Motion Capture Animation

Creating animations with body and face motion performances

Today

- Course Outline
  - Material
  - Format
  - Software
  - Assessments
- Introduction to Motion Capture
- Break (install software)
- First Exercise – Mixamo / Blender
- Assessment 1 outline

About Me

I'm a **media artist, researcher, and educator.**

I'm focussed on 'demystifying' technologies as art-making tools, and producing innovative expressive outcomes explored via hacking, experimentation, and play.

Since 2017, I've hosted a collaborative experimental studio program working with **creatively and culturally diverse artists to explore virtual reality,** AR/XR, Machine Learning, Photogrammetry, and Motion Capture, and other emerging technologies.

Tactical Space Lab

Tactical Space Lab is a research initiative focussing on encouraging innovation, accessibility, and diversity at the intersection of art and technology. It's goal is to **host, nourish, and nurture artistic practices and projects that critically explore emerging technology** – particularly through the development in virtual reality. We engage in collaborative practice-based research through experimentation, improvised creation, and prototyping / proof of concepts.

Since 2017 I've hosted an ongoing **experimental VR studio program**, working with established artists to explore innovative uses of virtual reality, photogrammetry, AI / ML, and real-time tracking technologies in their practices, leading to major outcomes including **Bianca Willoughby's 2018 Liveworks performance** *'Circles of Fire'*, **Joan Ross's 2019 ACMI/Mordant VR commission** *'Did you ask the river?'*, inclusion in the **Ars Electronica 2020** program, **2021 City of Sydney Creative Fellowship with Jason Phu**, and **Tully Arnot's 2022 ACMI/Mordant VR commission** *'Epiphytes'*. Since inception, we have **successfully acquitted AU$500,000** of art/technology research and development funding.

Tactical Space Lab – 2020 studios
Youtube video

ABC Art Works Series 2 Ep 23 Tactical Space Lab (clip)

VR studio with Joan Ross (2018)

VR studio with Bianca Willoughby (2018)

VR studio with Claudia Nicholson (2020)

VR studio with John Gillies (2020)

VR studio with Kylie Banyard (2020)

VR studio with Tarik Ahlip (2020)

VR studio with Jason Phu (2020)

VR studio with Abdul Abdullah (2022)

VR studio with Cigdem Aydemir (2020)

VR studio with Louise Zhang (2020)

Joan Ross

Did you ask the river? (2019 ACMI VR commission) subverted the audiences expectations of virtual reality experiences.

Joan enjoyed world-building, but didn't like how people experienced it.

VR work had camera that printed real photos.

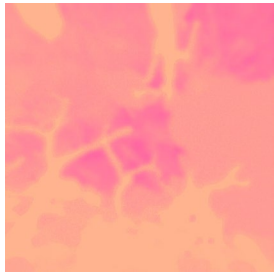
https://vimeo.com/385629502

Tully Arnot

Epiphytes (2020 ACMI VR commission) explored non-human perception of plants.

VR project de-privileging vision; counter-ocularcentric, unfocussed spatial light fields, with an emphasis on the 2nd order ambisonic soundscape.

Magenta field is colour green plants are sensitive to, and **shifted participants' perception** with green afterglow after use.



Animation

Project: ***We meet on the moon, where we share our gaze***

Experimenting with character animation and more narrative-based work. A recent animation commission allowed for prototyping character creation and the desired representational style. Characters created from reference images in *Character Creator 3*; clothes modelled and draped in *Marvelous Designer;* texturing in *Substance Painter;* motion capture data generated using *Deepmotion* cloud service, from video taken from interviews conducted over *Zoom*. Lipsync generated in nvidia's *Audio2Face*. Final animation rendered in *Blender*.

Gina Rizakos and mother, from Canada Bay project

Characters

Experiments with animation and live performance workflow

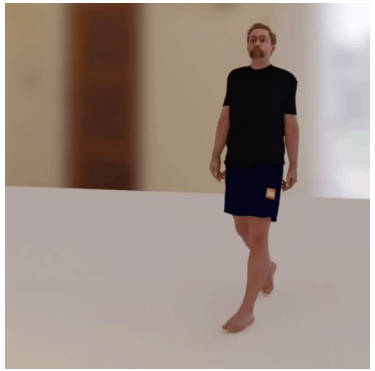
In the last few months we've been refining our use of iPhone live face performance capture, full-body mocap, and experimenting with different possibilities for representing the artists/characters in the experience, e.g. a muppet-inspired version of our first 2022 VR Studio artist, Abdul Abdullah.

Abdul Abdullah character tests

Characters

Experiments with AI lip-sync and full-body motion capture

More recently, we've refined our workflow using the Xsens Awinda system, with finger-tracking gloves, and demonstrated the entire process of character creation (Character Creator 3, Metahuman), digital costuming (Marvelous Designer), motion capture (Xsens MVN Animate Pro), cleanup (iClone 7), lip-sync generation (NVIDIA Omniverse Audio2Face), and facial performance (iPhone Live link).



Josh character tests: Metahuman model, combined motion capture elements

Course Outline

Next three weeks

Motion Capture Studio

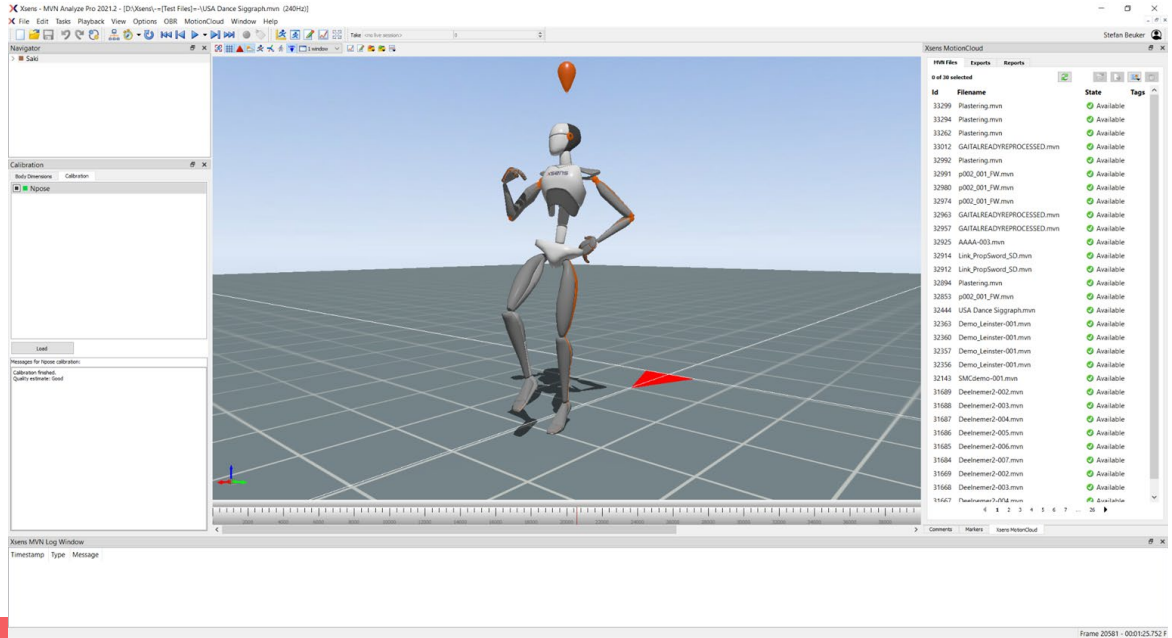
Format: Lecture, Tutorials, and Studio practice

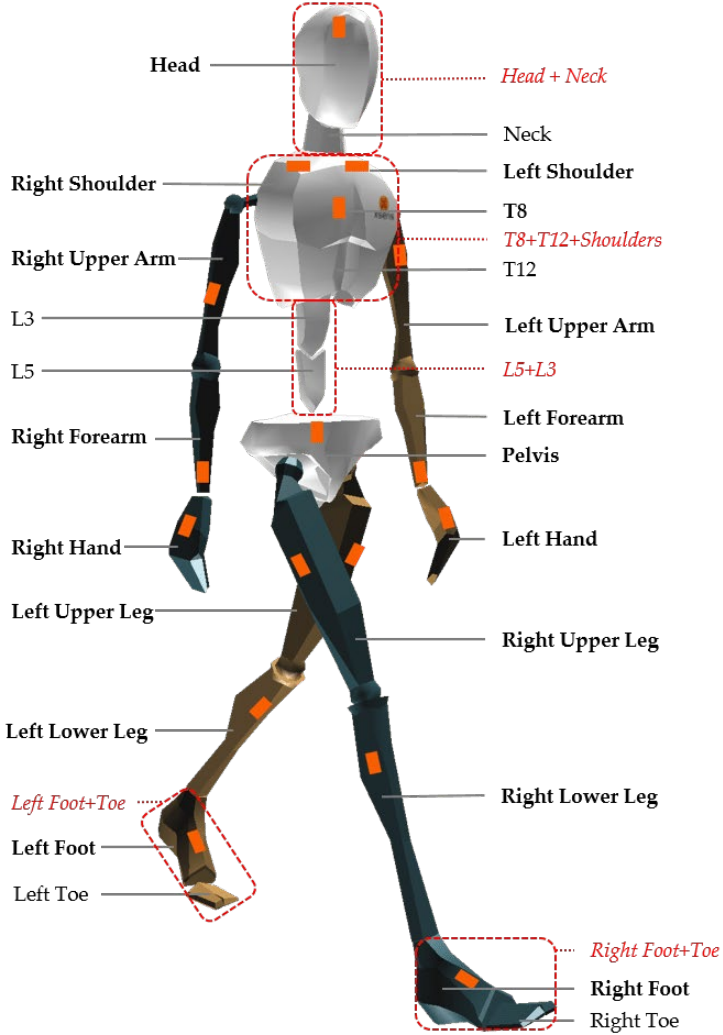
Course topics: how does Mocap work, rigging, target transfer, approaches (optical, IMU, AI), characters,

