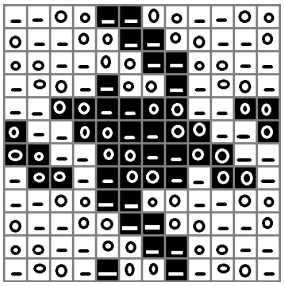
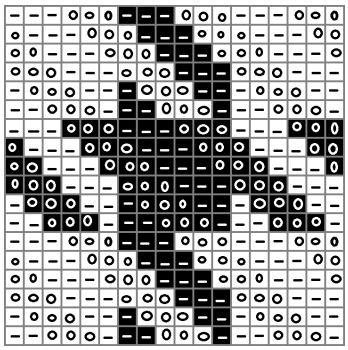
Supplement to “An Aperiodic Pied-de-Poule (Houndstooth) Tiling for e-Fashion”: Exploration into Weaving the Aperiodic Pattern.

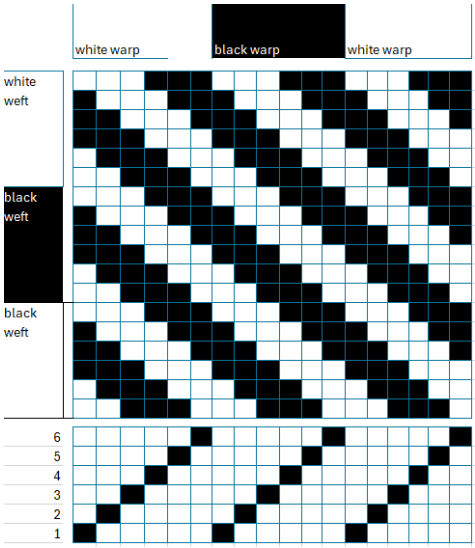
Loe Feijs, Eindhoven University of Technology and LAURENTIUS.LAB; l.m.g.feijs@tue.nl

Preliminaries

We assume the reader is familiar with some weaving terminology such as warp and weft. First, we show some images of classical Pied-de-poule and its binding (weave). Following the terminology of Feijs’ 2012 Bridges paper, we consider the $N = 2$ (left image) and $N = 3$ (second) members of the Pied-de-poule family.







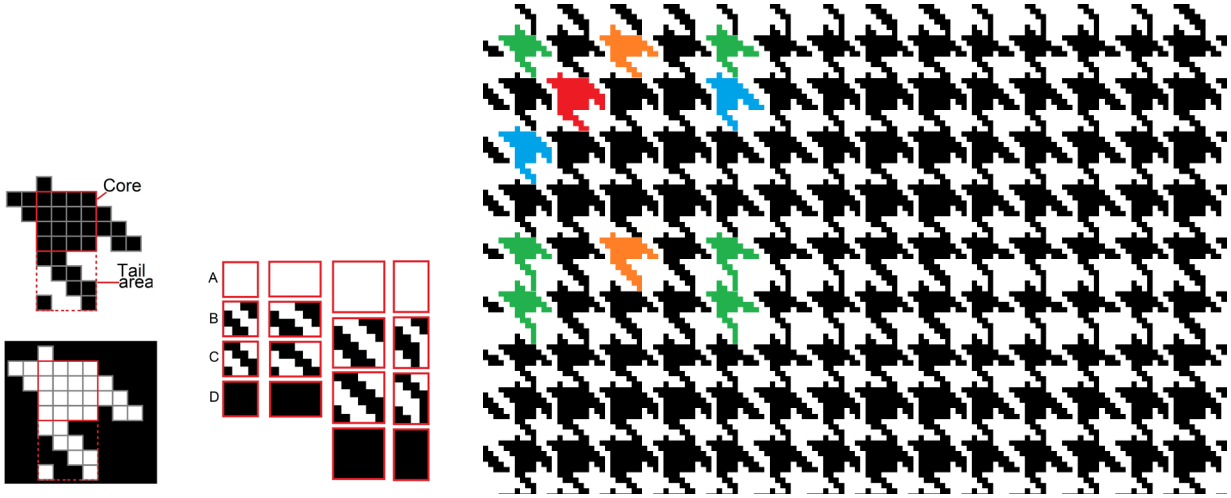
To weave these, we need bands of white and black yarns in both weft and warp. In the left image these bands are: 4 white yarns, 4 black, 4 white. In the second image we see 6 white, 6 black, 6 white (in both directions). So Pied-de-poule has bands of *fixed* width. The circles indicate that the weft goes *over* the warp (so the weft is visible, the warp color is hidden). The dashes mean that the weft goes *under* the warp.

