THE STATE OF ANIMATION IN GAMES

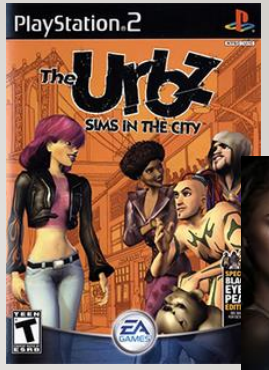
SCAD: INTERVIEW PRESENTATION V3

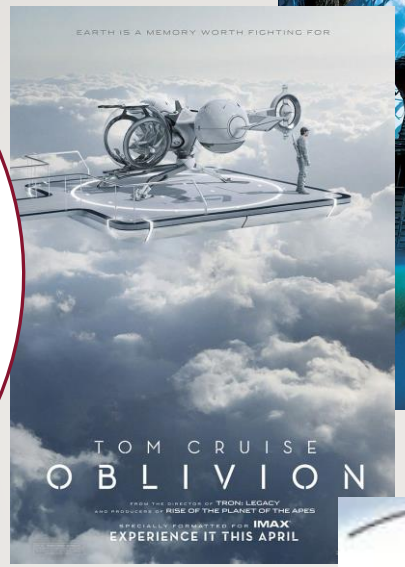
NYE WARBURTON

07/02/20

HELLO!
MY NAME IS

NYE!





>GIT CLONE HTTP://GITHUB.COM/NYEGUY/STATEANIMATIONGAMES

PRESENTATION

RIGS / ANIMATION

LINKS AND REFERENCE BY SLIDE

POWERPOINT3

AUTODESK MAYA 2019

UNREAL ENGINE 4.24

OPEN BROADCAST SOFTWARE 25.0.04

THE STATE OF ANIMATION IN GAMES

REAL TIME

ANIMATION DATA (AVATARS)

CINEMATICS

(SAND BOX AND CUT SCENES)

NEURAL NETWORKS

("THEY'RE HERE.")

