Crackle Weave

Crackle weave, a version of point twill, offers many possibilities for interesting patterns and, if done in the standard manner, has maximum floats of three and makes a strong cloth.

Block Design

Blocks

Conventional crackle weave design is based on blocks with 3 shafts and 4 ends. For 4 shafts, the blocks are

A 1, 2, 3, 2 

B 2, 3, 4, 3 

C 3, 4, 1, 4 

D 4, 1, 2, 1 

Adjustments at Block Boundaries

Blocks can be arranged in any sequence, although some sequences produce better results than others. Examples of block sequences are

AAABBBCCCDDD

and

ABCDCBABCDCBA

Incidentals are inserted or ends removed to meet the structural requirements of crackle weave. Berta Frey [1] lists these rules (abbreviated and paraphrased here):

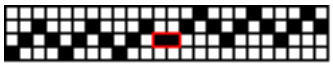
1. An odd/even progression of shafts must be maintained.
2. The 3-shaft character must be maintained; incidentals can be added or ends removed to achieve this.
3. There may be no more than three threads on two adjacent shafts (for example, 2, 1, 2, 1 is not allowed).
4. There may be no more than 4 shafts before direction changes.

Although incidentals can be inserted and ends removed in various ways,

the rules established by Harriet Tidball [2] are logical, systematic, and now generally used in crackle weave design. If an incidental is needed after a block, it is put on the shaft that is one less than the last thread of the block:

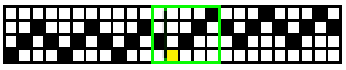
A 1
B 2
C 3
D 4 (wrapping around from 1)

If the same block is used in succession, as in AAA, no incidentals are required. Going from one block to the next, as in AAABBB, however, there is a problem:



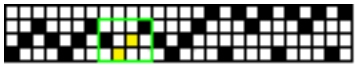
The adjacent duplicates are outlined in red. There are two choices. One is to delete one of the duplicates:

The area where the duplicate was removed is outlined in green. The other choice is to insert an incidental, shown in yellow:



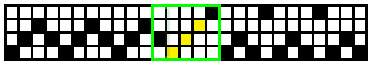
If a block is skipped, as in AAACCC, Frey's Rule 3 is violated:

Incidentals for block A and the skipped block B need to be inserted



The same principle applies for skipping two blocks, as in AAAADDDD:

where the incidentals for blocks A, B, and C need to be inserted:



It is worth noting that only four essentially different situations occur at block boundaries:


Either an end can be deleted or an incidental inserted


No change is needed.


An incidental is needed to connect the shafts.


Two incidentals are needed to connect the shafts.

There are, of course, the horizontal reflections of these, to which the same rules apply.

More Shafts

Crackle weave is not limited to 4 shafts; more shafts can be used. For example, for 6 shafts, there are six blocks:

A 1, 2, 3, 2
B 2, 3, 4, 3
C 3, 4, 5, 4
D 4, 5, 6, 5
E 5, 6, 1, 6
F 6, 1, 2, 1

The same rule for incidentals applies.

Crackle also can be woven on an odd number of shafts.

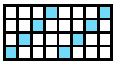
If more that 4 shafts are used, there are more different situations that may arise at block boundaries.

Motif Along a Path

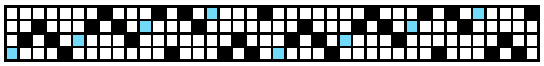
There is another way to view the design process for crackle weave.

Note that blocks B, C, and D are simply successively upwards shifted versions of block A, with wrap-around from top to bottom. There is only one *motif*, which can be taken to be block A.

This motif can be placed as successive points along a *path* to give the same result as using different blocks in succession. For example, if the path is a straight draw, as in



the result is the same as using the block sequence ABCDABCD:



The first threads of successive motifs are shown in blue to emphasize the path.

Incidentals are, of course, handled in the same way as for blocks.

The advantage of motif-along-a-path design is that different motifs and paths can be tried independently. For example, the motif 1, 2, 3, 2, 1, 2, 3, 4, 3 is equivalent to the block sequence AB with the required incidental. But by using the combination motif, design can be done in terms of a single motif.

