A collage of Uncharted-themed items including a handheld GPS, a map, a compass, a key, and a skull.

Creating a Character in Uncharted: Drake's Fortune

Christian Gyrling
Naughty Dog

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Who Am I?

- Programmer at Naughty Dog
- Created the enemy characters in Uncharted
- Co-authored the AI.



Talk Overview

- “The Problem”
- Character Animation Architecture
- Additive animations and how we used them
- Adding Variation
- Q & A

A collage of treasure-themed items including a handheld GPS, bullets, a map, a compass, and a key.

THE PROBLEM

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UNCHARTED

NAUGHTY DOG

Last Gen



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UNCHARTED

NAUGHTY DOG



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UNCHARTED

NAUGHTY DOG

BIGGER...



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NAUGHTY DOG

A group of 16 stylized human figures, each with a grey head and torso and white limbs, arranged in a loose cluster. They are positioned over a brown-toned world map background. The word "MORE!!!" is written in large, bold, black letters at the top center of the slide.

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Bottom Line...

- Expecting 10 – 20x of last console generations animation count
- More complex animation blend trees
- 1 programmer and 1 animator for every two characters

Things To Address

- **Game Play - Scope**
 - We can not make EVERYTHING better!
 - What parts should we make better?
- **Asset Creation – Iteration Time**
 - How to create all these animations
- **Programming - Complexity**
 - Organizing Animations
 - AI and Animation – More Complex AI Code?

A collage of adventure-themed items including a handheld GPS, a map, bullets, a compass, and a treasure chest.

GAME PLAY

Scope

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Meet the Enemy

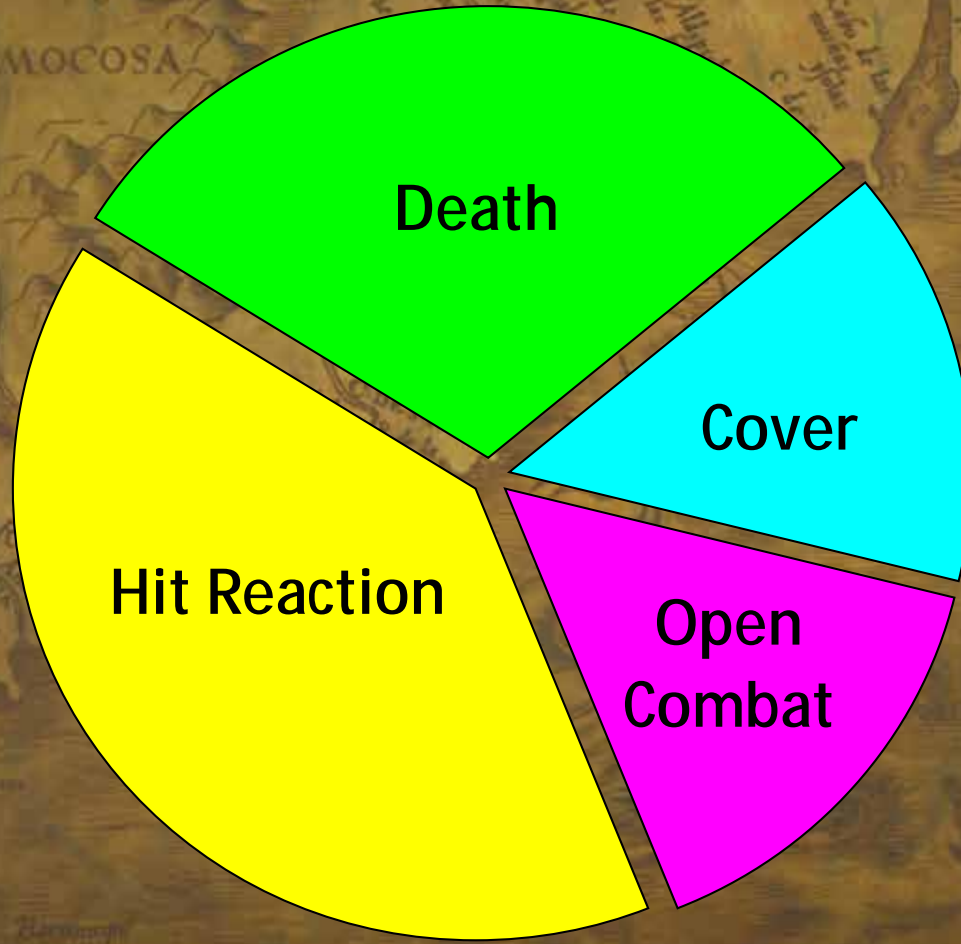


Pirate



Mercenary

What Needs Variation?



A collage of adventure-themed items including a handheld GPS, a map, bullets, a compass, a key, and a skull.

ASSET CREATION

Iteration Time

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Problems

- Lots of animation files
 - Slow to open referenced scenes in Maya
 - Mismatching key-frames
- Verify and polish
 - Play the new animation in-game
 - Tune blends

Solutions

- Fewer files...
 - Related animations in same Maya file
 - Works with only 1 animator per character
 - Key-frames are quickly copied/verified
 - Fewer bugs

Solutions

- See things in-game 'fast'
 - In-Game Character Animation Test Bed
 - Maya to Controlling Npc – ~ 1 minute
 - Fast Animation Asset Creation / Renaming
 - Setup new animation – ~ 1 minute
 - Reloading of Animation Scripts
 - Rebuild and reload scripts – ~ 30 sec

A detailed game scene from Uncharted: Drake's Fortune. The background features a weathered, yellowed map of a coastal region with various landmarks and handwritten notes. Scattered around the map are several brass bullets, a small brass container, a brass compass, and a large, ornate brass key. In the bottom right corner, a small label reads "UNCHARTED Drake's Fortune".