ANIMATION NARRATIVE

ANIMATION DATA

AVATAR

CHARACTER MESH

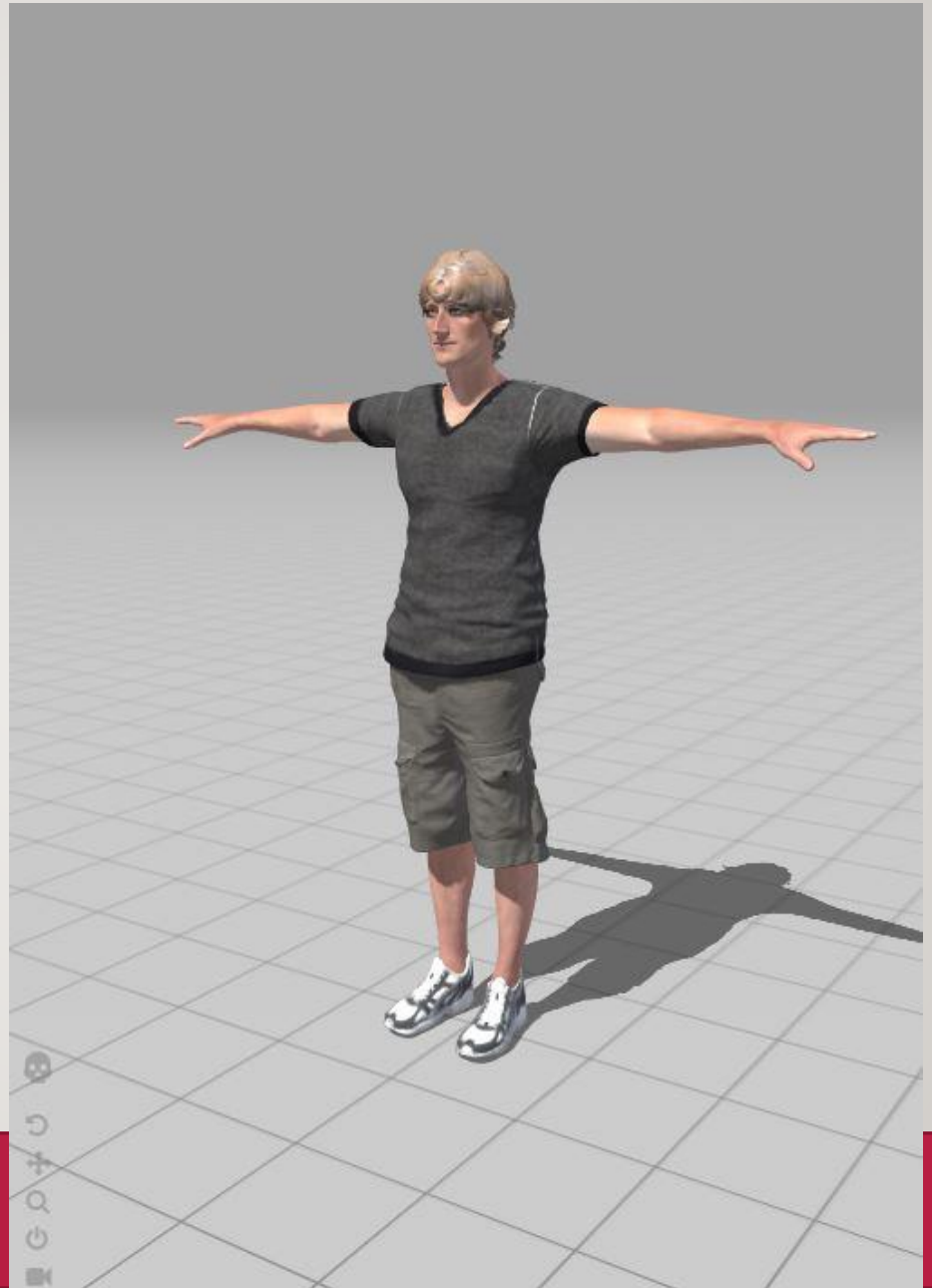
CHARACTER RIG

CHARACTER CONTROL

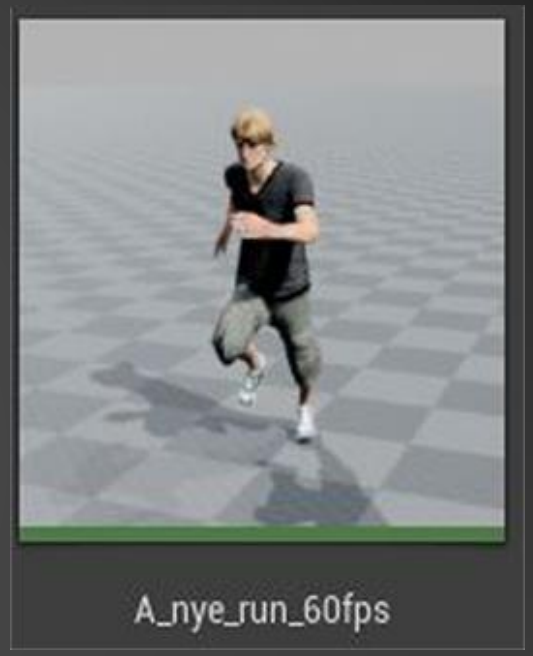
CARTESIAN COORDINATE SYSTEM

X, Y, Z

