

How Does Motion Capture Affect Animation?

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1 Introduction

The application of motion capture in the movie industry has continued to increase in the last couple of years, ranging from background action to major characters. Using motion capture in a production pipeline requires both motion capture and animation experience. An animator needs an understanding of biomechanics and how the body moves both for planning marker placement and to be able to apply motion capture to a character in such a way that it fits the character and the story development. For motion capture to be usable, it requires planning well in advance, knowing what needs to be captured and how it's going to be applied.

Although no one really believes that motion capture will replace the need for animators, we are interested in how motion capture has affected the animator's job. Has it made it easier or more difficult? Is it just another tool for the animator to use? This panel will be discussing the advantages and disadvantages of currently using motion capture in the production pipeline and what advances need to be made to improve motion capture usability.

2 Margaret S. Geroch

I believe that motion capture technology can have a much greater impact on animation and film than simply as an automated method for obtaining realistic movement in computer generated or computer enhanced characters. Through motion capture we are able to see and record in detail the visual facets of a complex human movement. A character that shares many attributes with the person who provided the motion to be captured can then be animated with the subtle details that give individuality along with realism. Much of the "talent" providing the motion, however, is professional. Actors, dancers, sports figures – those for whom movement is a professional matter are providing the action for all kinds of characters. The result is that the characters also look like professional movers, rather than like the normal people we might encounter in our daily lives. However, through this technology, in particular, by capturing the motion of many different kinds of people, both "talent" and people off the street, and thoroughly analyzing and comparing this motion, we can progress further towards understanding the range of motion attributes that people are capable of. And we can begin to identify those details which make human motion so complex and so difficult to simulate realistically.

Margaret Geroch is an Associate Professor of Computer Science at Wheeling Jesuit University and a Ph.D. Candidate in Computer Graphics, The Ohio State University and the Advanced Computing Center for the Arts and Design. Her dissertation topic involves

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using motion capture data to understand the range and variation of human motion for animating human figures realistically.

3 Evan Hirsch

Having ran a motion capture studio and worked in various capacities on key frame animation projects, I can say with great certainty that given a choice, both approaches have their time and place. For complex sports, stunts and the like, motion capture is hard to beat for rich, detailed secondary animation. We have seen numerous games and even a feature length film that were motion captured yet in many cases, when the images make their way to the viewers' eyes, something still seems slightly disturbing. On the other hand, what do you do when you need to create unique personalities for 30 complete characters in less than 9 months? Key frame animation is hardly the solution assuming your employer or client chooses to stay in business. Procedural animation could be the solution, but do we really want programmers animating our characters? Why is it so painful to edit or alter motion capture moves? Why is layering motion still so hard? The reality is that despite the hype, the tools have let us down entirely and we still have a long way to go. We've been at this for almost 10 years and yet, its still much harder then it should be. I plan to propose some principles for which approach makes sense when, and to lay out a challenge to tools developers for the perfect animation system.

Evan Hirsch was most recently based in London as Head of Visual Development for Electronic Arts Worldwide Studios where his focus was primarily on the Art Direction and CG processes EA uses to develop their next generation console games. Prior to his move the UK, was the Manager of EA's Vancouver Motion Capture Studio. While at EA Canada, he supervised Motion Capture shoots with Tiger Woods, World Championship Wrestling and a complete F1 Pit Crew and oversaw the design of the world's largest purpose built motion capture stage. Before joining EA, he was a Partner for at Acme Animation Group, a small, 3D shop that catered to Design and Advertising clients. He is a member of BAFTA, SIGGRAPH and the IDSA in addition to being a Contributing Editor to Computer Graphics World since 1990.

4 Joan Staveley

Motion capture and key-frame animation are two separate animating techniques. Both require skilled animators with creative vision. Each technique lends itself to a different kind and quality of expression. Motion capture is in its infancy compared to key-framing, and so far it has proven to be a good match when the creative direction requires realistic human motion. Key-frame animation is superior to motion capture as a technique when the creative direction requires the imitation of traditional animation and animation narratives. Neither technique alone determines "a great work" of animation. The factors that lead to great works are a complex set,

involving creative ingenuity, technical mastery and ingenuity, funding, and hitting a chord within society.

I arrived at the above conclusions regarding "motion-capture vs. key-frame" animation as the result of having worked at Windlight Studios in Minneapolis, Minnesota back in the 1990's. Motion capture was a new technique at the time. At Windlight we experimented heavily with motion-capture animation, attempting to use it for both realistic human motion, and for character animation. One of the beliefs that Windlight was founded on turned out to be incorrect: that motion capture could be used as a fast and inexpensive substitute for traditional character animation. Making motion capture mimic traditional animation requires a huge amount of additional animation and tweaking of the underlying motion capture curves. And, of course, one must start with a great character actor for the motion talent. Once Windlight animators developed techniques for mimicking character animation with motion capture, we produced many visually appealing character animations, but it was not cheaper or faster than key-framing the same motion.

