The Pathfinding Mold

Procedural Pathfinding & Organic Growth

Creator: Weijun Wang

Software: SideFX Houdini 21, Karma CPU, KineFX

Core Concepts: Procedural Growth Simulation, Shortest Path Algorithm, VEX Scripting, KineFX Rigging, Emissive Shading

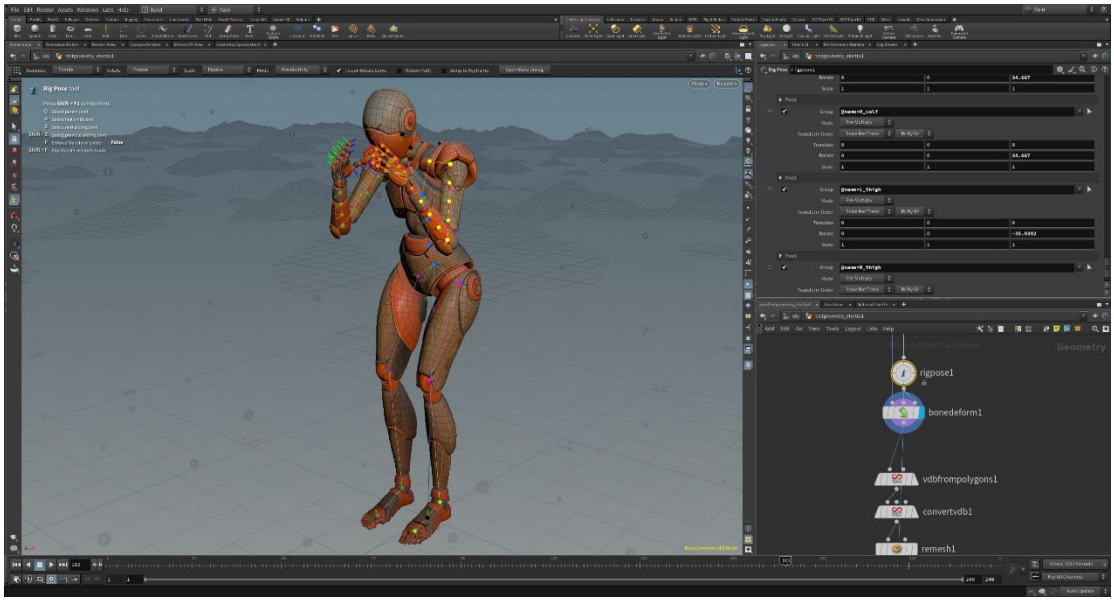
Design Concept

This project explores the intersection of organic growth patterns and rigid procedural algorithms. It visualizes a parasitic, highly emissive network autonomously colonizing a human figure. Rather than relying on traditional keyframe animation, the growth is entirely driven by mathematical pathfinding rules seeking resources across a dynamic topology. The visual style contrasts the hyper-emissive, creeping veins with the cold, lifeless obsidian environment, creating a sense of quiet, creeping inevitability and showcasing the power of rule-based procedural generation.