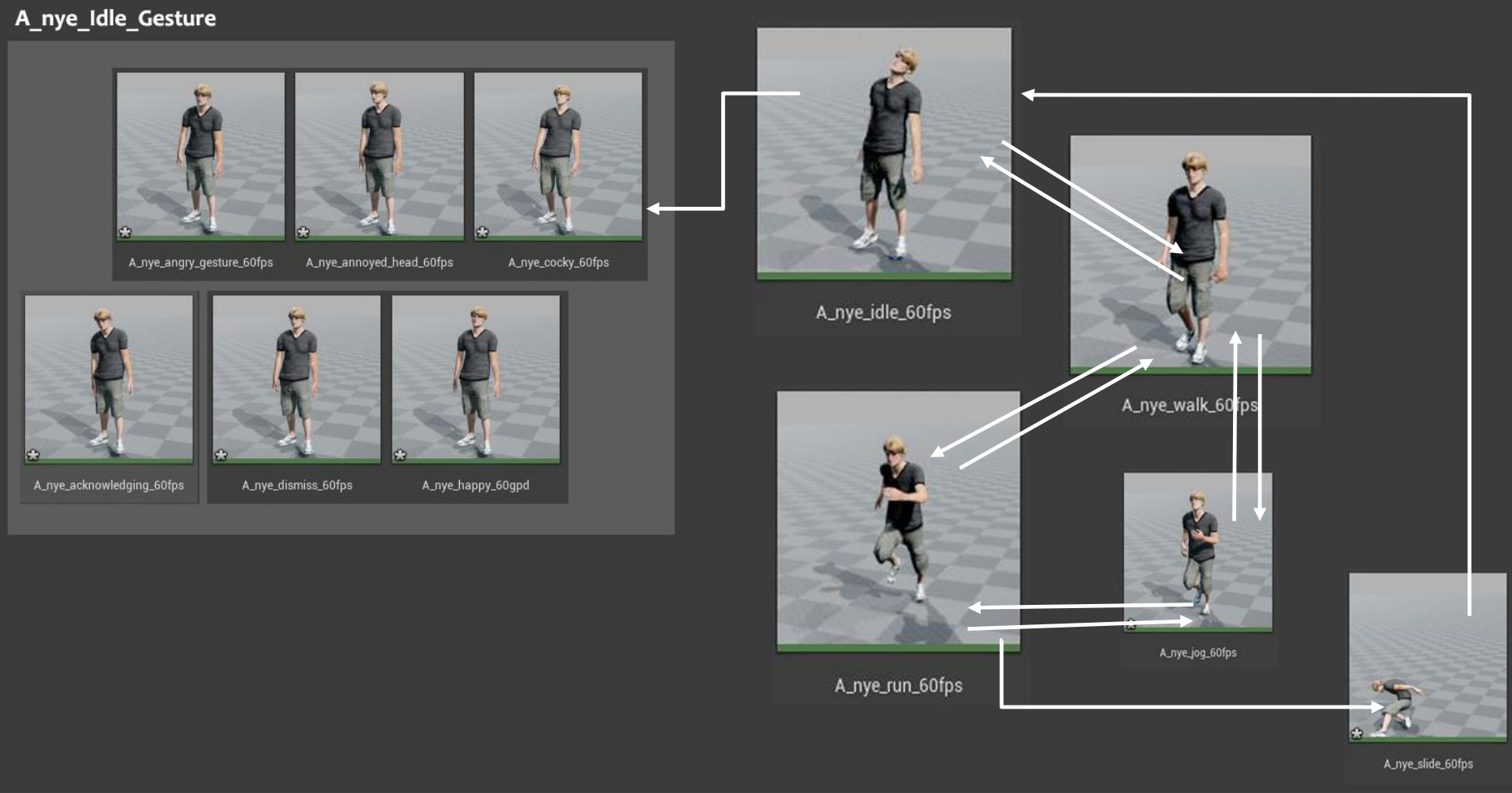
RETARGETING



VELOCITY



STATE MACHINE



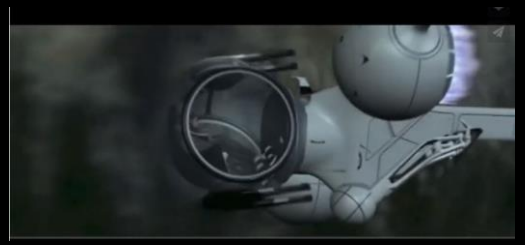
SANDBOX

JUST DO IT!

BREAK IT!

TRY IT!

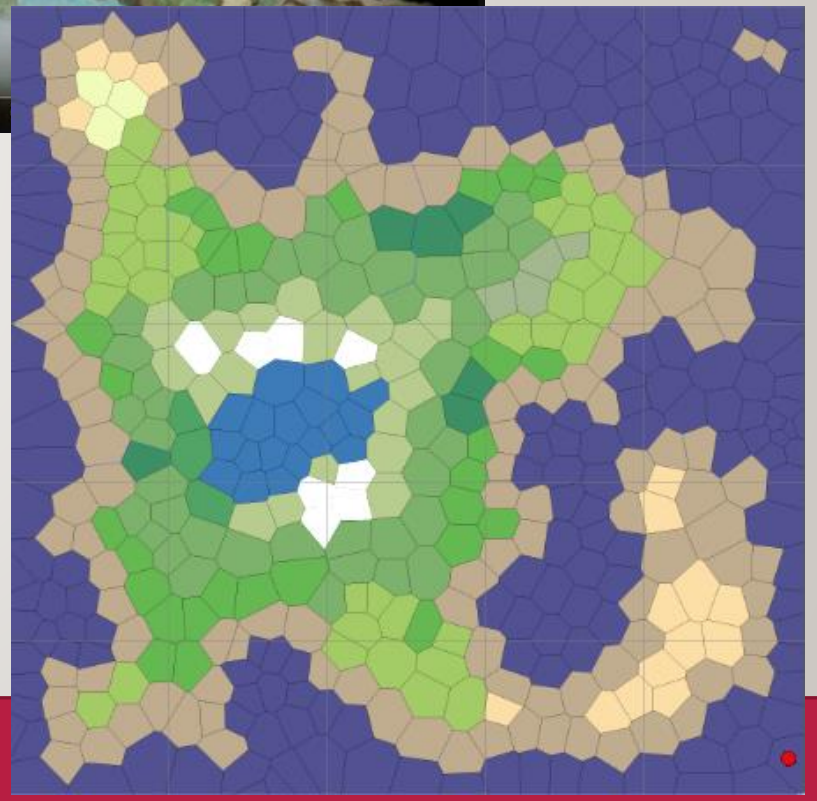
NO FEAR!



