# Using Panda3D to Create 3D Games

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## 1 Abstract

Panda3D, a 3D game engine developed by Disney and Carnegie Mellon University, combines the power and speed of C++ and the ease of development of Python. In spite of being released under the modified BSD (Berkley Software Distribution) license, it is fully-featured and is used commercially by Disney in their theme parks and *Pirates of the Caribbean Online*, as well as educationally by Carnegie Mellon University. Owing to the fact that Panda3D was developed for both educational and commercial use and coupled with the free software license, Panda3D is ideal for small game developers, hobbyists, and—as an industry relevant introduction to 3D game design—for interested computer science students.

## 2 Engine Features

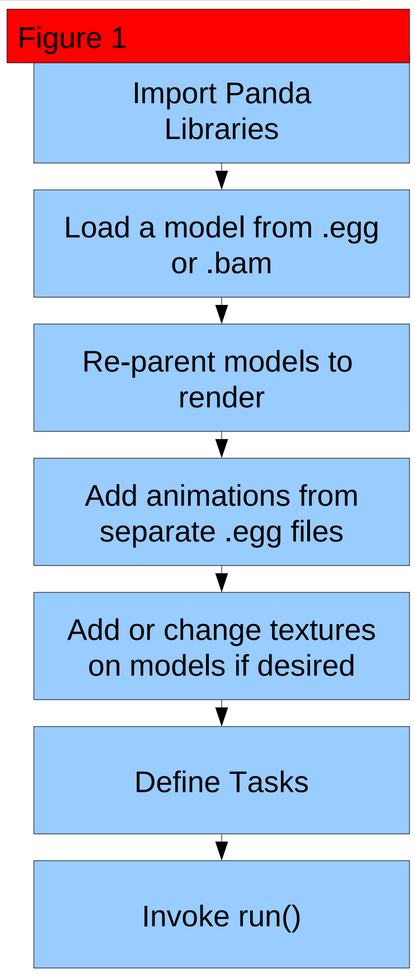
- Multi-platform: Development can be done on Windows, Mac OS X, or Linux. Can use either DirectX 8 or 9, or OpenGL.
- Uses a hierarchical tree structure to store objects to be rendered, instead of a list.
- Fully integrated with Python, including running interactively in the Python interpreter shell and garbage collection.
- One can use one's favorite development environment, such as Eclipse with Pydev or Emacs.
- Performance Monitoring. Panda3D includes utilities to track CPU (Central Processing Unit) and GPU (Graphics Processing Unit) usage, as well as debugging tools.
- Packaging tools are included, which can be used to package games to either be run in the Panda3D runtime or as standalone applications.
- A browser plug-in for web deployment is also available.
- A large library which allows use of video, audio, and networking, as well as advanced rendering techniques.[3]

## 3 Structure of a Panda3D App

### Program structure – Figure 1

- The Panda3D application is started by importing the base panda module, either DirectStart or ShowBase.
- 3D models are loaded into a "node" from either of the Panda3D model types: .egg, or the optimized .bam files. To add to the "scene graph" (the render tree), the resultant node is re-parented either to render, or some node that is already a child of render.
- Animations are added to the node from a separate .egg file. Animations can be played or looped.
- Textures can be changed or added to nodes.
- Tasks—procedures that are called once during a run cycle—are defined and added to the task manager. Event handlers are like tasks, but are only called at specific times, such as for mouse clicks. Task chains are similar to tasks, but implement threaded execution.
- Finally, the main loop of the application is invoked with a call to run().[3]