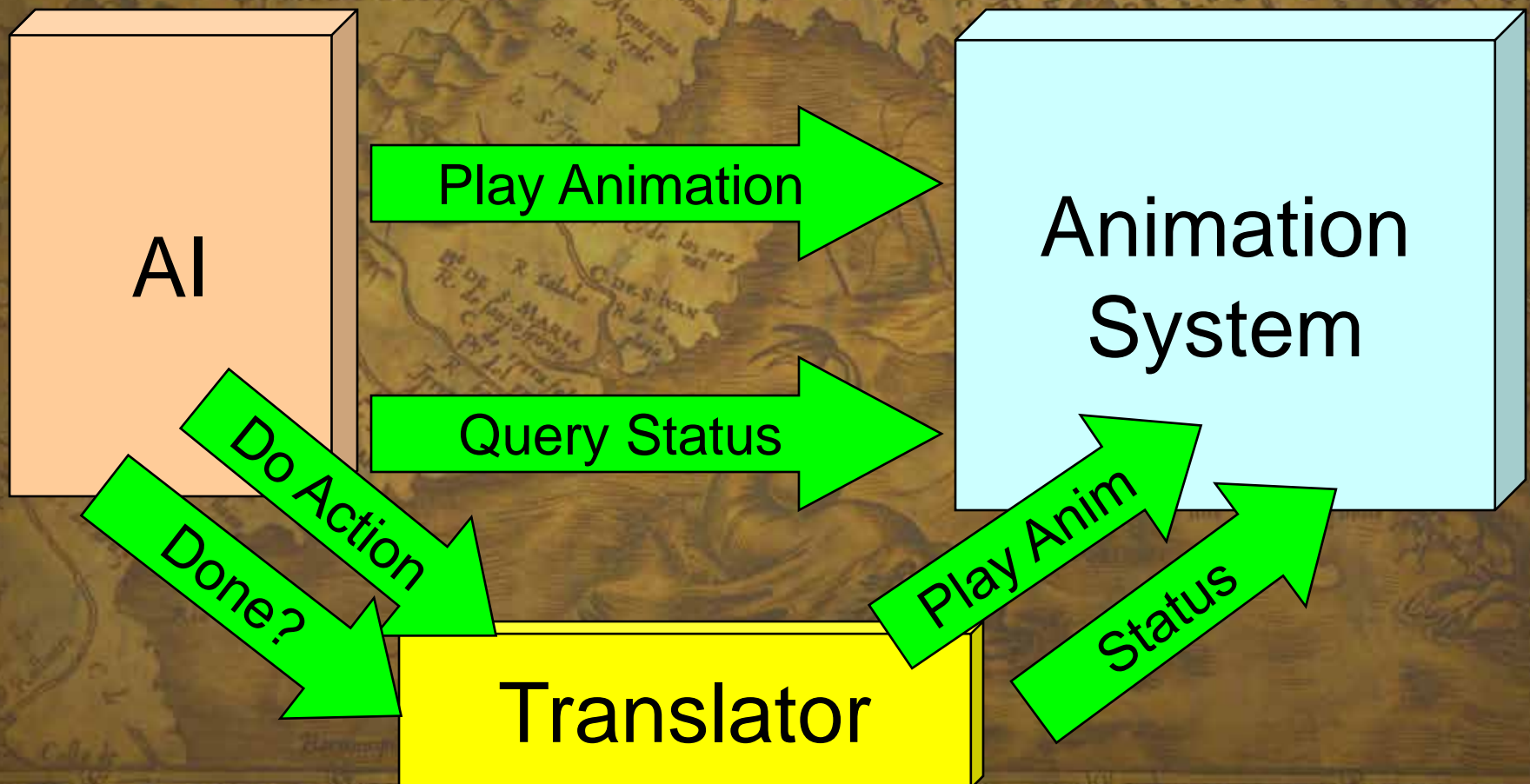
AI & ANIMATION

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Needed AI Functionality

- Basic
 - Request Animation
 - Wait For Animation
 - Status - Playing any animations?
- Special
 - Play animations relative to objects in the world (action pack animations)

