Project Gustav: Immersive Digital Painting

William Baxter
Microsoft Research

Nelson Chu
Microsoft Research

Naga Govindaraju
Microsoft Research

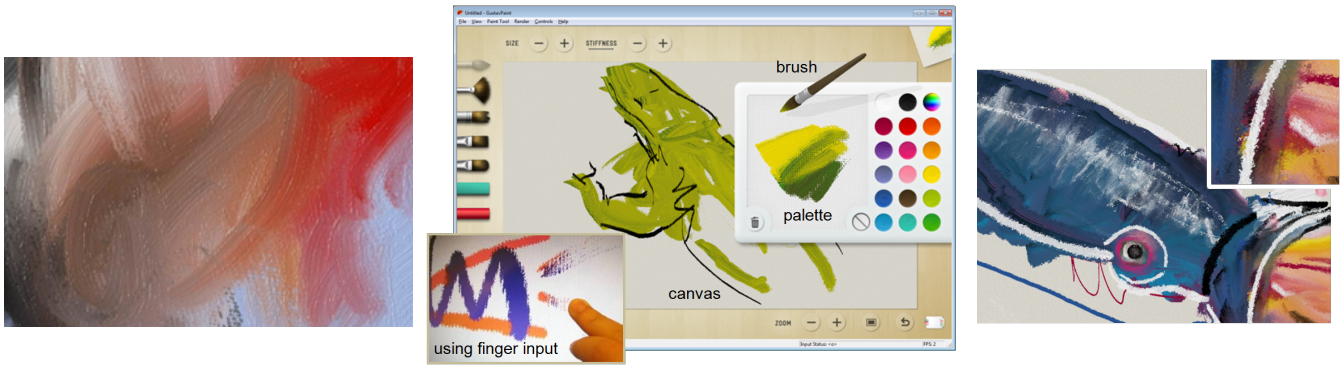

Figure 1: *User interface of our painting system and close-ups of our oil and pastel art media models.*

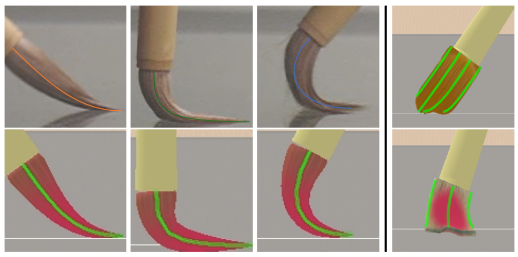

Figure 2: *We capture brush deformations from video sequences, and create a variety of brushes using this data.*

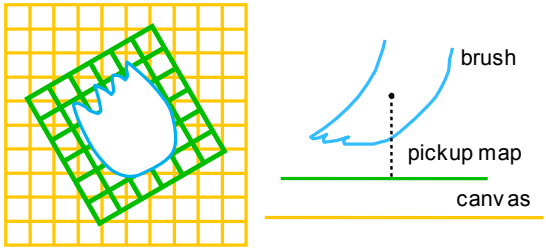

Figure 3: *Resolution-matched 2D pickup map preserves fine color detail better than the 3D mapping technique used in previous 3D brush paint systems.*

Abstract

Project Gustav is a digital painting system that enables artists to become immersed in the digital painting experience. It achieves interactivity and realism by leveraging the GPU to implement our novel art media modeling and brush simulation algorithms.

Compared with current digital painting packages, there are two main advances over state-of-the-art. The first is a highly efficient, data-driven 3D deformable brush simulation [Baxter and Govindaraju 2010]. The second is paint modeling algorithms for oil and pastel that preserve stroke details as paints are smeared and mixed [Chu et al. 2010]. Together these allow digital painting in a manner much closer to the real-world experience. This not only makes it possible to paint digitally with very little training but also respects the skills artists have acquired in real life. We further combine our painting simulation with the latest touch and pen input technology to make Project Gustav even more enjoyable to use. Together, these features provide a responsive and realistic digital painting experience never before attained.

1 Brush Simulation

We create dynamic deformable 3D brushes based on measurements taken of actual brush deformations (Fig. 2, top left). We find that a small table of such measurments is enough to recreate the key deformation characteristics of a brush (Fig. 2, bottom left), and the result is a fast, stable and realsitic brush model for use in a digital painting system. To get realistic dynamics, we augment the static deformation data with a simplified energy optimization that has a closed form solution, leading to an extremely efficient simulation technique. We also introduce two new methods for skinning mesh deformations based on control spines.

SIGGRAPH 2010, Los Angeles, California, July 25 – 29, 2010.
ISBN 978-1-4503-0210-4/10/0007

2 Paint Model

Previous work such as [Baxter et al. 2001] showed the benefits of combining 3D brush models with a paint media model; however, the way these works mapped paint onto the 3D brush surface and used repeated back-and-forth tranfers to implement smearing led to excessive blurring of color detail. By making the counter-intuitive choice of using a 2D pickup map with matched resolution (Fig. 3) to implement bidirectional transfer of paint, our technique minimizes re-sampling artifacts. Furthermore, by using a special snapshot buffer, we are able to prevent the other major source of blurring, the repeated resampling. Together these techniques allow us to better preserve the fine streaks and color details that are characteristic of oil and pastel styles.

References

BAXTER, W., AND GOVINDARAJU, N. 2010. Simple data-driven modeling of brushes. In *Proc. Symposium on Interactive 3D Graphics (I3D 2010)*.

BAXTER, W., SCHEIB, V., LIN, M., AND MANOCHA, D. 2001. Dab: Haptic painting with 3d virtual brushes. *Proc. of ACM SIGGRAPH*, 461–468.

CHU, N., BAXTER, W., WEI, L.-Y., AND GOVINDARAJU, N. 2010. Detail-preserving paint modeling for 3D brushes. In *Proc. Symposium on Non-Photorealistic Animation and Rendering (NPAR 2010)*.