

Designing Weave Structures Using Boolean Operations, Part 3

A Design Program

Previous articles [1,2] described the use of Boolean operations for designing drawdowns.

The techniques described in these two articles can be done by hand, at least for small patterns, but the process is so time consuming and error prone that it is not likely to be used, despite its potential for creating attractive and novel patterns.

This article describes an interactive program that makes it easy to design drawdowns using Boolean operations.

The Program

The program has three components:

- a design laboratory
- a drawdown editor
- a Boolean operator array editor

The editors are invoked from the design laboratory and are subordinate to it.

The Design Laboratory

Figure 1 shows the Design Laboratory interface.

The three lists at the left correspond to the components of a Boolean operation:

$$X \ A \ Y \rightarrow Z$$

where X and Y are Boolean arrays representing drawdowns, A is an array of Boolean operations [2], and Z is the drawdown resulting from applying A to X and Y.

The X and Y lists are the same, and contain the names of available drawdowns. The A list contains the names of the available Boolean operator arrays.

Some drawdowns and arrays are built in; others can be added when the program is run.

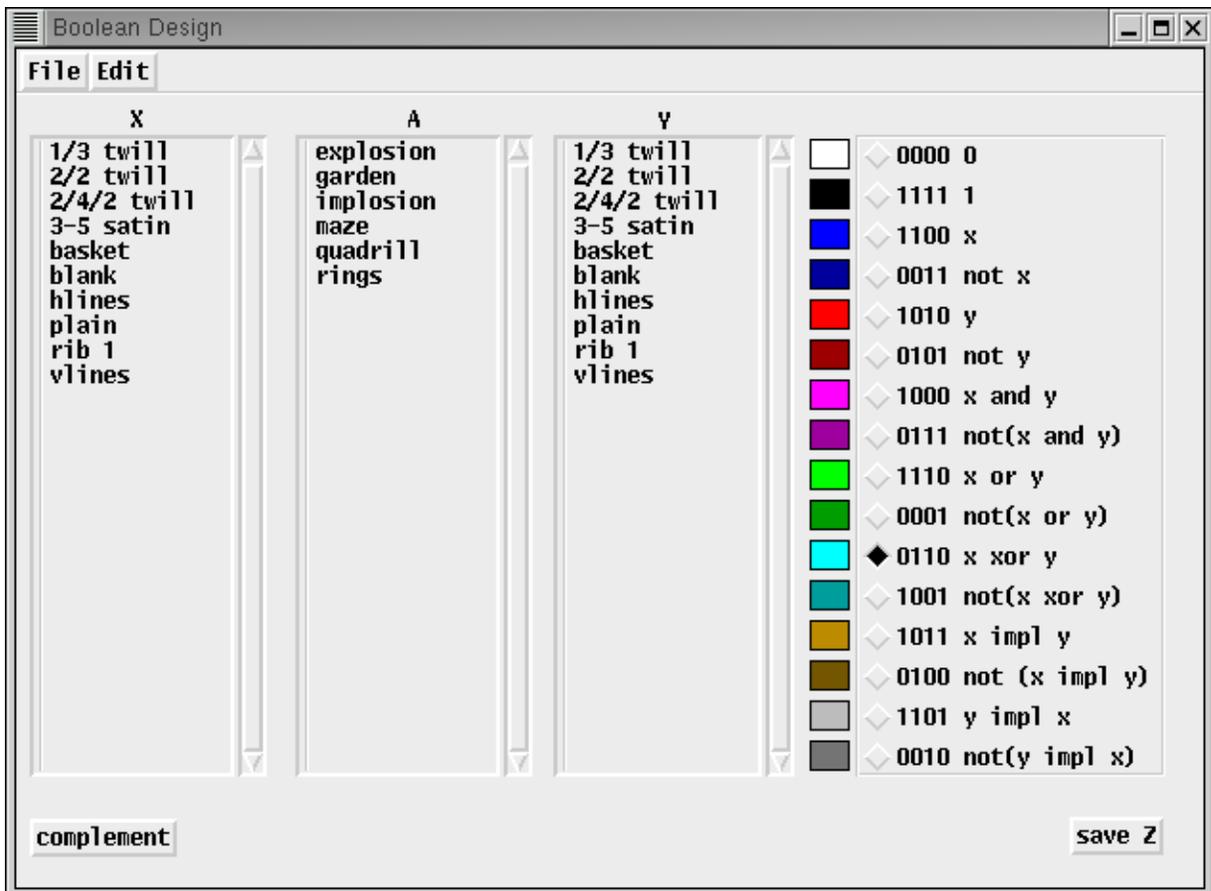