The Animation Interface

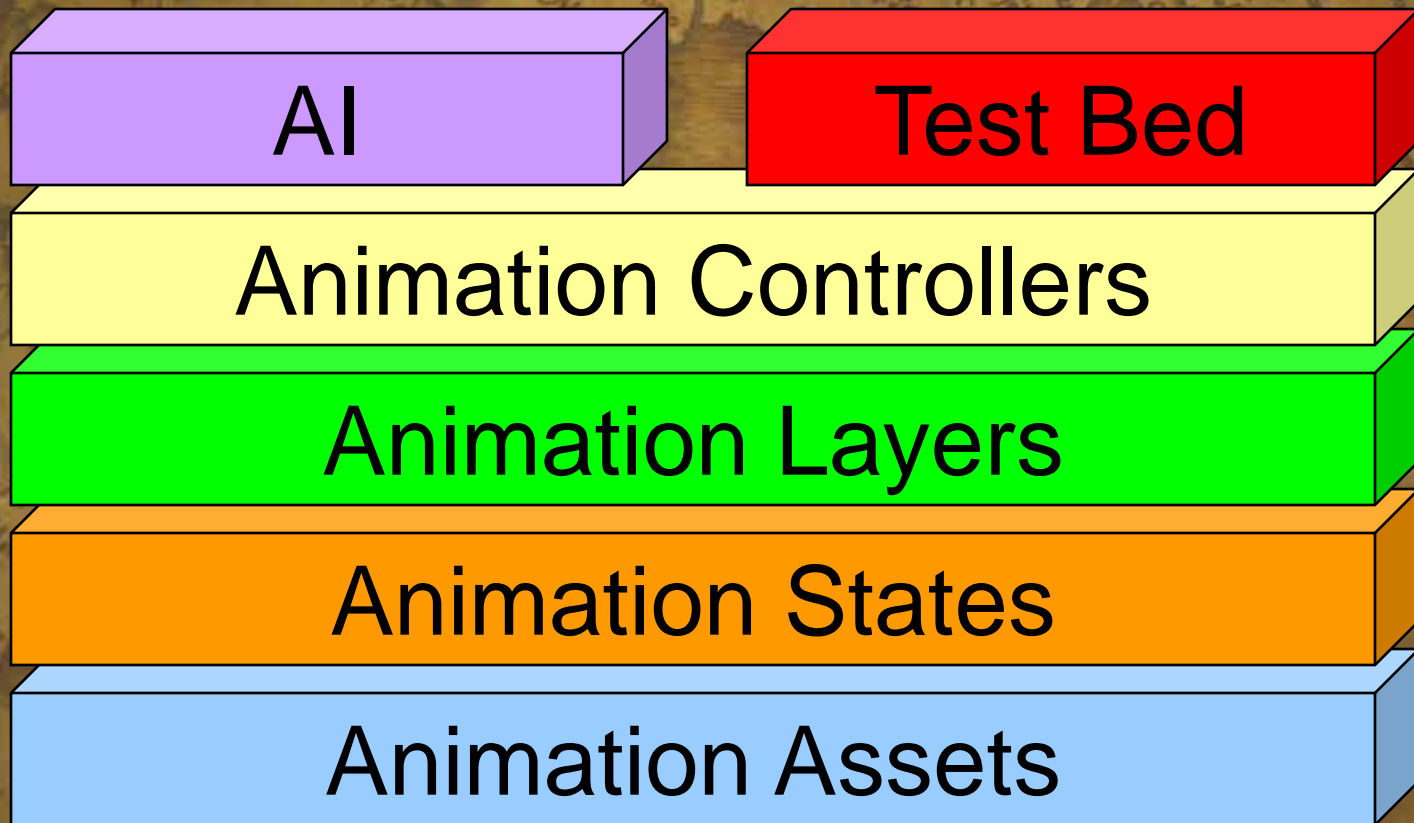


A collage of adventure-themed items including a handheld GPS, a map, a compass, a key, and a book titled 'UNCHARTED'. The background is a dark, textured surface with various objects scattered across it. The title 'Character Animation Architecture' is prominently displayed in the center in a large, white, bold font.

Character Animation Architecture

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Character Animation Architecture



Animation Assets

AI

Test Bed

Animation Controllers

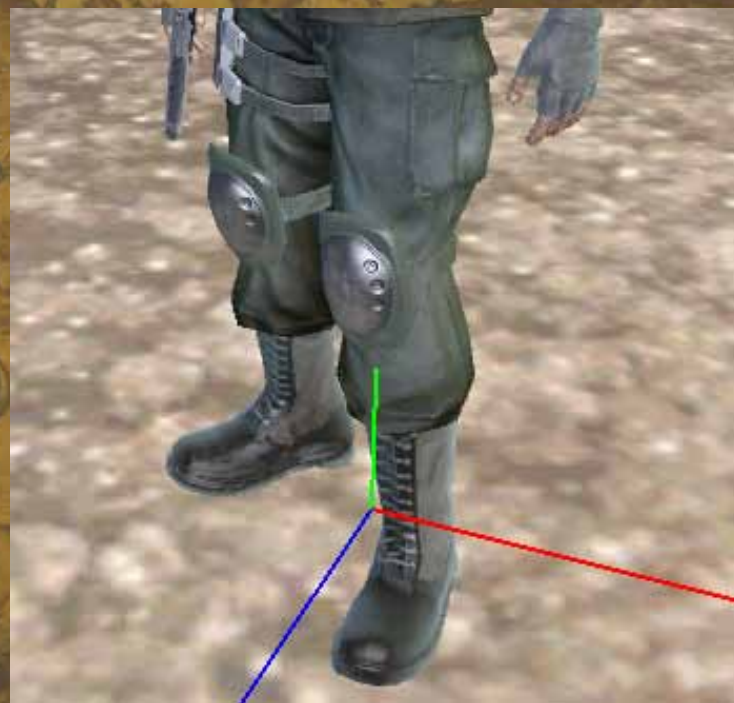
Animation Layers

Animation States

Animation Assets

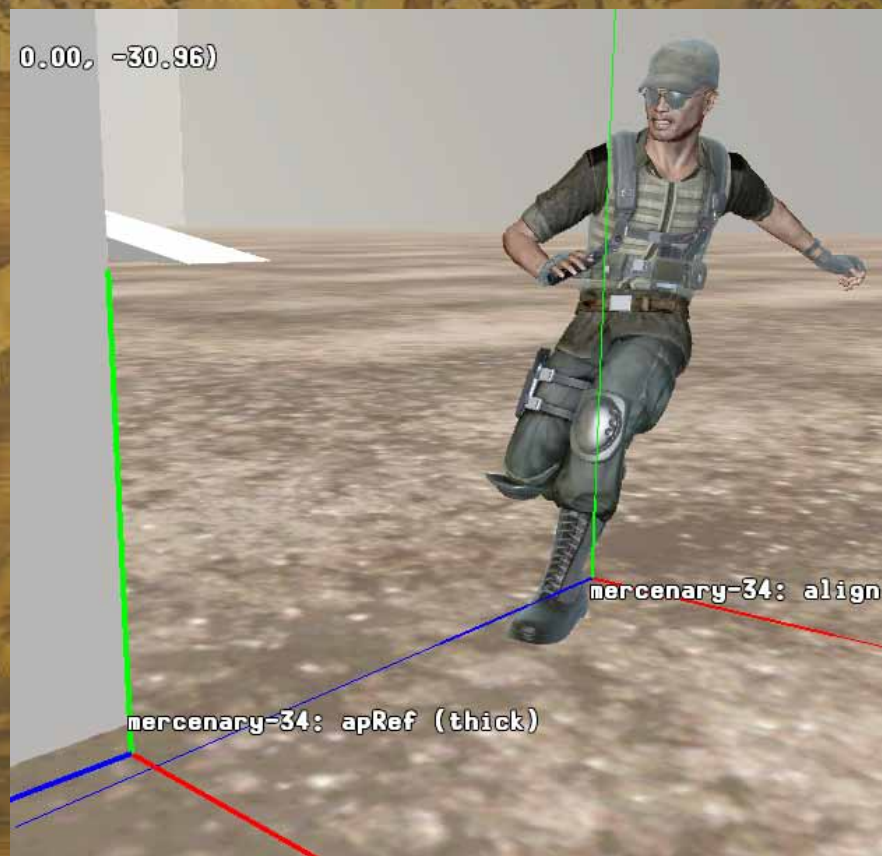
Character Locator

- Exist in all animations
- Motion is extracted from this locator
- Easy to blend between animations
- Used in 'action packs'
 - Relative to objects



Action Packs

- Two Locators
 - Character Locator
 - Reference Locator
- World-relative animation play-back
- Examples:
 - Cover
 - Vehicles
 - Spawn Animations



[Video!!](#)

What Is An Additive Animation?

