Integration of Motion Capture into 3D Animation Workflows

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Types of Motion Capture

There are several methods of motion capture.

- Optical methods, such as Those where white spots are applied to the body at the joints. Their movement across the visual planes of a camera are tracked and analyzed computationally in order to define a motion path for each joint in 3D space.

- Mechanical methods, such as Those where mechanical sensors 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 Vicon motion capture suit which uses inertial sensors attached to the body. This method avoids the major problem of the other methods. It is relatively unintrusive to the actor movement allowing a fine range of movement at both the intense scale and the large scale up to a radius of 150 metres. The disadvantages are the sensors are effected by electromagnetic interference, and absorption. So the data produced is effected by incidental topical noise. Also physical disturbance of the sensors causes errors in the data. e.g. if they are knock out of position in vigorous actions. There are optical methods, such as Those 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.

The limitations of the MoCap suit are that it records 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.

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 settled before calibrating the suit.

The Xsens MoCap software provided the makers of the suit gives live feedback of the data readings. The data from the sensors is transmitted wirelessly 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 orientations of the sensors. This is further constrained by manually imposing 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 calibrating 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 fixed similar to a simplified film workflow. We produced a list of movements that were needed to tell our story. The scene was set up using improvisation props to match the intimate movements dictated by the contents of the story. We also had to be aware of the layout and ground plans of the scene so that the actor's movements in real space matched the architecture of the 3D model sets. The degree of freedom offered by the Xsens MoCap suit allowed a lot of latitude for improvisation in the use of space. E.g. we used the underside of stairwell to simulate the character climbing upside down a girder.

The data gathered of 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 at rest there are small rotations of the joints. It is this 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.
- Enormous static rotations caused by the sensors slipping out of place after the calibration.
- Fluctuations in the motion paths, caused by signal interference.
- Interpolation errors, caused by inappropriate interpolation of data by the MoCap software in instantaneous instances of signal failure.

Many of these errors are just a few frames in length and can be fixed quite simply deleting data held on the problematic frames and creating an appropriate interpolation between the good data the surrounds it. This is a painstaking and labour intensive process. Longer errors not worthwhile repairing as it is less work to re-shoot the shot or manually animate later on in the process.

The MoCap data is re-aggregated onto a control rig which is standard forward kinematic and inverse kinematic rig in Motion Builder software. This means the rotations and translations are applied to the rig. Thus applied, the errors in the data are more easily read and corrected. This is an industry standard animation control rig for driving 3D characters. This rig can control over more parts of the body including fingers, jaws etc. The MoCap data drives to movement of the parts of the animation rig if the data for and leaves the rest unchanged. These will be animated manually later.

The animation control rig then has a 2D character model applied to it. The model is moved by the rig and the rig is used in animation software to drive and adjust the final movements of the designed characters.