

Mastering the 3D Experience

Track: Designing Rich Content



The 2005 Macromedia® Conference



A Demonstration of a 2D Scrolling Game in Shockwave 3D at Macromedia MAX 2005

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Project Broadsword is a demonstration implementation of a complete 2D game engine in Shockwave 3D. **NOTE: this is not intended to represent a completely playable game.** The primary purpose of using S3D in this fashion is to gain access to hardware-accelerated low-level drawing routines, as opposed to using Flash or Director's standard sprite engine. By using the 3D engine, the demo also gains access to lighting, additive texture blending and integrated 3D models in much the same way as a D3DXSprite class in Direct3D. [1]

The demo is constructed around several different "managers" – which are objects that oversee various sub-areas of the game engine. The primary managers are:

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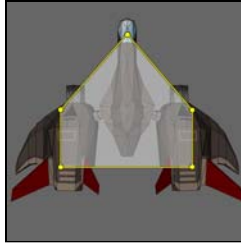
MANAGERS AND ASSOCIATED CONTROL	
TILE_MGR	Manages "tiles" which are view oriented 2-triangle rectangular meshes.
WEAPONS_MGR	Manages individual weapon types (AI), relies on base_weapons for underlying functionality.
BASE_WEAPON_MGR	Manages the base weapons which all weapons build on top of, uses TILES to draw.
ENEMY_MGR	Manages all ships and associated AI. Uses either tiles or 3D models to draw.
TEXTURE_MGR	Manages all textures and avoids duplication.
WINDOW_MGR	Manages windows ovetop of the scene (ex: title, score, etc.), uses TILES to draw.

Each of these managers receives an update per-frame, which it then propagates to its managed objects as needed. One interesting side-effect of this architecture, which works in conjunction with the 3D engine, is that all of the tile geometry and textures are created at startup, and any object in the engine can request a tile to use, draw with, and then release.



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In developing this application, several issues that are trivial in standard 2D engines arose, that needed to be overcome. The first of these was **draw-order**. S3D gives no explicit control to draw order, so this implementation uses "render groups" to assign different types of geometry to different cameras, as cameras draw in world list order. More on this technique is available in the MXDJ article on Multi-Camera Scene-Graph Control [2].

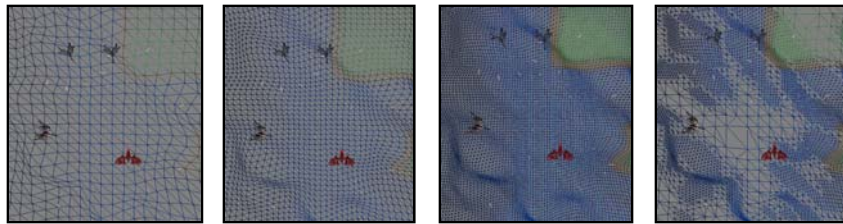


Above: 2D armatures for collision detection.
Right: Render Groups
Below: Subdivisions for landscape lighting.



A second issue that needed to be dealt with was **collision detection**, which is critical in nearly all forms of game design. A full scale 3D collision detection system based around the Director collision modifiers proved to be overkill for the system: instead a 2D system was employed based on polygon armatures and space partitioning via "binning". This system, which operates in a 2D space based on the orthographic projection of the scene, is presented in detail at the Macromedia DevNet Center and the Director - Online Users Group [3].

Project Broadsword has also served as a technology base for C++ game development, and was the pre-cursor to *Wings of Megaira*, one of the E.T. Laboratory's signature games.



Adaptive subdivision was added to the engine by applying a #SDS modifier to the existing land mesh. This allows the landscape to be smoothed for better shadows and landscape transitions. The scene above shows the default level [left], one subdivision [middle left], two subdivisions [middle right], and using adaptive subdivision [right].



BUILDS CONTAINED IN THIS DEMO PACK	
Directory	Description
/Broadsword/Lingo_Syntax	The original Broadsword 3D implementation, with render groups, 2D collision detection, and effects for additive textures and clouds. Also contains a version marked "DEMO_ULTRA" that turns on all effects for fast machines.
/Broadsword/JS_Syntax	An updated version of Broadsword in JavaScript Syntax, with additional tools to define levels with XML startup files.
/Broadsword/Doc	Additional documentation files and associated papers on collision detection, camera groups, etc.

Andrew Phelps regularly publishes work at the Macromedia DevNet Center and the Director Online article repository [www.director-online.com], and is the editor for the Director column in the MX Developer's Journal.

- [1] Pazera, Ernest. *Focus on 2D in Direct3D*. Edited: Andre LaMothe. Premier Press, 2002.
 [2] Phelps, A. and A. Cloutier. "Using Multiple Cameras." MX Developer's Journal, Vol 12. Issue 2. Online: <http://mxdj.sys-con.com/read/47587.htm>
 [3] Phelps, A and A. Cloutier. "2D Collision Detection Using Polygon Armatures." Macromedia DevNet Center. Online: http://www.macromedia.com/devnet/mx/director/articles/collision_detection/collision_detection_lingo.pdf

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