Tired Run

—

Run

=

Additive Anim – ‘Tired’

What Is An Additive Animation?

[Video!!](#)

Walk

Run

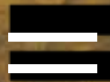
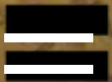
Jog



Tired

Tired

Tired

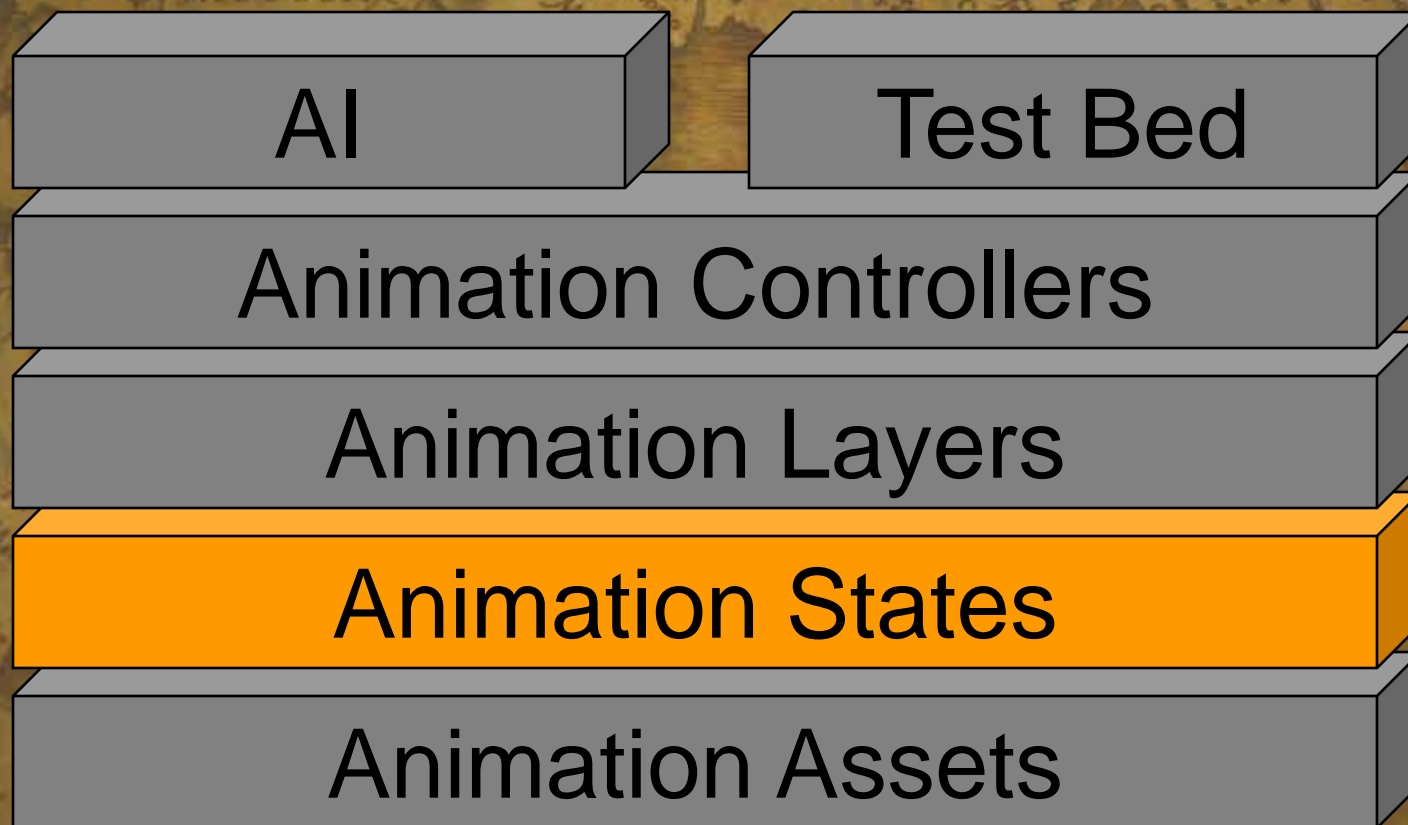


Tired Walk

Tired Run

Tired Jog

Animation States



Animation States

- Centered around a character action
- Contains transitions to all other possible states
- Semi-Static animation blend tree
- Defined in script (DC)
 - “Adventures in Data Compilation”
 - 2:30 PM – Room 3020 - Dan Liebgold

Transitions

- Action Based
 - Run, Stop, Exit...
- Contains
 - Next State
 - Blend Time
 - Blend Curve (Linear, Ease In/Out...)
 - Guards
 - IF MoveAngle > 80° Then...
- Transitions added without code changes

