Leevon Levasseur, V00868326
University of Victoria, CSC 473
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Interim:
Animating Powder, Liquid, and Semi-Solid Fluid using Globular Dynamics

This project will delve into the process of animating fluids using a connected globule-particle system. The final result will compare how altering the repulsion/attraction and drag of a globule will influence the type of material the fluid represents. These materials include powder, liquid, and solid. Dynamic flow is achieved by calculating the summation of forces on each globule, including the inter-globule force and gravity, to calculate the acceleration. An Eulerian approach was used to determine velocity and position of a globule over a time step of 0.01s. At this stage of the project, gravity was neglected for simplicity. The simulation was implemented using c++ and OpenGL. The animation was tested with anim.tcl.

This report follows the implementation of the first research paper listed below. The purpose of this paper was to explore and accelerate fluid animation through globules. Brian Wyvills lecture was used to understand what values to assign for constants in the physics simulator. The last paper uses a semi-lagrangian approach that can be compared against the intended Eulerian approach, if time permits.

Related works:

- Miller, Gavin, and Andrew Pearce. “Globular Dynamics: A Connected Particle System for Animating Viscous Fluids.” *Computers & Graphics*, Pergamon, 1989.
- Wyvill, Brian. “20-Globular Dynamics.” CSC 473: Fundamentals of Animation. CSC 473: Fundamentals of Animation, Victoria, B.C, University of Victoria.
- PDI/DreamWorks, Nick Foster, et al. “Practical Animation of Liquids.” *Practical Animation of Liquids | Proceedings of the 28th Annual Conference on Computer Graphics and Interactive Techniques*, 1 Aug. 2001.

Milestones:
The globule particle system and simulator have been implemented with basic functionality. The system takes in a number of globules with initial position, velocity, mass, and radius. The simulator takes in variables for the inter-globule force calculation, and a material type and timestep. The resulting animation lacks true identity to differentiate between material types, but it is believed that this will improve with more realistic settings like gravity and collision detection.

Weeks 5/6: Implement gravity and collision detection with the ground plane. Drop globules on top of each other. Shot globules in a fountain-like projectile motion.
Weeks 7/8+: Create demonstration and slide deck for presentation. Implement collision detection with effector spheres to demonstrate pooling and a semi-lagrangian approach, if time permits. Complete report. Think about future research.

Notable difficulties faced and pending:
- Spent too much time trying to comprehend rendering software including Blender and Unity. Was unable to have complete control over simulation physics with sparse experience with both.
- Questions about decisions made by research paper author's when creating the physics simulator. For example, should the repulsive force between globules have a leading modulator of $(r^2_{max} - r^2)$? It is unclear what r_{max} is.