Nemal, Nemal

In their 1980 paper on the geometry of fabrics [1], Grünbaum and Shephard introduced a variety of mathematically oriented ideas on fabric structure. The majority of the paper is devoted to *isonemal* fabric fabrics (interlacements), defined by them as follows:

> A fabric F is isonemal if its symmetry group S(F) is transitive on its strands [threads]. In other words, for any two strands s_1 and s_2 there exists a symmetry than maps s_1 onto s_2.

If you understand that, I'm impressed. I didn't when I first read the paper and after re-reading the paper several times and reading later papers on the subject, I still don't understand it well enough to explain it in a nontechnical way. While trying to get a deep understanding, I was heard to mutter "nemal, nemal".

In their paper, Grünbaum and Shephard stated that isonemal fabrics are

> … an extremely important class of fabrics, both from a mathematical as well as a practical point of view.

I'll grant them the mathematical importance. They are experts and the idea certainly generated a lot of subsequent work on the subject.

But I take issue with their claim of the practical importance of isonemal fabrics. The only evidence Grünbaum and Shephard provided for this is that many commonly used weaves are isonemal. For example, all regular twills are isonemal and some (but not all) regular satins are. But many commonly used weaves are not isonemal. There is no evidence that the property of isonemality, however vaguely it might have been understood, had anything to do with the design of fabrics that happen to be isonemal.

And there is nothing about isonemal fabrics that make them sounder or more attractive than non-isonemal weaves. In fact, Grünbaum and Shephard show many examples of non-isonemal weaves that are common and attractive. Examples of isonemal and non-isonemal fbrics derived from their paper are on the next page.

Grünbaum and Shephard did address the issue of whether a fabric "hangs together" [2] and discarded otherwise isonemal fabrics that wouldn't hang together if woven. However, they did not address the issue of float length, and there is nothing about isonemal fabrics in this regard compared to non-isonemal fabrics of similar appearance.

So, in my opinion, isonemality is just a mathematical property that has little practical relevance for weaving.

Of course, mathematics need not have practical relevance. And many mathematical ideas once thought to have no practical value have turned out to be very important in the real world.

I'm willing to grant that this may be the case with isonemality. But for now, "nemal, nemal".

References

1. "Satins and Twills: An Introduction to the Geometry of Fabrics", Branko Grünbaum and G. C. Shephard, *Mathematics Magazine*, 1980 (53), 139-161.

2. *When a Fabric Hangs Together (Or Doesn't)*, Ralph E. Griswold, 2004: http://www.cs.arizona.edu/patterns/weaving/webdocs/gre_hng1.pdf