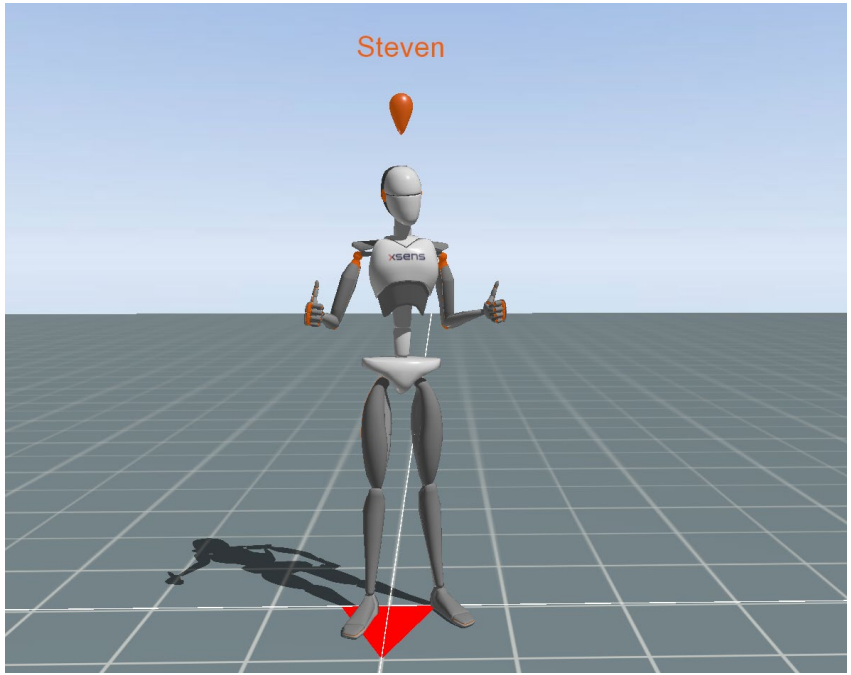
Tools: Pre-generated motion, AI mocap, Xsens motion capture suit and face capture

Final outcome: a short animation created in Unreal Engine or Blender, using Metahumans, stylised character, or hand-modelled character

Xsens Suit


Xsens - MVN Analyze Pro 2021.2
File Edit Tasks Playback View Options OBR MotionCloud Window Help
Navigator
Calibration
Xsens MotionCloud
Xsens MVN Log Window
Timestamp Type Message

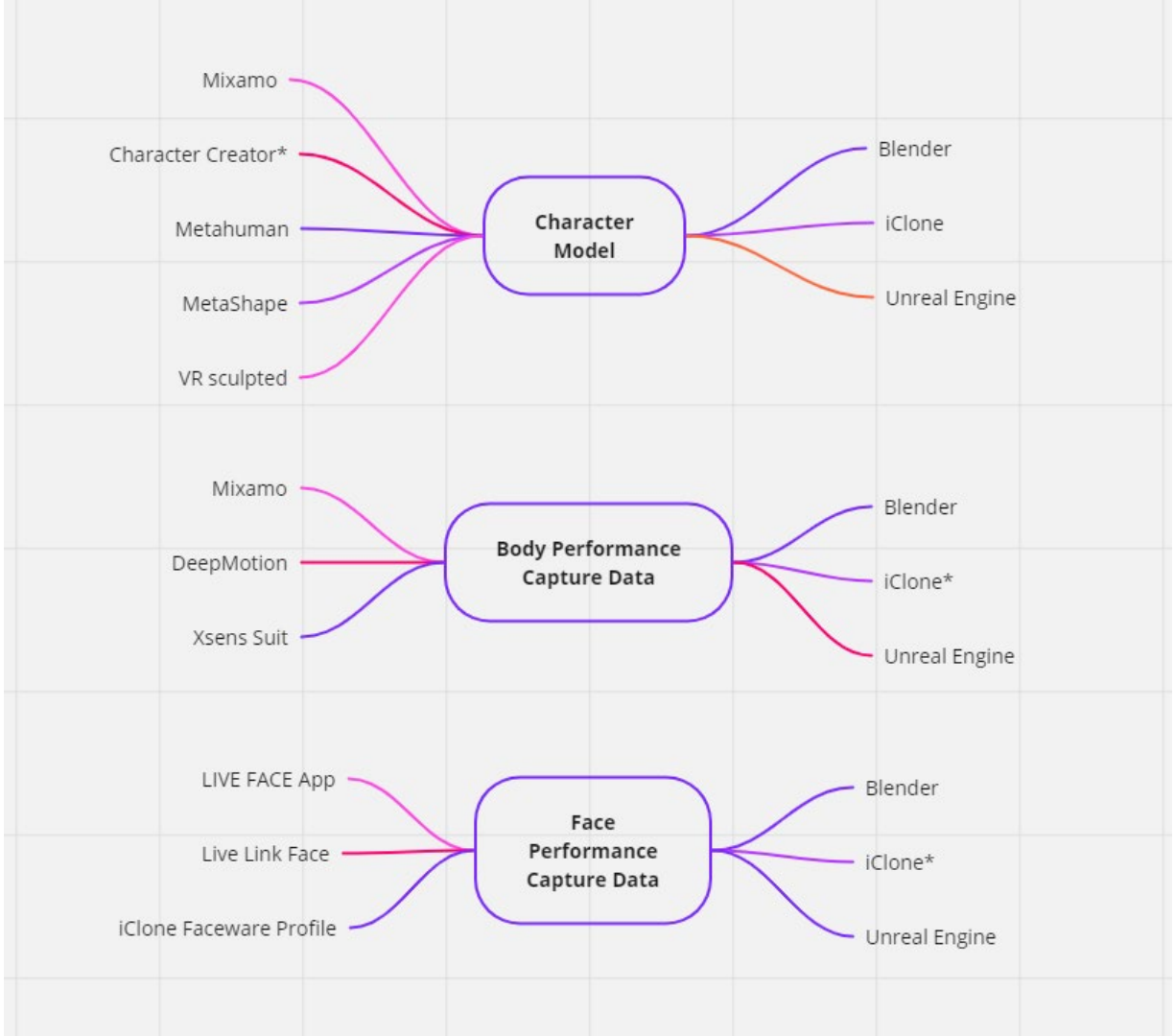

Head
Head + Neck
Neck
Right Shoulder
Left Shoulder
T8
T8+T12+Shoulders
Right Upper Arm
T12
L3
Left Upper Arm
L5
L5+L3
Left Forearm
Right Forearm
Pelvis
Right Hand
Left Hand
Left Upper Leg
Right Upper Leg
Left Lower Leg
Right Lower Leg
Left Foot+Toe
Left Foot
Left Toe
Right Foot+Toe
Right Foot
Right Toe


Steven
xsens

Topics

- Fundamentals of Motion Capture
- Rigging, weights, retargeting
- Character Creation Basics
- Body tracking approaches (optical, IMU, AI)
- Face animation / mocap approaches
- The workflow / logistics: storyboarding, planning, performance, cleanup, compositing
- Camera sequences in Unreal Engine
- (advanced – if time) Dynamic Cloth animation

	Access	Platform
MetaShape	Trial 30 days	mac + pc
Blender	Free	mac + pc
Deep Motion	Limited Free	online
Xsens	Licensed	pc
Unreal Engine 5.2	Free	mac + pc
Character Creator	Trial 30 days	pc
iClone	Trial 30 days	pc
iClone LIVE FACE Profile	Trial 30 days	pc
iClone Faceware Profile	Trial 30 days	pc
LIVE FACE App	Free (iphone)	iphone
Live Link Face	Free (iphone)	iphone
Premier Pro	or alternative	mac + pc
Mixamo	Free	online
Miro	Free	online
Marvelous Designer?	Trial 30 days	pc
Descript?	Limited Free	pc
Substance Painter, etc.	Trial 30 days	mac + pc


Mixamo
Character Creator*
Metahuman
MetaShape
VR sculpted
Character Model
Blender
iClone
Unreal Engine
Mixamo
DeepMotion
Xsens Suit
Body Performance Capture Data
Blender
iClone*
Unreal Engine
LIVE FACE App
Live Link Face
iClone Faceware Profile
Face Performance Capture Data
Blender
iClone*
Unreal Engine

Assessments

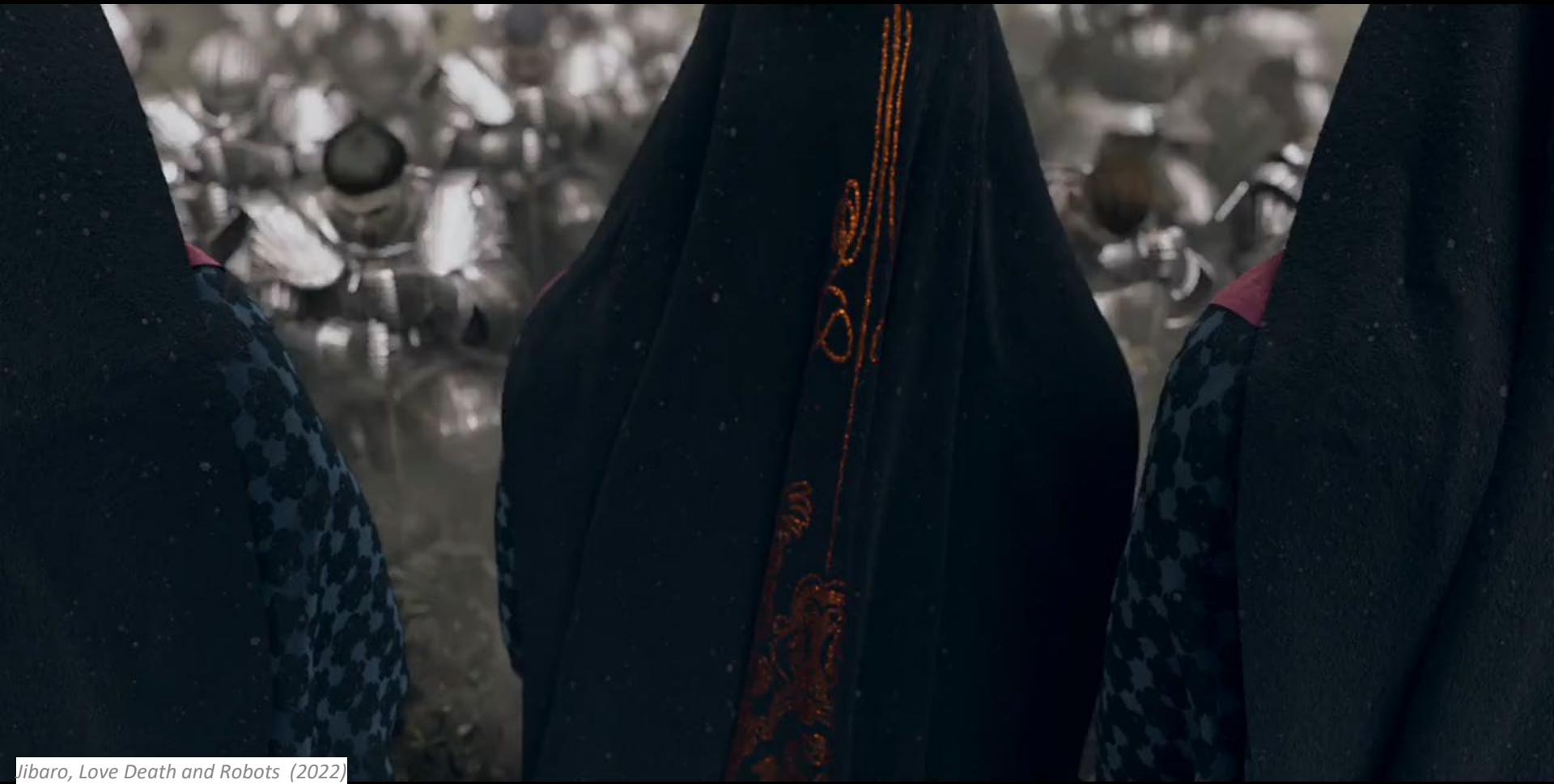
WEEK 1	1A: CHOOSE A SOURCE VIDEO TO RECREATE	Make a short presentation about topics that interest you, related to motion and gesture (e.g., dance, action movies, video games) Choose a scene from film, video game, music video, dance that you want to recreate. Create a presentation with the clip, and some visual reference material around the idea
	1B: SIDE-BY-SIDE	Present Side-by-side video of original segment and your version
WEEK 2	2A: IDEA	Prepare a presentation on an idea for an original animation
	2B: DEVELOP	(in class tutorial - I will check storyboards, etc)
WEEK 3	2C: MOCAP SESSION	**Project:** Record motion in groups of 4. Choose 1 person to be performer. Create shot lists from each student's projects. Take recordings, edit, and clean up. Record at least 4 different pieces of animation.
	2D: FINAL WORK	**Delivery**: Present your animation to class, with composite documentation (with sound, camera motion or multiple shots, post processing, environment). Video (or game experience).

