Digital Airbrushing with Spatial Augmented Reality

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1 Introduction

Virtual design has the potential to greatly improve the dialog between designer and client. We have been investigating the use of Spatial Augmented Reality (SAR) in the industrial design process, including sculpting [2], and virtual control panel design [4]. This demo shows how SAR can be used by designers to preview designs, by allowing them to digitally airbrush onto physical objects.

2 Airbrushing with Digital Paint

We have implemented a technique for digitally airbrushing against a virtual stencil, as shown in Figure 1. Participants will be able to interact with our system to paint onto physical objects using physical-virtual tools.

Two tools are used in the airbrushing application:

- The Airbrush
- The Stencil

The airbrush tool allows participants to digitally paint in a similar way to traditional airbrushing. The distance between the airbrush and the object affects how the paint falls onto the object. Spraying from far away causes the paint to spread over a wider area, with each point on the target receiving less paint. Spraying up close causes a dense, narrow stream of paint to appear on the surface. The paint is feathered at the edges, and blending allows mixing between colors.

The stencil tool allows participants to mask certain areas from receiving paint. Physically, the stencil tool is a white piece of board; the actual stencil shape is projected onto it. Participants can select from a variety of stencil shapes to mask areas of paint. In addition to the shapes provided, the user can create custom stencil shapes at runtime. New stencils can be created by drawing onto the tool with the airbrush. An outline of the shape is projected onto the tool as it is being drawn. When a closed loop is detected, the previous stencil is replaced with the custom one. This offers the user more flexibility, as they can create shapes for specific situations.

3 Implementation Details

Digital Airbrushing is implemented using C++ and OpenGL. The airbrush is implemented in the following manner:

1. Setup a Frame Buffer Object (FBO) with perspective projection from the point of view of the airbrush.
2. Render the stencil shape to the stencil buffer of a Frame Buffer Object (FBO). This will mask the paint correctly.
3. Render the scene to the FBO using a shader. Instead of color information, the shader writes the texture coordinates and paint intensity of the objects hit with paint.

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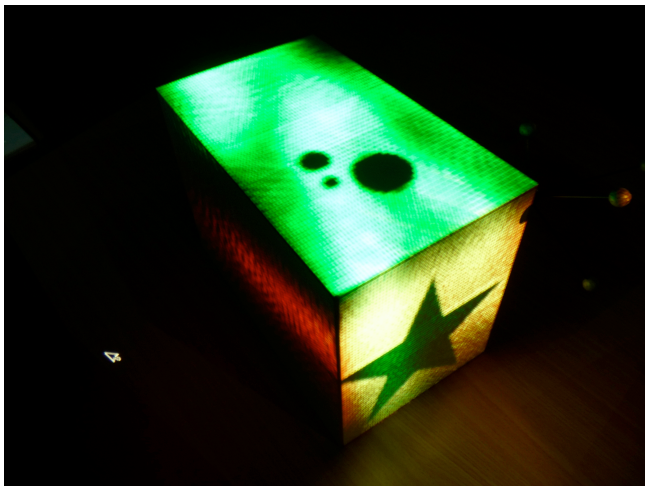

Figure 1: The result of digitally airbrushing onto a physical box.

4. Iterate over the data in the FBO. For each point hit with paint, modify the color of the object's texture, at the texture coordinates indicated in the FBO.
5. Render the scene as normal to the projector, causing the digital paint to appear correctly on the physical object.

4 Related Work

Digital airbrushing is a demo application to showcase our physical-virtual tools [3] concept for SAR user interfaces. Our investigations are inspired by Shader Lamps [5], a SAR technology that utilizes digital projectors to augment physical objects with computer generated images. In particular, Dynamic Shader Lamps [1] allows users to digitally draw on objects using a tracked stylus. We have extended this idea and provided an airbrush and stencil.

References

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