CSC2521: Topics in CG:
3D Facial Modeling and Animation

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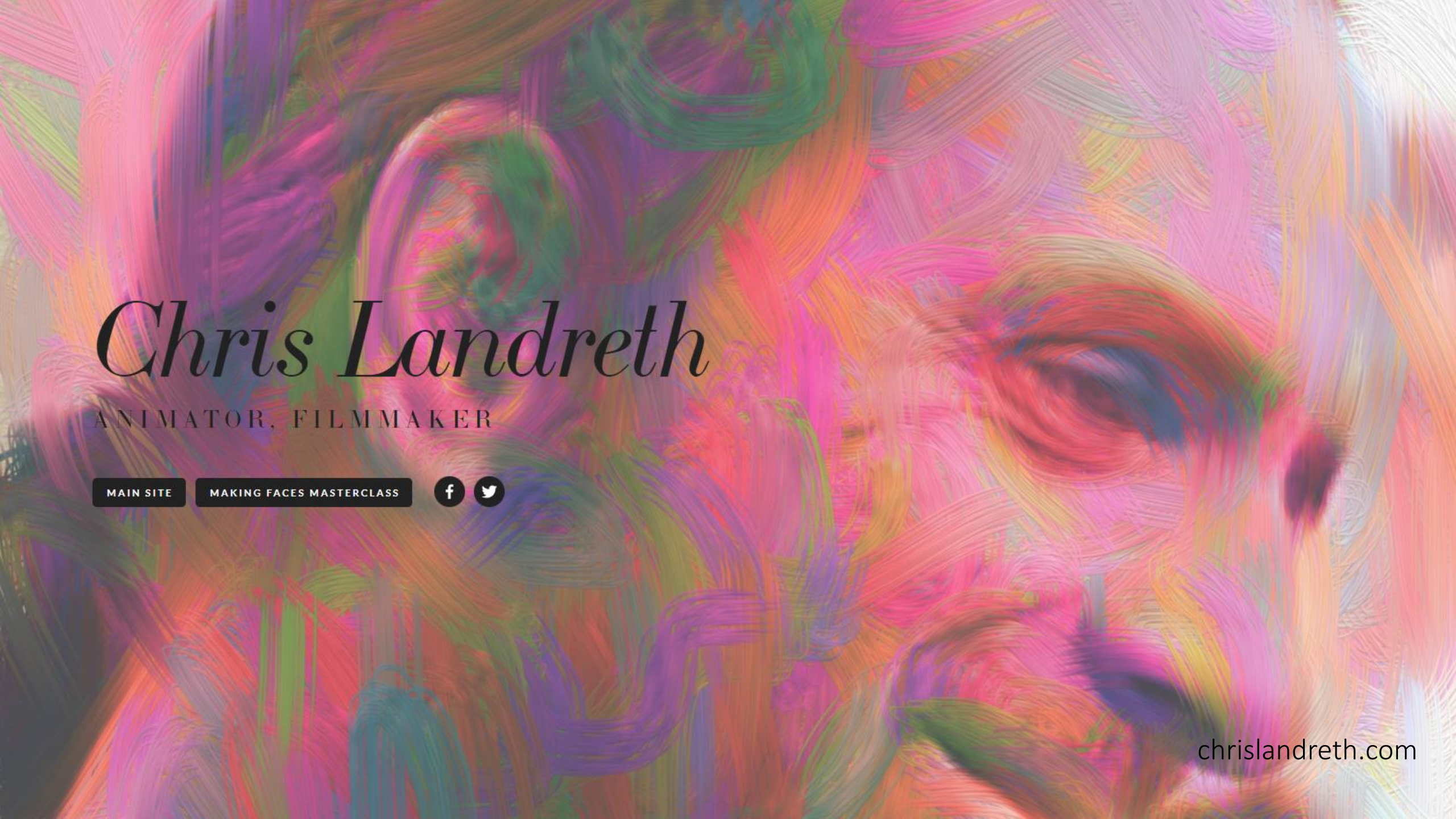

Chris Landreth
ANIMATOR. FILMMAKER
MAIN SITE
MAKING FACES MASTERCLASS
chrislandreth.com

State of the Art (Film) *Avatar: the way of water*

State of the Art (Games) *Call of Duty 2: Modern Warfare*

What is this course about?