Motion Capture

Introduction

Examples of Great Motion Capture - games

- The Last of Us Part II (2020) - The game's realistic character movements and facial expressions were achieved through advanced motion capture techniques, making it one of the most visually impressive games to date.
- Red Dead Redemption 2 is a great example of motion capture in video games. The attention to detail in the movements of the characters is impressive, and the technology used to capture and animate the performances is top-notch.
- Hellblade - Senua's sacrifice (face mocap, and example of Metahuman animator)
- Uncharted 4: A Thief's End (2016) - used motion capture to create realistic character movements and facial expressions
- Assassin's Creed Odyssey (2018) - used motion capture to create realistic combat movements and animations
- Avatar (2009) - The groundbreaking motion capture used to create the Na'vi characters set a new standard for the technology in the film industry.
- Lord of the Rings Trilogy (2001-2003) - The motion capture technology used to bring Gollum to life paved the way for future advancements in the field, and earned Andy Serkis critical acclaim for his performance.
- Love Death and robots series



Jibaro, Love Death and Robots (2022)

The Last of Us Part 1 Remake

Enter the Spiderverse


Gamer Max Channel
Half-Life Alyx

Imagine Dragons x J.I.D Enemy from the series Arcane League of Legends

Motion Capture Fundementals

Basics

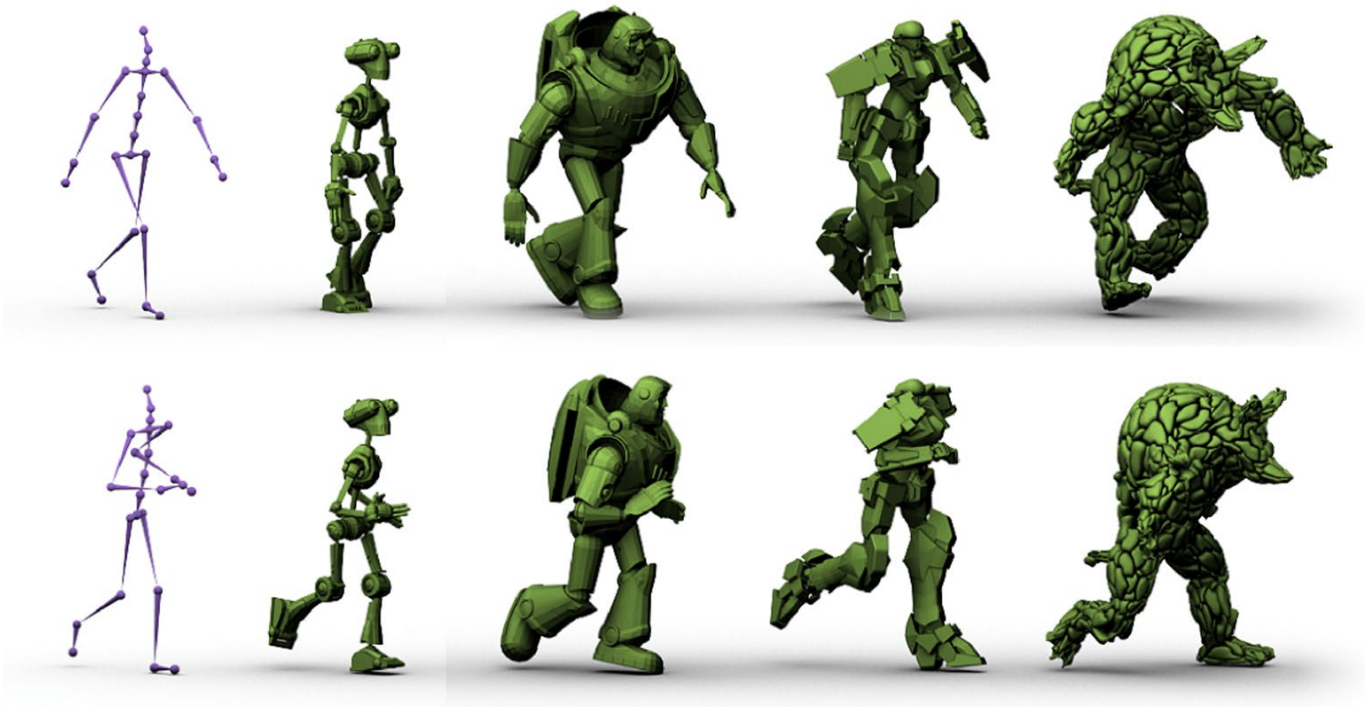
- **Skeleton**: Set of bones / joints. Rotations on these describe gestures / motion
- **Rigging**: A mesh / character being fitted with skeleton
- **Skin-weights**: How much the position of each bone effects the skin near it

More Advanced

- **Mesh Deformation Modifiers:** Adjusting the shape of the mesh in particular poses to fix weird effects
- **Retargetting:** transferring animation from one skeleton to another
- **Morph targets AKA Blendshapes:** changes in the shape of a mesh that can be turned on or off

