# Interactive Watercolor Animations

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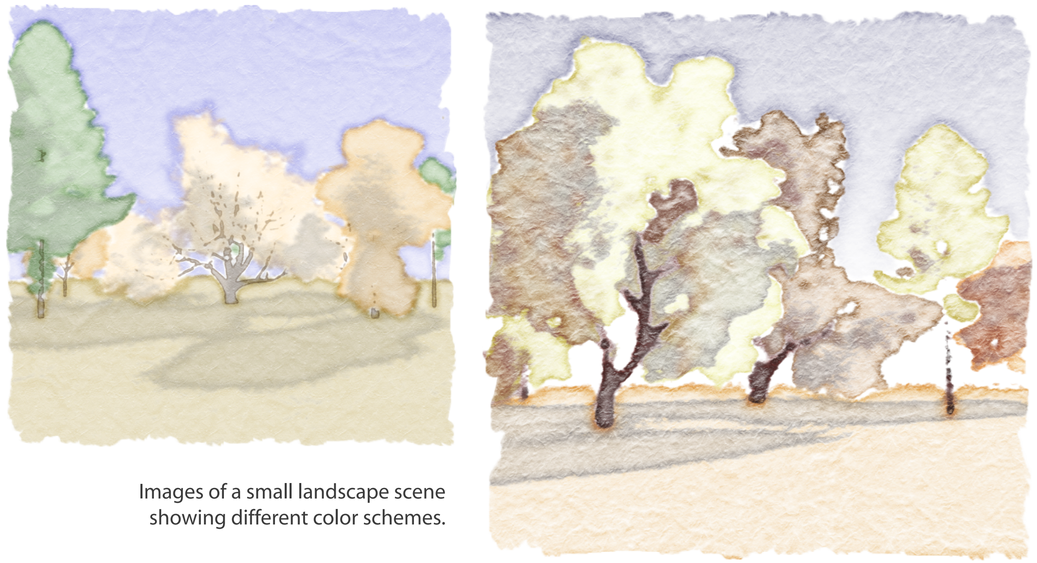
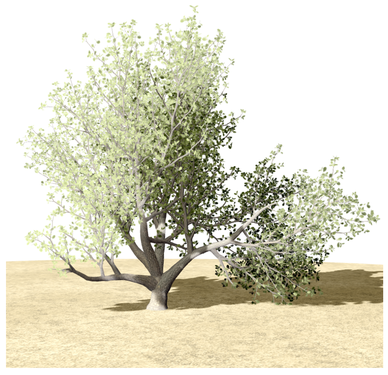


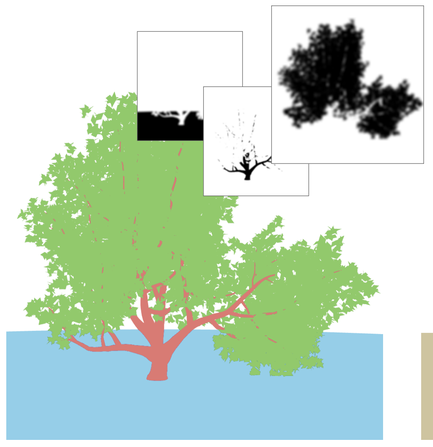
Images of a small landscape scene showing different color schemes.

## Introduction

Watercolor is a unique drawing medium that is characterized by soft, flowing, and complex patterns, which occur due to the motion of water and color pigments during the painting and drying process. Specific textures are created by numerous natural effects such as diffusion, backruns, pigment granulation, and color graduation. A skilled artist exploits the very complex nature of watercolors in order to achieve a wide variety of artistic effects. In the field of non-photorealistic computer graphics, the production of watercolor paintings is one of the most intricate and complex processes. In contrast to already known simulation algorithms, our aim is to create convincing watercolor renderings of 3D-scenes in real-time. We introduce several algorithms that allow the imitation of the most important drawing techniques and natural effects, and give the appearance of natural watercolor paintings. Our approach incorporates two essential painting techniques: the wet-in-wet and the wet-on-dry painting. We especially rely on the potentials of hardware accelerated shaders, in order to create real-time graphics.