- Learn anatomy, modeling, rigging, and interactive animation of 3D faces.
- Read, understand, present and critique state of the art facial research papers.
- Model and animate expressive 3D faces using existing software and rigs: Metahuman, Maya, JALI.
- Build technical prototypes to enable creative applications in facial animation.

Evaluation:

- Creative experiment/prototype 30%.
- Technical Paper presentation 30%.
- Project 40% (mid-term evaluation 10%).

T ACQUISITION

REPRESENTATION I

A A D

N T SPEECH

S O N

F COMMUNICATION

E O Y I

R N EMOTION

T Y

APPEARANCE

O

L

Identity

Are animated digital faces and characters, fingerprints of the future?

Identity

Which of these faces is Keanu Reeves?

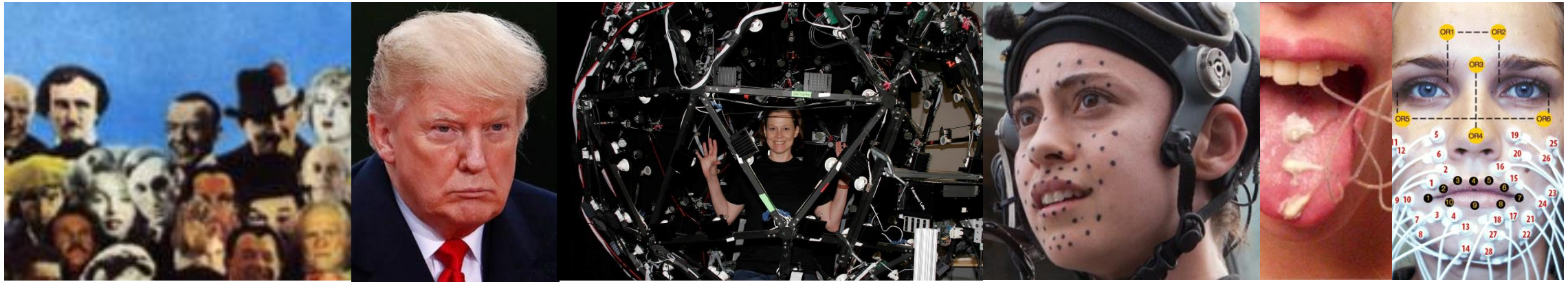
Identity

Who are all these people?

Are deep fakes, simply modern day forgeries?

Acquisition

face-in-the-crowd selfie video 3D-scan vocap|mocap CT|MRI|EMG...



Representation

2D|3D textures anatomy FACS++ landmarks poses|dynamics…

Robert Deniro in **Cape Fear**, 1991

Image Credit: Chris Landreth

AU 20

Action: Grimace
Muscle: Risorius/Platysma
Signature: Stretched lower lip

Control

real-time| offline hand-animated procedural vocap|mocap AI...

What is research in facial animation about?

- **Representation** (FACS, muscles, strains, manifolds…).
- **Transfer/Re-targeting** (latent spaces, landmarks…).
- **Acquisition/Modeling** (selfies, scans, sketches, morphable models...).
- **Rigging** (deformers, simulation, performance-data…).
- **Animation** (keyframing, keyposing, video, audio…).
- **Behaviour** (emotion, speech, song, gestures, cognition, sentience…).
- **Appearance** (skin, wrinkles, eyes, hair…).
- **Interactive Control** (audio, video, controllers, UI…).

CHALLENGE:

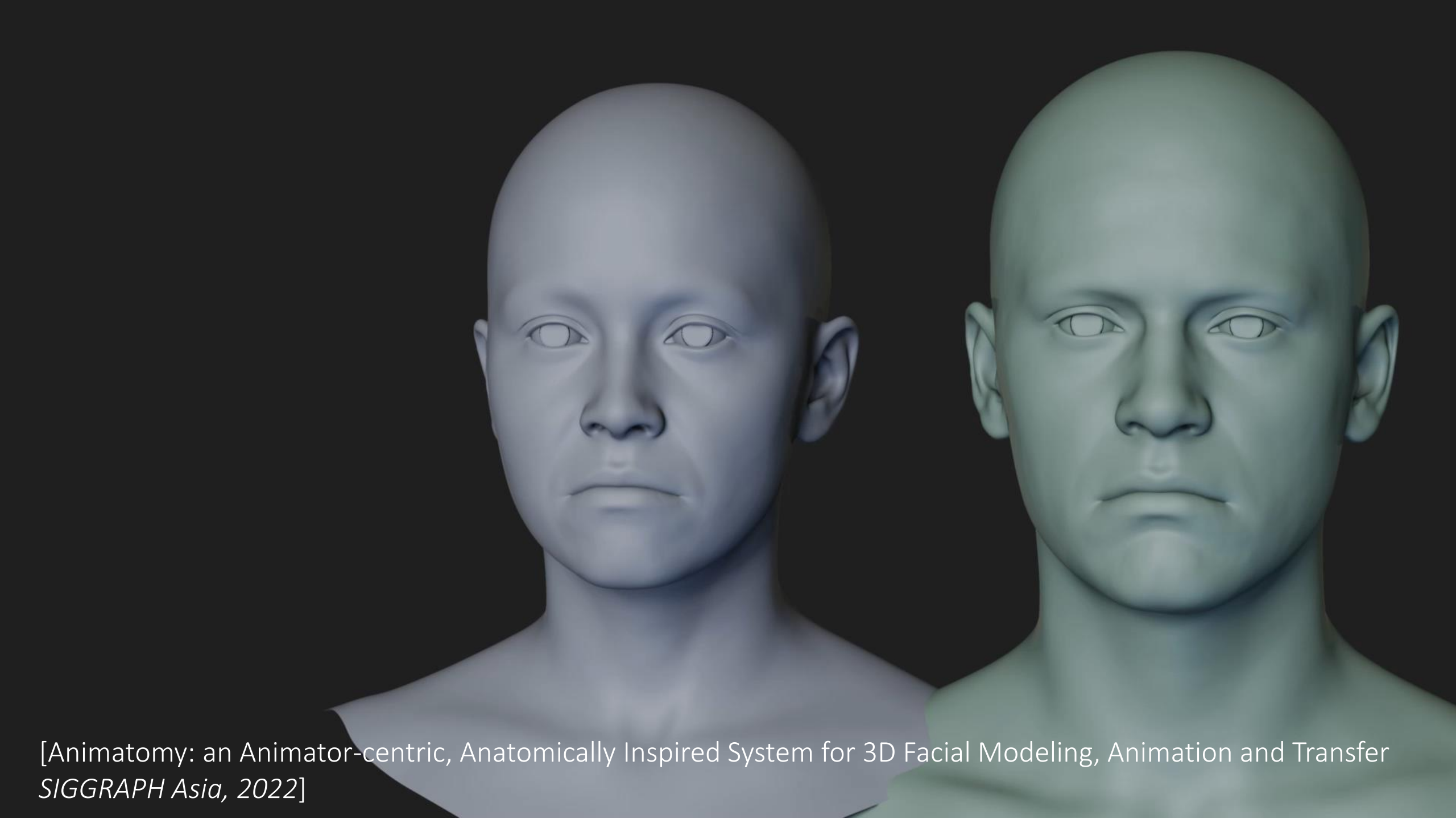
Face representations are **HIGH** dimensional!

Auto-computed lower dimensional latent spaces have no animator intuition.

Animator-centric representations are still high dimensional and highly redundant.

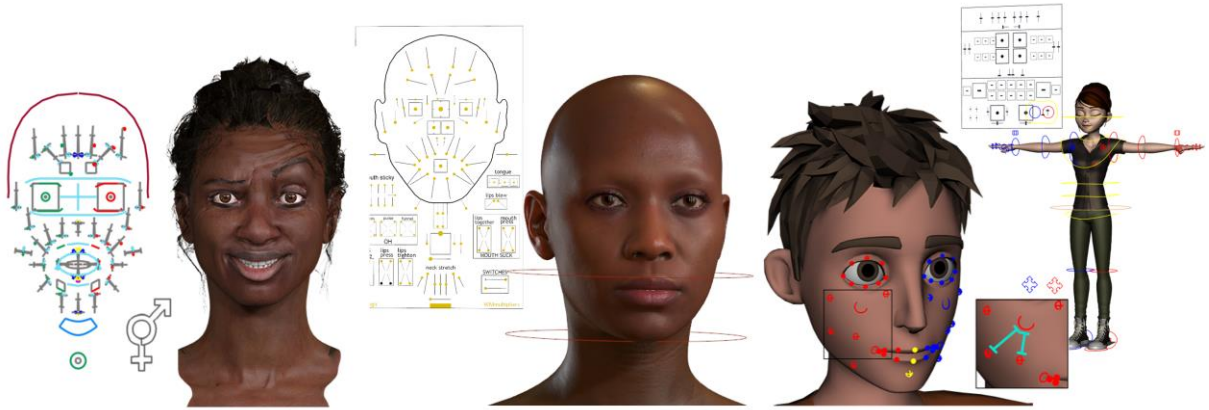
=> seek animator-centric latent spaces to control with low dimensions and redundancy.