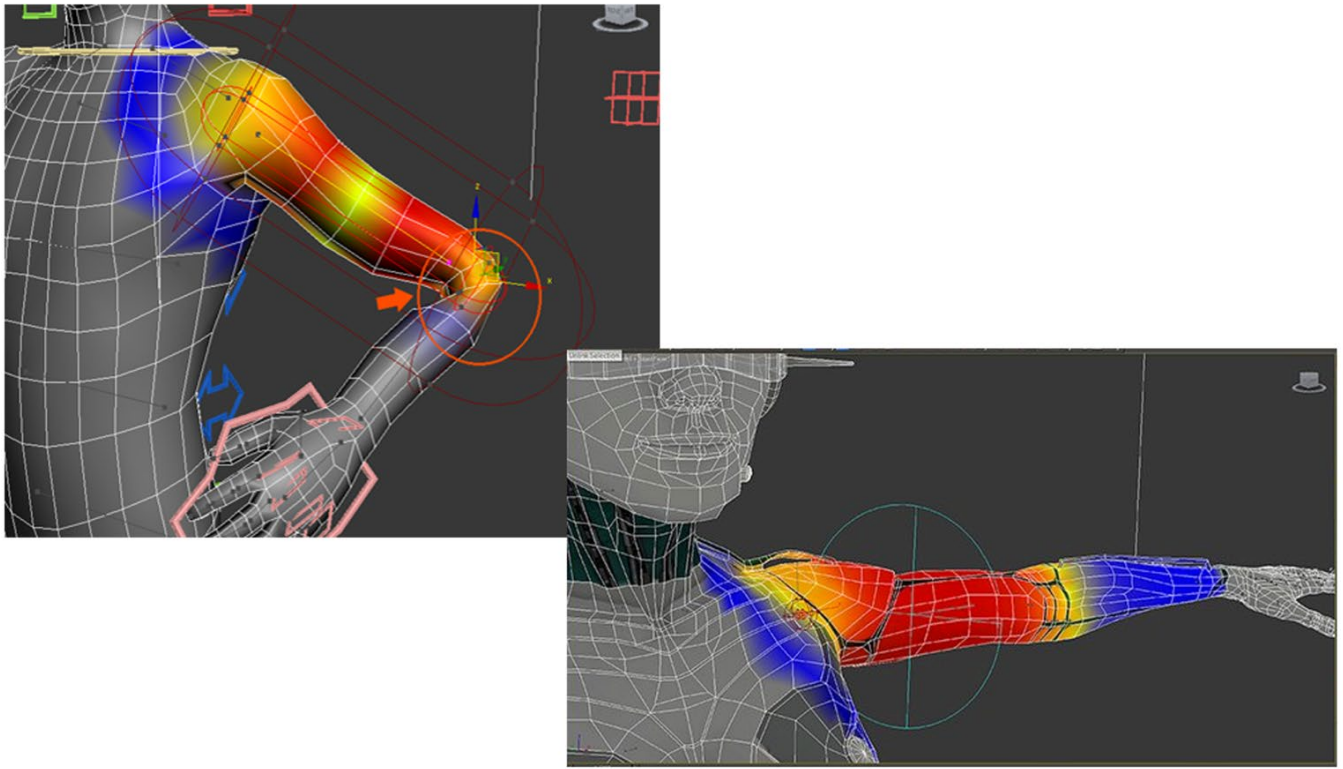
Rigging

Putting a skeleton inside a character



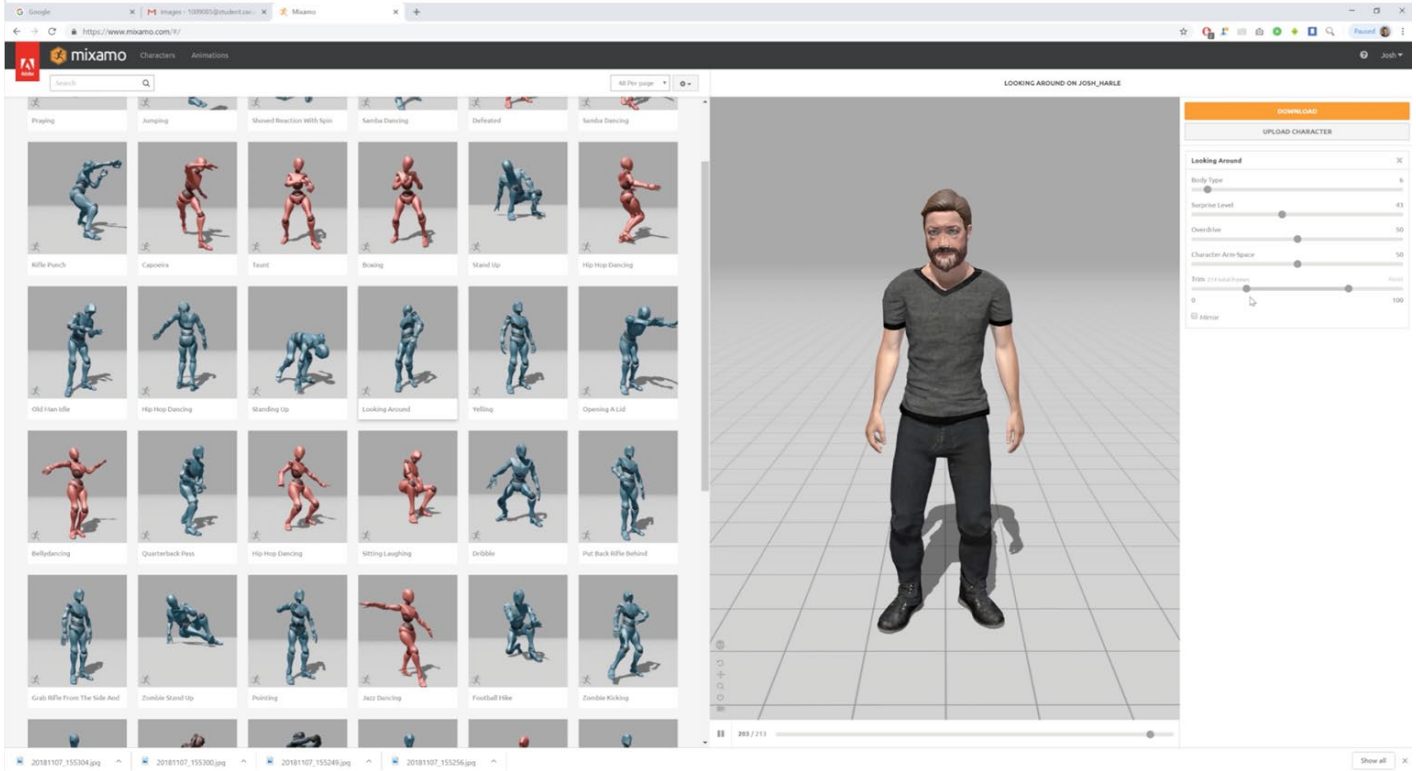
Skinning

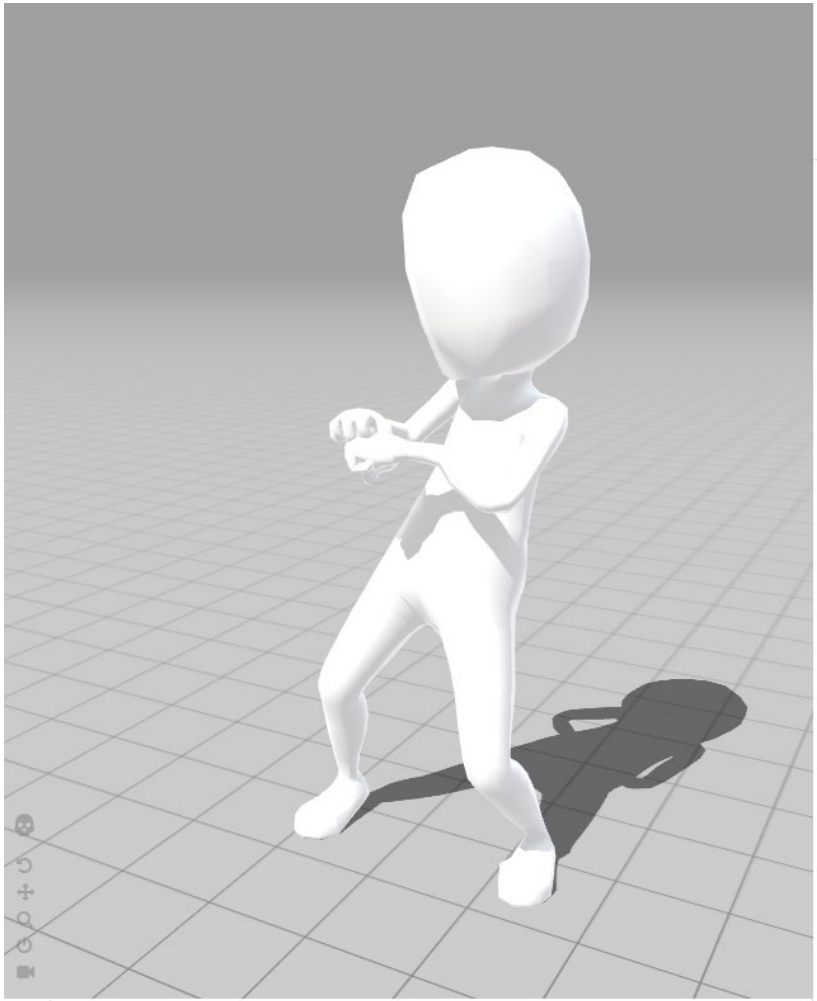
Setting the ‘weights’ of the bones affecting the characters skin

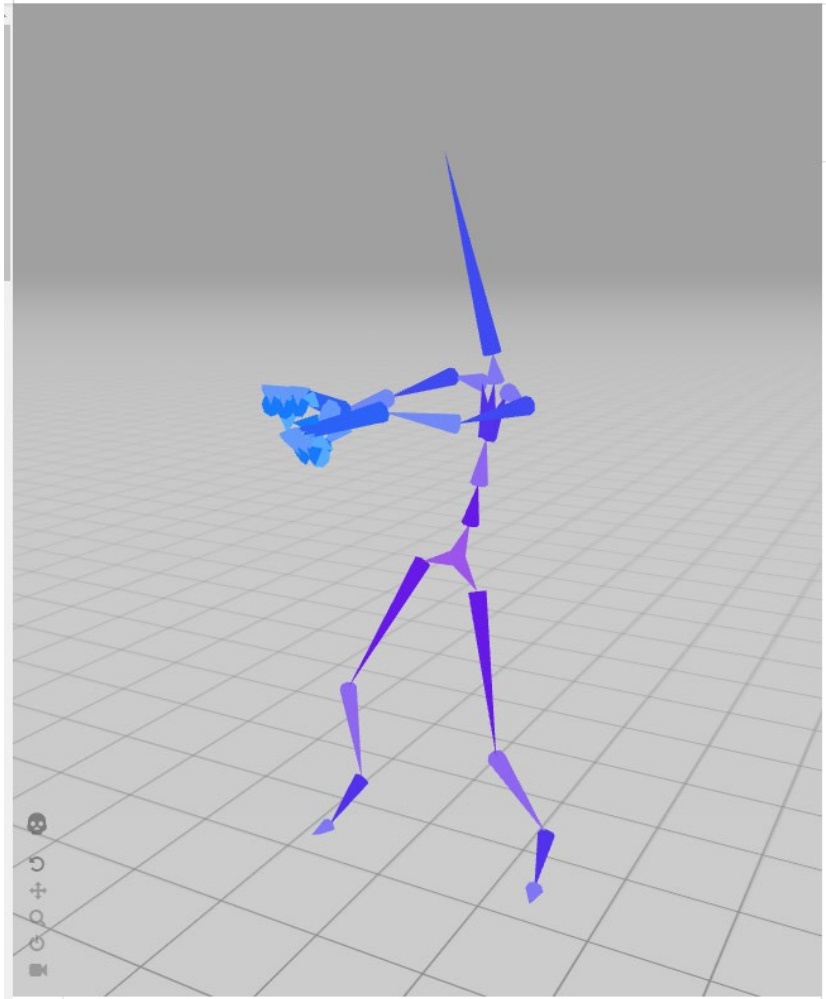


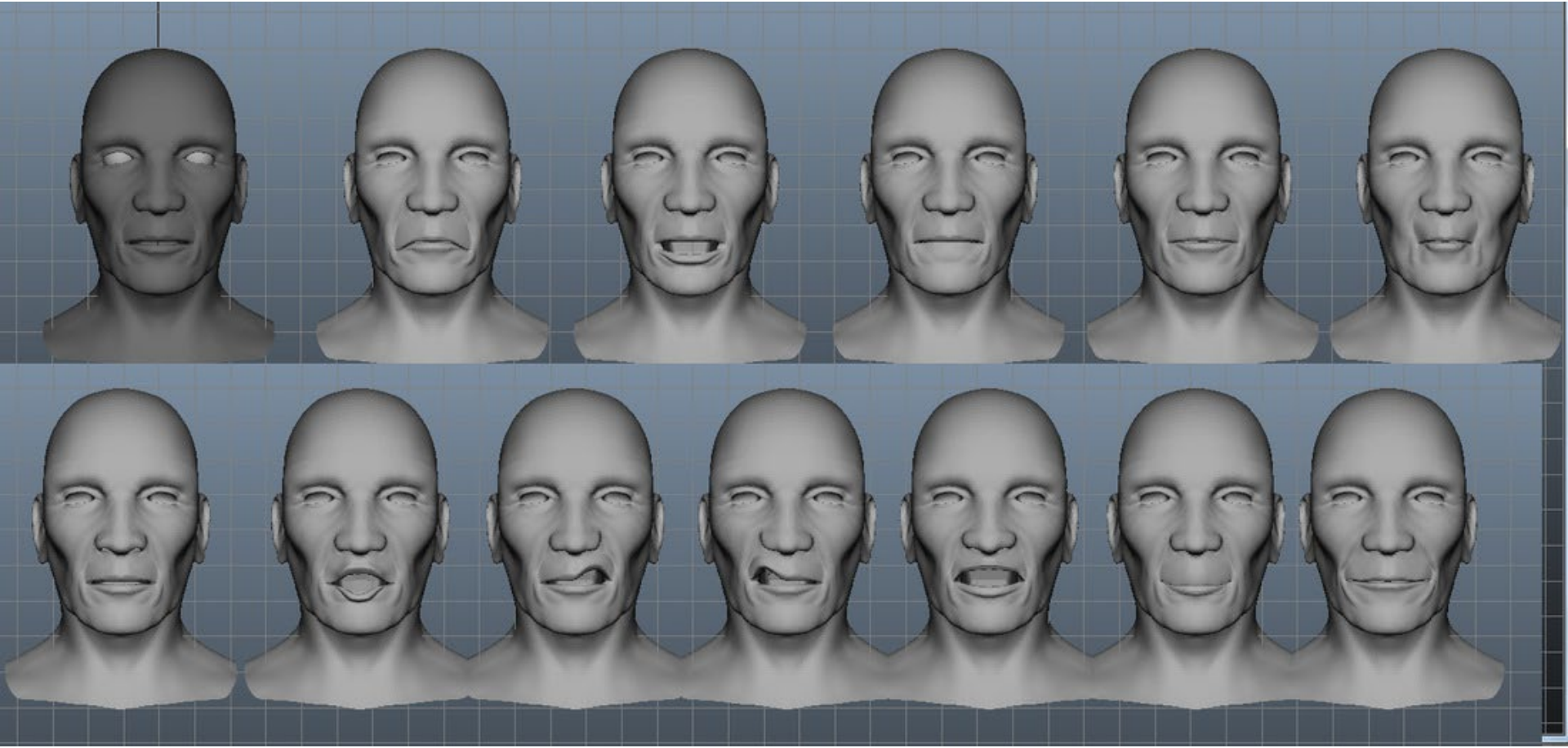
Animation

Applying pre-recorder (motion capture) animations to character using rigged skeleton