CINEMATICS

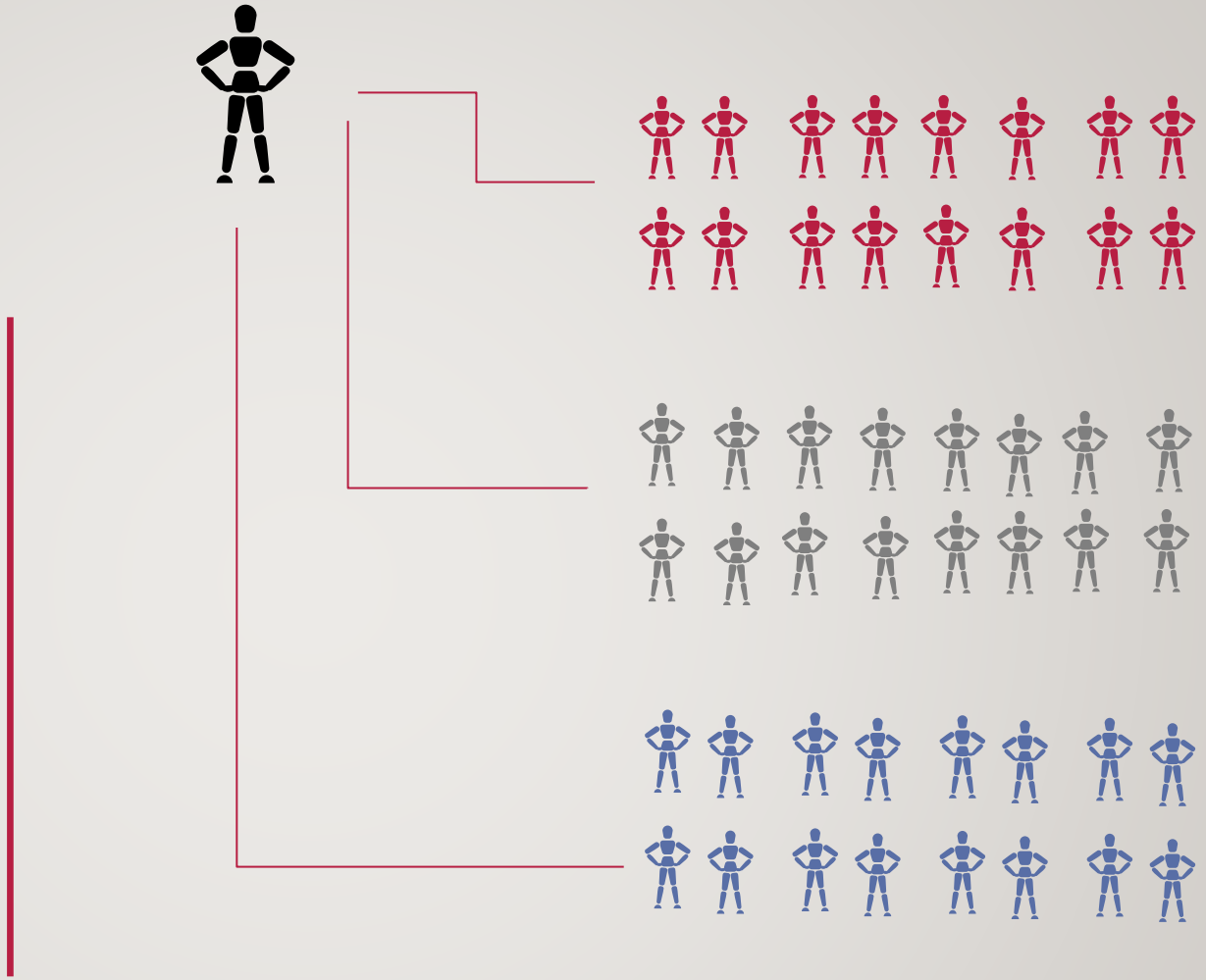
PERSISTENT WORLD?