Research Examples…

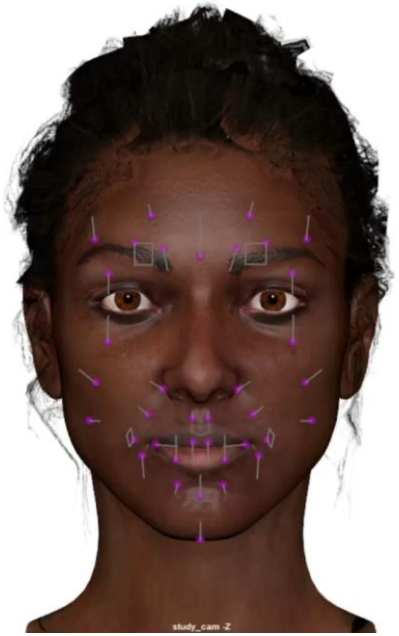


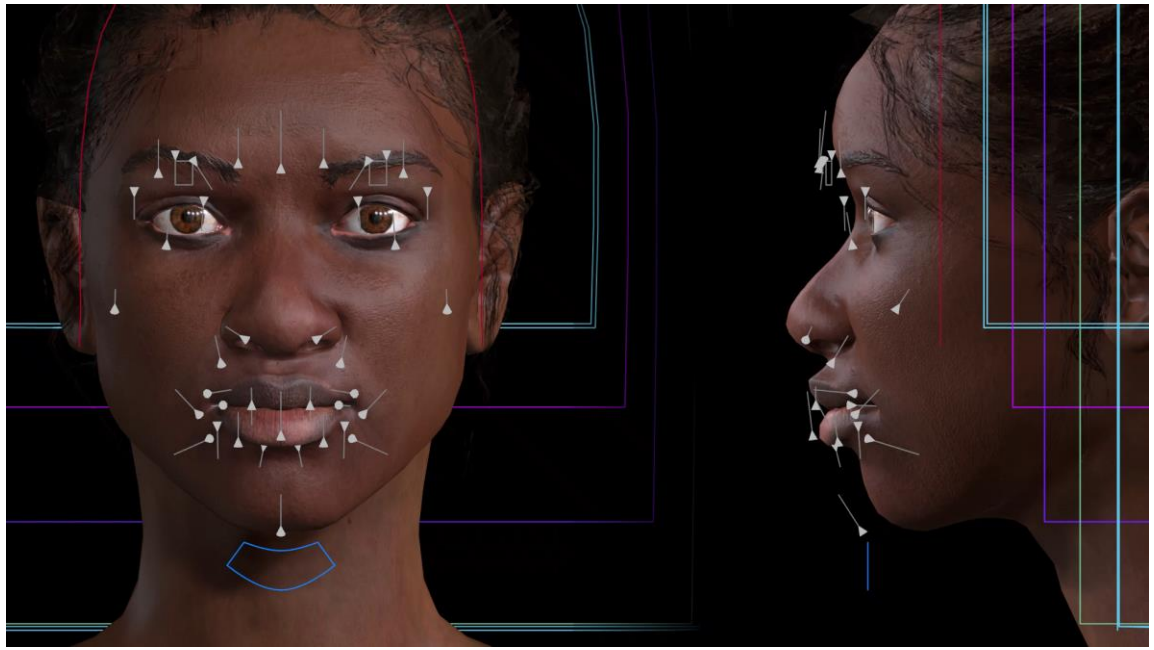
[Animatomy: an Animator-centric, Anatomically Inspired System for 3D Facial Modeling, Animation and Transfer *SIGGRAPH Asia, 2022*]