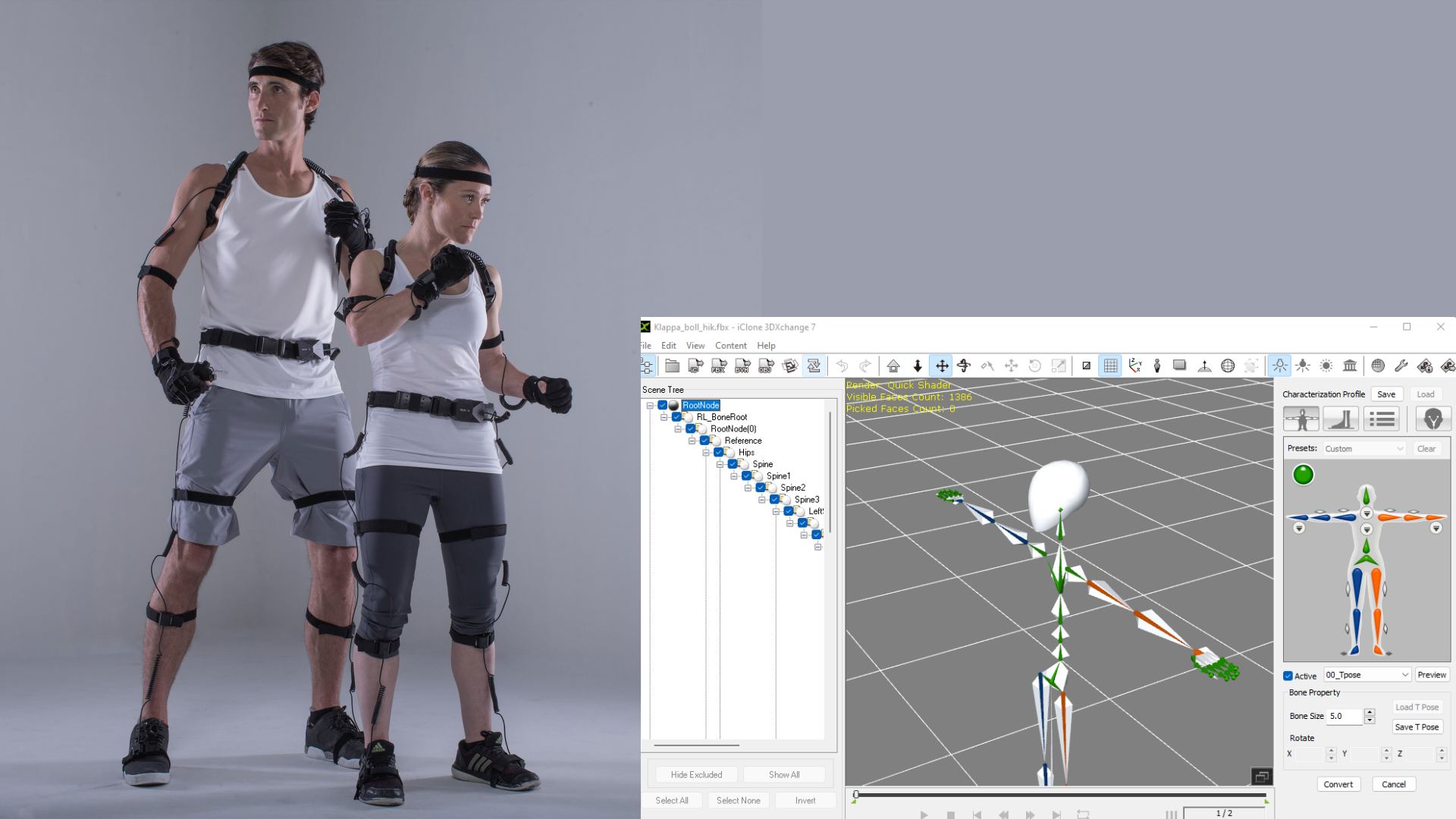




Motion Capture approaches

Technologies

- **Optical motion capture**: This is the most common form of motion capture, which uses cameras to track markers on the subject's body. The data is then used to create a digital model of the subject's movements.
- **Inertial motion capture**: This technology uses sensors attached to the subject's body to track movement. It is often used in situations where optical motion capture is not feasible, such as outdoor environments.
- **Facial motion capture**: This technology is used to capture the movements of a subject's face, which can then be used to animate digital characters. It often involves the use of markers or sensors placed on the subject's face.
- **NOW: AI video based.**


Klappa_boll_hik.fbx - iClone 3DXchange 7
File Edit View Content Help
Scene Tree
RootNode
RL_BoneRoot
RootNode(0)
Reference
Hips
Spine
Spine1
Spine2
Spine3
Render: Quick Shader
Visible Faces Count: 1386
Picked Faces Count: 0
Characterization Profile
Save
Load
Presets:
Custom
Clear
Active
00_Tpose
Preview
Bone Property
Bone Size
5.0
Load T Pose
Save T Pose
Rotate
X
Y
Z
Convert
Cancel
Hide Excluded
Show All
Select All
Select None
Invert
1 / 2


DEEPMOTION


Ellie

Break

Sign up for mixamo.com
Install Blender from USB

Exercise 1: Motion Capture Animations

Mixamo and Blender

Process

- **Install Blender (a little introduction to Blender if needed)**
- **We'll download some animations from Mixamo:**
  - **a character in T Pose, 2 motion animations**
- **Import the fbx files into Blender, then rename the objects and animations to something clearer**
- **Using the Non-Linear Animation (NLA) tool, showing how to modify and blend animations**
- **Setting up lighting and camera**
- **Rendering (with world HDRI lighting, slow vs quick)**
- **Bringing into Video Sequence and rendering as video**

Blender

- **Workspaces**
- **Modes**
- **Viewport Shading Modes**
- **Editor Windows**
- **Outliner**
- **Viewport**
- **Details (materials, transform, etc.)**

