FRENCH SURFACE:

A New Technique for Surface Design

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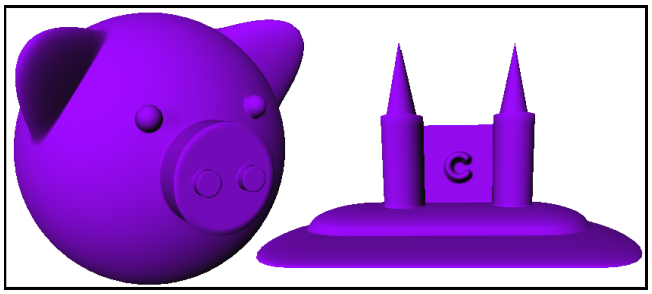

Fig 1: Models created using FRENCH SURFACE.

Introduction and Motivation

We present a new user-friendly interface for surface design. The goal is to overcome limitations associated with traditional methods: their dependence on freehand controling and their rigid mathematical structures. Our solution is motivated by the drafter's tool called *French curves*, which are used as *templates* for tracing curves. Digital French curves are, for example, investigated by Singh[2].

Our project considers its analogue in one higher dimension, namely 3D surfaces. A predrawn set of surfaces, called *French surfaces*, is given to the user to choose from. The selected surfaces are then connected together to form the final model. The advantage of this approach is that the only input from the users is their artistic expressions, not their mathematical skills. Initial testing shows that the system is easy to learn and can be quickly used to construct models. Examples usings our technique are shown in Fig 1.

General Scheme

Fig 2 shows the stages in using FRENCH SURFACE. In each stage, the user selects a surface from the initial set of French surfaces on the control panel as a *starting point* for their search. Then they find the exact one they want by adjusting scale-bars and action-buttons. For example, users can stretch or crop a cone, extend the ring of a torus, tilt the angle of a wedge, or bend a cylinder. The selected surface is then positioned over the ongoing model and then blending may be applied.

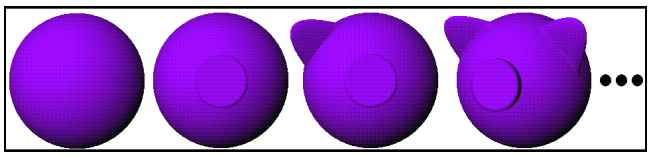

Fig 2: Stages in creating the piggy in Fig 1.

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The Set of French Surfaces

The set of French surfaces must be large enough to give any shape, but not too large to allow for easy searching. We have come up with a *minimal* set of *primitive* surfaces (Fig 3). This includes surfaces ranging from those with a rounded base to those with an elongated base; and from those with a smooth top to those with a pointed top. It also runs through surfaces of different scale, tilt and extent. Theoretically, this set, together with the powerful blending technique, is enough to give any surface. Our system is different from methods where users manipulate or draw surfaces, such as the generalized cylinders or Welch's approach[3]. In our system, users navigate surfaces rather than manipulate control points to get the surface they want.

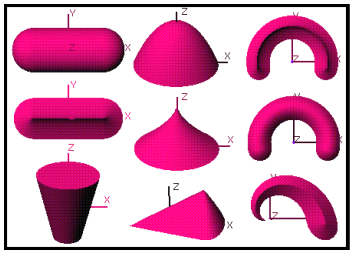

Fig 3: Some French surfaces.

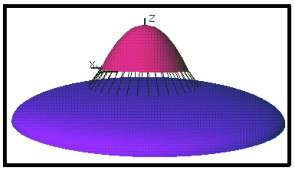

Fig 4: Rays as a guide.

Blending Surfaces

Blending is vital to our system. The blend between our triangle tesselated shapes is formed by a family of Bezier curves. This is similar to Welch's method[3], except the degree of blending is user-adjustable. Rays from the rim serve as a blending guide (Fig 4). In our system, blending preserves the original shape of both the surface and the model.

What's next?

Our project suggests a new direction for surface modelling. We have developed a set of French surfaces that can be blended to create any surface features. The idea of using predefined, modifiable surfaces leverages off the advantages of the French curves. Our technique applies to applications such as creating predefined libraries of shapes for CSG, spline models, or even freeform shapes for TEDDY[1]. Future research includes improvements to the blending algorithm, more user testing, integration of our technique with various surface modelling packages, the support for creating personalized libraries, and the use of AI techniques to learn commonly used surfaces for easy access.

[1] T. Igarashi, S. Matsuoka, and H. Tanaka. Teddy: A Sketching Interface for 3D Freeform Design. *SIGGRAPH 1999 Conference Proceedings*, pp.409-416, 1999.

[2] K. Singh. Interactive Curve Design using Digital French Curves. *1999 Symposium on Interactive 3D Graphics Atlanta GAUSA*, pp.23-30, 1999.

[3] W. Welch and A. Witkin. Free-form Shape Design Using Triangulated Surfaces. *SIGGRAPH 94 Conference Proceedings*, pp.247-256, 1994.