Interactive Face Control



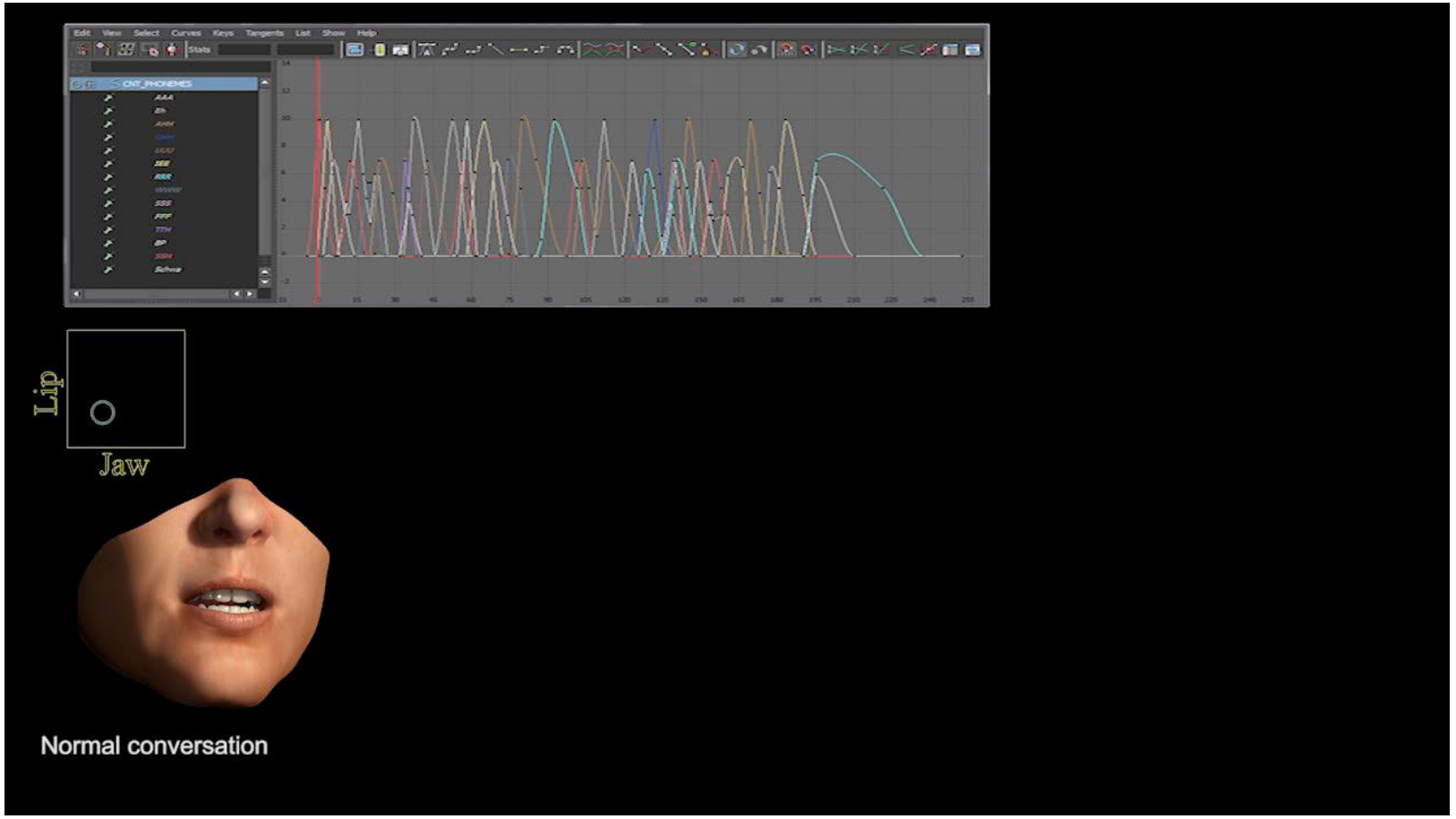
Dakar Valley Girl ©Chris Landreth, Metahuman ©Epic Games, Inc., Ray Character Rig by CGTarian ©UAB MOCAP.LT.