T Pose

mixamo Characters Animations Joshua

Search

48 Per page

CH46_NONPBR

DOWNLOAD

SEND TO AERO

UPLOAD CHARACTER

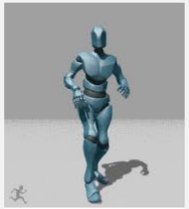
FIND ANIMATIONS

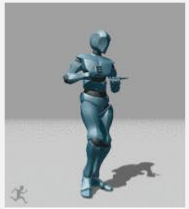

Body Block


Double Dagger Stab


Zombie Stand Up

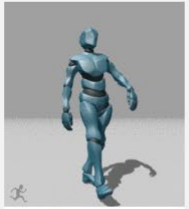

Hip Hop Dancing

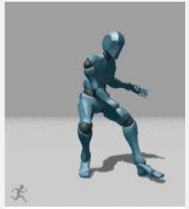

Slow Jog Backwards


Reloading


Dancing


Hip Hop Dancing


Strut Walking

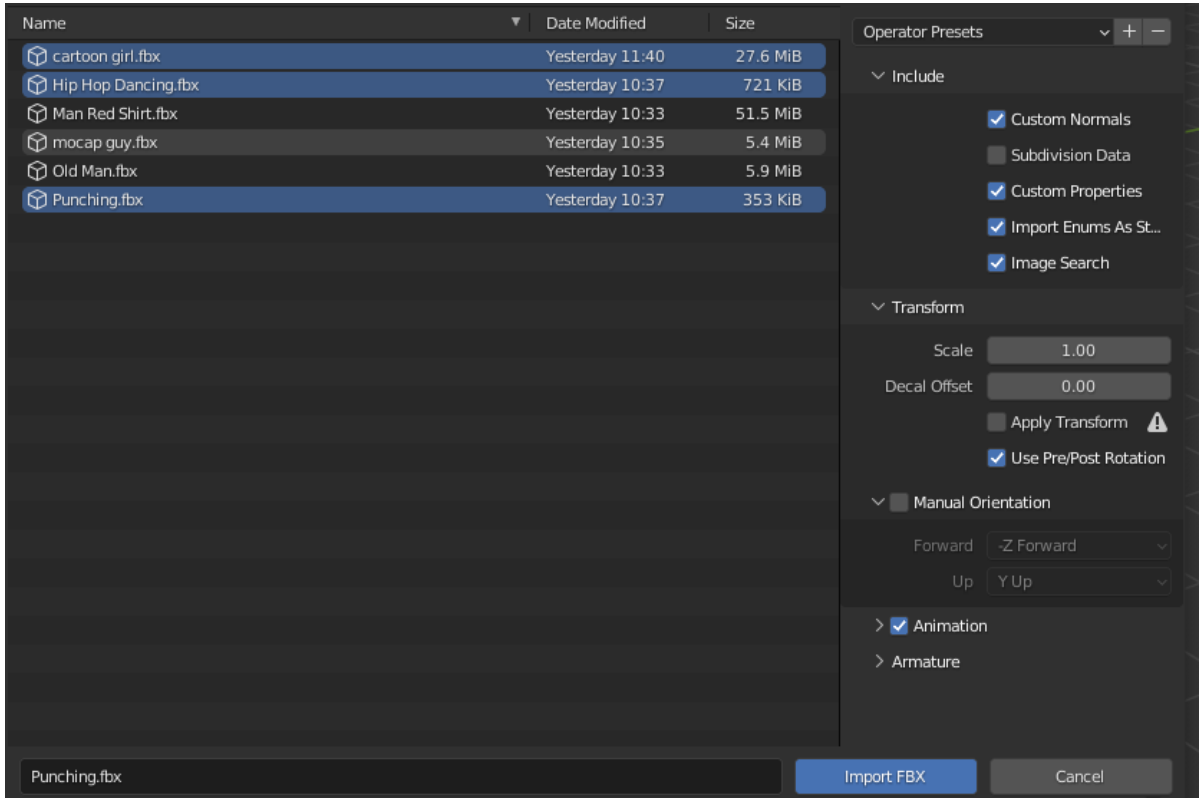

Jumping Down


Punching


22
Action Adventure Pack

0 / 0

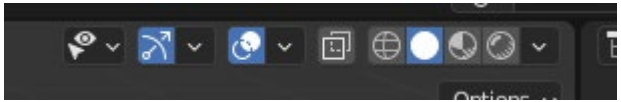
Import Character & animation FBX

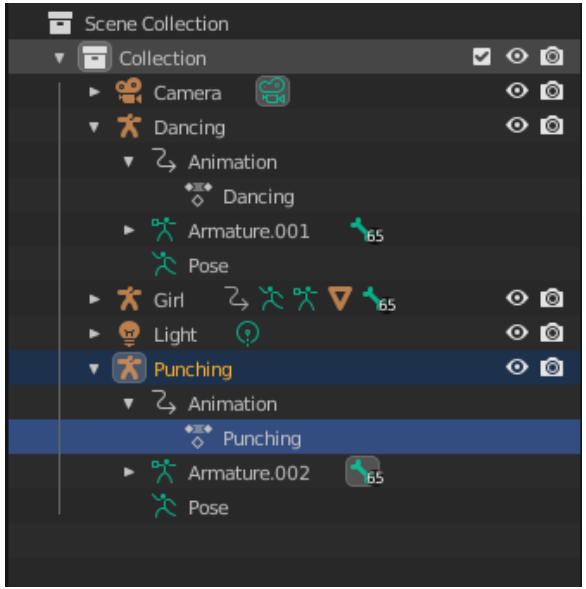


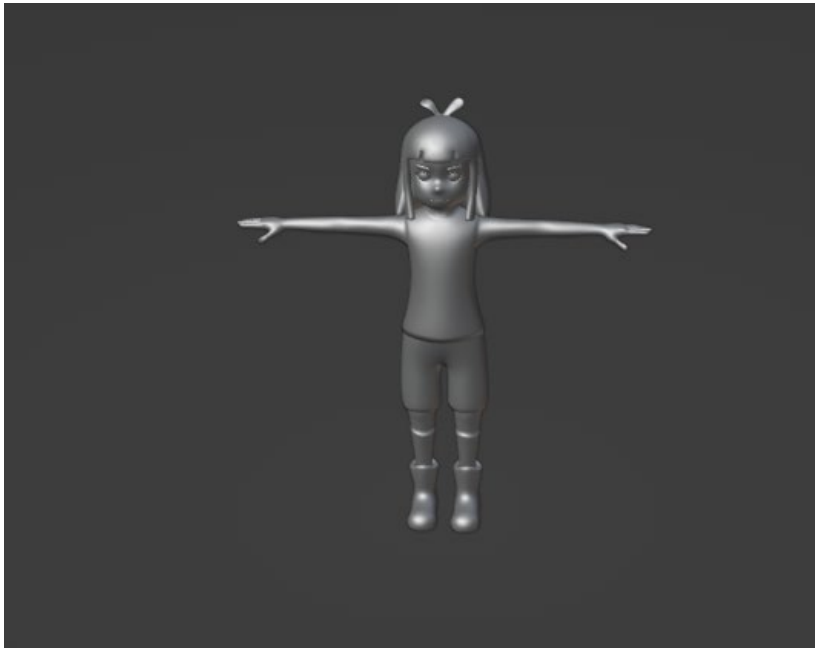
Visibility

- **Visibility in Blender is toggled in Outliner**
  - **NUM . go to selected object, Eye is viewport visibility, Camera is rendering visibility**
  - **Overlays can be turned on or off**
- **Spacebar to play animations**

Rename objects and Animations

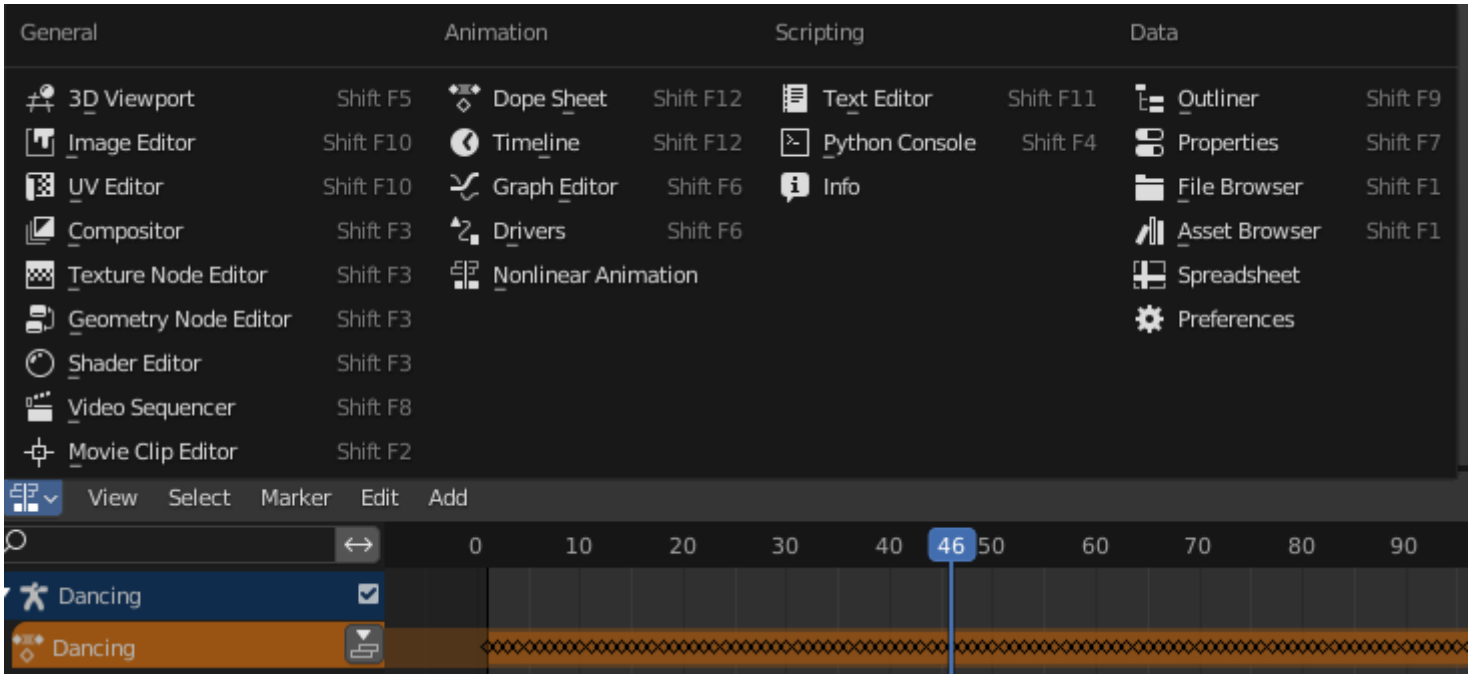






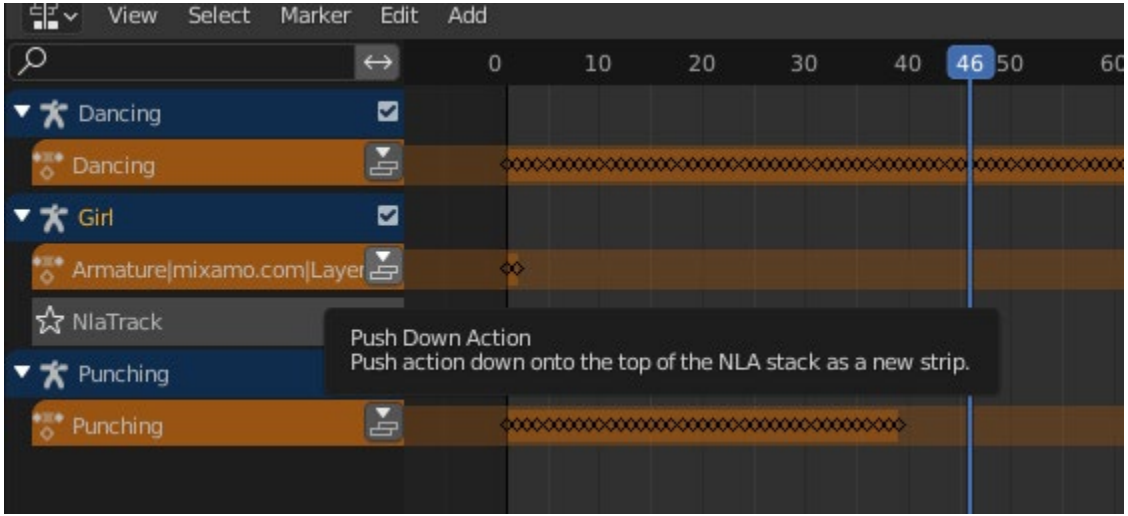
Animations

- Select character in Non-Linear Animation
- Add action strip and select desired animation
- Blend using strip settings (press < icon in right to open)
- Can adjust the animations too with an “Add” strip
- Star buttons, check boxes control what plays
- Can set blend in and out

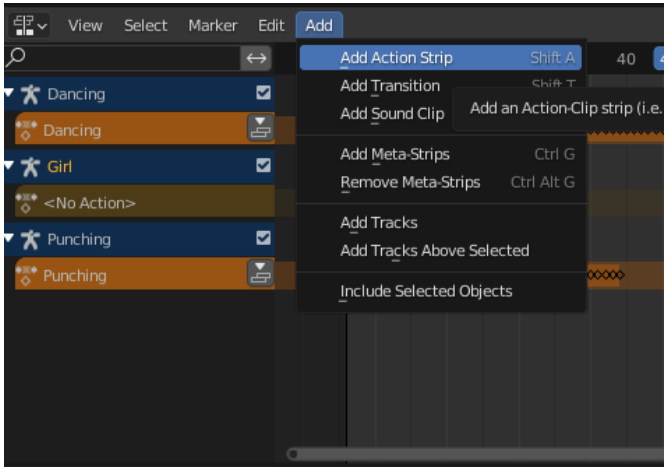

General
3D Viewport Shift F5
Image Editor Shift F10
UV Editor Shift F10
Compositor Shift F3
Texture Node Editor Shift F3
Geometry Node Editor Shift F3
Shader Editor Shift F3
Video Sequencer Shift F8
Movie Clip Editor Shift F2
Animation
Dope Sheet Shift F12
Timeline Shift F12
Graph Editor Shift F6
Drivers Shift F6
Nonlinear Animation
Scripting
Text Editor Shift F11
Python Console Shift F4
Info
Data
Outliner Shift F9
Properties Shift F7
File Browser Shift F1
Asset Browser Shift F1
Spreadsheet
Preferences
View Select Marker Edit Add
0 10 20 30 40 46 50 60 70 80 90
Dancing
Dancing

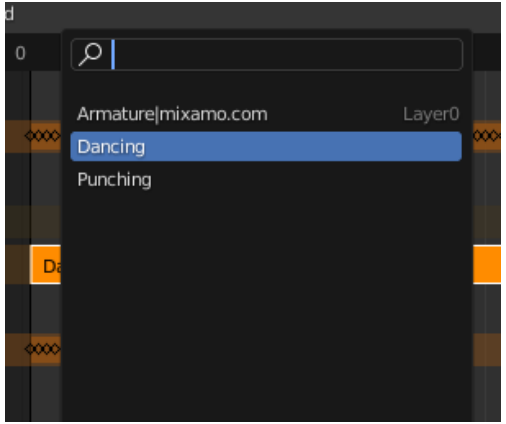
Push current action then delete it

Current editing of animations is a different mode to the movable blocks of animation.