By contrast, animating realistic, human movement using motion capture worked quite well. It was fast, looked better than key-framing in most cases, and was much more cost efficient. Most of the additional animation is put on top of the motion curves and does not require major overhauls in the timing of the underlying curves. Cost efficiency is relative, however. If a company is doing a lot of realistic human motion it makes sense to invest in setting up a motion capture studio. It is not cost efficient to invest in motion capture if there's isn't anyone on the staff who knows when and how to use it effectively, or the company does not intend on using motion capture regularly. A motion capture director must know how to pull out a great performance from an actor, and must know what kinds of motion will translate well into animation.

What remains the biggest challenge for creating realistic, human-like figures regardless of whether one uses motion capture or key-frame animation is the lack of sophistication in solving the very complicated movement of muscles, tendons, hair, skin and clothing for the body. These huge feats have to catch up with the sophistication of the skeletal motion that animators create. Realistic, beautiful people are very difficult to mimic in animation, as are realistically fat or sinewy people. The grotesque, strange and surrealistic works best because the technology for moving muscles, skin and clothing inherently communicates something "off" or grotesque. Our eyes are great at picking up on the inconsistencies in human motion. Creating more realistic-looking humans in the near future will not be dependent on either motion capture or key-frame animation. Instead, creating a closer human likeness in animation will depend on developing more realistic simulations of muscle, tendons, hair, skin, and clothing.

Motion capture has a creative future outside of animation in the performing arts. I can't wait to see dances and theater productions that make sophisticated use of this new creative tool. It has already established itself as a creative technique in animation, films and electronic games, and will continue to evolve in these media also. Motion capture, like traditional animation is here to stay!

Joan Staveley is currently Vice President of Faust Logic, Inc. in Minneapolis, Minnesota. Joan has extensive experience directing both key frame and motion capture animation for commercial and artistic purposes. Over the past ten years Joan has served on numerous Siggraph panels and juries, and has had several animations screened at the Siggraph Electronic Theater.

5 Tom Tolles

The good news is that motion capture is finally starting to come out of the dark ages. By a combination of improved capture hardware, capture and processing software and industry experience, certain types of motion capture work are now fairly rote. However, there

are many areas for improvement, it is a little daunting. Some typical examples include:

- 1) First unit friendliness - currently, the idea of having mocap technology on a live shoot is terrifying. Yes, with 18 or 24 cameras, we can capture quite well but losing calibration in an environment like that is far too easy to do. Solutions may include some sort of self-healing or auto-tracking calibration.
- 2) Entire Performance Capture - full body capture is pretty good these days but combined with facial and/or hand capture, all you've got is a mess. This will be real tough one to solve.
- 3) While improvements have been made in the processing of optical motion capture data, it is still far too hard to deliver initially clean capture data based on the original performer. There will be some fairly significant advances here this year, I believe.
- 4) Post-processing software - just like traditional animators study human motions to help create content, I would like to see a 3D animator be able to gracefully use motion capture data and make changes to it at a high level (hmmm, walk a bit more aggressively or fall down more like a cartoon character).
- 5) We need a combination of really easy to use low-end systems to expand the low-end market while, at the same time, we need more competent systems (see items 1 and 2 above) to push the envelope.

Tom Tolles is the President and Co-founder of hOuse Of mOves motion capture studios. hOuse Of mOves is now in its 7th year of business and has grown to be one of largest providers of motion capture studio services. hOuse Of mOves's credits include motion capture work on feature films such as "Titanic", "Mortal Kombat: Annihilation", "Practical Magic", commercials for Coca-Cola, Mazda, Simmons Mattresses, TV series including Johnny Quest, and video games such as NBA 2K, NFL 2K, Madden 99, Tekken3, Knockout Kings, Parasitve Eve, and Tomorrow Never Dies. Although Tom has been working directly with motion capture for seven years, he has also been working in the CG industry for 17 years. In the mid-to-late 80s, Tom was the co-founder of FTI West, an animation production company that was located in San Francisco. Prior to forming House of Moves, Tom was Vice President, Sales & Marketing, Viewpoint DataLabs. Tom is a graduate of the Anderson School of Management ('91) and also holds a BSME/MSME from Stanford ('81/'82).

6 Barb Helfer

Barbara Helfer is a Senior Graphics Researcher at ACCAD, a center for graduate study in computer animation and movement housed in the College of Arts at the Ohio State University. Her teaching focus is in motion capture, digital video, and compositing aspects of computer graphics with video. She has worked as a course reviewer since 1993 as well as being the SIGGRAPH Courses Chair in 1997 and 1999.

7 Suba Varadarajan

Suba Varadarajan is a Graphics Research Specialist at ACCAD at the Ohio State University (OSU) and is in charge of the College of the Arts motion capture facility. She received her M.S. in Computer Science from OSU and is currently working on a Ph.D. Her area of research is in 3D model-based image processing of human figures and is interested in motion editing and re-use.