

# MOCAP in the Classroom: Now & Tomorrow

Gregory P. Garvey  
Quinnipiac University  
[greg.garvey@quinnipiac.edu](mailto:greg.garvey@quinnipiac.edu)

Anezka Sebek  
Parsons School of Design  
[sebek@newschool.edu](mailto:sebek@newschool.edu)

## Abstract

From Robert Abel's "Sexy Robot" of 20 years ago to Tom Hank's tour-de-force multi-role performance in the computer animated feature Polar Express, motion capture and motion tracking have made important changes to how computer animation is planned and carried out for film and game production. The frontier of the analysis, understanding and quantification of human (and even animal) motion promises many new exciting innovations. This presentation will address the use of motion capture technology by educational institutions and the necessary changes to curricula. Models for adoption/integration will be presented by showcasing animation projects completed by undergraduates at Quinnipiac University and team projects completed by graduate students at Parsons School of Design. Finally a look ahead will examine future developments.

## 1 Introduction

The cost of the acquisition of professional level motion capture technology and the associated hardware/software remains prohibitive for many academic institutions. For many fine art and design departments, which offer programs in computer graphics animation this technology remains out of reach. Yet there is considerable demand from industry for skilled personnel in this area. Increasingly, games and feature films incorporate motion capture as a key element in computer generated animation. Quinnipiac University in Connecticut and Parsons School of Design in New York and other institutions such as NYU are exploring innovative approaches to the problems of the acquisition and use of motion capture technology for both research and education. Presenters will describe their experiences and results with motion capture technology and its integration into the curriculum.

## 2 Quinnipiac University

Quinnipiac University is a community of more than 8,000 students, faculty and staff located in Hamden, Connecticut. The university offers broadly based undergraduate programs together with graduate programs in selected professional fields. At the undergraduate level, through integrated liberal arts and professional curricula, programs in the Schools of Business, Communications, Health Sciences, and the College of Liberal Arts prepare students for career entry or advanced studies. Graduate programs are designed to provide professional qualifications for success in business, education, health sciences, communications, and law.

## 3 Interactive Digital Design

This new Interactive Digital Design major, the first of its kind in Connecticut, emphasizes the synthesis of artistic expression and technological expertise in a curriculum that puts interactive digital design in the larger context of the humanities and society. Course work includes art and design, computer applications, and the study of interactivity. Students develop design projects in multiple courses, building an extensive digital portfolio of their work. In addition, they have the option of an internship that can be completed as part of their course work.

## 4 A Collaborative Process

At Quinnipiac University the departments of Physical Therapy and Athletic Training acquired the Motion Analysis motion capture system for the purpose of faculty and graduate student research. Faculty and students from the department of Computer Science and Interactive Digital Design were invited to use the Motion Capture Laboratory to capture data for animations.

During the 2003-2004 Academic Year essential assistance was provided by undergraduate Keo Heng, a major in Interactive Digital Design, whose participation was funded in part through the work-study program. Keo also pursued an independent study using motion capture during Fall 2003. Keo mastered the basic editing features of the Motion Analysis Software, including Eva RT (for actual data capture). Additional work was done using Alias Motion Builder, which provides a simpler workflow for preparing data for use with MAYA (3D modeling, animation and rendering software). This demonstrates how important a single student's engagement can be as a key ingredient to the success of this research and paves his way to pursue a career in this field. At the time of the writing of this proposal Keo is employed by SONY doing motion capture work for games.

Juan Garbalosa Director of the Motion Capture Laboratory and Prof. Stephen Straub, faculty member teaching in the programs in Physical Therapy, Athletics Training Education were both instrumental in providing access, training and assistance with the operation of the Motion Capture Facility. Nicole Pallatto, a 2003 graduate of the program in Interactive Digital Design kindly donated her time as a motion capture subject for additional sessions. It is clear that a technologically intensive project is dependent upon the efforts of many individuals. In spring 2005 another independent study student, Jason Corrigan has chosen to focus on motion capture. Students enrolled in IDD 401 Advanced Topics in Computer Graphics will each contribute to a series of motion capture sessions geared to collecting data to be applied to a game character. For this course students use the text: The Game Artist's Guide to MAYA by Michael McKinley. A semester long project entails building a polygonal character and applying motion capture data.