Transitions

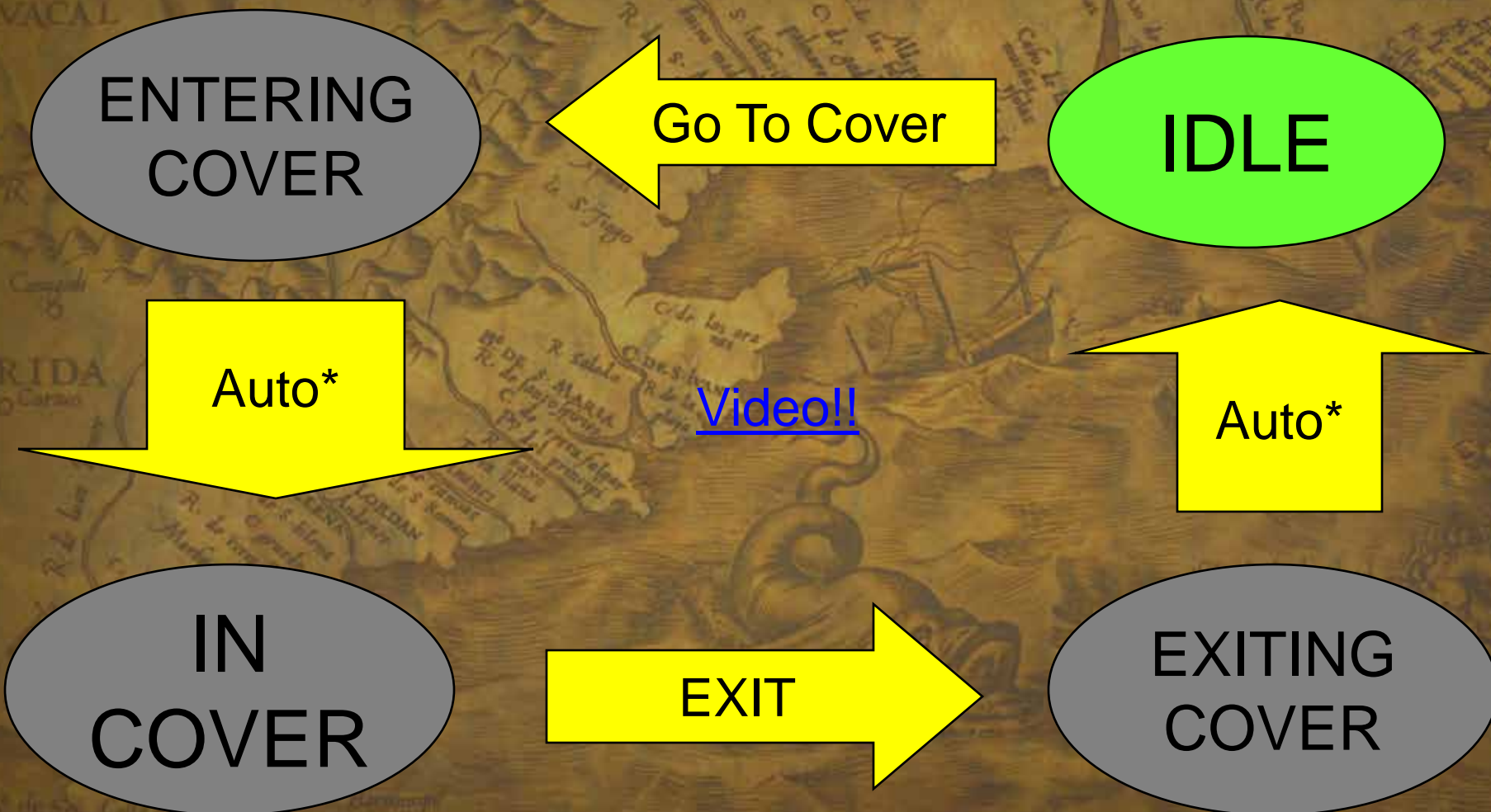
IDLE

Go To Cover

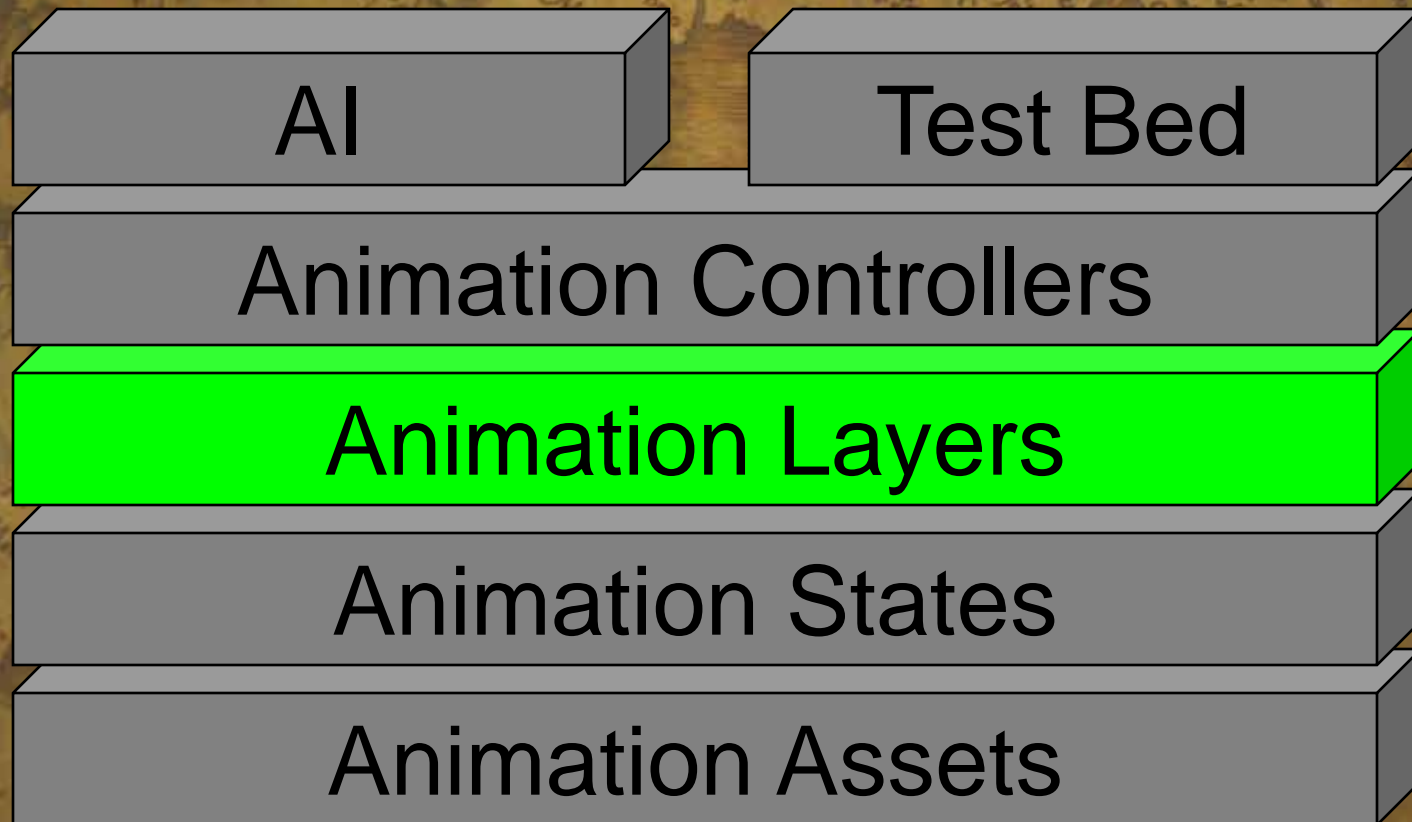
EXIT

IN
COVER

Transitions



Character Animation Architecture



Animation Layers

- Independent Actions
 - Moving
 - Breathing
 - Facial Animations
- Has a selected animation state
- Blends between states during transitions
- Blended together to final pose

Animation Layers

Facial – 160 Frames

Additive: Run Noise – 300 Frames

Run - 30 Frames

Run - 30 Frames

Run - 30 Frames

Run - 30 Frames

[Video!!](#)

Animation Controllers

AI

Test Bed

Animation Controllers

Animation Layers

Animation States

Animation Assets

Animation Controllers

- Used To Control Character
 - Locomotion Controller
 - Weapon Controller
- ‘Action’ Interface
- Contract of making the character perform an action
- Maintains Character Status
 - Can new actions be requested?

