

Whitepaper

The Evolution of Games Animation

The Games Animation Market

One of the most significant challenges in modern games development is the creation and integration of high-quality character animation. To produce a compelling game, developers must effectively generate high volumes of animation, often torn between time-consuming keyframe animation and expensive motion capture. With the emergence of new platforms, development timelines are shortening, stymieing traditional approaches such as outsourcing animation overseas, and forcing developers to find new ways to balance increasing player demands for realistic movement with the short timelines between game inception and delivery.

The relative cost of animation in most games - both dollar and percentage-wise - is staggering. The average first-person shooter platform game produced today typically includes between 2000 and 3000 unique seconds of character motion. At an industry-average price of \$100-\$200 per second of character animation, that means on an average platform game almost half a million dollars will be spent on animation production alone. Animation is an equally difficult consideration for smaller, Independent Developers, who don't have the resources of a publisher at their disposal, and who can't commit to large volumes of animation data. In practice, Indie studios are often obliged to resort to keyframe animation, which costs far more per second than other methods – developers can often spend upwards of 20% of A \$1m budget (\$300-\$400K) for their animation needs alone.

In short, games delivery platforms and methods are evolving quickly. It's time for animation production to do the same.

Traditional Animation Solutions

The two most common methods of creating animation for games are keyframe animation - in which individual character "positions" are set manually by an artist to create a clip - and motion capture, in which position data is "recorded" through the use of optical or video cameras, and then digitally applied to a character model to create movement.

Keyframing, while very precise, is expensive to produce (\$100-\$250/character second), and requires a trained animator to create. A typical professional animator produces 2-3 seconds of finished character animation per day – which means a staff of ten animators, working full-time, will take four months to produce the total animation required for a single platform game.

Motion Capture (Mocap), while less expensive per second, generally requires a much larger commitment on the part of the studio, and involves significant expense for motion cleanup, mapping (to game characters), and integration. Despite the recent availability of lower-cost motion capture systems, any studio working with motion capture is still obliged to clean up and map the captured motion data to their characters. This implies time-cost as well as expense – most outsourcers charge \$9-\$10 per character second for cleanup services. When all is said and done, Motion capture typically costs in the \$100-\$150 range per animated character second.

Various other solutions to the animation problem have been tried in past years, including motion-capture libraries. Unfortunately, MoCap libraries have never succeeded commercially – it's important to note that usability of a library is indivisible both from its stylistic application to the characters in question, and also it's ability to be mapped to those characters. Many of the larger games studios have vast motion libraries, which are almost never used due to the time cost and difficulty of mapping motions to new characters, as well as the inability to customize the “stylistics” of the motion in the context of the new character.

Introducing Mixamo: Animation as a Service

Mixamo (www.mixamo.com) is a novel online animation service that combines high-quality motion capture with the customization abilities of keyframe animation, and makes the resultant motion available to games developers on a 24/7 basis. Mixamo fundamentally changes the games animation production equation, providing game-ready motions which can be selected, customized, and downloaded into a games production pipeline at a fraction of the cost of other techniques. With hundreds of different motion models on-line, Mixamo provides a tremendous starting point for generating animation.

Mixamo integrates seamlessly with existing keyframe and motion capture pipelines, and can be used at any point in the production process (see below). Mixamo's general attributes include:

- **Clean, High-Quality Motion** – Mixamo animation, although based on motion capture, requires no cleanup, and can be downloaded and used immediately. Most Mixamo animations can also be downloaded as loops, and are ready to be applied either as in-game content or as part of longer sequences for general use and cut scenes.
- **Powerful Customization Controls** – Mixamo provides high-level, intuitive customization controls, usable by both animators and producers. Animations can be downloaded at varying frame rates, with a host of different attributes designed to make editing of the downloaded animations easier for experienced animators.
- **Automatic Retargeting** – In addition to a set of pre-defined “default” characters, Mixamo allows the user to upload their specific character to be animated. A semi-automatic mapping step guarantees the matching between the user's uploaded character skeleton

and Mixamo's standard skeleton, ensuring that every motion can be retargeted directly to the user's character.

- **Standardized Formats** – Mixamo animations can be downloaded in a variety of industry-standard formats, for easy integration into almost any games-tool pipeline (Maya, 3DS Max, Motionbuilder, XSI, etc), or directly into a games engine. Supported file formats include Autodesk FBX®, Collada, and .bvh formats, including special versions necessary for 3Dstudio Max® BiPed.

The Mixamo Workflow

The typical Mixamo workflow typically includes only four steps between selecting a motion and integrating it into a games pipeline:

