

OPTIMIZATION OF SINGLE AND LAYERED SURFACE TEXTURING

A Dissertation

by

ALETHEA SCATTERGOOD BAIR

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2009

Major Subject: Architecture

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Chair of Committee,	Donald House
Committee Members,	Nancy Amato
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ABSTRACT

Optimization of Single and Layered Surface Texturing. (May 2009)

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Chair of Advisory Committee: Dr. Donald House

In visualization problems, surface shape is often a piece of data that must be shown effectively. One factor that strongly affects shape perception is texture. For example, patterns of texture on a surface can show the surface orientation from foreshortening or compression of the texture marks, and surface depth through size variation from perspective projection. However, texture is generally under-used in the scientific visualization community. The benefits of using texture on single surfaces also apply to layered surfaces. Layering of multiple surfaces in a single viewpoint allows direct comparison of surface shape. The studies presented in this dissertation aim to find optimal methods for texturing of both single and layered surfaces.

This line of research starts with open, many-parameter experiments using human subjects to find what factors are important for optimal texturing of layered surfaces. These experiments showed that texture shape parameters are very important, and that texture brightness is critical so that shading cues are available. Also, the optimal textures seem to be task dependent; a feature finding task needed relatively little texture information, but more shape-dependent tasks needed stronger texture cues.

Subsequent, narrower experiments investigated specific texture parameters for optimal textures. Textures with significant directionality and structure were found to be useful on both surface layers. A range of viable top surface opacities was found, and relationships between texture sizes were investigated. A feasibility experiment was run to estimate bounds on the number of layers that can be effectively visualized. Finally, a single surface experiment was run to investigate causes of bias and error in principal direction and projected grid textures. Overall performances of principal direction and projected grid textures were not statistically different, but differences were found in the location of errors between the two texture types.

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NOMENCLATURE

ANOVA	Analysis of Variance
PCA	Parallel Coordinate Analysis
LDA	Linear Discriminant Analysis

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