From Spark to Inferno: Scalable Stylized Fire in Disney and Pixar's *Hoppers*

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Figure 1: A forest fire rages in Disney and Pixar's *Hoppers*. © 2026 Disney/Pixar

ABSTRACT

At a pivotal moment in the film *Hoppers*, a forest fire rages out of control, surrounding our heroes and engulfing the glade which Mabel swore to protect. Achieving a highly stylized look, and immersive feel for the forest fire to support our story across two sequences and close to 150 shots was a significant production challenge. Hundreds of dressable fire-volume instances, hero fire assets, smoke plumes, and supporting elements contributed to the final look of the scene as well as providing the basis for the illumination in these sequences.

Our talk describes how we tackled this challenge through our production strategy, looks and rig development, fire 'taxonomy' and dressing, lighting and compositing workflows, as well as optimizations for both our fire dressing and an optimized fire lighting representation which was created during shot production.

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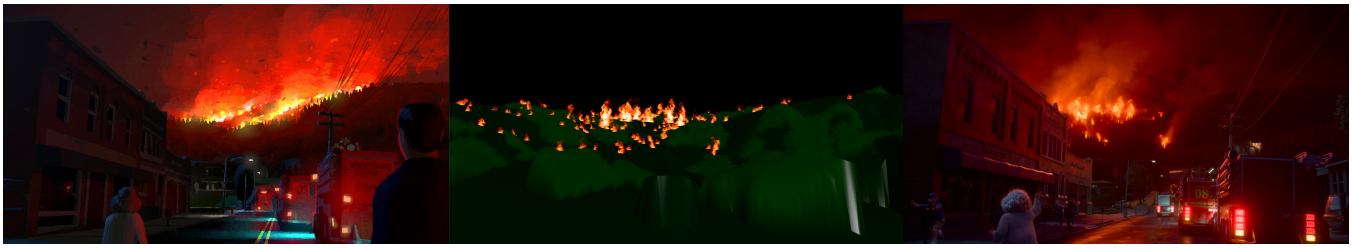


Figure 2: Left to right: concept artwork, Houdini GL view with baked emission/density, final RenderMan render. © 2026 Disney/Pixar

1 LOOKS AND RIG DEVELOPMENT

To achieve precise fire aesthetics, an adjustable color lookup mapped simulation data to specific colors, which were then baked into emission and density values for RenderMan. This ensured a 1:1 color match between Houdini's viewport and final renders, allowing for rapid, consistent adjustments before asset creation (Figure 2).

Three dedicated systems were developed: Fire Dress, Fire Mid, and Fire Hero. Each system was designed with its own robust logic to efficiently solve a specific problem.

1.1 FIRE DRESS

Instancing was used to populate large areas of fire and smoke. A library of simulation assets was created, featuring variations in size, activity, wind, and extinguishing events. A custom "Fire Instancer" node was developed to allow artists to easily place these assets on points, using attributes to control rotation and event timing to meet specific shot requirements. Larger "aggregate" smoke plumes were also constructed as library assets that could be placed directly in a shot. This allowed finer control of compositional smoke as opposed to smoke sourced directly from fires.

1.2 FIRE MID



Figure 3: Left: point cloud growth signal. Right: resulting rendered fire. © 2026 Disney/Pixar

After laying out the Fire Dress elements, we promoted the most visible sections which did not feature character interaction to a Fire Mid rig. Fire Mid loaded large amounts of set geometry such as trees and grass, and simulated fire growing along that geometry at a medium resolution. Our goal for Fire Mid was to achieve believable growth of the fire across a relatively large area of the midground set geometry. To achieve this, we procedurally authored a per-point growth attribute to direct the spread of the fire, combining a wind direction with a Poisson solver [de Goes et al. 2020] used to generate smooth vectors from the trunks of the trees to their branches. In addition to providing the source for the Fire Mid simulation, we also rasterized the growth attribute into a burn signal that was referenced by the shaders for all affected set pieces, allowing us to burn and char large areas of the set quickly (Figure 3).

1.3 HERO FIRE AND SET INTERACTION

Fire Hero shots used similar techniques as Fire Mid, but enabled higher resolutions and more art directability in the growth and simulation of the fire for close up shots. For example, in addition to the procedural growth atttribute provided by the Fire Mid rig, our Fire Hero rig allowed artists to directly paint and keyframe the growth attribute to achieve specific timing and growth patterns. This was crucial for shots where the fire interacted with characters or needed to follow a specific art directed progression.

2 LIGHTING AND COMPOSITING

The fire sequences are the film's emotional and visual climax, contrasting cool cyan moonlight with violent flames to convey scale and intensity. The aggressive motion and extreme color (reds, oranges, whites) of the fire contrast with the subdued, teal-lit, sometimes silhouetted environment. Wide shots emphasize the fire's magnitude and the environment's scale, while close-up shots foreground the flames, with the city barely visible through dense smoke, stressing danger and urgency.



Figure 4: A breakdown of standard layers used in lighting and compositing for fire shots. © 2026 Disney/Pixar

Achieving the final look required close FX and Lighting collaboration. The FX team provided layered elements (hero fire, mid-ground,

dressing fires, burning signals, embers, and smoke) for heavy compositing to shape the fire, push contrast, and deliver the necessary scale and intensity (Figure 4).

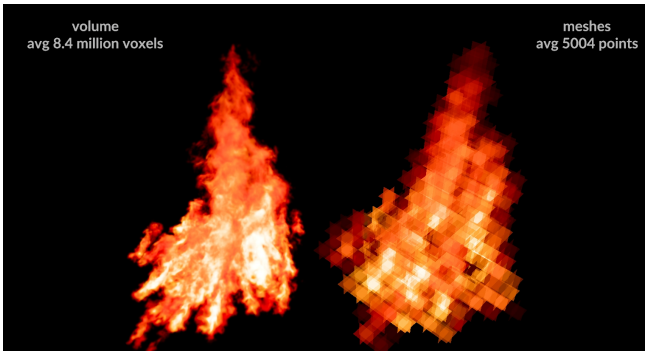


Figure 5: Left: Volumetric fire data. Right: Soxel light representation. © 2026 Disney/Pixar

3 SCALABILITY AND OPTIMIZATIONS

Scaling our fire pipeline to forest-sized environments required decoupling simulation cost from tree count. We developed three techniques to achieve this. Temporal visibility ranking prioritized the most screen-prominent trees across each frame range, focusing simulation effort where it had the greatest visual impact. Canopy visibility culling further reduced computation by selecting only the visible portions of each tree's foliage, skipping fire on occluded branches. Finally, decoupled clustering maps separated computation scheduling from the underlying geometry, allowing lightweight tasks to run on a single machine while heavier simulations were distributed across many machines in parallel. These optimizations enabled us to process arbitrarily large forests without a proportional increase in cost.

Fire lighting on the scale of our forest also required special consideration. After pursuing lighting our scenes entirely with emissive volumes, we could not achieve a sufficiently high number of samples to converge the fire lighting in a reasonable time frame. To address this, we developed an optimized fire lighting representation based on surface aggregates of the emissive volumes, which we called "soxel" (or "surface voxel") lights (Figure 5). These soxel lights were designed to preserve the energy of the original volumetric fire while significantly reducing the computational load for lighting. By converting the emissive fire volumes into these surface aggregates, we were able to achieve a much faster convergence in our renders, allowing us to maintain the visual fidelity and lighting color complexity of the fire while optimizing our rendering times.

REFERENCES

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