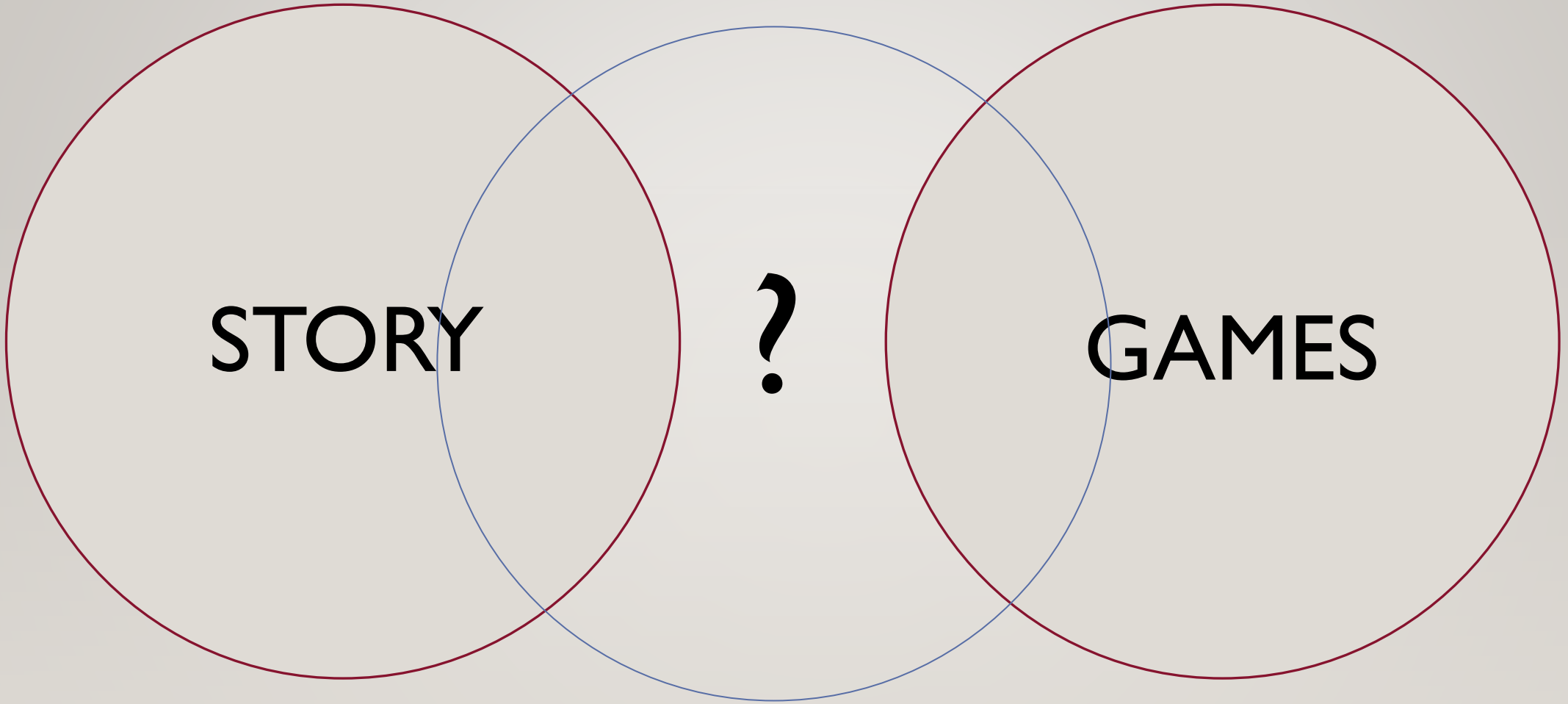
NARRATIVE SYSTEMS



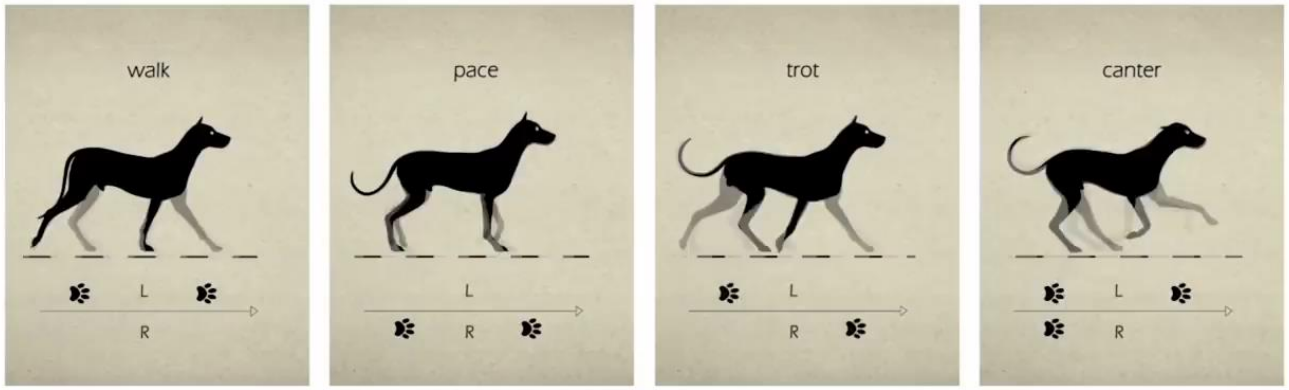
ANIMATION SYSTEMS

(RUNNING, COMBAT, ACTING, FLYING, DANCING, POKER PLAYING?)




STORY
?
GAMES

Quadruped Locomotion Patterns



Courtesy of Stephen Cunnane

Mode-Adaptive Neural Networks for Quadruped Motion Control

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SEBASTIAN STARKE†, University of Edinburgh
TAKU KOMURA, University of Edinburgh
JUN SAITO, Adobe Research

Fig. 1. A selection of results using our method for quadruped animation. We show some different modes for sitting, turning trot, pace, canter, jumping and standing from left to right. The locomotion gaits are not labeled individually, but naturally produced by the movement velocity control.

Quadruped motion includes a wide variation of gaits such as walk, pace, trot and canter, and actions such as jumping, sitting, turning and idling. Applying existing data-driven character control frameworks to such data requires a significant amount of data preprocessing such as motion labeling and alignment. In this paper, we propose a novel neural network architecture called Mode-Adaptive Neural Networks for controlling quadruped characters. The system is composed of the motion prediction network and the gating network. At each frame, the motion prediction network computes the character state in the current frame given the state in the previous frame and the user-provided control signals. The gating network dynamically updates the weights of the motion prediction network by selecting and blending what we call the expert weights, each of which specializes in a particular movement. Due to the increased flexibility, the system can learn consistent expert weights across a wide range of non-periodic/periodic actions, from unstructured motion capture data, in an end-to-end fashion. In addition, the users are released from performing complex labeling of phases in different gaits. We show that this architecture is suitable for encoding the multi-modality of quadruped locomotion and synthesizing responsive motion in real-time.

