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Integration of Motion Capture into 3D Animation Workflows

Introduction

Motion Capture (MoCap) is a technique for gathering data of the movements of the human body. With the intention of using this information to drive the movements of 3D models in computer generated animation, MoCap offers significant advantages for producing natural and believable movement in 3D animation and opens up the possibility of bringing this information to drive the movements of 3D models in computer generated animation. MoCap offers significant advantages in automating the labour intensive and very highly skilled process of manually animating 3D characters. However it is wishful to think that MoCap can replace animators with actors.

There are optical methods, such as Vicon, where white spots are applied to the body at the joints. Their movement across the visual plane of a camera are tracked and analyzed computationally in order to define a motion path for each joint in 3D space. This is widely used in the industry, but has the significant disadvantages of producing noisy data and being limited to movements that take place with the frame of a static camera or set of static cameras.

There are mechanical methods that are attached to the body and measure the rotation of the joints. This is a fairly accurate method of data capture but has the unfortunate effect of influencing the actual movements of the actor who wears it.

The method we used is based on the Xsens motion capture suit which uses inertial sensors attached to the body. This method avoids the major problem of the other methods. It is relatively unobtrusive to the actor movement allowing a larger range of movement at both the full scale and the large scale up to a radius of 150 metres. The disadvantages are the sensors are affected by electromagnetic interference and absorption. So the data produced is affected by incidental local noise. Also physical disturbance of the sensors causes errors in the data. e.g. if they are knocked out of position in vigorous actions. These problems aside the Motion Capture suit method appears to offer the most flexible system for acquiring natural movement.

The limitations of the MoCap suit are that it recovers only the limbs and some movements, there is no data for finger movement or facial movement. The Xsens suit does not log any information in the vertical dimension relative to the ground. This must be applied manually afterwards.

Types of Motion Capture

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In Practice

In practice, we required three people the actor and a minimum of two people to tend the kit and operate the software. Setting up the suit took time and a certain amount of understanding of how it is supposed to work. The sensors need to be in the right locations and well suited before calibrating the suit.

The Moven software provided the makers of the suit gives live feedback of the data readings. The data from the sensors is transmitted accurately and represented on screen as a standard animation skeleton. Calibration involves the actor taking up predetermined poses and performing controlled predetermined gestures. This allows the software to calculate the relative positions and relative rotations of the sensors. This is further computed by manually inspecting the physical dimensions of the actor. In the first sessions this process took several hours, but with practice we gained an intuition for how the software calculating and the process could be completed in a few minutes.

The animation process meant that we had to plan the capture session quite carefully. In a process that is quite similar to a simplified film shoot. We produced a lot of movements that were needed to tell our story. The source was set up using predefined props to match the movements of the characters. The architecture of the 3D model was taken from the concept art files and the cameras were placed in front of the models.

The degree of freedom offered by the Xsens motion capture suit allowed a lot of freedom for improvisation in the use of space. E.g we used the underside of tables to simulate the character climbing upside down on a giraffe.

The data gathered from these acting sessions is remarkably sensitive, seeing the representation of the movements on the skeleton reveals how subtle our movements are and how continuous they are even when we are not really small rotations of the joints. It is a subtlety of movement that gives the unconscious sense of believability that is missing from much computer animation.

The Clean Up

The data in raw form contains errors of various types.

- There are spikes in the motion curves caused by radio frequency interference
- Excessive static rotations caused by the sensors slipping out of position after the calibration
- Fluctuations in the motion paths, caused by signal interference
- Interpolation errors, caused by inappropriate interpolation of data by the Moven software in motion instances of signal failure.

Many of these errors are not a few frames in length and can be fixed quite simply deletion of data held on the problematic frames as the sensitivity of the system reveals minute gestures and movements that we do not perceive with the naked eye.

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