

Autonomous Digital Actors

Interactive Actors That Express Emotion

ACTOR MACHINE™

<http://www.actorMachine.com>

Fully Procedural Animation of Emotive Digital Actors

Goal: Create Believable, Emotive Digital Actors that take Direction

Value: Separate specialized skills of an animator from the higher level planning of how an actor performs a scene (by a human director or game AI)

Approach: Rather than being required to animate a character separately for each motion sequence, animators will be able to interact with software authoring tools that will let them train an Autonomous Digital Actor (ADA) how to employ various styles of movement, body language, techniques for conveying specific emotions, best acting choices, and other general performance skills.

Once properly trained, such an ADA will be able to take direction interactively from a non-animator, to play many different scenes while effectively conveying changing nuances of mood, personality and intention.

These digital actors will be able to follow stage directions and sight lines, manipulate props, and effectively express the shifting relationships between characters in the scene.

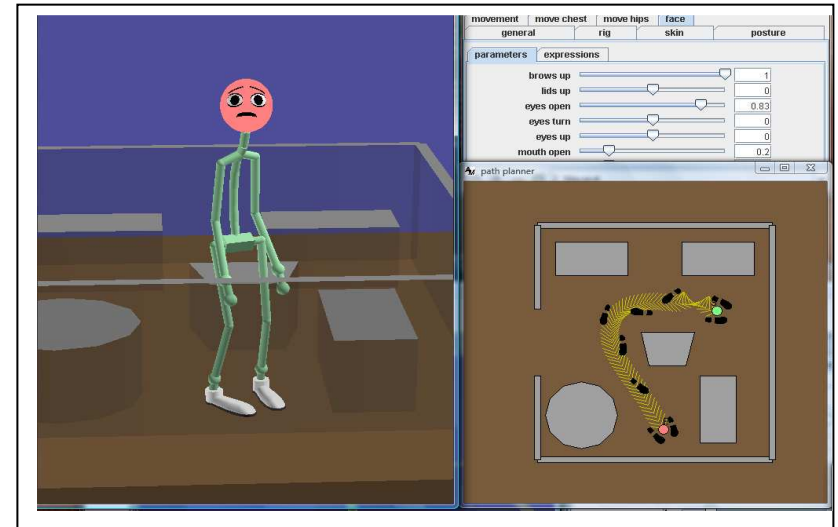
Application: Linear animation (film/pre-visualization), games, virtual worlds, simulations or live (real time) performances

Comparison: Unlike blended animation, all motion is procedurally generated, namely all motion is synthesized/simulated. No animation clips are used, so you never get the 'sameness' of motion typical in current games and virtual worlds that breaks the audience's belief that the character is 'alive'.

Assertion: Much of the 3D animation and gaming industry will soon be shifting to a new way to create and animate 3D characters.

Future: A consequence of this development is that animated movies and interactive media will begin to converge, both in their production practices and in their content, potentially evolving into new genres of interactive character-driven storytelling that can emotionally engage audiences in ways that cannot be achieved by either movies or games.

The future of computer games and animated films is not in spaceships or dragons or laser death rays, but rather in the mysteries of the human heart.



Training a Digital Actor with the Movement Coach

Analyze → Synthesize

Analyze Emotional Beats

Synthesize Emotional Beats

Analyze Gestures

Synthesize Gestures

Eyes open
Eye brows
Gaze object
Head gesture
Body gesture
Arm gesture
Hand gesture
...

Eyes open
Eye brows
Gaze object
Head gesture
Body gesture
Arm gesture
Hand gesture
...

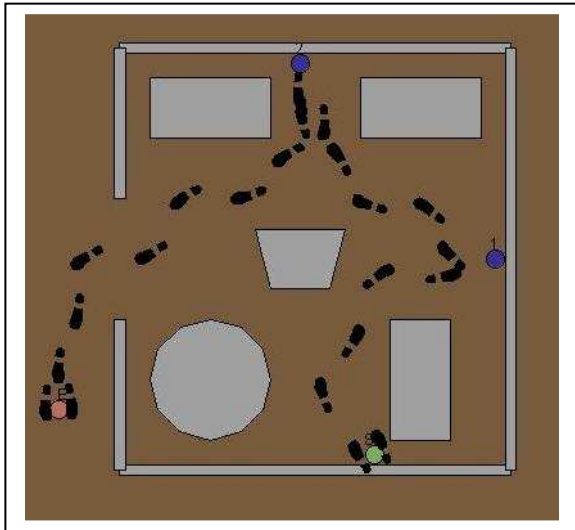
Training of Digital Actors: Creating Procedural Assets

Unlike Animation Assets, Procedural Assets can be thought of as movement and/or **Emotive Shaders** that can be blended to create the desired character performance.

