

Expresii Watercolor

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Figure 1: 'Dancing Man' painting created with Expresii.

ABSTRACT

We present Expresii, a software tool that gives digital artists the serendipity of painting with water-based media like never before. Our watercolor simulation is based on Computational Fluid Dynamics to give true fluidity. We devised a novel hybrid-vector-raster rendering method to allow large output at 12k+ resolution. Our expressive virtual brush can capture stroke rhythm as if wielding a real brush to give organic variations. Finally, we also make use of G-Sensor in today's tablet computer for surface tilting and stylus pressure for variation in color loading to make the painting experience closer to real life.

CCS CONCEPTS

• Applied computing → Arts and humanities → Fine arts

ADDITIONAL KEYWORDS AND PHRASES

Painting, Ink, Watercolor, Simulation, Brush

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1 BACKGROUND

Watercolor has been a major challenge in digital painting technology. Many software packages such as *Corel Painter* have 'watercolor' brushes but they appear to be based on improvised physics and do not look natural enough. These simulations are often done in low resolution due to simulation inefficiency, which is another major complaint from artists.

To combat the low-resolution problem, DiVerdi et al. [2012] devised a method which shoots out polygons from the cursor to simulate watercolor-like effect. Unfortunately, since what you get are discrete polygons, the result does not look natural when zoomed into, defeating the purpose of such a solution. Blaškovič [2016] based their watercolor simulator on Navier-Stokes equations but the results lack natural-looking flow patterns.

2 METHOD

Simulation To better simulate water-based media with natural flow patterns (Figure 1), we solve the Lattice Boltzmann equations on the GPU as described in [Chu and Tai 2005] and improved upon it the accuracy of the flow and the paint transfer. For stroking, we employ the 3D brush model from [Chu and Tai 2004] for its modeling efficiency allowing vastly different marks to be made simply by wielding the virtual brush.

Rendering We devised a novel hybrid-vector-raster method for high-resolution artwork rendering. This is implemented fully on the GPU and is closely coupled with our paint simulation model. Unlike fully-vector-based methods, the rendering cost is only proportional to the display resolution rather than the number of strokes in an artwork, making pan-and-zoom interaction always smooth even on a mobile device.

3 USER INTERFACE DESIGN

Here we highlight a number of new ways of doing things first introduced in Expresii.

Surface Tilt Users can direct the paint flow by tilting a tablet computer equipped with a G-Sensor (Figure 2), via a game controller thumb-stick or a tilt sensor [Chu et al. 2013, Chu 2016].



Figure 2: Tilting device to direct ink flow using G-Sensor.

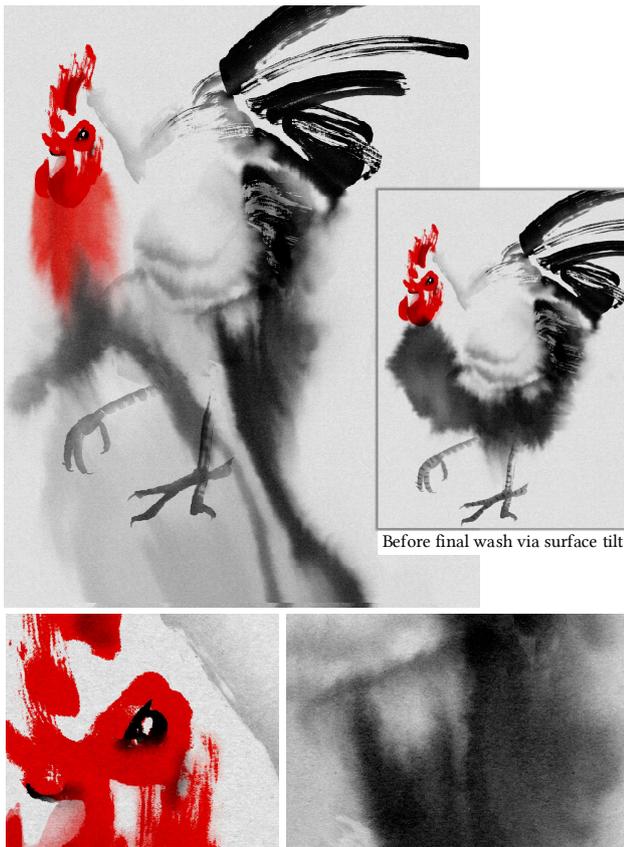


Figure 3: 'Rooster' painting created with Expresii.

Brush Visualization By rendering the 3D brush right where the stylus points [Chu and Tai 2004], artists can make better decisions when they can see exactly how the strokes develop. This is especially true for Eastern watercolor or calligraphy.

Color Loading Most paint apps allow only one single color loaded at a time. However, in real-life Eastern watercolor, we often load a gradient by picking up multiple colors. In Expresii, we allow this type of operation by having the color going more into the brush when users press the stylus harder.

4 RESULTS AND DISCUSSION

Painting We can do various organic wash effects (Figures 1-5) without pixelation when zoomed in at 12+ resolution (Figure 3).

Calligraphy Our virtual brush is also capable of doing Eastern calligraphy (Figure 4), an art form with high demand on the ability to create various marks via rhythmic brush wielding.

Animation Figure 5 shows two frames from a sample animation. Each frame was done in Expresii and a third-party tool was used to combine the frames. Such animations with Eastern ink painting effect were not possible before.

In conclusion, Expresii is the first paint system truly capable of giving the charm of water-based media to digital artists. Visit <http://www.expresii.com> for videos and more.

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Figure 4: Sample painting with calligraphy created with Expresii (Painting courtesy of Shuen Leung; calligraphy by paper author).

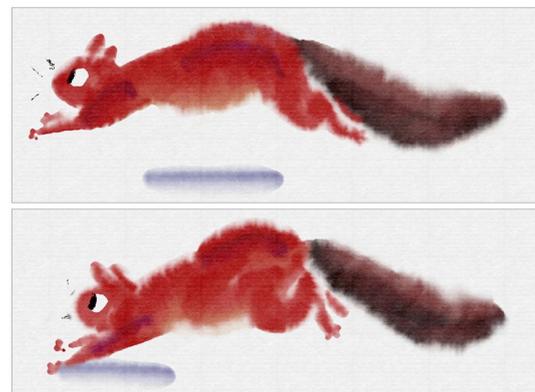


Figure 5: Two frames from an animation created with Expresii (Courtesy of Angela Wong).