Chapter 37

Generic Textile Structure Editor

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ABSTRACT

Non-rectilinear structures dominate traditional Andean weaving patterns. A systematic description is essential for enabling weavers to document and secure intellectual property rights and for preserving their rich cultural heritage. The author presents a system for modelling non-rectilinear as well as rectilinear weaving patterns; it is the first of its kind. The authors have implemented an editor demonstrating the capabilities of the approach and show its application.

INTRODUCTION

Rectangular weavings (like the output of common mechanical looms) exhibit a very regular structure based on warp threads running away from the weaver and one or more weft threads woven crosswise. These structures are represented in rectangular grids in existing editors.

Non-rectilinear constructions include netting, braiding, twining, knotting, interknotting, linking, interlinking, and interlacing. Sprang (interlacing warps with no wefts), is common in very old textile samples found in the Middle East, Peru, and Scandinavia. These cannot be represented in regular grids.

Editors developed for topological modelling offer functionality for domains unrelated to textile production (Barth 1986; Fleischer et al., 2003) and are unsuitable for weaving structures.

There is work concerned with modelling and simulating physical properties of textiles realistically (Hearle 1978a, 1978b; Smith & Chen, 2009) and rendering the textiles accurately in three dimensions, including, for example, draping the fabric over other objects (Adabala et al. 2003; Okabe et al., 1992). All the publications we know of in this area describe the pattern using a regular grid.

Grishanov et al. describe textile structures for classification using unit cells and topological methods (Grishanov et al., 2009) but they developed no editor.

Our objective was to develop an editor to model complex weavings and visualize the un-
underlying structure of the textiles (as opposed to photographs). The editor must give help to arrange the structure and the thread curves so that a user can visually identify textiles and structures. We demonstrate the editor on complex weaving patterns found in Andean textiles.

This work was done in the project “Weaving Communities of Practice” supported by the AHRC Grant AH/G012180/1.

DATA STRUCTURE

The textile is viewed from the top like knot diagrams. The basic object is the crossing of two threads. A crossing identifies the thread above the other, has a position in the plane and is numbered. In addition, it has and four links (named N(orth), W, E and S) to connect it to links of other crossings, following the segments of threads between them. At the destination of each link another link points back to its origin. A thread entering a crossing at a link either exits at the opposite link or ends there (and the opposite link will be unused). Threads can be assigned a colour at a link.

This representation implies that instead of modifying the contents of a fixed grid we have three separate problems to handle. First the user has to define the topological structure of the weaving, then the crossings have to be arranged in the plane and finally the thread passing on top of the other has to be identified at each crossing.

The editor maintains two structures: the numbered list of crossings (Figure 1) and the list of the coloured links with the colours. Threads are, in consequence, represented implicitly and changing a link will change the course of the thread.

Given the knowledge representation model, different users will wish for different interfaces to edit the same structure, for instance a non-weaver would use different operators to create a structure than the weaver who knows how it was woven.

THE EDITOR

The editor has three display modes for the structure: full structure (Figures 5 and 6), structure and coloured threads (Figure 1), coloured threads only (Figure 2, 1 – 4 from left, Figure 7 right, Figure 8). It also has a rendering mode (Figure 2 right, Figure 3). Rendering mode became necessary as commercial CAD programs refused to render tens of thousands of thread segments (determining all the occlusions being the likely problem).

As we show all the crossings and segments in the structure by default, to identify techniques and substructures, the display will be different from a photographic reproduction which shows only

![Figure 1. Left: Simple structure. Right: Internal representation of its crossings with crossing numbers.](image-url)
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