Production Process

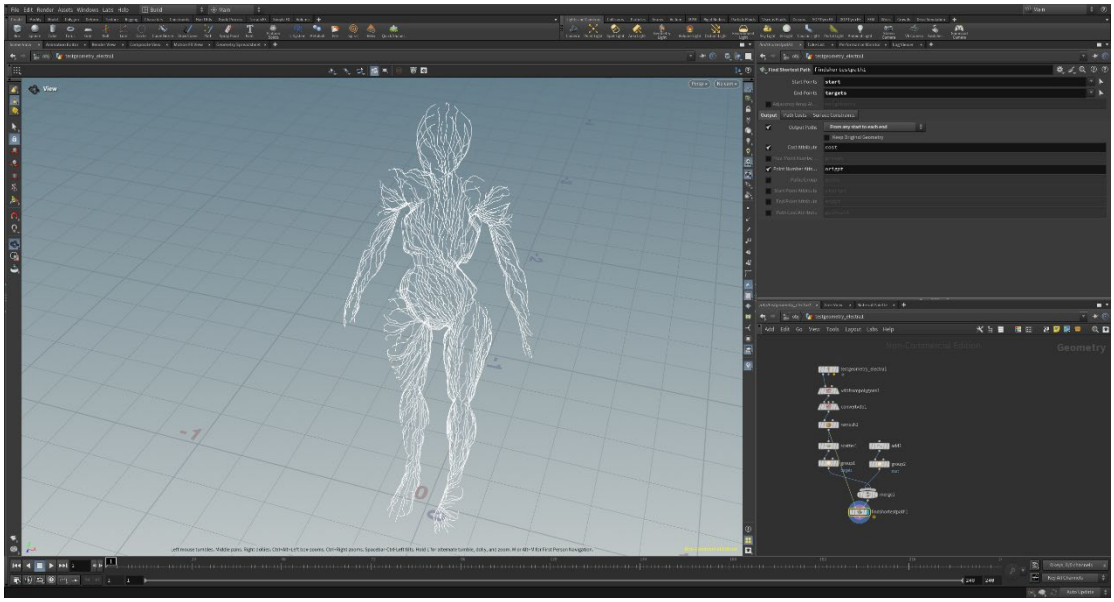
Phase 1: Topographical Host & KineFX Rigging

The project began by preparing the base human geometry. Using Houdini's KineFX system (rigpose and bonedeform), the model was procedurally posed into a suspended, fetal position. A peak node was utilized to slightly offset the pathfinding mesh from the rendering mesh. This decoupled workflow prevented Z-fighting while ensuring the generated network hugged the host's contours perfectly, demonstrating non-destructive pipeline management.



Phase 2: The Pathfinding Logic

To simulate the brainless, efficient growth of organisms like slime molds, the geometry was remeshed into an even grid. Thousands of target "resource" points were scattered across the surface, with origin points defined at the base. A findshortestpath node generated a complex polyline web, mathematically calculating the most efficient routes across the topology, mimicking natural capillary formation.