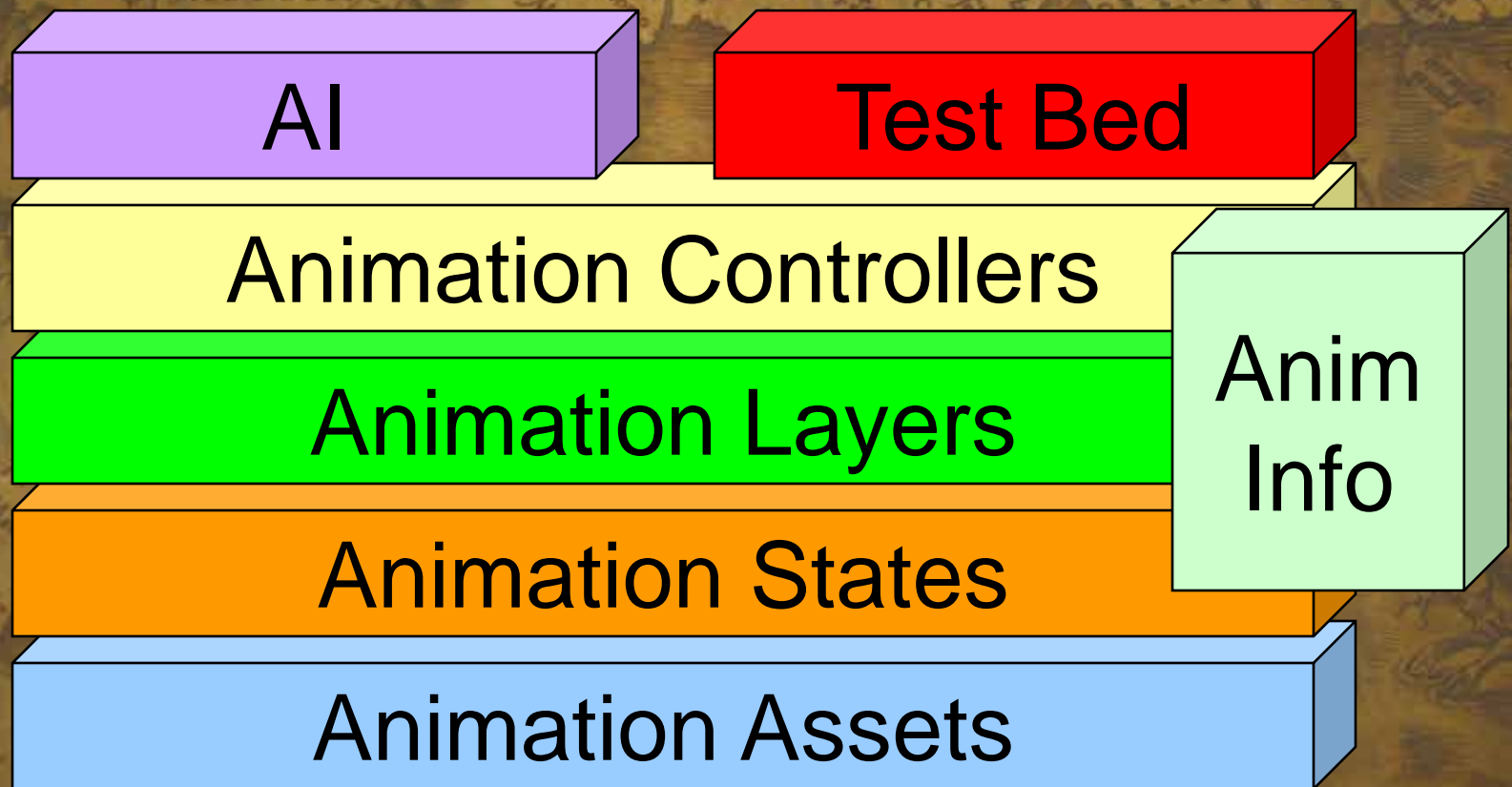
Animation Info

- Control Structure
- Second way of interfacing with the animation system
- Info from the game affecting the animation states
 - Modifies the animation blend tree at runtime
 - Ex: Blend aiming in / out

Animation Info

- **Movement Angle**
 - Movement relative to forward direction
- **Movement Angle Delta**
 - Frame to Frame delta to detect special turns
- **Aim and Look-At Angle**
 - Control look-at direction
- **Pose Selection Index**

Character Control Architecture



Requests Vs. Anim Info

- State changes in the AI often lead to a new action request (anim state change)
 - Enter cover
 - React to bullet / explosion [Video!!](#)
- Smaller AI adjustments result in anim info changes.
 - Movement direction
 - Look-At and aim direction [Video!!](#)

A collage of adventure-themed items including a handheld GPS, a map, a compass, a key, and a skull.