If a motif not corresponding to combinations of blocks is used, such as 1, 2, 3, 4, 3, 2, the result may be floats longer than 3 and not true crackle. But many more patterns are possible and if care is taken, the resulting cloths will be sound.

Tie-Ups

Crackle is a twill weave, a variety of point twill. As such, twill tie-ups normally are used. In order to keep the maximum float length to 3, expected of conventional crackle weaves, twill counters must be less than 3.

The following tie-ups work well for crackle:

4 shafts:

2/2

5 shafts:

1/2/1/1

6 shafts:

1/1/2/2
1/2/1/2
1/2/2/1
2/1/2/1

7 shafts:

1/2/1/1/1/1
2/2/2/1

8 shafts:

1/1/1/1/2/2
1/1/1/2/1/2
1/1/1/2/2/1
1/1/2/1/1/2
1/1/2/1/2/1
2/2/2/2 (same as a 4-shaft twill)

9 shafts:

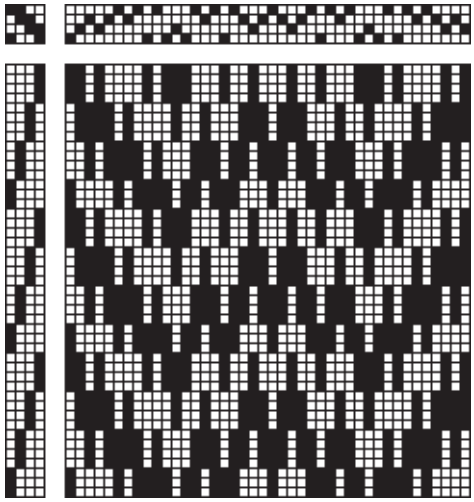
1/1/1/2/2/2
1/1/2/1/2/2
1/1/2/2/1/2
1/1/2/2/2/1
1/2/1/2/1/2
1/2/1/2/2/1
1/2/2/1/2/1
2/1/2/1/2/1

10 shafts:

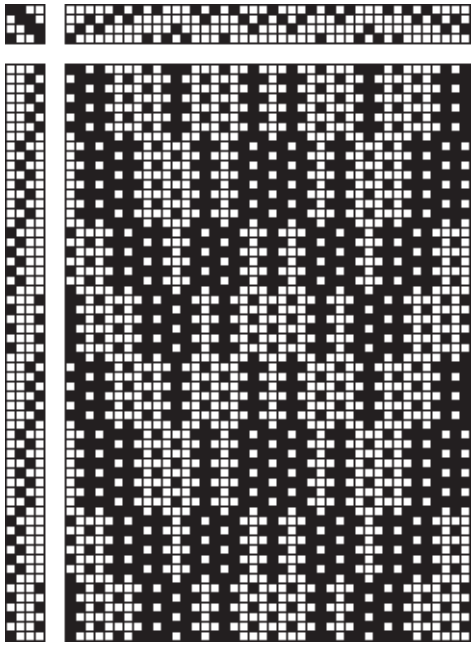
1/1/2/2/2/2
1/2/1/2/2/2
1/2/2/1/2/2
1/2/2/2/2/1
2/1/2/1/2/2

Treadling

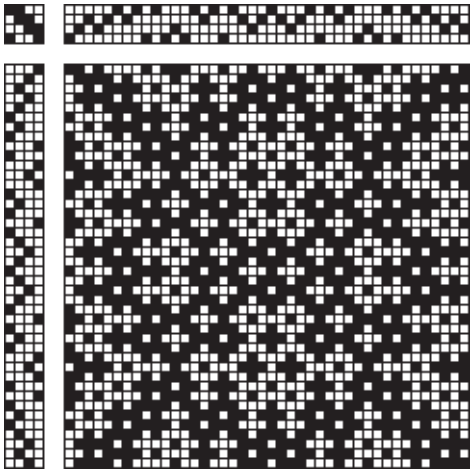
Traditional crackle threading uses the same treadle for all the threads of one block, with pattern picks alternating with binding picks. Here is an example, in which the binding picks are not shown:



Summer and Winter is another conventional treadling for crackle, with two treadles alternating, the first block woven on treadles 4 and 3, the second on 3 and two, the third on 1 and 2, the fourth on 1, and 4, and then repeating. Here is an example:



Crackle also can be treadled as drawn in. This is the treadling now most commonly used. Here is an example:

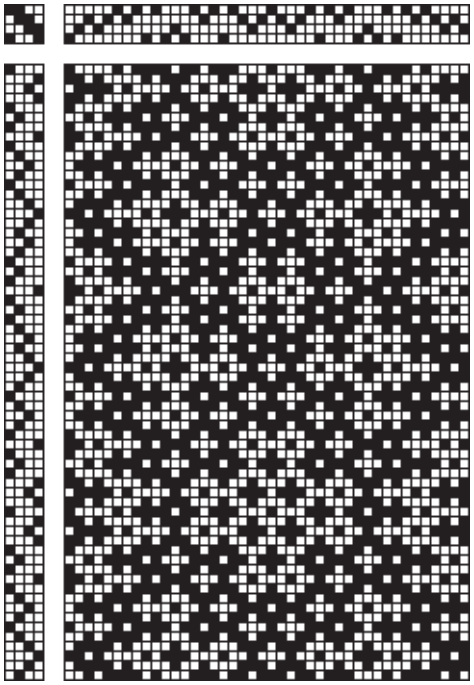


See Reference 2 for more information on conventional crackle treadling.

Many other treadlings have been tried, including straight draws, point twill, and advancing twills.

Crackle treadling is an area for experimentation, which may produce interesting results.

One particularly interesting method is to use one crackle sequence for threading and a different crackle sequence for treadling. Here is an example:



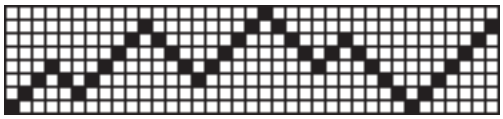
Path Design

Except for the path, all is formular in conventional crackle weave design: the 1,2,3,2 motif and specified ways for fixing problems that may occur between the boundaries of the successively placed motif. The only design element is the path.

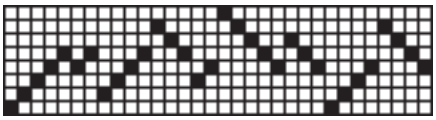
In design, a path is not constrained to a specified number of shafts. Adaptation to a specified number of shafts is done after the motif is placed along the path.

Path Properties

Paths can be classified in a variety of ways. For example, a path may be connected or disconnected, as shown in these examples:

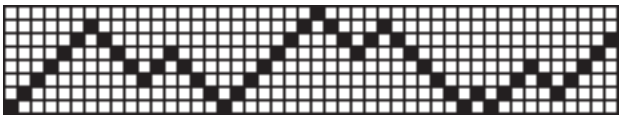


connected

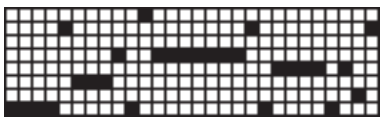


disconnected

A path may be "friendly" or "unfriendly" [2]. A friendly path is one in which each value is one greater or one less than the preceding one. Friendly paths are, of course, connected. Here are examples of friendly and unfriendly paths:

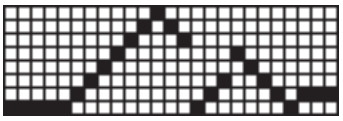


friendly



(very) unfriendly

Unfriendly paths may, of course, have friendly segments, as in



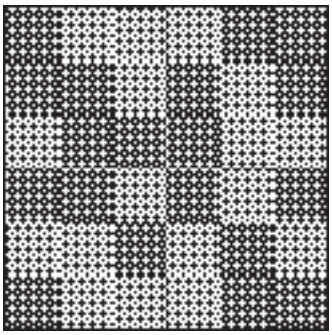
(somewhat) unfriendly

The *extent* of a path is the difference between its largest and smallest values, plus 1. Without losing anything (or, as a mathematician would say "without loss of generality"), the smallest value can be taken to be 1, so that the extent of a path is given by its largest value.