Figure 1. Design Laboratory Interface

Clicking on a name in one of the lists makes the corresponding drawdown or operator array current. Windows show the current drawdowns and operator array. Selecting plain for X, rings for A, and 2/2 twill for Y produces the result shown in Figure 2.

The panel on the right side of the design laboratory interface shown in Figure 1 contains buttons for selecting a Boolean operator that applies to all cells in the X and Y drawdowns. Three forms of identification are provided for the operators: the associated color [2], the value pattern, and a symbolic form.

Selecting an operator replaces the current array by one in which all operators are the selected one. The Z drawdown is updated accordingly. Figure 3 shows the result of selecting *exclusive or* operation.

The complement button at the bottom left of the design laboratory interface brings up a dialog in which X, Y, or Z can be complemented. See Figure 4.

The Save Z button at the bottom right of the design laboratory interface brings up a dialog in which a name can be specified for saving the Z pattern. See Figure 5.

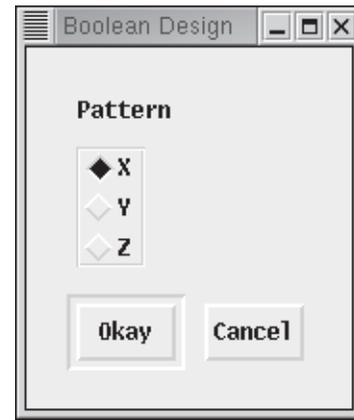


Figure 4. Complement Dialog

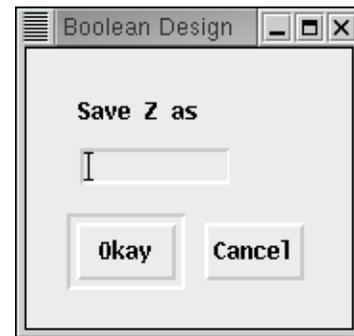


Figure 5. Save Z Dialog

The Z pattern is saved and the name is added to the X and Y lists.