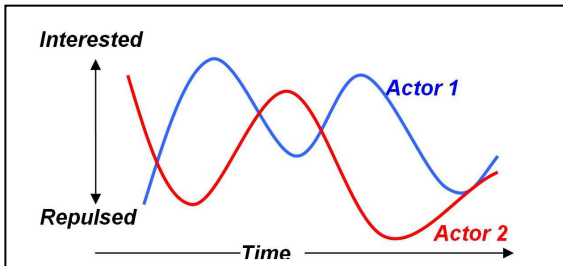
Movement Coach™: Train a digital actor about the basic aspects of how to walk, move, sways, rhythms, etc. by creating/editing **Procedural Movement Assets**. In essence, the animator uses this tool to tune the 'style' of movement for that digital actor (John Wayne and Marilyn Monroe, not to mention Shrek, have their own unique style of movement).

Gesture Coach™: Used to train a digital actor hand and facial gestures by creating/editing **Procedural Gesture Assets**. These gestural assets may represent pointing, hand waving, chin stroking, leers, smirks, etc.

Acting Coach™: This is where emotive training occurs. While Movement and Gesture Assets are lower level assets, defining the vocabulary of movements that are available to a procedural actor, the Acting Couch is used to creating/editing **Procedural Emotion Assets**.



Blocking Machine and Path Planner correctly placing footsteps



High Level Direction of shifting emotive relationship

Use of Procedural Assets to Animate Actors

Walking Machine™: Unlike with blended animation techniques, it is not necessary to create countless walk-cycles. ADAs can automatically walk along any path, terrain (even moving terrain), start/stop, stand/sit, walk up/down stairs, etc. without anything more than these procedural movement assets. They do this while maintaining the style/rhythm of the actor while respecting emotive settings (sad/tired/indignant/limp)

Blocking Machine™: ADAs can follow any set up waypoints for one or more characters in a scene to hit as they walk. Using their Procedural Movement Assets, the Path Planner will not only find an appropriate path given the obstacles in your scene, it will *correctly* place the feet, move the head, hips and shoulders, correct for arm swing, etc. It will do all this while maintaining the designated emotional movement style and cadence of the actor as well as maintaining sight lines based on the heights of the obstacles and gazing targets. The result is complex foot placement along with body orientation/sway/movement with only blocking information as input..

Actor Machine Core Engine™: This is at the heart of all the magic. It can be embedded in an authoring tool, such as our Maya Plugin or a custom pre-visualization tool or powerfully inside of a game, simulation or virtual world engine. Within an application, the Actor Machine Engine considers things in the following layering

Response to other actors:

Get angry when your date checks out another character

Emotional Direction:

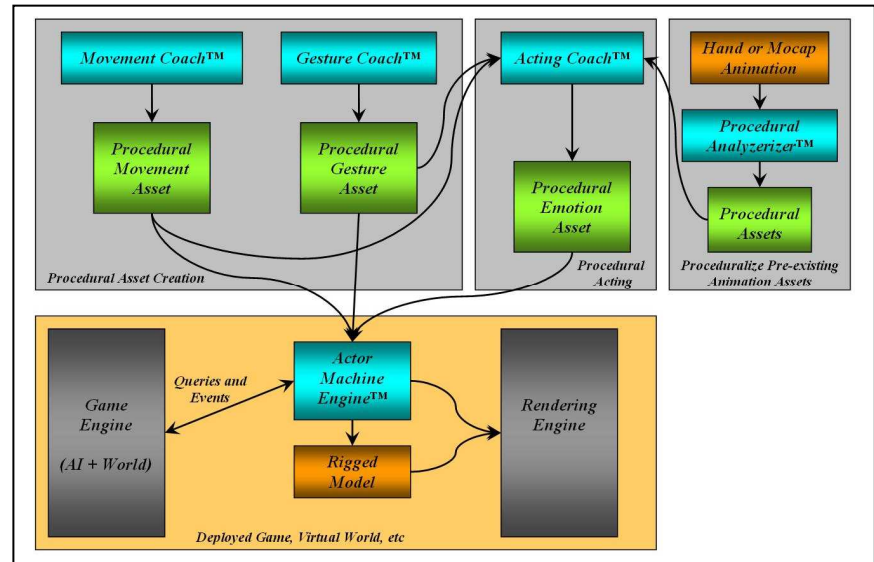
Act Angry, confused, wistful, weary

Physical Direction:

Shoulders back, knees bent

Physicality:

Joint movement



Integrating into an existing Game/Rendering Pipeline

Types of Input to the Actor Machine Engine:

- Emotional direction for each character
- Inter-Character Relationship
- Character Blocking Goals (including things like, 'meander')
- Character Action Goals (pick something up, sit down, embrace another character, etc)
- Terrain
- Obstacles
- Props (augmented with, for example, grasping handles)

Game/Scene Output from the Actor Machine Engine

- Query about actor state
- Events about Current State

Rendering Output from the Actor Machine Engine:

- You can think of our output is that it looks like Procedural Mocap
- As far as an animation or rendering engine is concerned, we are just providing movement bone transformations based on input from the client application (Game Logic or Linear Animation tool such as Maya). These would look to the animation/rendering pipeline like similar transformations generated by current
- Since we appear like blended animation to the animation pipeline, our animations can be blended in/out with linear animation clips or ragdoll animation.

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