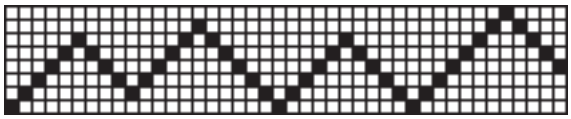
Design Considerations

Paths with "flats", runs of the same value, as in

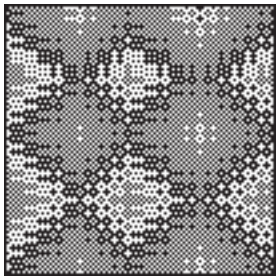
produce blocky, rectilinear patterns. The path shown above produces this drawdown for 4 shafts and a 2/2 twill tie-up, treadled as drawn in:



Friendly paths can produce varied patterns. An example is

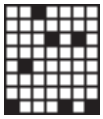


A drawdown based on placing the motif on this path is

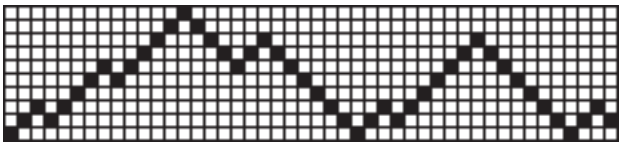


Paths with large extents are capable of producing more elaborate patterns than paths with small extents. However, the number of shafts used limits the possibilities once the motif has been placed along the path.

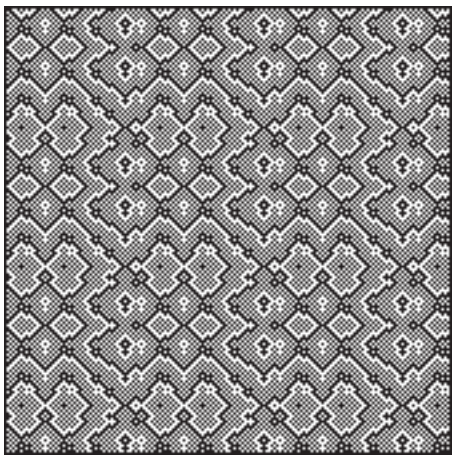
Perhaps surprisingly, disconnected paths are capable of producing the most dramatic patterns. Here is an example of a disconnected path:



Although the path is short, placing the motif along it produces a much longer sequence because of the incidentals needed to connect separated motifs:



A drawdown with this sequence adapted to 8 shafts is



The reason disconnected paths can produce elaborate patterns is the runs

introduced by the incidentals needed to connect separated motifs. One problem with disconnected paths is that they may result in floats longer than 3. Nonetheless, they often produce sound fabrics and the marvelous patterns that can result may more than compensate for the increased float lengths.

Horizontal reflection of a threading sequence to produce a palindrome usually produces a pattern that is more attractive than the unreflected sequence. However, since the motif itself is not symmetric, the result of placing a motif along a palindromic *path* is not a true palindrome. Palindromic enhancement is best done after the motif is placed along the path.

Results of Motif Placement

When the motif is placed along a path, the maximum value in the resulting sequence is two greater than the extent of the path, since the motif goes up two above the largest path point.

Once the motif is placed along the path, modular reduction [3] can be used to bring the sequence within the range of the number of shafts to be used.

Experimenting with Crackle Design

The number of possible paths for all but trivial situations is very large. If the range of a path is n and its length is k, there are n^k possible paths. For example, if n is only 4 and the k is only 8, there are $4^8 = 65{,}536$ possible paths.

Even with a program to run through the possibilities, it is impractical to create, much less evaluate, all crackle weaves drafts of even modest extent.

But that is the challenge of intelligent, artistic exploration — to find gems in vast mountains of debris.