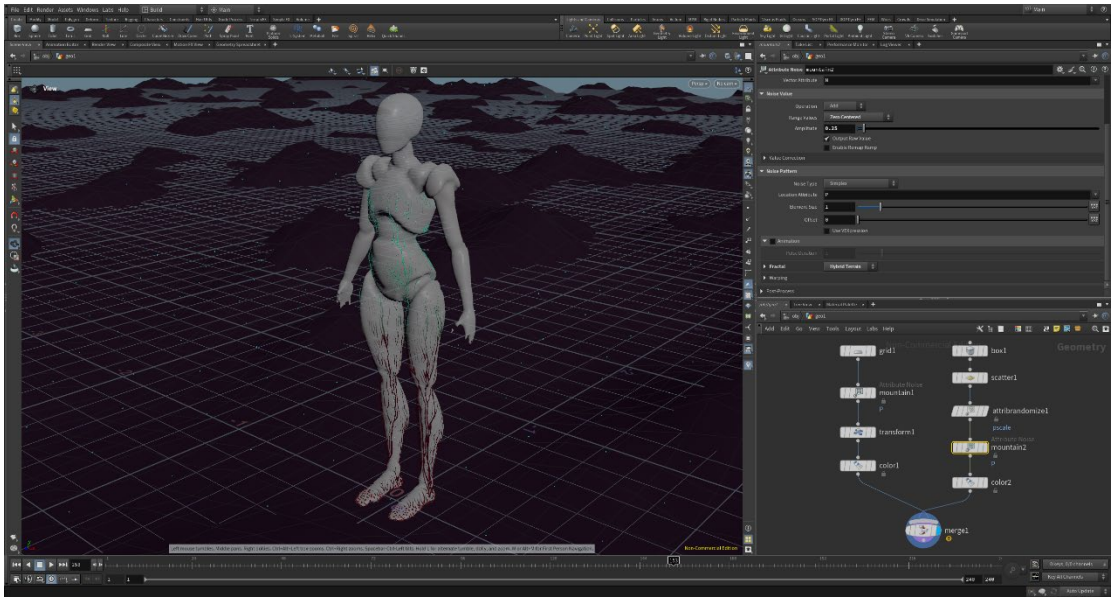
Phase 3: VEX-Driven Organic Animation

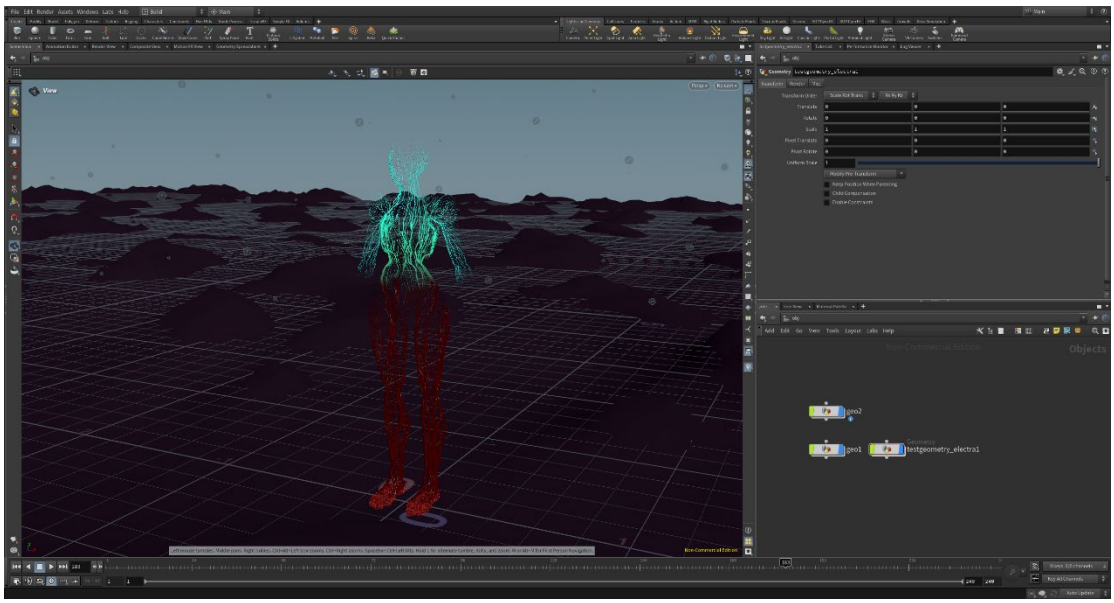
To avoid the unnatural, uniform speed of percentage-based animation (carve node),

custom VEX code was implemented in an Attribute Wrangle to drive the growth based on physical distance (cost).

float dist = ch("grow") - @cost; f@fade = fit(dist, 0, ch("tail_length"), 1.0, 0.0);

This logic not only animated the creeping vines but also generated a dynamic color attribute (fade). The leading edges received extremely high energy values (simulating active growth), while the trailing paths decayed into dark, exhausted veins.





Phase 4: LookDev & Karma Rendering

The environment was constructed using noise-driven displacement to create an alien terrain, assigned a low-roughness PBR obsidian material to serve as a dark mirror. Floating, semi-transparent spheres were instanced via copytopoints and animated with upward buoyancy to simulate an amniotic fluid environment. Due to the extreme polygon count and complex emission bounces, the sequence was rendered using Karma CPU, utilizing a clean node to filter degenerate primitives and ensure memory stability.

Conclusion

This simulation serves as a rigorous exercise in procedural ecosystem building. By leveraging shortest-path algorithms, VEX-driven attributes, and decoupled rendering workflows, the project demonstrates how complex, organic visual effects can be achieved through pure mathematical logic and highly optimized Houdini pipelines.