ADDITIVE ANIMATIONS

And how we used them...

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Look – At & Aim

- Procedural IK on neck / spine joints
 - Skinning around neck got weird when in low poses.
- Partial Animations (neck/spine only)
 - Made the character look stiff
- Additive Animations
 - Preserve base animation motion (texture)

Additive Approach

- Natural 'swaying' on arms and head
- Arms and head combined in Look-At
- Give the animator power to control the look and feel
 - Special look-at animation for each pose
- Animators will ALWAYS make things look better
 - If not... find better animators! ☺

[Video!!](#)

Cost

- **Runtime**
 - Ice (similar to Edge) Animation Modules
 - Animation blending on the SPUs is nearly free
 - 9 clips and 9 blends in normal battle – 10 us
 - Double or triple when changing directions
- **Memory**
 - Animation compression (< 1Kb each)
- **Creation Time**
 - Only takes a couple of minutes if animated in same file as the base animation

Problems

- Unwanted Results
 - Hands and weapon not lining up
 - Not aiming at target
- Some Rules
 - Keep hip rotation in base anim to a minimum
 - Avoid rotations on arms and shoulders = **REALLY BAD!!**



A collage of treasure-themed items including a handheld GPS, bullets, a map, a compass, and a book titled 'UNCHARTED'.

ADDING VARIATION

[Video!!](#)

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Shipped Variations

- 60+ Deaths
- 70+ Hit reactions
- 80+ Gun-out poses
- 40+ Ways of entering cover
- and many more...

