

# Final Project: Dune Worm Roaster

## Purpose :

To create a 3D game wherein sand worms, which surface from the desert and squirm toward a mining operation can be burned with a large overhead magnifying glass controlled by the player. The worms will catch on fire, and their movement will kick up small dust clouds on the desert surface.

## Statement :

The object of the game is the protection of a mining operation from enroaching worms. The basic idea of destroying enemies as they slowly advance position is borrowed from space invaders, but in this project, a magnifying glass will be used to focus the sun and inflame worms.

The most fun and interesting part of the project will be modelling fire and blowing dust on the surface of worms and of the desert, respectively. It will particularly difficult to create a satisfying animation of the burning and decay of a worm that looks realistic but is fast enough to simulate in real-time.

I will learn how to implement a particle system and tune it to model two different real-world phenomena (fire and blowing dust). I will also learn how to use shaders in opengl to model a refractive material.

## Technical Outline :

A simple particle system will be used in which particles will be continually created, move according to a stochastic differential equation (DE) and die off after some time. The DEs will be tuned for the fire and dust simulations to model their real-world behaviour.

A GLSL shader will be created to implement the refractive material of the magnifying glass.

## Bibliography :

"Particle Systems - A Technique for Modeling a Class of Fuzzy Objects", William T. Reeves, ACM Transactions on Graphics, 1983, volume 2, pp 359-576.

"Interactive Image-Space Refraction of Nearby Geometry", Chris Wyman, University of Ottawa, Proceedings of GRAPHITE, 205-211, December 2005.

"Simulation of glass surfaces".

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## Objectives:

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- Display fluid fire and blowing dust using a particle system.
- Enhance the particle system by applying alpha-blending on the particle quads.
- Implement a refractive magnifying glass surface which provides a slightly distorted view into the world.
- Model the animations of a worm emerging from below the desert surface and crawling toward its target.
- Have the worm model deform (decay) while it is on fire.
- Display mini-map which indicates the location of all incoming worms in the world and warps the camera to the appropriate location when clicked.
- Enhance the worm model with texture and bump mapping.
- Randomly generate the bump maps for desert boulders using Perlin noise.
- Use shadow maps to display real-time shadows of the worms and magnifying glass.
- Use a CFG to randomly generate structure of mining operation.