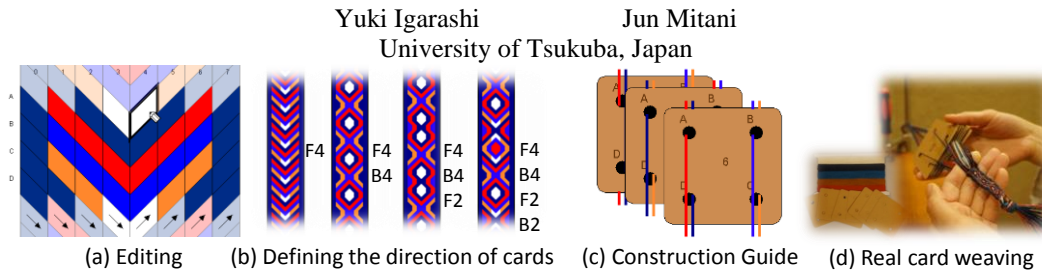


# Interactive Card Weaving Design and Construction



**Figure 1:** System overview. (a) The user designs a textile pattern using a painting interface. (b) The user defines the direction of the cards. (c) The system shows the user how each yarn should pass through the card. (d) The user finally weaves the yarns using the cards.

## 1 Introduction

Weaving is a method of fabric production, consisting of two distinct sets of yarns (warp and weft). It is popular and similar to other fabric production methods, such as knitting, felting, and lace making. In particular, ‘card weaving’ is a very simple and easy weaving method. The user prepares nothing more than colored yarns and simple cardboard squares with four holes [Crockett 1991]. The user can produce exquisitely patterned woven bands, such as ribbons, straps, and hair accessories. However, the textile patterns are typically designed via a laborious manual process. The final textile design is determined by 1) the color of each warp yarn, 2) the direction of four yarns passing through each card, and 3) the direction and number of rotations of the cards.

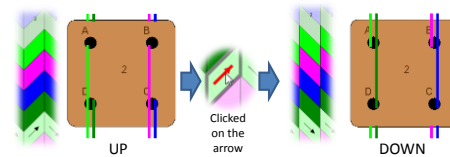
We therefore propose an interactive system to assist in the design of original weaving patterns and their construction. Coahranm and Fiume [2005] presented a sketch-based design system for quilting arts. In contrast, weaving textile design is more like pixel art (all pixels are the same size). The difference is that each pixel in a woven band is a diamond shape (not a square). The width (the number of columns) of a woven band is determined by the number of cards ( $n$ ). The number of colors for each column is determined by the number of holes in a card ( $4$  in our current system). The Card Weaver [Polak 2002] is a previous design system for card weaving. However, it only supported the design of patterns with simple repetitions and did not support free painting described in the next section.

## 2 User Interface

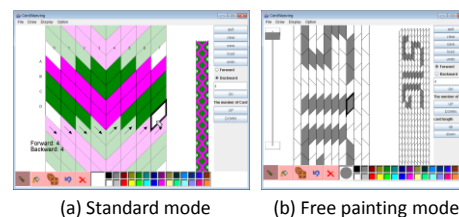
Figure 1 shows the overall process. The user first designs the color of warp yarns in the matrix of  $4 \times n$  cells, as shown in Figure 1(a). The user can increase/decrease the number of cards, and modify the direction of the four yarns passing through each card by clicking on the corresponding arrow (Fig. 2). The final textile design is defined by the direction and number of rotations of the cards (Fig. 1b). ‘F4B4’ means that the user first rotates all the cards four times in the forward direction and four times in the backward direction for this one set. The user repeats the set until he/she is satisfied with the length of the fabric. The user can check the final textile design in the system before real weaving. He/she then passes the yarn through the hole of each card using a construction guide (Fig. 1c). Finally, the user creates a real original weaving using these cards and yarns (Fig. 1d).

The system also provides a special mode that supports free painting with binary colors (Fig. 3b). In this mode, the user passes the yarns with the foreground color in the adjacent two holes in a card and the yarns with the background color in the remaining two

holes. The user then paints an arbitrary pattern on the band with the two colors. The system then automatically derives rotation direction of each card at each step from the pattern. The system also visualizes the orientation of the diamond shape at each cell, which is determined by the rotation direction at the cell.



**Figure 2:** Final orientation of the diamond shape (each cell) depends on how the yarn passes through the hole, up or down.



**Figure 3:** Snapshots of the system. (a) The standard mode. The user specifies the colors of 4 yarns of each card, as well as the rotation direction at each step. (b) The free painting mode. The user paints an arbitrary pattern and the system automatically derives the rotation direction of each card.

## 3 Results

We used our system to create textile designs and actual weaving results, as shown in Figure 4. A design session typically took about 10 min, and production of the weaving required 1 – 3 hours. Figure 4 right shows woven bands in the standard mode (top) and in the free painting mode (bottom).



**Figure 4:** Results using our system.

## References

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