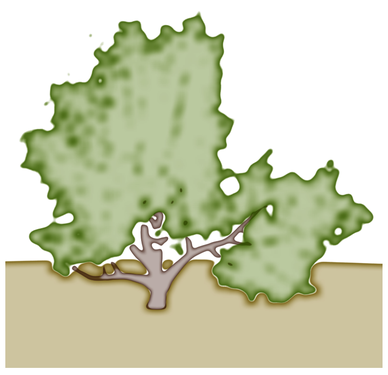
Our renderings are based on complex models that are usually used for photorealistic renderings. Special consideration must here be given to the scene complexity, its segmentation, and simplification.



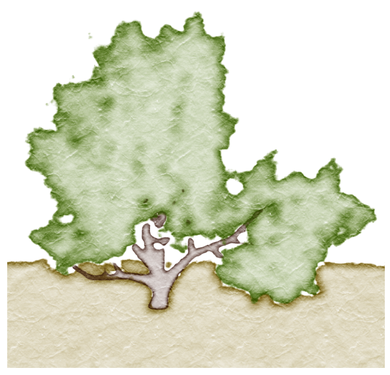
The segmentation is based on unique identifiers. The resulting ID-image contains several layers with a more or less uniform content. A Gaussian filter is applied to simplify the ID-layers.

The shape of the color layers arises from the intensity values of the filtered ID-layers. Here, a step function is applied to produce a first, hard edged shape of the color layers.

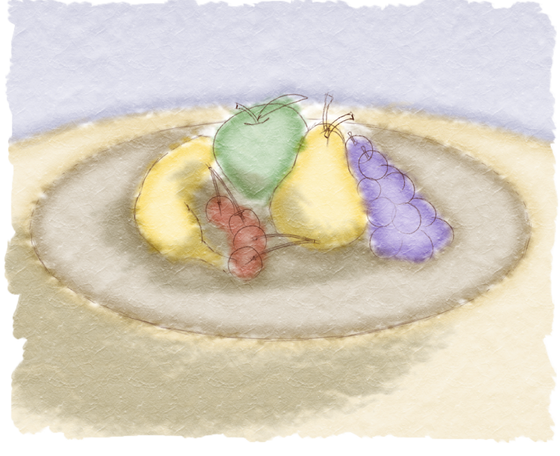
While the wet-on-dry painting causes a hard edged border, the wet-in-wet painting causes smooth, feathery patterns at the border. To adjust the border behavior we replace the step function with a smooth step function.



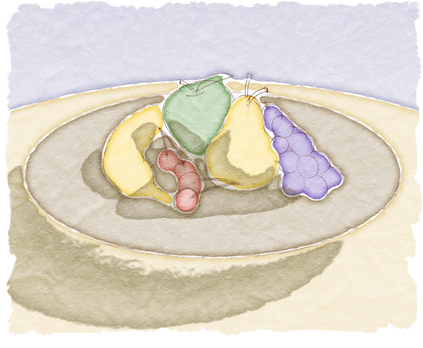
The edge darkening effect is easily imitated using the filtered ID-layer. Here, we modulate the color layers transparency by the smooth intensity values of the ID-layer.



To emphasize the effects of the underlying paper structure, we additionally modify the color layers transparency and the intensity values of the ID-layers according to a paper texture.



A still life showing different settings of the watercolor effects.



## Conclusion

We tested our implementation on a 3.0 GHz Pentium IV with an GeForce 6800 graphics board. A multipass rendering procedure is required. The scenes are rendered at 720 × 720 pixels, the ID-images at 360 × 360 pixels. The following table gives an overview of the scene complexity and the performance.

| Figure | Triangles | RendPasses | Colors | Fps |
|---|---|---|---|---|
| landscape | 420614 | 3 | 7 | 26.5 |
| single tree | 62624 | 1 | 3 | 134.3 |
| still life | 62560 | 4 | 8 | 44.7 |

Future work aims at the lighting and shading of the scenes. Currently, the color layers have a unique color and thus they produce a flat impression. Here the incorporation of a shading algorithm will be helpfull as well as the integration of additional color layers that emphasize highlighted or dark areas.

## References

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