Zodanga, The Walking City of John Carter

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Cinesite

1. Introduction

The brief - to create Zodanga, a photo real, self-contained, living city that traverses the surface of Mars.

Supplied with thorough art department concepts, we had to furnish the design of the vessel with elaborate detail. A full sized city was created for wide shots, including highly detailed areas that were going to be seen in close up. A handful of practical sets of specific locations within the city were built in the studio and needed to be seamlessly extended digitally to give a greater sense of depth and scale to the environments. The total number of digital assets used for the city was over 35.000. The total number of objects over 2 millions for a total polygon count over 2.5 billions. Efficient management of these assets was paramount in pushing Zodanga through our pipeline.

Zodanga is a unique mobile city “on legs”. Starting from the initial concept artwork we completed the design of the legs conveying a sense of scale and purpose, being ever mindful of creating something that would be mechanically correct. The challenge for our rigging and animation teams has been devising how the legs would look and move and how a large city would be mounted on top of them.

Render efficiency was key part of our work and we were able to produce ray traced renders with global illumination with render times between 1 and 3 hours per frame for large vistas of the whole city and 0.5 to 6 hours for detailed street level renders.

Finally the city was brought to life and populated with CG crowds and airships.

2. Implementation

Intricately detailed geometry was modelled and textured for the city buildings and to dress the virtual locations. Hundreds of CG props were added ranging from flyers, tables and tents to bags, bottles and cases. Because a lot of these props were animated or required a dynamic simulation we could not simply bake them into render archives. We solved this problem by re-writing our geometry caching pipeline to support hierarchical caching. Unlike the traditional caching systems that require data to be converted between the native and cache formats (i.e. between Maya and Alembic) our system supported cache files as a native geometry/animation type in Maya, which allowed us to display, modify and re-cache extremely complex animated scenes without the overhead of converting data between the Maya and cache format and without duplicating any data both on disk and in memory.

Using cache proxies as building blocks for our Maya scenes provided an invaluable framework for creating complex mechanical rigs with a single degree of freedom such as the opening-closing of a flyer wing or a walk cycle of a mechanical leg. We could bake an entire range of motion for a master rig into a cache file and use this file as a proxy rig with attributes for controlling the speed and offset of the animation cycle. This approach was used for creating 674 Zodanga city leg rigs, each made with thousands of independently moving and deforming objects.

To achieve the desired look, we built an efficient and highly optimized, ray-trace global illumination lighting pipeline focused on both interactive preview renders as well as at final render.

We used custom 'resource' files to define the shading properties of all rendering assets – these files allowed us to hide the complexity of shader setup from the artists, whilst giving them an option to override any shading parameter on any asset, should they need to. Also, since all shading properties in resource files were assigned to geometry using meta-data filters, we could update models and anim/fx rigs without worrying about breaking lighting rigs . We implemented tools to analyse visibility and resolution of rendered geometry and selected the optimal level-of-detail. These and many other optimisation tools were incorporated into an effective pipeline that allowed artists to use their creativity with lighter scenes and practical render times.

3. Conclusions

We were able to put the whole city into wide establishing shots and integrate it into a real plate or CG generated environment. In addition, we made the city look believable in daylight and also in evening lighting set ups. We could show any part of the city and populate it knowing that we wouldn’t have problems with render time. The result was that we were able to deliver a fully functioning, living city that could roam the surface of Mars and thus fulfilling our original brief.

SIGGRAPH 2012, Los Angeles, California, August 5 – 9, 2012.
ISBN 978-1-4503-1435-0/12/0008