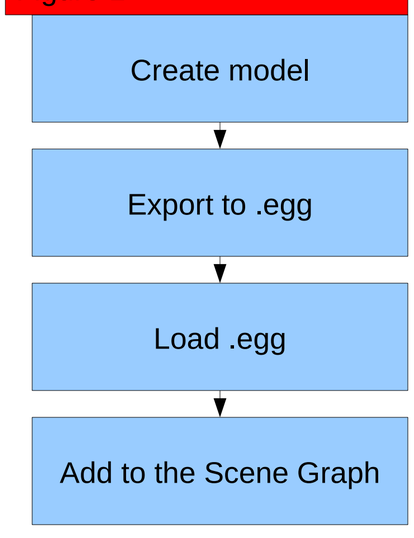
Figure 1




### Modeling and the Scene Graph - Figure 2

- Panda3D models can be created using Maya, 3D Studio Max, or Blender. Maya is the recommended application to use.
- Maya has the best support for exporting models to the .egg format as most Panda3D developers use Maya. Blender has a good 3rd-party exporter available. The 3D Max exporter is currently unreliable and only supports bone animations.
- When Panda3D loads a .egg file, it will optimize and automatically export to .bam for quicker loading in the future. If one leaves off the file extension when loading models, Panda3D will automatically load the .bam if one is present and is newer than the .egg of the same name. One can also use Panda3D's tools to convert .egg files to .bam for distribution.
- Objects can be inserted anywhere into the scene graph, and can be moved. Objects are positioned relative to their parent. Children will inherit any rendering attributes set to their parents.[3]

Figure 1




## 4 Games Developed with Panda3D

### Pirates of the Caribbean Online

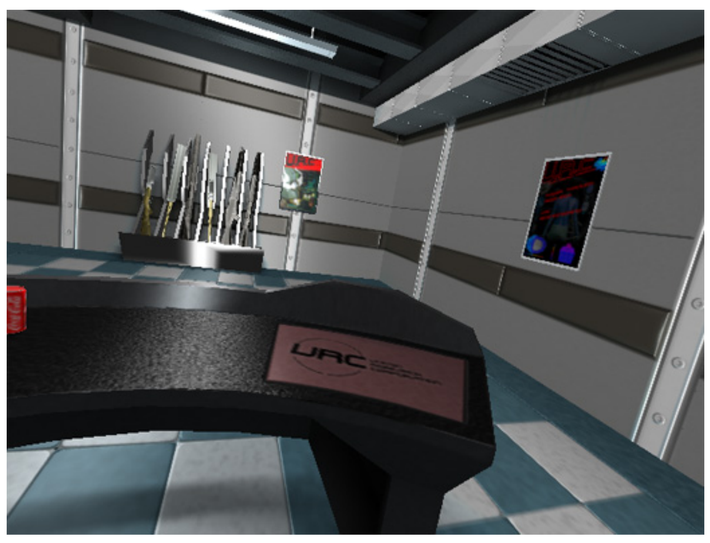
The most popular of the games developed with Panda3D is Pirates of the Caribbean Online by Disney. This is an MMO aimed at a younger audience (10+). In this game the player is a pirate, fighting a corrupt navy, trade company, and the villainous Jolly Roger. An interesting feature of this game is the ability to play in 3D using 3D glasses.[1]


### Code3D

Code3D is an application for creating simulations of real world events for training purposes. Custom environments can be created by the user to suit their particular training needs. Panda3D is used for Code3D's 3D rendering.[4]

### Blackout

This is an example of the work done by students at Carnegie Mellon's Entertainment Technology Center. In the Building Virtual Worlds class, groups of 4-5 students spend two weeks creating a game.[2]



## 5 Drawbacks

- It is necessary to learn Python before being able to use Panda3D effectively.
- While one can program in C++, it is much more complicated and requires more code. Also there is less documentation for Panda3D for C++.
- Becoming proficient with Panda3D requires going over a very steep learning curve.
- Panda3D does not have an integrated development environment.
- The manual has several incomplete sections.

## 6 Ongoing Work

- Continue to increase knowledge and proficiency of Python programming language.
- Experiment with the Panda3D engine to better learn the API and the engine's limitations.
- Introduce others to the Panda3D engine.
- Create small, educational demo games.

## 7 References

[1] *Disney Pirates of the Caribbean Online.* Disney, n.d. Web. 15 March 2010.
[2] *Panda3D.* Carnegie Mellon University, 2010. Web. 15 March 2010.
[3] *Panda3D Manual.* Carnegie Mellon University, 2010. Web. 15 March 2010.
[4] *Sim Ops Studios – Code 3D*. Sim Ops Studios, n.d. Web. 15 March 2010.

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