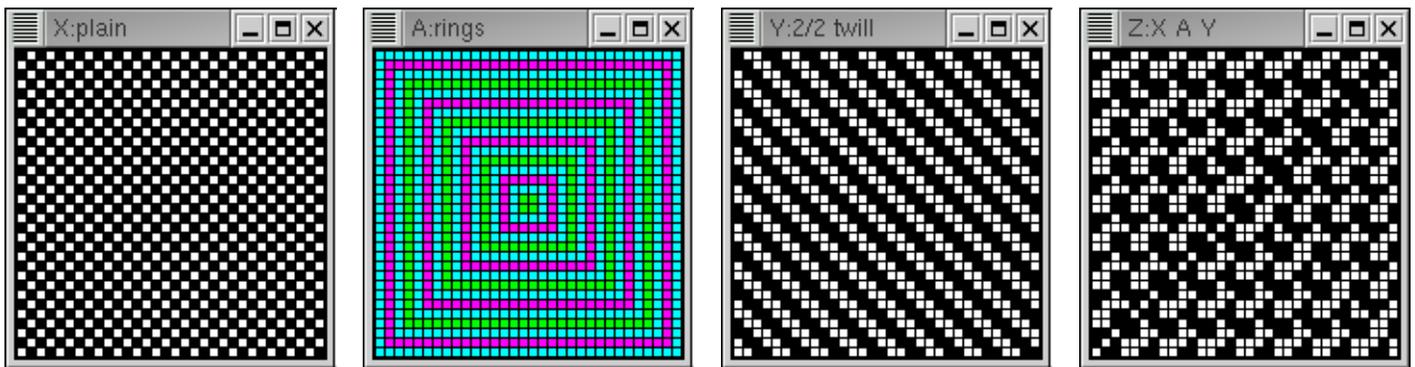


Figure 2. Drawdown and Operator Array Windows

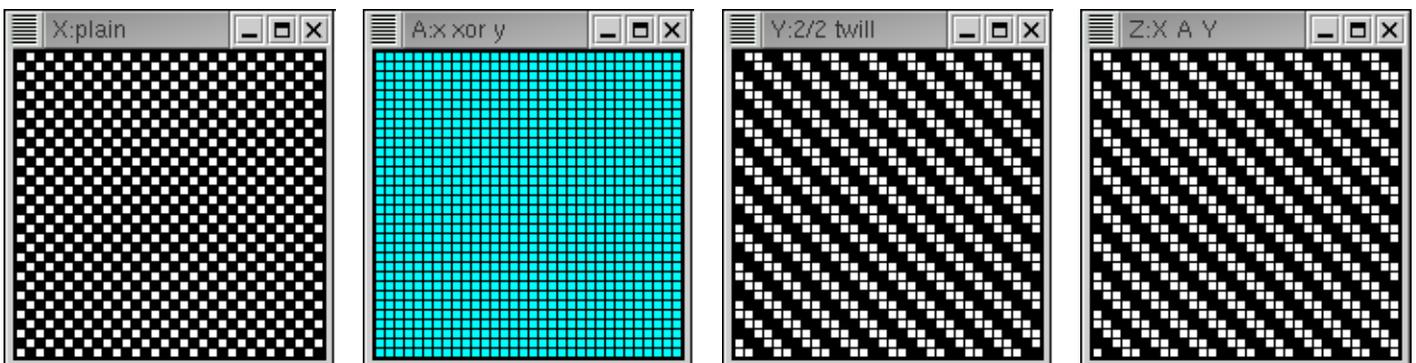


Figure 3. Drawdown and Operator Array Windows After Selecting *exclusive or*

The File menu, shown in Figure 6, provides items for saving the current design-laboratory configuration in a database, loading a saved database, importing and exporting patterns and arrays, and quitting the application.



Figure 6. The File Menu

The notations at the right provide reminders of keyboard shortcuts that can be used in place of the menu. The symbol @ indicates that a keyboard shortcut is invoked by depressing the meta modifier key and pressing the letter that follows. For example, pressing q while the meta modifier key is depressed quits the application.

The Edit menu, shown in Figure 7, provides items for invoking the drawdown and operator array editors.



Figure 7. The Edit menu

If drawdown is selected, a dialog listing the available patterns is presented. See Figure 8.



Figure 8. Drawdown Editor Dialog

The drawdown editor is launched with the selected drawdown.

If array is selected, a dialog listing the available operator arrays is presented. See Figure 9.



Figure 9. Operator Array Editor Dialog

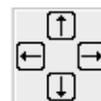
The operator array editor is launched with the selected array.

The Drawdown Editor

Figure 10 on the next page shows the drawdown editor.

The drawdown to be edited is displayed on the right side of the editor window.

Various editing tools are available through the panel on the left side of the window.



These buttons allow the drawdown to be rotated circularly in each of the four directions, one cell at a time.



These buttons allow the drawdown to be flipped around the axes indicated.



These buttons allow the drawdown to be rotated in increments of 90° as indicated.



These buttons affect the contents of cells. The left button clears all cells to white. The middle button inverts the drawdown, changing white cells to black and vice versa. The right button randomizes the pattern.