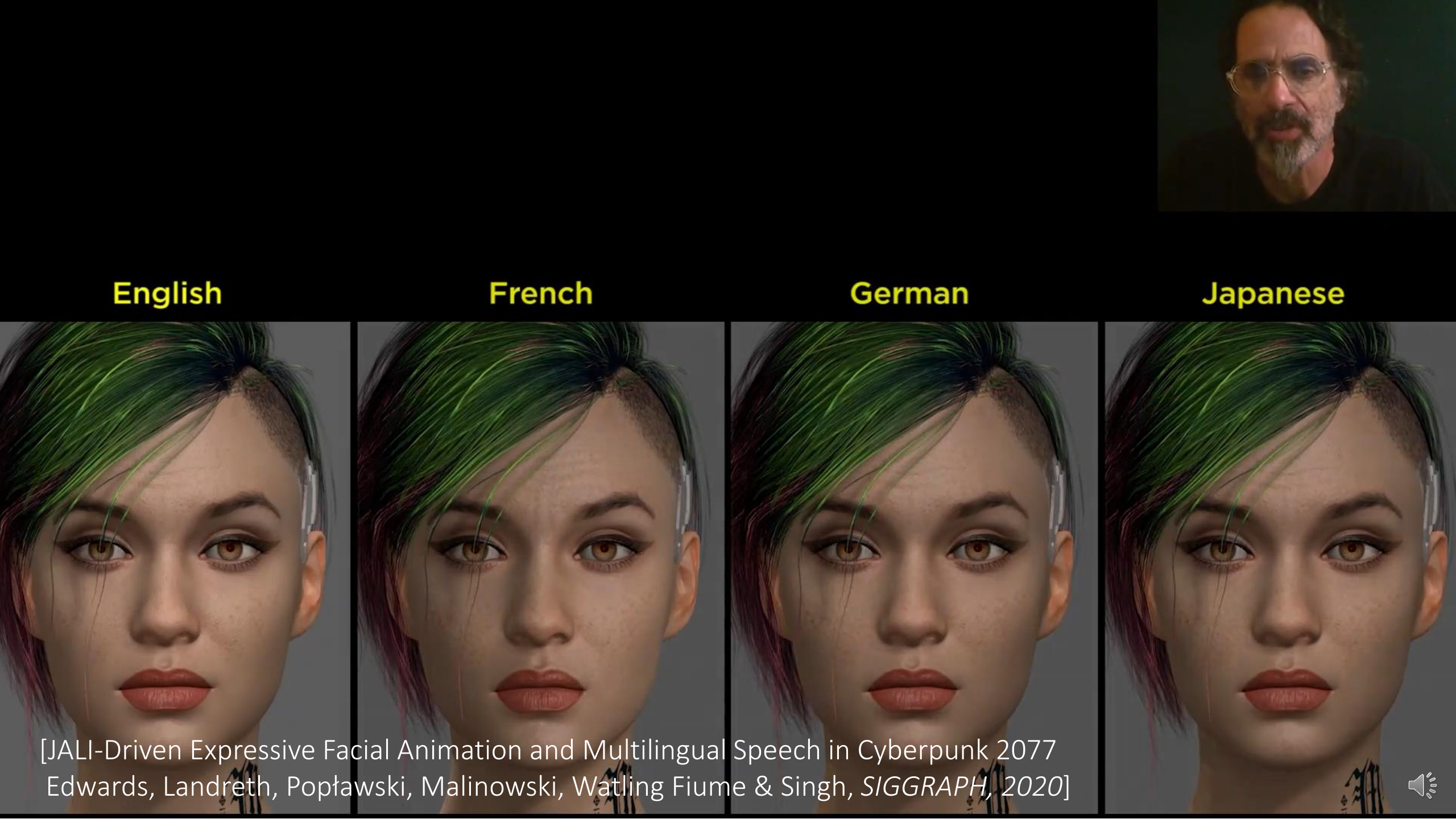


[Optimizing UI Layouts for Deformable Face-Rig Manipulation. Kim & Singh, *ACM SIGGRAPH, 2021*]