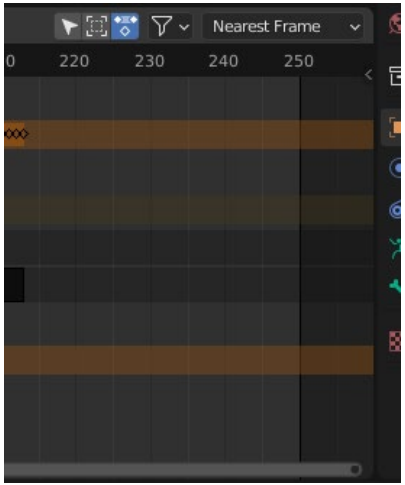


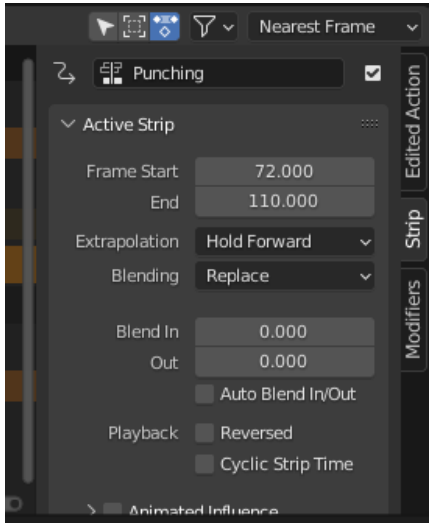
Add Action Strip with dance animation

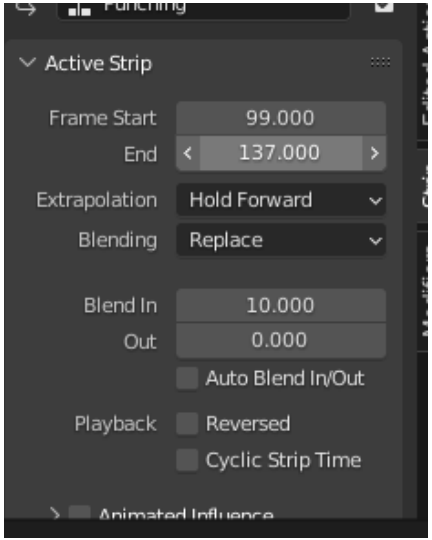




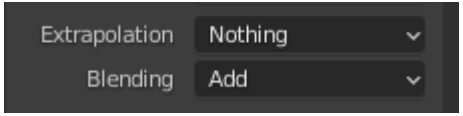
Add punching and blend it in

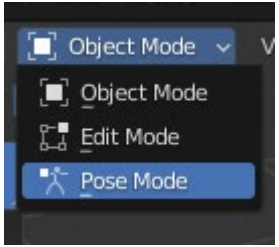


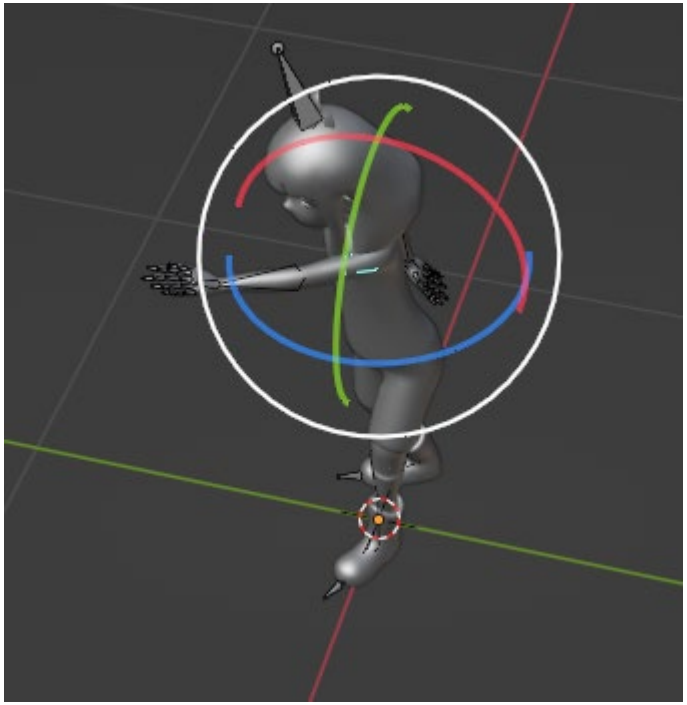


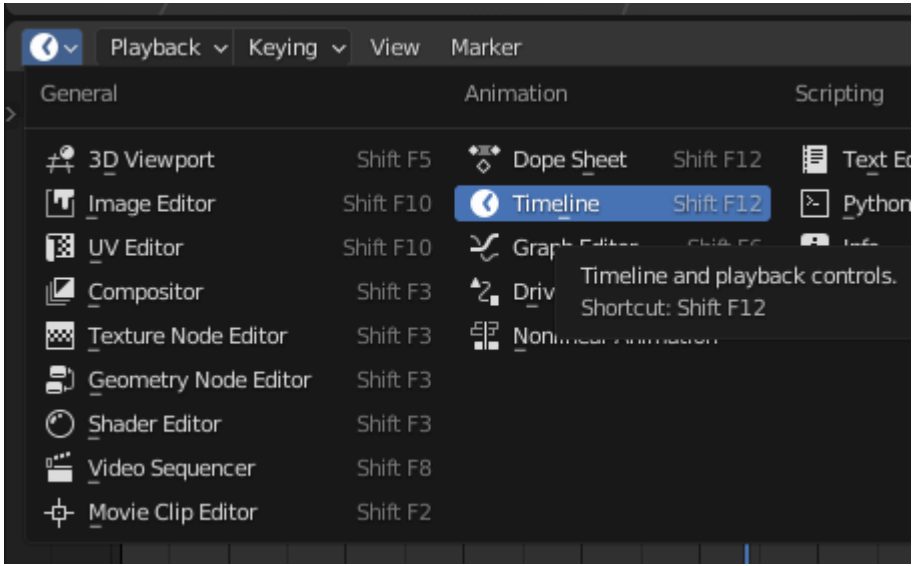


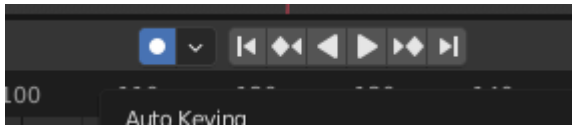
Add punching and blend it in

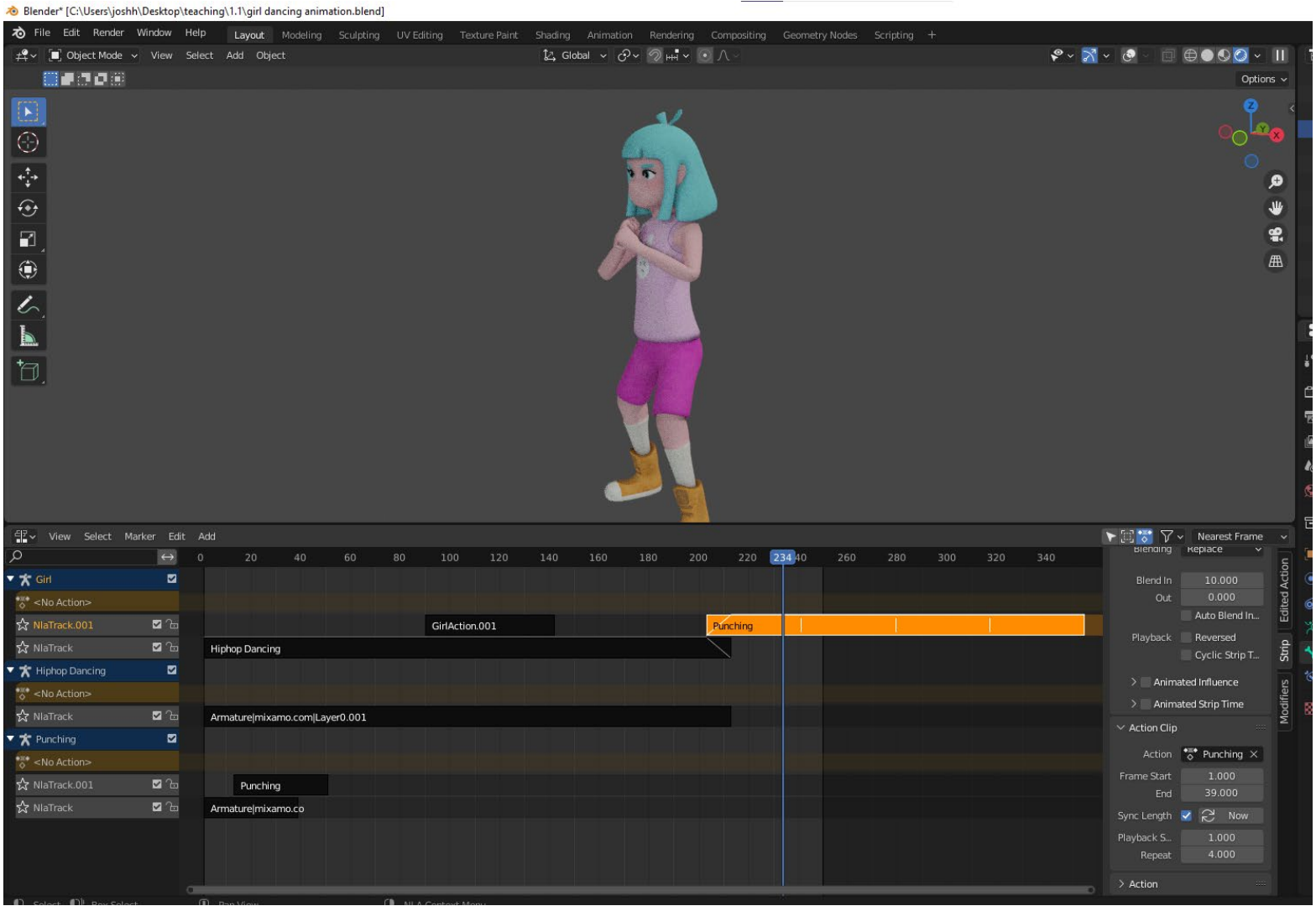






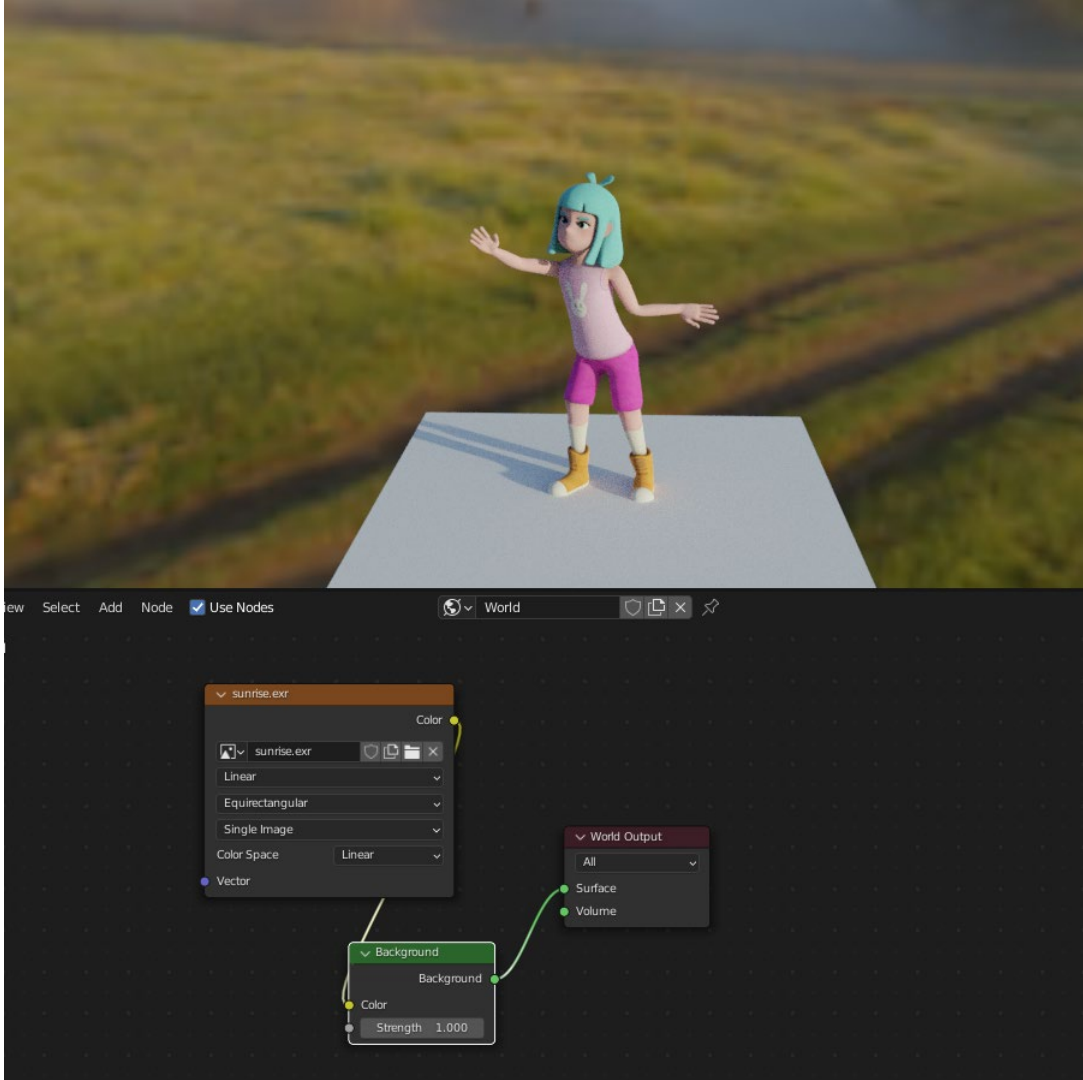





Blender* [C:\Users\joshh\Desktop\teaching\1.1\girl dancing animation.blend]
File Edit Render Window Help
Layout Modeling Sculpting UV Editing Texture Paint Shading Animation Rendering Compositing Geometry Nodes Scripting
Object Mode View Select Add Object
Global
Options
View Select Marker Edit Add
Nearest Frame
Girl
<No Action>
NlaTrack.001
NlaTrack
Hiphop Dancing
<No Action>
NlaTrack
Punching
<No Action>
NlaTrack.001
NlaTrack
GirlAction.001
Punching
Hiphop Dancing
Armature|mixamo.com|Layer0.001
Punching
Armature|mixamo.co
Blending Replace
Blend In 10.000
Out 0.000
Auto Blend In...
Playback Reversed
Cyclic Strip T...
Animated Influence
Animated Strip Time
Action Clip
Action Punching
Frame Start 1.000
End 39.000
Sync Length Now
Playback S... 1.000
Repeat 4.000
Action
Edited Action
Strip
Modifiers

Rendering with Scene Lighting

- [Windows] - `C:\Program Files\Blender Foundation\Blender <version>\<version>\Datafiles\Studiolights\World\`
- [MacOS] - `/Applications/Blender/Contents/Resources/<version>/Datafiles/Studiolights/World/`



Blender Rendering

- Rendering mode: Cycles (GPU)
- Rendering options: FPS, output directory, file type, colours (RGB not RGBA this time)
- Sample settings: Slow rendering versus a quick draft

Importing an image sequence

When you have rendered your image scene you need a compositor software to compile all the images together and export it to a video file. Fortunately, Blender does come with a compositor application for you to do this. Follow the simple steps to import your images.

1. Go to **File** > **New** > **Video Editing**
2. In the **Sequencer** area, hold down **Shift A** and add **Image/Sequence**
3. Locate your sequence rendered images the and then **select the first image** and hold down **Ctrl Shift** and select your **last image**. With your highlighted images go to **Add Image Strip** on the top right corner. You will now see your individual rendered images compile into one timeline.