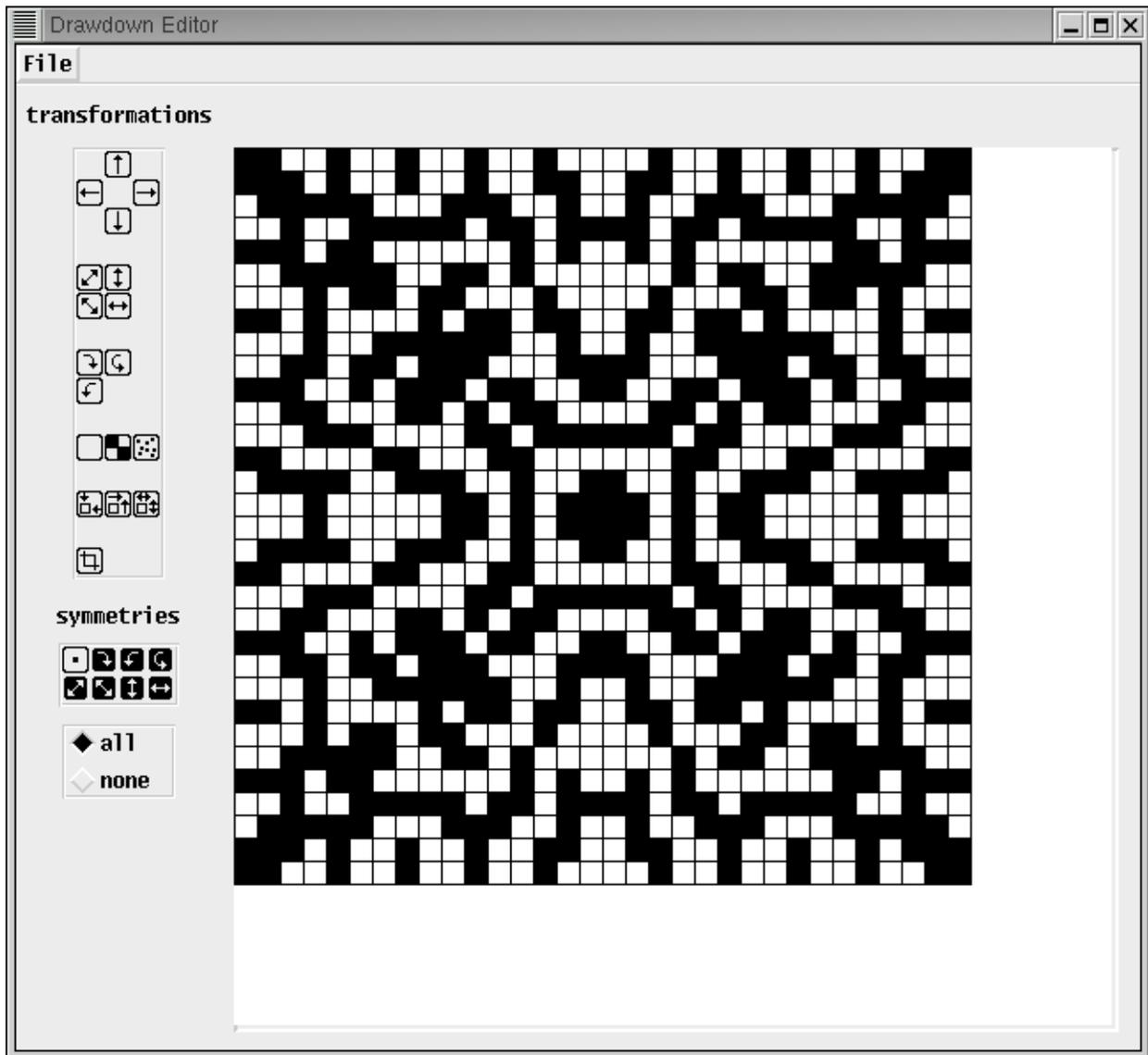


Figure 10. The Drawdown Editor

The Operator Array Editor

The operator array editor operates in a fashion similar to the application for creating weavable patterns [3]. See that article for a basic description.