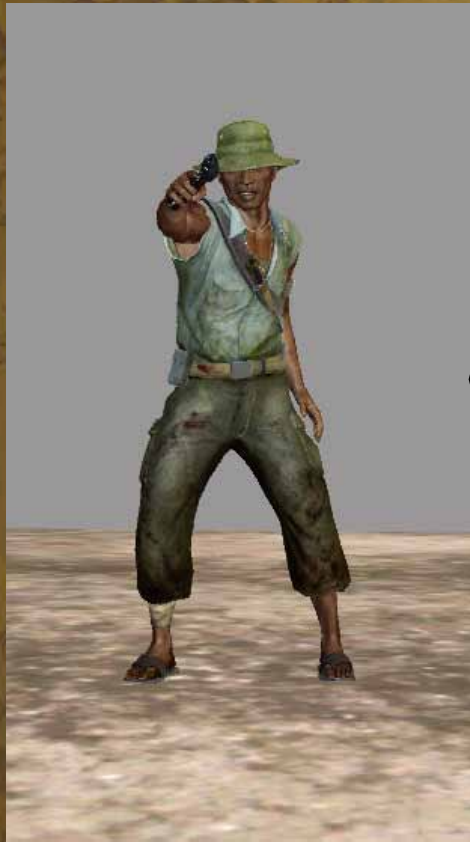


Adding Variation

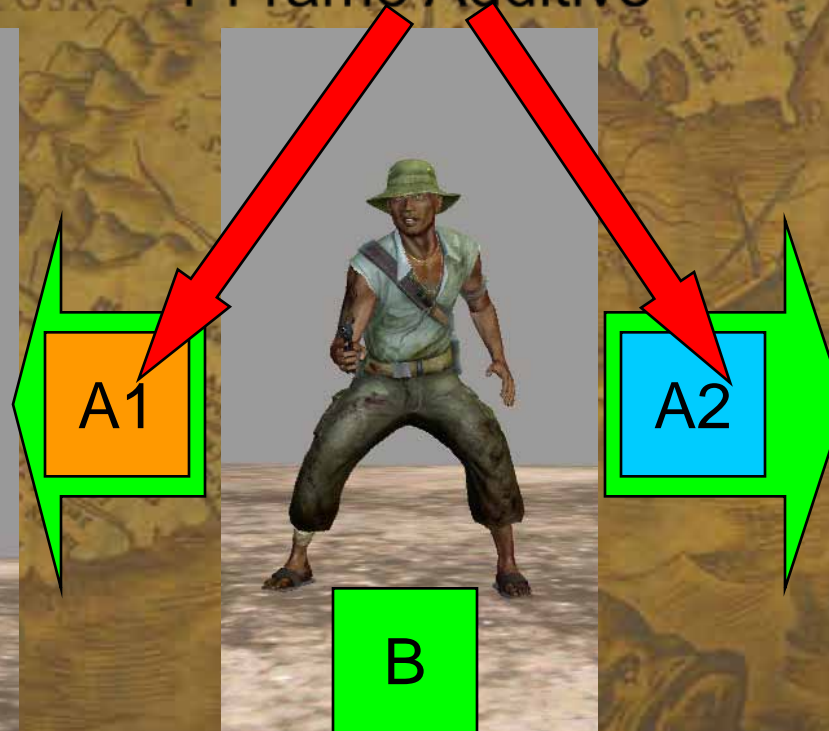


Additive Poses

1-Frame Additive



Resulting pose

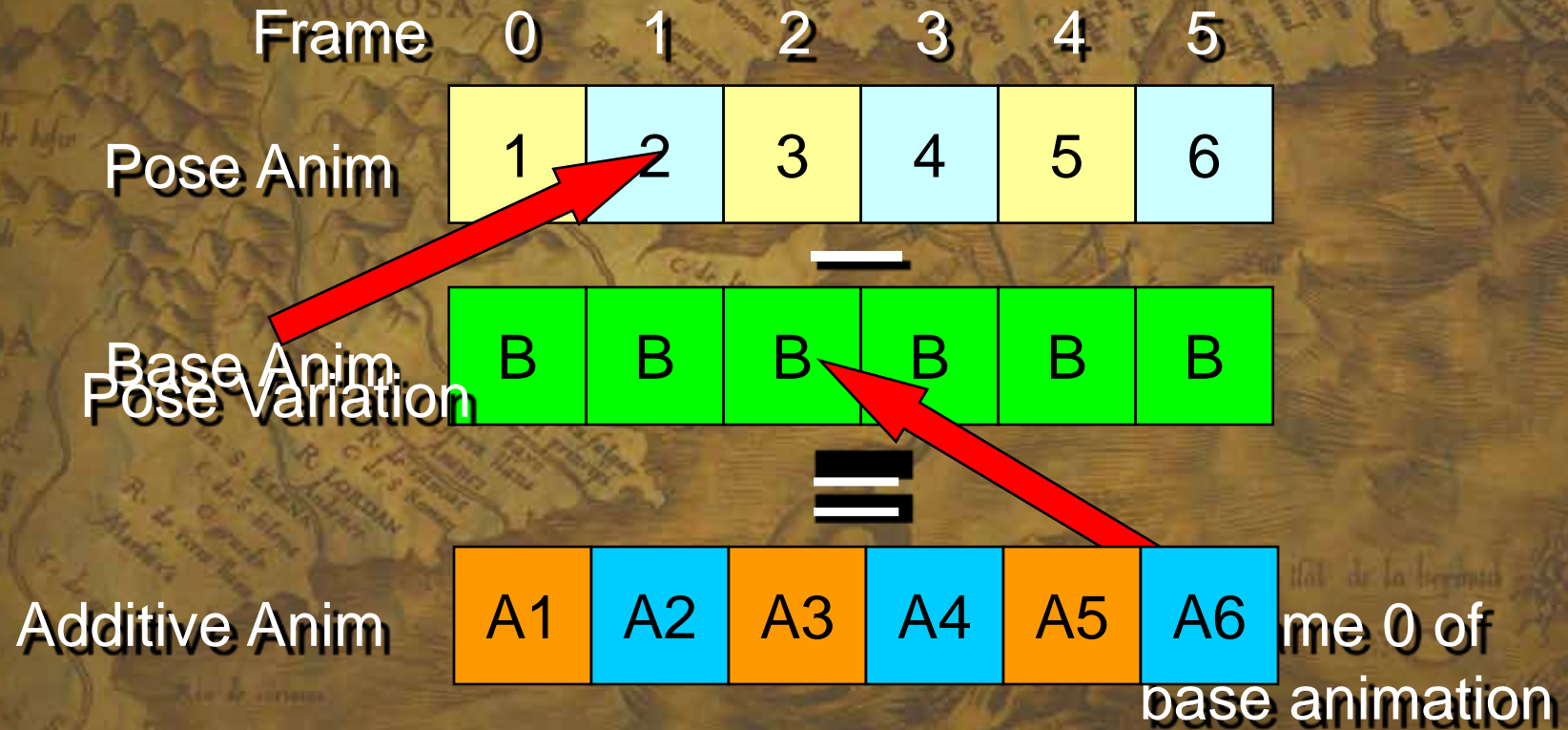


Base
Animation



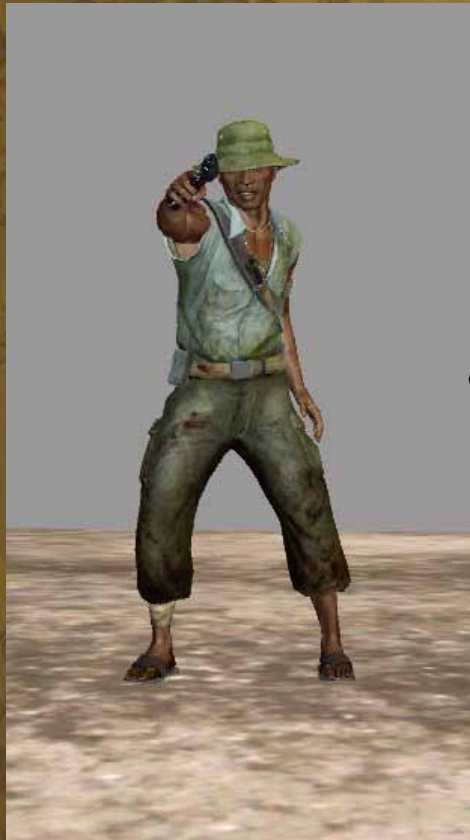
Resulting pose

Pose Anim Layout

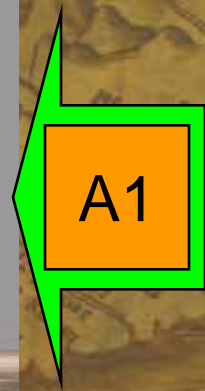


Additive Poses

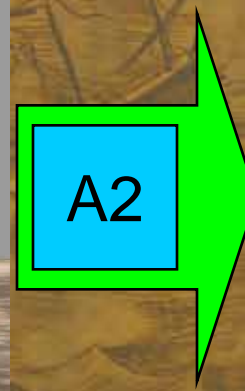
[Video!!](#)



Resulting pose



Base
Animation



Resulting pose

Careful...

- Unwanted Results
 - Severe swaying
 - Feet through the ground
 - Floating appearance
- Some Rules
 - No Y-translation on hip joints in base anim
 - Little to no hip rotation
 - Use rotated base anims
 - High and Low poses work great



Using a Specific Pose

- Select a pose
- Update the Anim Info with the new index
- Make a transition request to state that utilize poses
- The animation state will add the selected pose to the base animation



Implementation Details

- All pose selection logic is encapsulated in the animation controllers
- Randomness only in animation controllers
 - Hard to control otherwise... hard to test
 - No need to complicate the lower-level animation code
- Poses can be grouped and used only by certain characters types.

Summary

- Choose wisely where to spend your time
- Hide animation complexity from the AI through the use of actions
- Animation states are autonomous
 - Can be tested / verified in isolation
 - No surprises
- Additive animation
 - Cheap
 - More power to the animators – Better Visual Quality

UNCHARTED

NAUGHTY DOG

The Result



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Q & A

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