Assessment 1

Your Interests + choose video clip

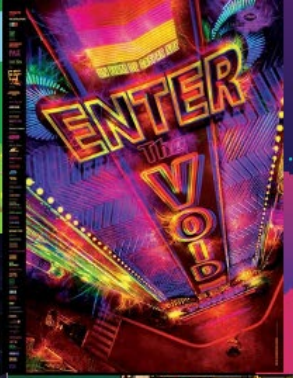
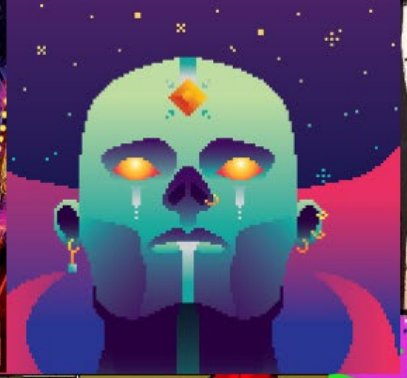
Mood Board and Chosen Video Clip

- **Mood Board of your interests:** Show me what your interests are, especially related to types of action / movement
- **Choose a video clip:** a short (40-60 second) video clip of some sort of body motion or action that you will recreate as an animation
- Mood board as PDF, video as an mp4. Include your name
- Present on Wednesday

Flume Chet Faker Drop the Game Official Music Video


BRAD PITT
MORGAN FREEMAN
Seven
GREMLINS
CRUISE
KIDMAN
KUBRICK
EYES WIDE SHUT
DAWN OF THE PLANET OF THE APES
PULP FICTION
THE STAR WARS SAGA CONTINUES
THE EMPIRE STRIKES BACK
MARK HAMILL · HARRISON FORD · CARRIE FISHER
BILLY DEE WILLIAMS · ANTHONY DANIELS
KENNY BAKER · PETER MAYHEW · DAVID PROWSE
IRVIN KERSHNER · GARY KURTZ
LEIGH BRACKETT · LAWRENCE KASDAN · GEORGE LUCAS
JOHN WILLIAMS
THE LORD OF THE RINGS
THE TWO TOWERS
GHOSTBUSTERS
ARMAGEDDON
BATTLE ROYALE
BR
THE DARK KNIGHT
SEAN CONNERY
F. MURRAY ABRAHAM
THE NAME OF THE ROSE
FIGHT CLUB
BRAD PITT EDWARD NORTON
A DAVID FINCHER FILM
MISCHIEF. MAYHEM. SOAP
THE GIRL WITH THE DRAGON TATTOO
THE SHAWSHANK REDEMPTION
THE USUAL SUSPECTS
STARSHIP TROOPERS
BATTLE ROYALE
snatch
BASIC INSTINCT
THE SILENCE OF THE LAMBS
THE FACULTY
THE GOONIES
THE ENGLISH PATIENT
CHARLTON HESTON · RODDY McDOWALL
PLANET OF THE APES
HITCHCOCK'S PSYCHO
ALIENS
E.T.
THE EXTRA-TERRESTRIAL
EX_MACHINA
A NIGHTMARE ON ELM STREET
HARRISON FORD
BLADE RUNNER
BACK TO THE FUTURE
WIDESCREEN COLLECTION
BIG FISH
BRING HIM HOME
THE MARTIAN
DAVID ARQUETTE · NEVE CAMPBELL · COURTENEY COX
SKEET ULRICH AND DREW BARRYMORE
SCREAM
GOOD BAD UGLY
AMERICAN BEAUTY
SCHWARZENEGGER
TERMINATOR 2 JUDGEMENT DAY
LE GRAND BLEU
LIFE IS A CONTACT SPORT.
AL PACINO · CAMERON DIAZ
DENNIS QUAID · JAMES WOODS
ANY GIVEN SUNDAY
TOM CRUISE
VANILLA SKY
LoveHateDreamsLifeWorkPlayFriendshipSex
AUDREY TAUTOU
MATHIEU KASSOVITZ
Le Fabuleux Destin d'Amélie Poulain
CONNERY · CAGE · HARRIS
THE ROCK
INCEPTION
THE ROAD WARRIOR
Frank CAPRA
IT'S A WONDERFUL LIFE
James STEWART
Donna REED
BENJAMIN BUTTON
METROPOLIS
THE SHINING
THE DEPARTED
MATRIX
ARMY of DARKNESS
Frank DARABONT
THE MIST


MENDL'S



ENTER
th
VOID










INCOHERENT
NONSENSE