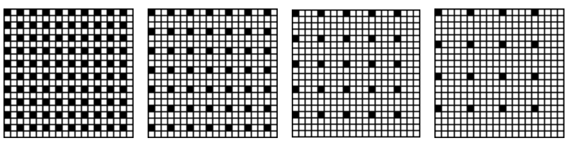
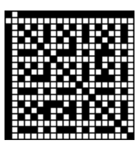
Grid Overlay Patterns, Part 1: Introduction

In his book, *A New Kind of Science*, Stephen Wolfram describes a system for constructing patterns by overlaying grid of cells with increasing separation.

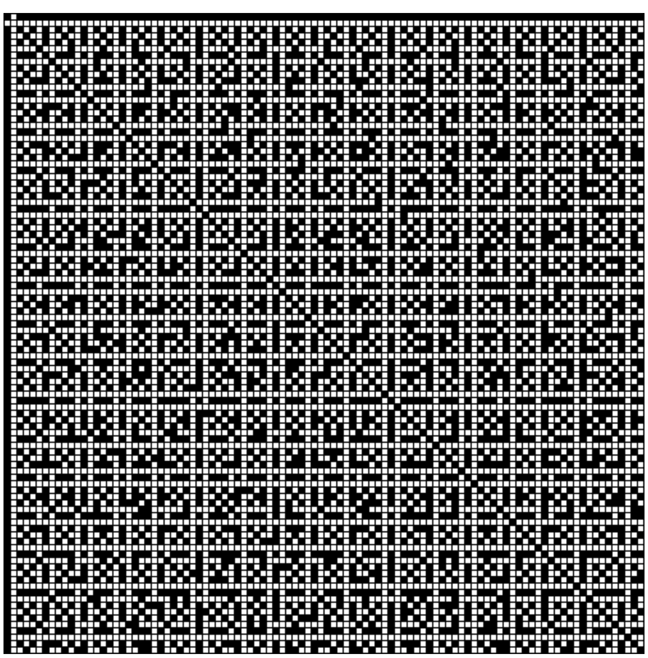
The basic scheme uses grids of black cells separated by rows and columns of white cells. In the first grid, the black cells are separated by single columns and rows of white cells. In the next grid, the separation is by two columns and rows, then three, and so on:

 …

If these grids are overlaid so that black cells show through (logical *or* if black represents *true* and white *false* [2]), the result looks like this:



For larger grids, the results are even more intricate:



While these patterns are not suitable a drawdowns *in toto* because of floats, portions of them are.

There are many possible generalizations to the basic scheme described above. Here are a few:

- using a motif more complicated than a single black cell
- using different motifs for successive grids
- varying the horizontal and vertical separations between the motifs in various ways
- combining successive overlays in different ways, not just with logical *or*

One version of a generalized system is based on sequences that apply to successive grids:

- motifs
- width separations
- height separations
- logical combination operations

The basic system described at the beginning of this article is characterized by the sequences

motifs:	■, ■, ■, ■, ■, …
width:	1, 2, 3, 4, 5, …
height:	1, 2, 3, 4, 5, …
operations:	+, +, +, +, +, …

As usually happens with such generalizations, there is a vast (in fact, infinite) number of possibilities. With some exploration, it may become clear what kinds of possibilities lead to interesting results.

One way to start is to depart from the basic scheme one way at a time. For example, if a different motif is used, but only one, as in

motifs: ■■, ■■, ■■, ■■, ■■, …

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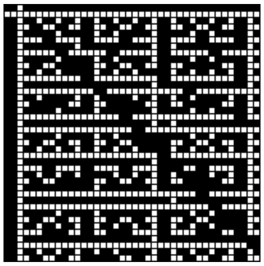
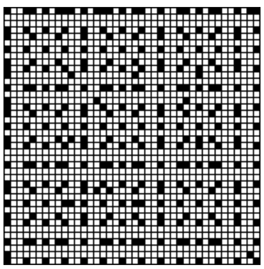
the result is:



Another simple change is to use prime numbers for the separations:

width: 2, 3, 5, 7, 11, …
height: 2, 3, 5, 7, 11, …

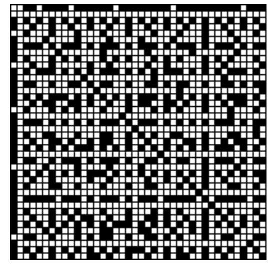
the result is:



Changing the operation to *exclusive or*, ⊕, so that

operations: ⊕, ⊕, ⊕, ⊕, ⊕, …

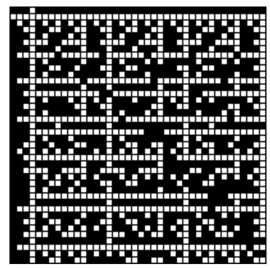
produces



All the changes so far are simple and uniform. Here's one that is a bit more complex:

motifs: ■, ■■, ■■■, ■■, ■, …

where the sequence of motifs shown is repeated. The result is:



What happens if some of these variations are tried in combination? What if they are more varied and complex? Are there schemes that produce results that are more interesting than other schemes?

In a subsequent article, we'll address these issues.

References

1. Stephen Wolfram, *A New Kind of Science*, Wolfram Media, 2002, pp. 612-613.
2. Ralph E. Griswold, "Designing Weave Structures Using Boolean Operations, Part 1", 2004: http://www.cs.arizona.edu/patterns/weaving/webdocs/gre_bol1.pdf

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