JALI: Speech Styles



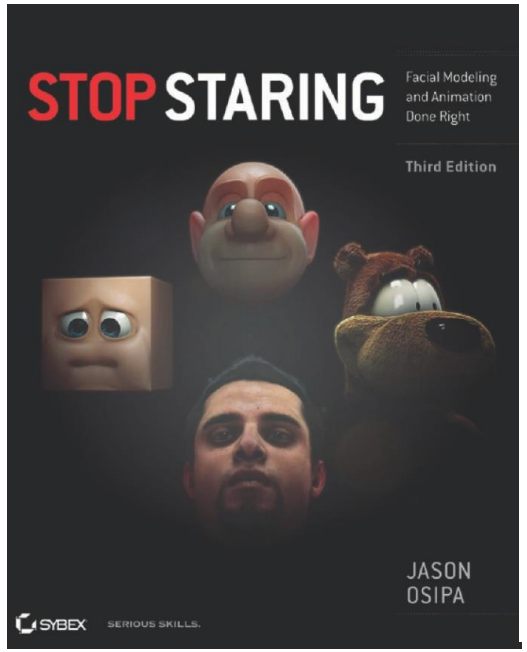
[JALI: An Animator-Centric Viseme Model for Expressive Lip-Synchronization, Edwards, Landreth, Fiume & Singh, *SIGGRAPH, 2016*]

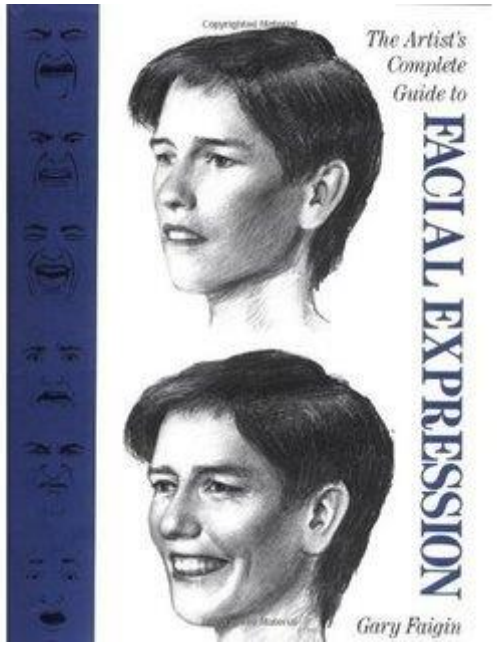


[JALI-Driven Expressive Facial Animation and Multilingual Speech in Cyberpunk 2077
Edwards, Landreth, Popławski, Malinowski, Watling Fiume & Singh, *SIGGRAPH, 2020*]

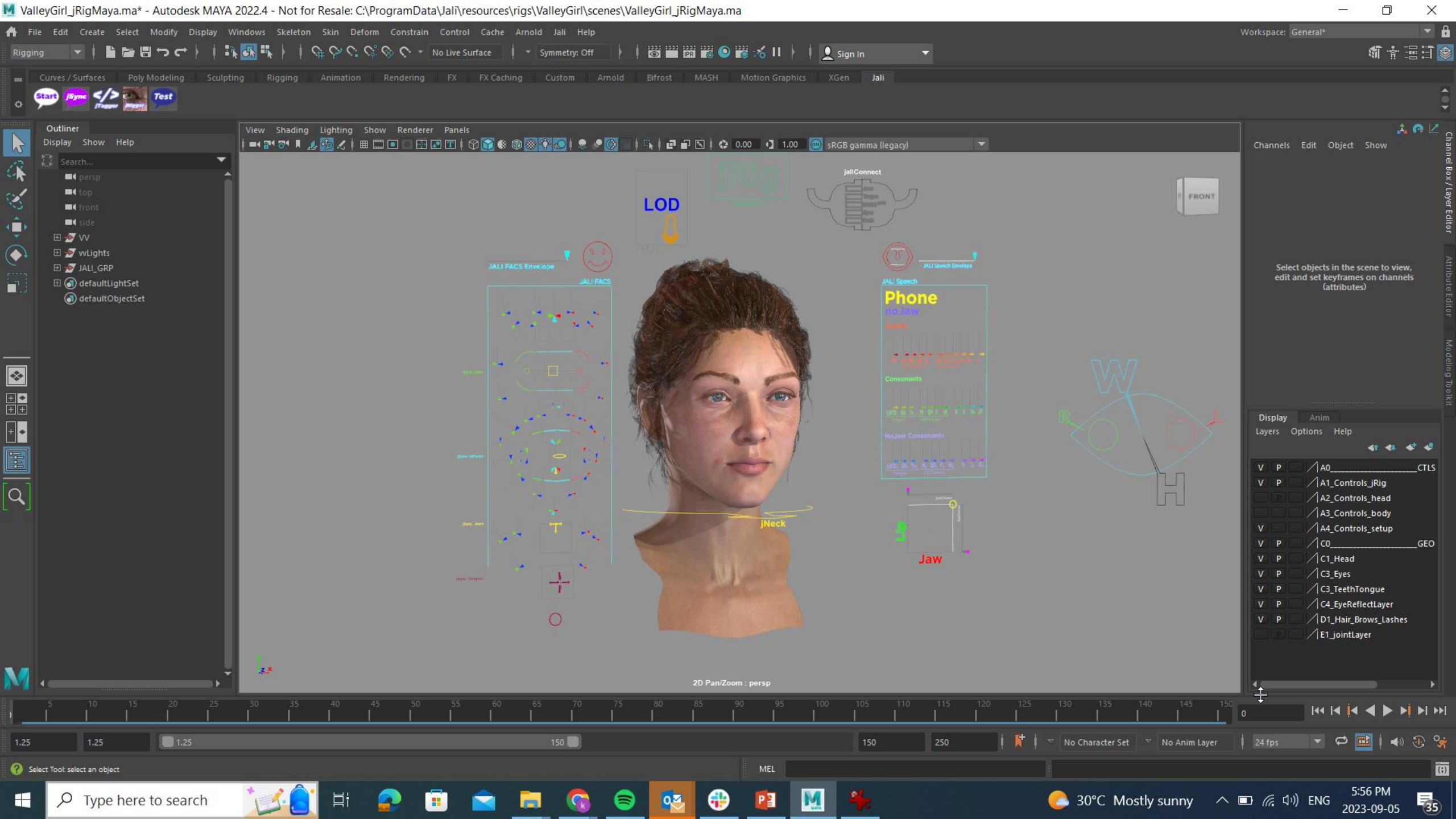
[VOCAL: Vowel and Consonant Layering for Expressive Animator-Centric Singing Animation, *SIGGRAPH Asia, 2022*]

