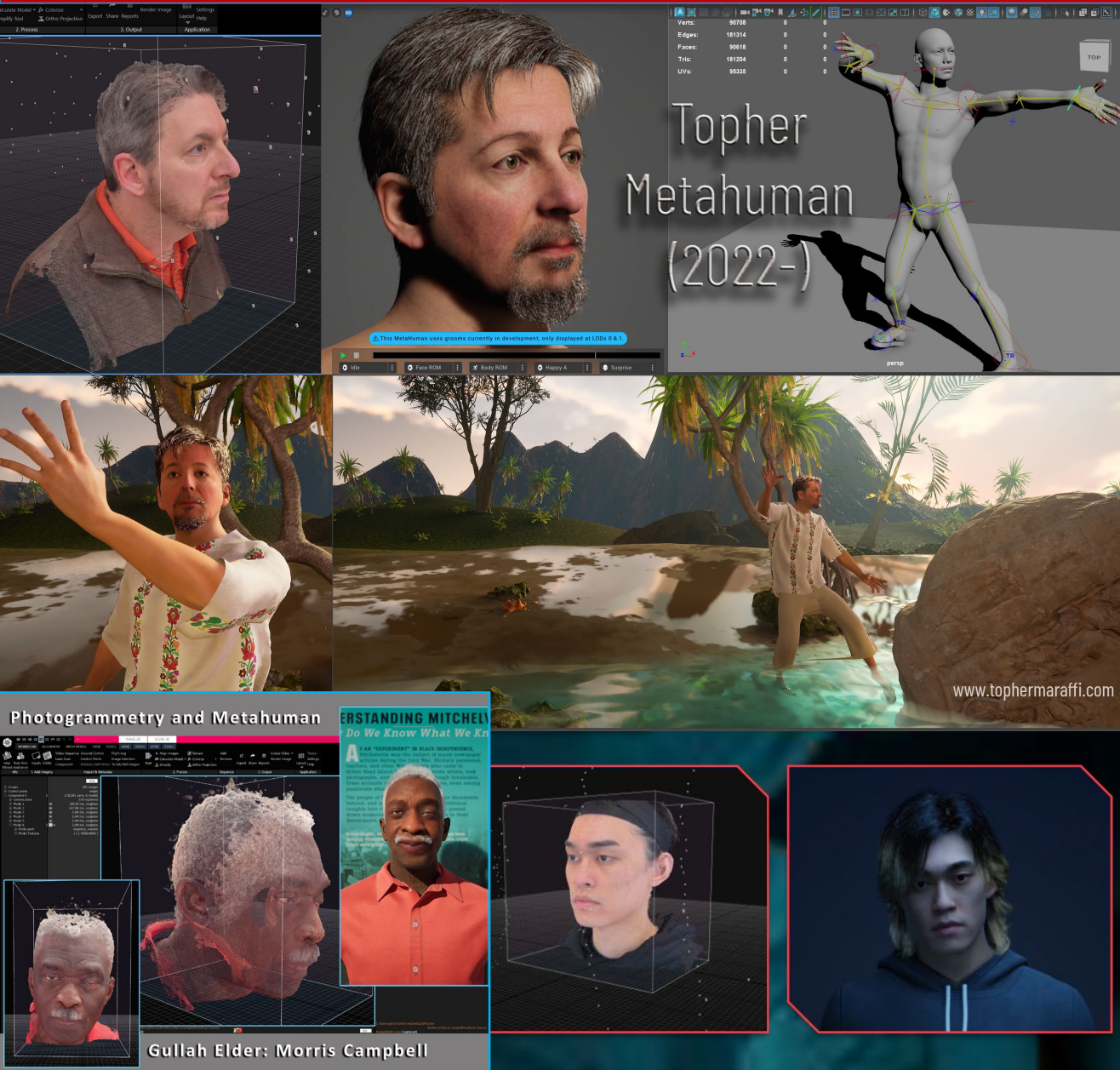
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Introduction

- **Metahuman performance process developed to make it easy for undergrad MADTech students to learn emerging technologies for real-time 3D animation.**
- **2-part technical pipeline where students first use photogrammetry to make a Metahuman double, and then use performance capture to animate their double in Unreal Engine 5.**
- **Taught in three weeks to MAD grad students in spring 2024 by removing extra programs like Autodesk Maya in the cleanup and retargeting stages.**
- **Performing arts approach with an emphasis on embodied performance and improvisation over scripting or storyboarding.**
- **While projects were rendered as cinematic shorts, in fall 2024 we are moving towards live theatre applications.**

Step 1: Photogrammetry to Metahuman Double



- **Students shot each other on video with their smart phones, and then processed the data in Reality Capture.**
- **Photogrammetry head models were then exported to Autodesk Maya for cleanup.**
- **FBX models of each student's head was then imported to Unreal Engine 5.2 to upload into Metahuman Creator.**
- **Students added textures, hair and clothes in cloud-based Metahuman Creator and imported to their UE5 scenes.**

Step 2: Performance Capture to Metahuman Animator



- We used a Noitom Perception Neuron Studio suit in fall 2023, and then added a Rokoko Smartsuit Pro 2 suit in spring 2024, including a Rokoko Headrig for facial capture and Coil Pro for drift.
- Inertial suits are cheaper than optical suits (<\$5K) and don't require a dedicated capture space. Suitless: [RADiCal](#).
- Initially we used Epic's Livelink Face app to capture live onto our Metahumans in Sequencer, and then switched to Metahuman Animator in spring 2024.
- Students bake to a control rig to manually fix and refine their animation on an additive layer in Sequencer using video reference from their performance.