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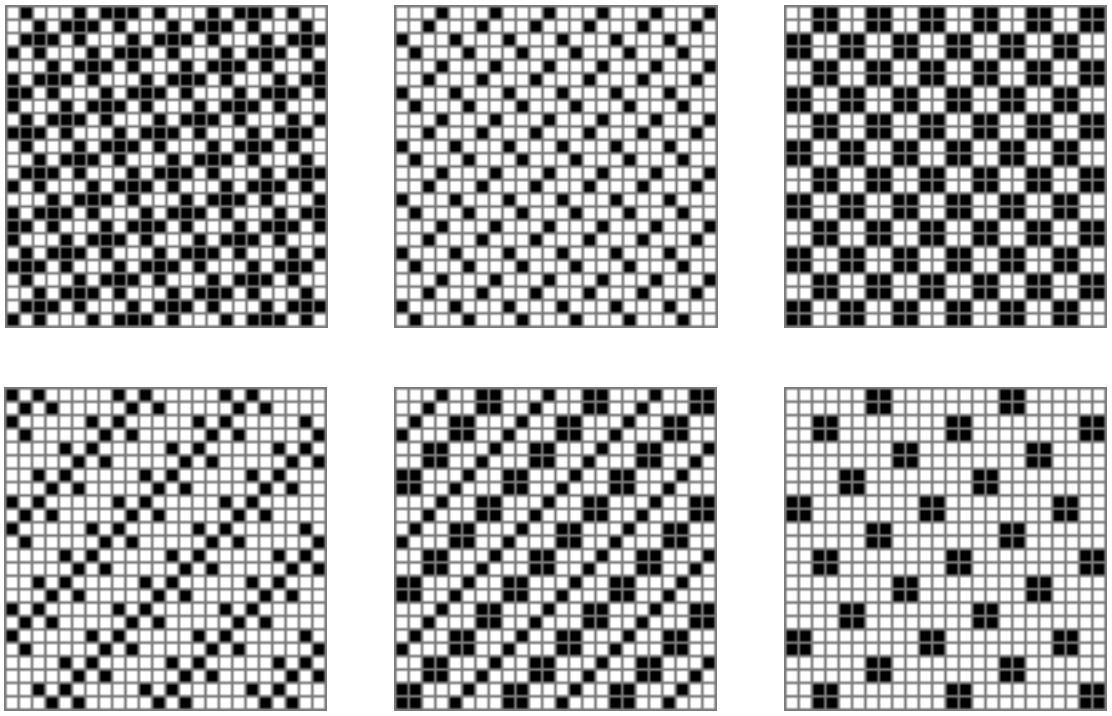
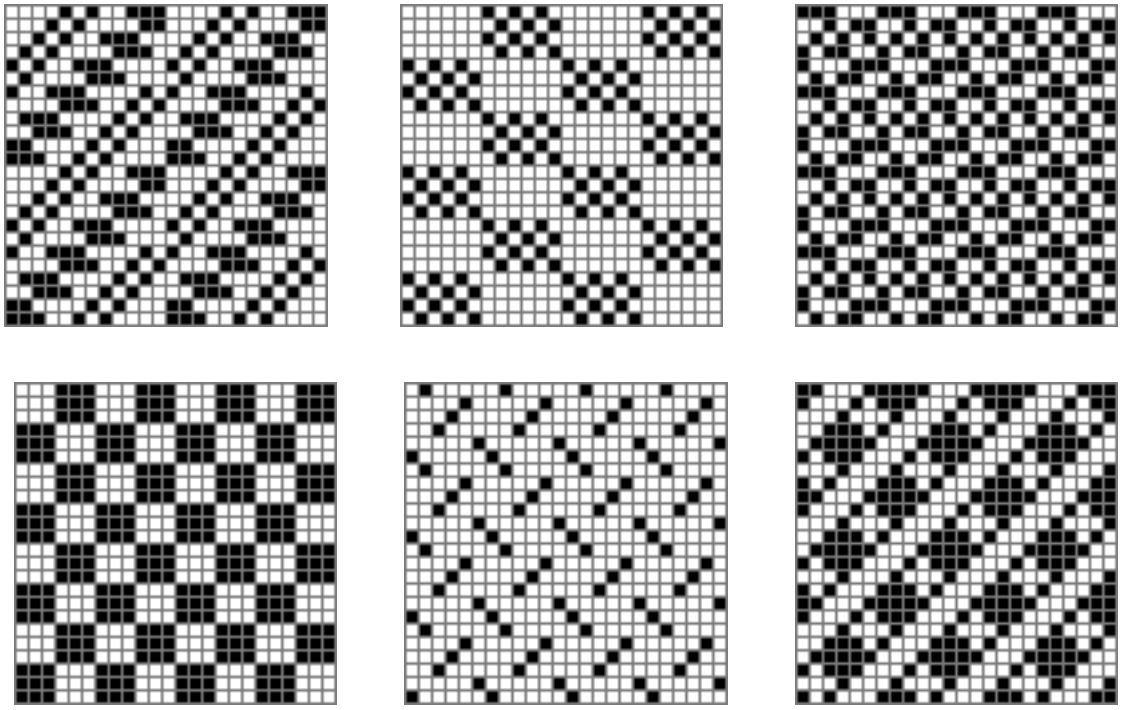


Isonemal Fabrics



Non-Isonemal Fabrics