Resources





- Autodesk Maya (https://www.autodesk.com/products/maya/)
- Metahuman (https://www.unrealengine.com/en-US/metahuman)
- JALI (https://jaliresearch.com/)
- Quercus (for various scene files, slides, and other material https://q.utoronto.ca/courses/328713)


ValleyGirl_jRigMaya.ma* - Autodesk MAYA 2022.4 - Not for Resale: C:\ProgramData\Jali\resources\rigs\ValleyGirl\scenes\ValleyGirl_jRigMaya.ma
File Edit Create Select Modify Display Windows Skeleton Skin Deform Constrain Control Cache Arnold Jali Help
Workspace: General*
Rigging
No Live Surface
Symmetry: Off
Sign In
Curves / Surfaces Poly Modeling Sculpting Rigging Animation Rendering FX FX Caching Custom Arnold Bifrost MASH Motion Graphics XGen Jali
Start jSync jTagger jPlayer Test
Outliner
Display Show Help
Search...
persp
top
front
side
VV
vvLights
JALI_GRP
defaultLightSet
defaultObjectSet
View Shading Lighting Show Renderer Panels
sRGB gamma (legacy)
LOD
jaliConnect
FRONT
JALI FACS Envelope
JALI FACS
JALI Speech Envelope
JALI Speech
Phone
noJaw
Consonants
NoJaw Consonants
jNeck
Lip
Jaw
W
R
L
H
Channels Edit Object Show
Select objects in the scene to view, edit and set keyframes on channels (attributes)
Display Anim
Layers Options Help
A0_____CTLS
A1_Controls_jRig
A2_Controls_head
A3_Controls_body
A4_Controls_setup
C0_____GEO
C1_Head
C3_Eyes
C3_TeethTongue
C4_EyeReflectLayer
D1_Hair_Brows_Lashes
E1_jointLayer
2D Pan/Zoom : persp
No Character Set
No Anim Layer
24 fps
Select Tool: select an object
MEL
Type here to search
30°C Mostly sunny
ENG
5:56 PM
2023-09-05

Maya Demo

- Alien Hand
  - Make a Cube > Node+Attributes > Show DAG / DG
  - Camera control
  - Extrude + Subdiv Modeling
  - Skeleton
  - Skinning
- Blob
  - Cages
  - Wires
  - BlendShapes
- Scripting/API
- Valley Girl

Next Lecture >

- Making Faces (part 1) : Landreth
  - Anatomy and Drawing Faces
  - FACS