CCS Concepts: • **Computing methodologies** → **Motion capture**; *Neural networks*;

Additional Key Words and Phrases: neural networks, locomotion, human motion, character animation, character control, deep learning

ACM Reference Format:
He Zhang†, Sebastian Starke†, Taku Komura, and Jun Saito. 2018. Mode-Adaptive Neural Networks for Quadruped Motion Control. *ACM Trans. Graph.* 37, 4, Article 145 (August 2018), 11 pages. https://doi.org/10.1145/3197517.3201366

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1 INTRODUCTION

Quadruped animation is one of the unsolved key problems in computer animation. It has particular relevance for applications in computer games and films, and also presents a challenging topic in robotics. When animating quadrupeds, animators must go through special training to design a wide range of complex movements. This complexity is inherently from the multi-modality of quadruped motions. For example, there are a number of locomotion modes [1] including walk, pace, trot, canter, and gallop, where the movements and the phases of the torso and limbs vary in a complex manner (see Fig. 2).

To the best of our knowledge, there is no prior work on systematically constructing quadruped motion controllers in a data-driven fashion. This difficulty stems from the complexity mentioned above, along with the issue that quadruped animals cannot be directed like humans for a controlled data acquisition. As a result, the captured

NEURAL NETWORKS

FIRST ORDER MOTION MODEL

First Order Motion Model for Image Animation

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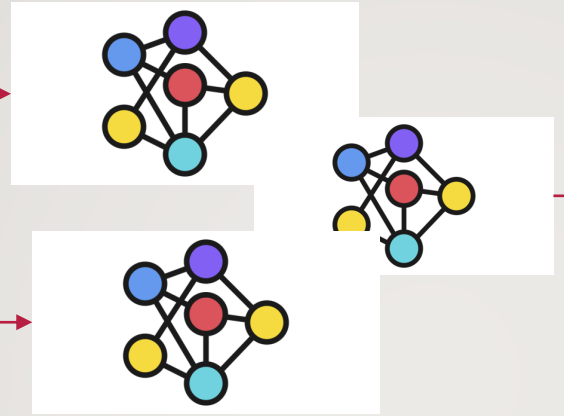
HYPOTHESIS: USABLE STRUCTURE

