N. Joseph Burnette
Technical Effects Artist
404 East Duffy Street, Savannah GA 31401
912.332.2648
NBJSARGENT@GMAIL.COM
WWW.VFX.DREAMERZSTUDIO.NET

# Breakdown Sheet

## Technical Effects Reel Summer 2010

**Kindred Dance First Sequence** - Kindred Dance is a procedural effects piece inspired by marine life and the Planet Earth documentary. The kelp forest is constructed entirely from a fully customizable kelp asset with integrated wire solver and dynamic forces. Houdini's procedural workflow, as well as an extensive use of trigonometric expressions allowed me to fully capture the gracefulness and uniqueness of an underwater kelp forest. A low density volumetric smoke adds visibility to light rays and caustic map. Added falloff of color values is produced by a Houdini VEX Z-depth fog shader. For the kelp blades, In order to achieve a look that is true to my reference, I wrote a shader to produce translucency and color based on light angle and intensity.

Kindred Dance is a major experiment in effectively putting the tools I develop to use on a project that is ultimately true to life and it's representation of nature.

- SideFx Houdini

**RenderMan Flame** - An experimentation using RenderMan Shading Language. This fire was created by animating noise on the ST Grid and Implementing gradients using specific smoothstep and sine functions. Parameters were created to control the speed, oxygen, size, incandescence and translucency of flame. The flame was then mapped onto 100 grids to create a volumetric look. Noise can be offset and randomized on each grid to add variation. Visit My RenderMan page for more information.

- RSL – Pixar RenderMan Studio
- Cutter / Text Editor

**FirePlace** - An experiment to produce a stable fire with Houdini. Extra attention was placed on environment detail to deliver a photorealistic look. Gas Constant attributes were fine tuned to get a naturalistic behavior for the fire.

- SideFx Houdini

**Plant Asset** – This plant was done as part of a group project, where I was responsible for creating the extensive procedural engine and user-friendly controls used to drive the animation. Under the hood is an innovative system that uses just one bone chain to drive the animation on every other part of each leaf. A bone chain's two positions are blended to create an animation, which in turn drives a curve. The other curves use the curled position of the last curve to blend with their original position. Geometry is then captured from curve proximity. Translation values for curve points are read into Channel nodes at real time, and can be lagged to create different animation speeds for each leaf. A wide array of expressions and vector math was used to reference relative point positions for later use. Emphasis was placed on ease of control for animators and so internal procedural variables were propagated up as simple to use parameters which can then be keyframed.

- SideFX Houdini

**Explosion** – This is a data visualization piece done for SideFX during my four-month internship in Toronto. As part of a two-man team, I was responsible for project management and the development of visualization techniques for complex volumes and debris simulation. We were given point data scanned from a real explosion. The goal was to visualize the points in the form of an explosion, while simultaneously staying true to the physical accuracy of the points. In this project, I used the trajectory of the points, along with its velocity and rotation attributes to create secondary smoke trails effects, as well as an extensive system for fracturing geometry to produce a number of shards equal to the number of points in the original data. Linear Interpolation equations were used to fracture each part of the truck differently, while still keeping a total amount of fractured pieces. In order to save time, no Houdini solver was used, except for the core smoke which utilized the pyro solver. All of the effects elements in this piece were done separately to achieve a specific look for each, and because of the amount of data to be simulated, the amount of points used was approximately 0.1% of the total points available in the original data.

- SideFX Houdini

**Cloth Shader** – This cloth shader utilizes the cellnoise() function of the RenderMan Shading Language to drive displacements. Parameters were created to control the iterations of the resulting voronoi cells and the value falloff from the center of each cell to the boundary edge. The resulting displacements provide for an image comparable to my reference but require a shading rate of 0.25 or less to avoid flickering in a moving image. This is a side effect of not having a level of detail high enough to capture the minute polygons produced through the high number of displacements.

- RSL – Pixar RenderMan Studio
- Cutter / Text Editor

**Kindred Dance Second Sequence -** Kindred Dance is a procedural effects piece inspired by marine life and the Planet Earth documentary. In the second sequence, I focused on creating a highly flexible system for simulating various flocking behaviors for schools of fish. The logics behind this system was loosely based on the research of Craig W. Reynolds and his 1987 Technical Paper titled "Flocks, Herds, and Schools: A Distributed Behavioral Model." Built from the ground up using a wide variety of VEX nodes and expressions in Houdini, this flocking system features rudimentary steering behaviors common in autonomous systems, namely Separation, Alignment/Cohesion, Obstacle Avoidance, Path Following and Wandering. Obstacle avoidance is achieved by shooting a ray from each particle in the direction of the particle's velocity vector. If the ray hits a primitive, it takes the normal of that primitive and apply a near inverse steering force to the particle. Functionality for Cohesion is achieved by averaging out the velocity of neighboring particles and applying that average as the new velocity for that group. Path Following and also Wandering is achieved by using Edge Normals to drive acceleration. As with the other tools that I develop, variables are propagated up to create artist-friendly parameters to control every aspect of the flocking system, including geometry, varying animation relative to acceleration, and thresholds for adjusting influences on neighboring particles.

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- SideFx Houdini