## 5 A New Work Flow

An internal Technology Grant permitted the acquisition of Motion Builder Pro, which dramatically speeds the process for applying motion capture data to a 3D humanoid model. Quinnipiac University has previously given internal grants to support the use of motion capture by the Program in Interactive Digital Design. A new workflow was established for use of the Motion Capture Laboratory to collect motion data of a live human subject and apply it to a 3D computer graphics character model using Alias Motion Builder Pro.

The work flow begins with the capture session using the Motion Analysis MOCAP Lab. Once the data is captured, using EvaRT a template identifying all the markers is applied to the data and the data is rectified and cleaned. The data is exported as a .trc file and can easily be imported into Motion Builder. In parallel the creation of the model in MAYA can proceed by adding the skeleton in MAYA using Motion Builder naming conventions. The skeleton is next bound to the skin (polygonal mesh) by either Smooth or Rigid binding. The .trc file is imported into Motion Builder where the markers containing the sensor motion capture data are linked to an "actor" which in turn is linked to a "character." The model is next added to the character and a FBX file is then exported and then imported into MAYA for final rendering. The resulting animations demonstrate life-like motion impossible to achieve using traditional keyframe animation techniques.

## 5 Outcomes

Capture sessions were documented by video and still photography. We established standard procedures for setup, calibration poses, and workflow to ensure consistent and usable data for future sessions. Renderings of animation sequences demonstrating the motion capture have been converted to QuickTime for presentation. The mo-cap data files and the QuickTime movies can be utilized to support classroom instruction in 3D animation. Sample videos from the capture sessions with graduate students from Parsons School of Design Department of Design & Technology can be viewed at: <http://a.parsons.edu/~motion>

## 6 Parsons MFA in Design and Technology

The Technology for Motion Capture and Tracking collaboration studio (see: <http://a.parsons.edu/~motion> ) in the Parsons MFA in Design and Technology program has three primary objectives, which seek to create an established motion capture research environment at The New School University:

(1) On the Internet, we are creating a centralized resource of information to give motion capture and tracking researchers and developers a place to build on previously discovered information and methodologies. The information will be searchable and will be open to other students in the department and universities for their projects.

(2) We are engaging students in a motion-tracking laboratory where research teams explore open source, low cost, state of the art motion capture technologies that includes the in-house development of a marker-less motion capture system.

(3) We have begun to build the foundation for an industry/educational symposium on human motion capture and tracking technologies and the studio's future goals are to work with other individuals, universities and industry groups to explore open source code solutions to the problems of motion capture and motion tracking. Starting small with the intention of growing in size over time, a bi-annual New School motion-tracking symposium with projects, papers and lectures will help propagate the online database and the Parsons Motion Tracking Studio's laboratory contributions.

## 7 The Pedagogical Environment

The MFA in Design & Technology department uses the collaboration studio environment as an opportunity for students to develop 'real world' research goals as well as manifest projects and services for clients. The intimate, small size of the studio gives each student an opportunity to learn about ideas of teamwork and leadership. Students are split into teams of interest such as gesture recognition and human motion as a trigger device in environments; application of new computer vision algorithms to multiple camera-image capture to create human motion files. All documentation and research links are posted to an online database.

## 8 Objectives

The Motion Collaboration Studio's objectives are to give students exposure to motion capture and motion tracking and to apply these technologies to animation and game design. As an example, the class in Fall of 2004 designed a game in which a user would engage in combat with a robot within a virtual office environment. Animations were created using Maya, Motion Builder and motion capture data (captured at the Quinnipiac University facility) of a martial arts expert. An initial prototype of the game was built using Macromedia Director for the game interface, and [www.eyesweb.org](http://www.eyesweb.org) open source software and two web-cams were used to track the player's movements in three dimensions. In the spring 2005, the studio's goals were to research further the creation of an open-source, marker-less motion tracking and capture system. In addition, the studio is applying motion captured at Quinnipiac University to an animated opening title sequence for the 2005 Parsons School of Design DV and Animation festival.

## 9 Conclusion

The field of motion capture and motion tracking is a new and exciting field that is only about fifteen to twenty years old. It is a rich and untilled field of study that demands ongoing research. The collaboration/research model between Quinnipiac University and Parsons School of Design collaboration studio environment gives students the opportunity to work in teams, develop tangible and achievable research goals and models, and to design knowledge mapping for open source motion capture and tracking solutions. Students learn to take lead in the areas of all modes of research, algorithmic problem solving, physical computing, videography, user interface design and animation. The continuation of this research requires institutional support and commitment to an appropriate technological infrastructure.