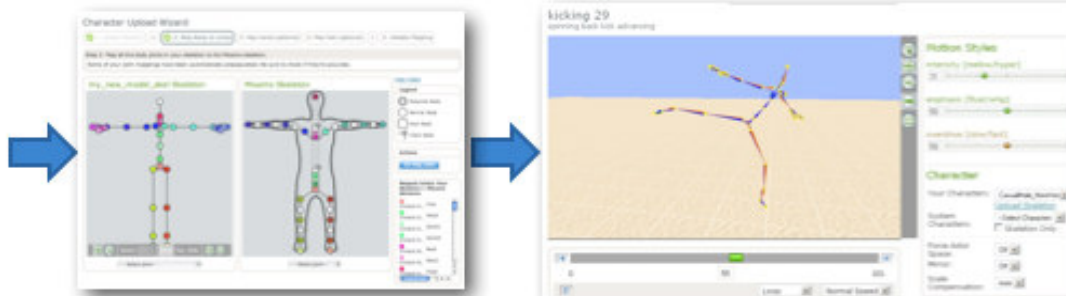


1. Select a Motion Model

- Mixamo has hundreds of motions
- Many more being added each week

2. Design & Synthesize Motion

- using built-in sliders & controls



3. Upload your model skeleton

- automatic mapping for standard skeletons

4. Final Preview & Download

- Preview to your heart's content
- Only download when you're satisfied

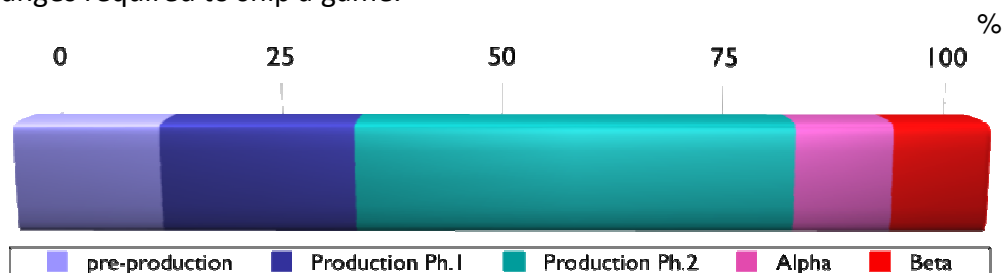
Technology Backgrounder

The core technologies underlying the Mixamo platform were developed at Stanford University across several years, and licensed exclusively by Mixamo. Developed by Stefano Corazza and a team of motion capture researchers, these technologies allow motion to be synthesized from mathematical models, and applied to virtually any anthropomorphic or animal character, regardless of size, proportion, or number of joints. Mixamo’s related patent suite covers a wide range of capture and anthropomorphological techniques that bridge the difficult gap between pure capture data, and production-quality games animation. The commercial result of these efforts, Mixamo’s online animation “models” are based on high-quality motion capture data, mathematically modified, and stylized by hand to generate highly-customizable animations.

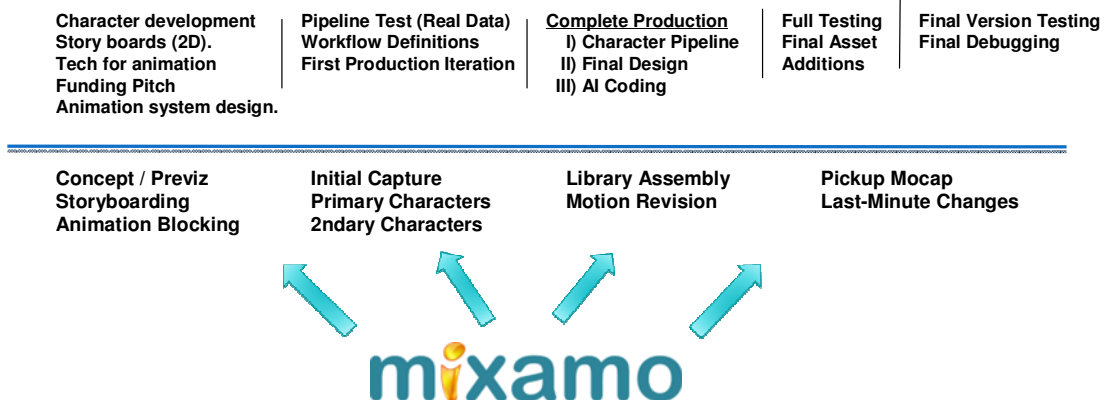
Mixamo in the Animation Pipeline

The Mixamo service has significant utility during the entire scope of the games pipeline, and brings a tangible benefit to each part of production.

- **Storyboarding** - Mixamo provides a quick and effective way of blocking-out animation (storyboarding), and assembling tests and funding pitches.
- **Initial Production** – Mixamo shines in primary and secondary capture, and is a highly-capital-efficient way of dealing with complex multi-character scenes.
- **Secondary Production** – Mixamo-generated assets can be used as the basis for run-time motion libraries, and re-used and re-targeted for characters throughout the production.
- **Final Production** – Mixamo’s high-availability and low cost can dramatically reduce the financial burden of last-minute (“pickup”) mocap, as well as any other last-minute changes required to ship a game.




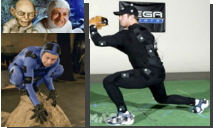

Task List



Conclusions

Game developers can benefit from Mixamo in many ways, including significant time and cost savings in game production, as well as simplified workflow and reduced dependency on outsourcers. Whether a developer is creating multi-character scenes in Autodesk Maya®, and needs variety of walk cycles, or creating an iPhone game, and in need of basic bipedal moves to be sent directly to their games engine, Mixamo can provide the required animation.

The below chart provides a general comparison of Mixamo vis-à-vis other animation techniques:

Technique	Positives	Negatives	Final In-Game Cost
 Keyframing	Complete Control No Data Cleanup Fair Precision	Slow (2-3 seconds/day) Costly	\$100-\$250/second
 Motion Capture	Lower Dollar Cost Quick Creation High Precision	Requires Planning Requires Staff (Actors) Requires Cleanup Requires Mapping Costly late in cycle	\$100-\$150/second
 mixamo	Complete Control High Precision No Data Cleanup No Mapping Available 24/7		\$35/second

In the context of real-world production, Mixamo stands as a strong third option for professional animation creation - an evolution of keyframing and motion capture, and a highly-effective way to save time and money in the game development process.