The operator array editor window is shown in Figure 11 .

The palette of colors used to identify Boolean operators is displayed in a separate window. See Figure 12.

A third window displays the current operator array. See Figure 13.

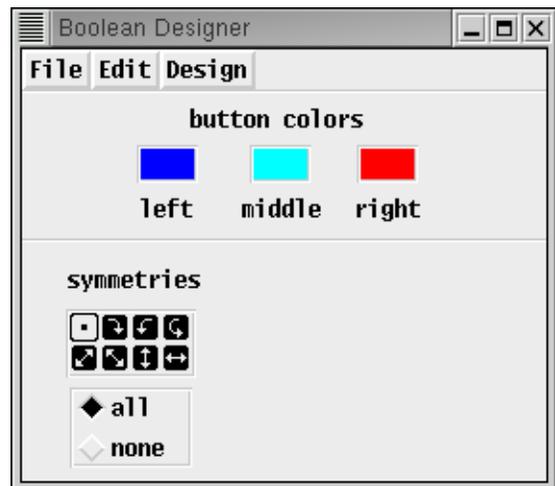


Figure 11. Operator Array Editor Window

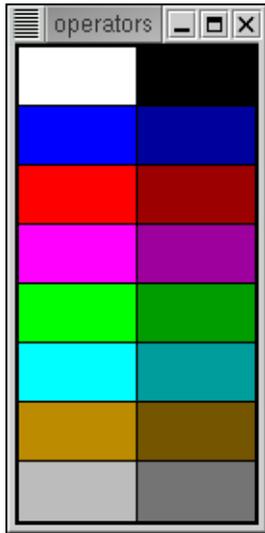


Figure 12. Boolean Operator Palette

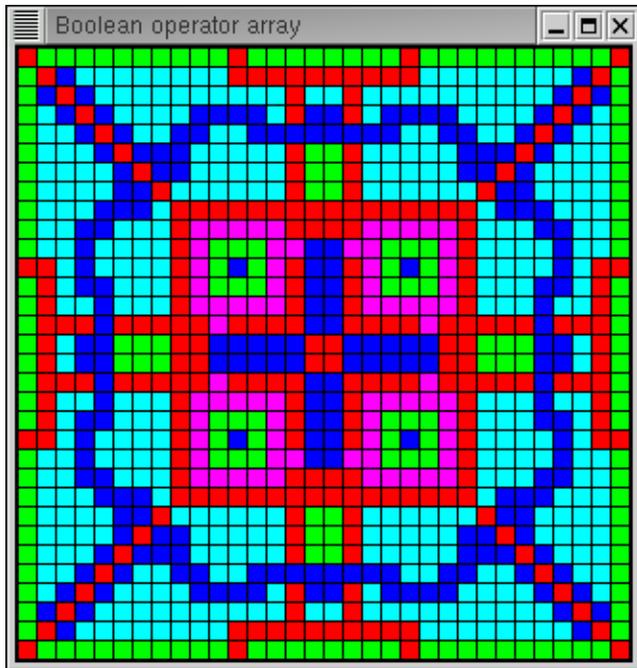


Figure 13. Boolean Operator Array

The File menu provides the usual items for importing and exporting patterns and dismissing the editor. When the array operator editor is dismissed, a dialog is presented to name the array. The array then is added to the *A* list.

Program Limitations

At the time of writing, the program only supports 32×32 drawdowns and operator arrays. This limitation avoids having to deal with a host of conceptual and implementation problems associated with handling a variety of sizes.

This limitation can be removed at the expense of a considerable amount of time and effort. This could be justified only by demonstrated need.

A compromise would be to continue with the present size constraint but provide a mechanism to mask drawdowns and arrays to a smaller size.

References

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