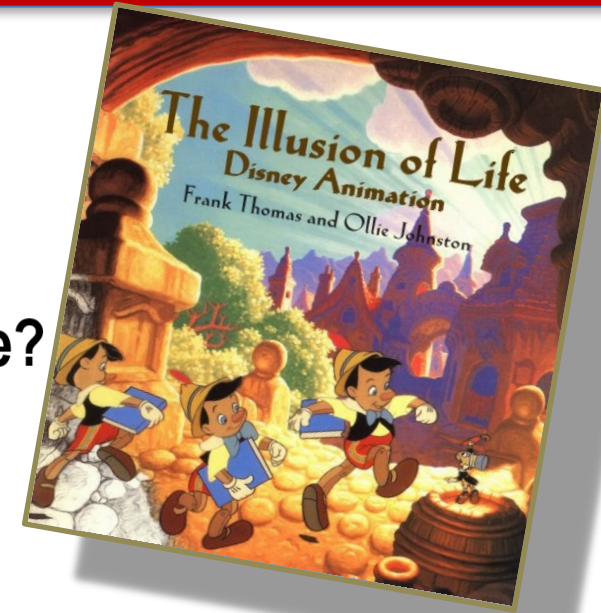
Performing Arts Influences and Concepts



- Hickman's Hyper-Reality concept based on stage magic principles.
- Metahumans as Craig's Uber-Marionettes or Super-Puppets.
- Barba's Theatre Anthropology that explores the performer's craft, and Devised Theatre that develops a play from theatrical moments (Kaufman's Moment Work).
- Disney's animation principles learned from studying and rotoscoping performers since the 1930s, an early form of performance capture, applied full-circle back to acting for mocap.

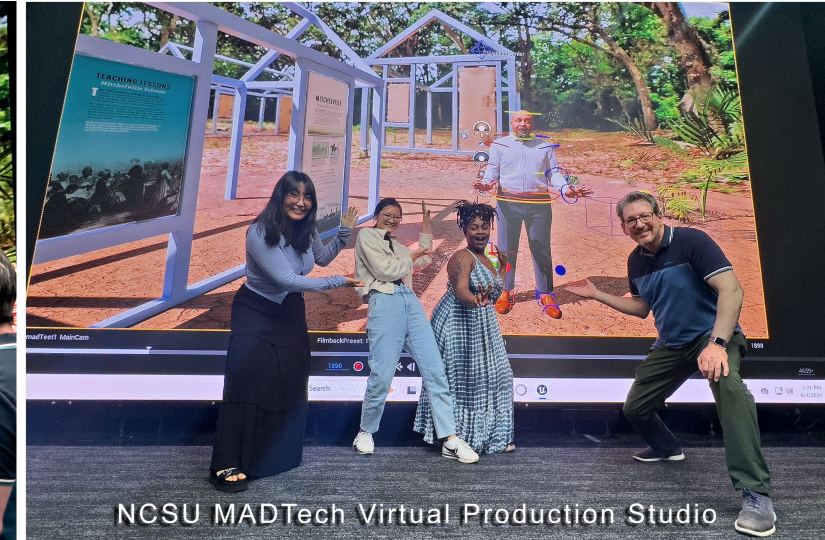
Disney's 12 Principles Applied to Performance Capture

- 1) Timing = speed / what is the energy of your character's movement?
- 2) Squash/Stretch = volume / compress and extend your character's body.
- 3) Slow In/Slow Out = inertia / how does gravity effect your character?
- 4) Arcs = trajectories / How does the limbs of your character naturally move?
- 5) Solid Drawing = volume / emphasize and isolate clear character poses.
- 6) Follow Through = momentum / continue a character act to completion.
- 7) Anticipation = indicating / emphasize an action through contrasting movement.
- 8) Exaggeration = gesture / project your performance through the technology.
- 9) Staging = framing action / think about where the spectator may be.
- 10) Secondary Action = visual interest / support the dominant action with accents or ticks.
- 11) Appeal = stage presence / being "on" or activated in your whole body.
- 12) Straight Ahead/Pose to Pose = improvising vs blocking to "hit your mark".



Fall 2024 Metahuman Class Projects

- **MAGIC Tour of Mitchelville** funded research on interactive Metahuman docents in our LED wall.
- **Hyper-Reality Theatre** production of Macbeth (Act 1, Scene 1) in our Virtual Production Studio where a live actor will interact with their Metahuman doubles.



Student Project Results and Discussion

- **Final projects** were aesthetically different than student animations created through a traditional 3D animation process (scripting, storyboarding, pose to pose keyframing, etc.).
- **Displays unique character details, personality ticks, and figurative liveness from improvised or unscripted reactions in the performance capture sessions.**
- **The Metahuman performance pipeline seem easier and more accessible to students because many of the basic procedures of modeling, rigging, and animation are semi-automated to produce rough results faster; and performing was “fun” for most students.**
- **Students spend more time on higher-level character performance, scene design, and art direction.**
- **However, to achieve the most expressive results, students had to put extra time to cleanup and iteratively refine the performance capture data using additive control rig edits in UE5 Sequencer.**



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Thanks!

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