Improving Meta!Blast with Dynamic Elements

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What is Meta!Blast?

Meta!Blast is an educational game about cell biology geared towards high school and college students. The game helps students visualize an accurate representation of a three-dimensional plant cell. Students learn cellular plant biology by exploring a virtual soybean cell and perform biochemical reactions to help keep the plant alive.

Project Goals

Today's video games are designed with superb graphics and visual effects. The same is needed for educational games in order to keep the user's attention. The goal of this project is to animate characters that move like humans, add particle systems to imitate natural environments, and create a look and feel that matches graphics of the game to enhance the user experience.

Emulating natural environments through particle systems

What are particles systems?

- Particle systems refer to 3D graphics used to replicate very intricate and complex environmental phenomena, which usually entails particles' lifespan, initial velocity, and generation rate.

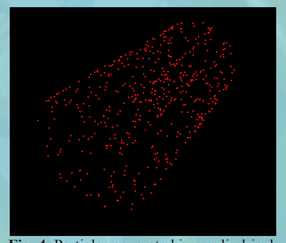

Fig. 4 Particles generated in a cylindrical prism form.

Examples

- Simulate physics-based explosions when a player fires upon an attacking virus.
- Particle-based models simulate visual fading with distance based on the real-world optics; a thylakoid in the foreground is seen with more detail while the cell membrane in the background visually appears faded in less detail.

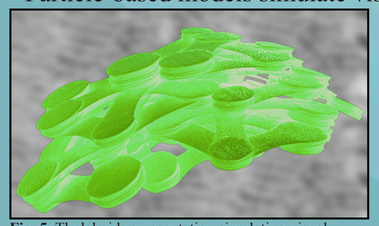

Fig. 5 Thylakoid representation simulating visual enhancement with distance within the inner membrane.

Developing a user interface look and feel

Just as Windows and Mac use a consistent look and feel unique to their brand, the buttons, text boxes, and other controls of Meta!Blast have been thematically skinned to match the game.

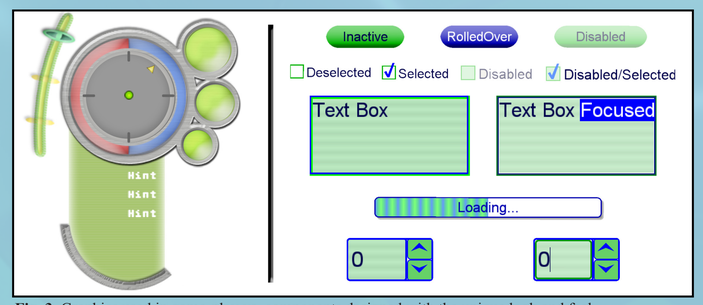

Fig. 3 Graphics used in game-play vs. components designed with the unique look and feel.

Meta!Blast has a unique interaction design that remains consistent throughout the game. The look and feel of the buttons are designed to mirror the organic look and feel of plant life. The components have affordances that let the player know how to interact with the interface without relearning how the components *should* react.

Bringing characters to life

- **Skeleton animation** or *rigging* is a technique in computer animation in which the animated character is represented in two parts: **skeleton** and **mesh**.
- The **skeleton** is a hierarchical set of bones waiting to be animated. The **mesh** is the skin that will be blended or attached to the bones.
- The addition of skeleton animation and **inverse kinematics** gives Meta!Blast characters realistic poses and joint movement by applying movement constrictions to the joints.

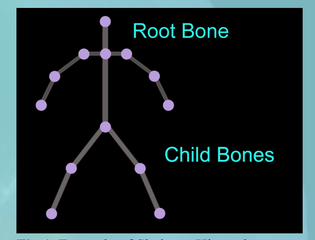

Fig.1 Example of Skeleton Hierarchy

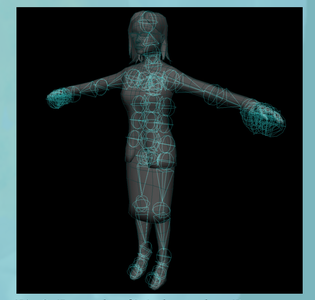

Fig.2 Example of Mesh attach to Bones

Future of Meta!Blast

Meta!Blast will continue pursuing realism with the addition of these dynamic components. Future work includes visual authoring of the user interface, using particle systems to replace polygons on structural objects, and animations based on real-time motion capture. The game will continue to develop into an entertaining interactive educational game. Meta!Blast is being distributed to high school students for educational and research purposes.

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