Input /
- Video
- Drawing
- Vectors
- Anim Data

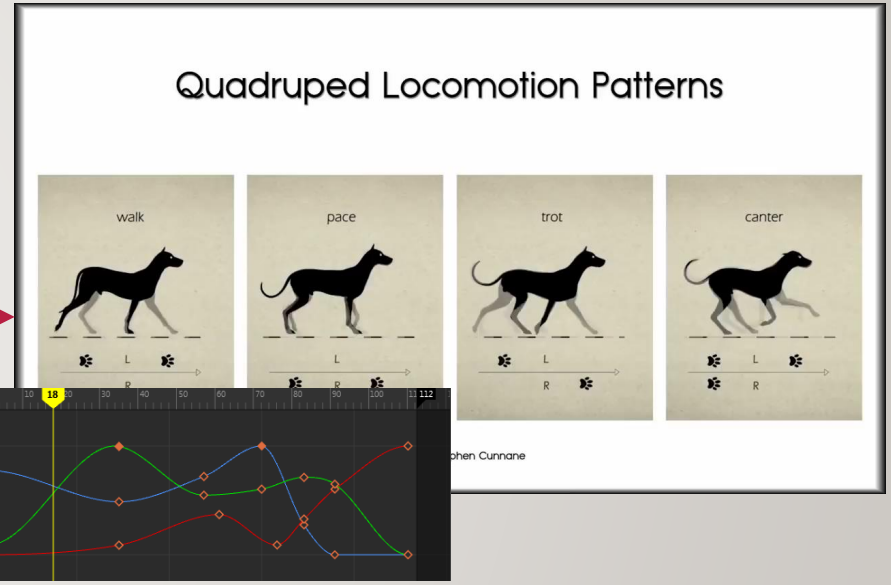
Target /
- Video
- Drawing
- Vectors
- Anim Data



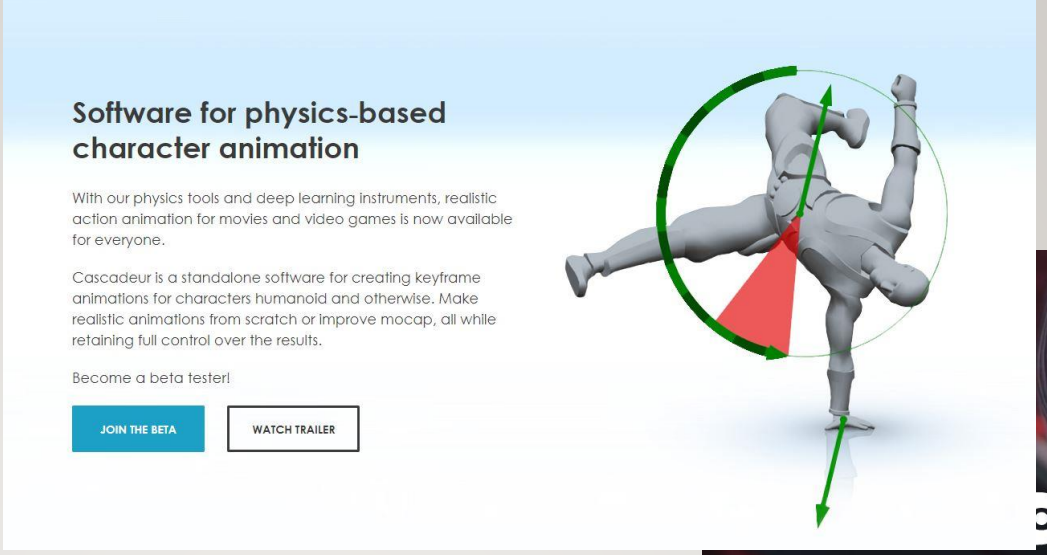
Data set

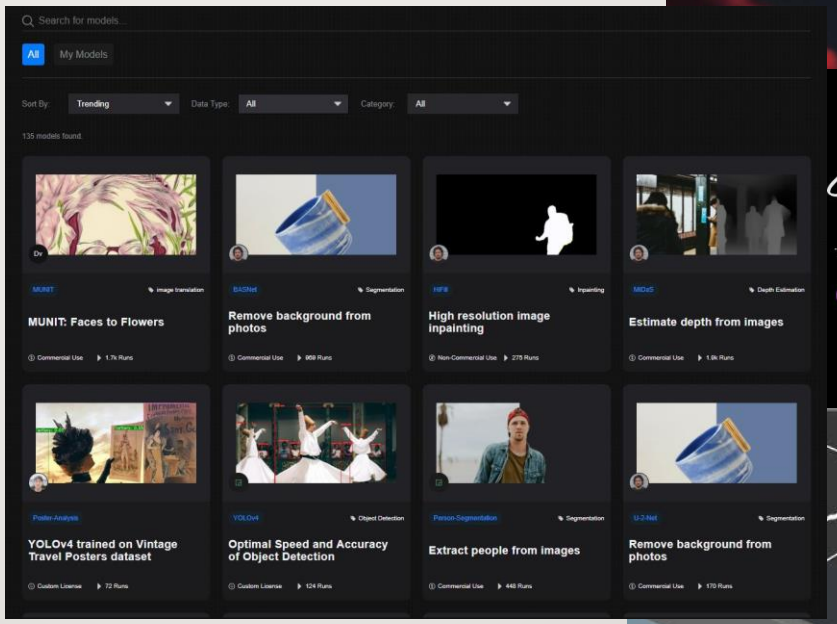
Data set

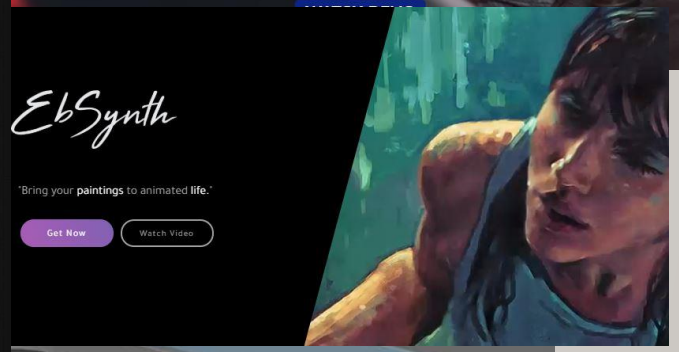
Data set



CASCADEUR
RUNWAY ML
RADICAL AI
DYNAMIXYZ
EB SYNTH
UNITY
– ML AGENTS







THE STATE OF ANIMATION IN GAMES

REAL TIME

ANIMATION DATA (AVATARS)

CINEMATICS (SAND BOX-PERSISTENT WORLDS)

NEURAL NETWORKS

NYE'S READING LIST

(EVERYONE CARRIES A SKETCHBOOK)

ANIMATION

- *"THE ANIMATOR'S SURVIVAL KIT"*, WILLIAMS
- *"ILLUSION OF LIFE"*, THOMAS & JOHNSON

FILM

- *"FILM DIRECTING SHOT BY SHOT"*, KATZ
- *"HERO OF 1000 FACES"*, CAMPBELL
- *"STORY"*, MCKEE

GAME DEVELOPMENT

- *"3D MATH PRIMER FOR GRAPHICS AND GAME DEVELOPMENT"*, DUNN & PARBERRY
- *"GAME PROGRAMMING PATTERNS"*, NYSTROM
- *"DESIGNING GAMES"*, SYLVESTER

INTELLECTUAL PROPERTY AND IDEAS

- *"THE MEDIUM IS THE MESSAGE"*, MCLUHAN
- *"THE BLACK SWAN"*, TALIB
- *"POSTCAPITALISM"*, MASON

GREAT IDEAS COMES FROM "INSANE" AMOUNTS OF ITERATION.

-NYE

NOW CONSIDER WHAT INFORMATION TECHNOLOGY HAS DONE TO THE DESIGN PROCESS. THERE ARE AIRCRAFT STILL FLYING THAT WERE DESIGNED ON PAPER, STRESS-TESTED USING SLIDE RULES, CONSTRUCTED FROM FULL-SIZED TEMPLATES DRAWN ON SILK. NEW AIRCRAFT ARE DESIGNED AND TESTED VIRTUALLY, ON A SUPERCOMPUTER.

'WHEN WE DESIGNED THE TAIL FIN OF THE TORNADO FIGHTER WE DID TWELVE STRESS CASES ON IT,' ONE VETERAN ENGINEER TOLD ME. 'WITH ITS REPLACEMENT THE TYPHOON, WE DID 186 MILLION.'

(POSTCAPITALISM, CHAPTER 5, PART 2, PAUL MASON 2015, P. 110)

THE STATE OF ANIMATION IN GAMES

THANK YOU!

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