The third diagram resembles the traditional “weaving draft”, which focuses on the binding; here for the case $N = 3$. The main 18×18 grid shows all weft-warp crossing points (as an Excel cell). A cell is marked black if the weft goes *over* the warp, white otherwise. The lower area with numbers 1–6 is about the “threading”: each number marks those warp yarns which behave the same. Warp yarns which behave the same can have their heddles be connected to the same shaft. Therefore, in my understanding, to weave an $N = 3$ type Pied-de-poule, one needs a 6-shaft loom.

Towards the variable-width pattern

The vocabulary of the Feijs 2024 Bridges paper is used. The weft colors and the warp colors are organized in bands, like in Pied-de-poule or Gingham, but now they have variable width: either 4 or 6. The bands give rise to intersection areas (“blocks”) of 4×4, 4×6, 6×4 and 6×6 (width×height). We need two kinds of blocks, viz. “core” blocks, which are entirely black or entirely white, and “tail” blocks, which are mixed black/white, see the figure below. We label the block types: A “white core”, B “white tail”, C “black tail”, D “black core”. In a white column (warp band), we alternate between A and B blocks: in a black column C and D. The block size is governed by an aperiodic sequence of zeros and ones. The same sequence is used

for the vertical and the horizontal. The bands shown are 6,4,4,6,4,6,4, 6,4,4,6,4,6,4,4,6,4,6,4,4,6 etc. wide, corresponding to a certain sequence 100101010010100101001 etc. proposed by professor N.G. De Bruijn in 1981.

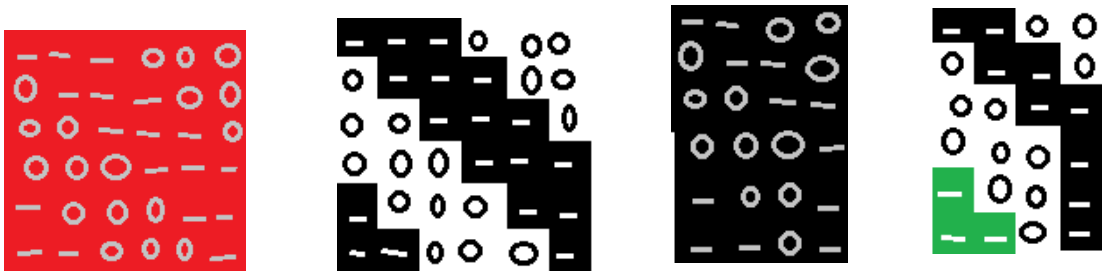


How to weave this?

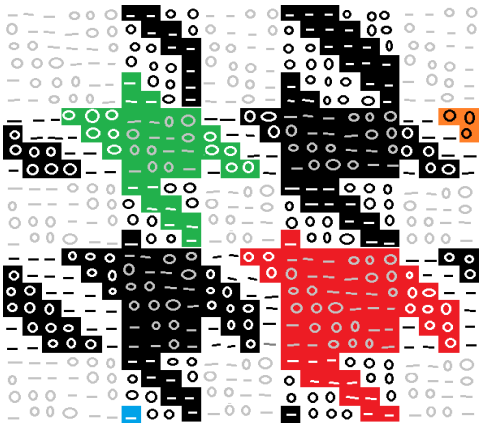
We consider the 64464 left-upper part of the above pattern (6 warp bands: wide, narrow, narrow, wide, narrow, idem for the weft). Please consider red, green, blue, green, and orange as essentially black (the color was used in another figure to show the mutants). The visual appearance and the A,B,C,D blocks are assumed given now. The question which remains is how to weave them, in other words, we must design the pattern that governs where the weft goes over the warp and where it goes under. First, we discuss the design considerations for the weave, then we give the images.

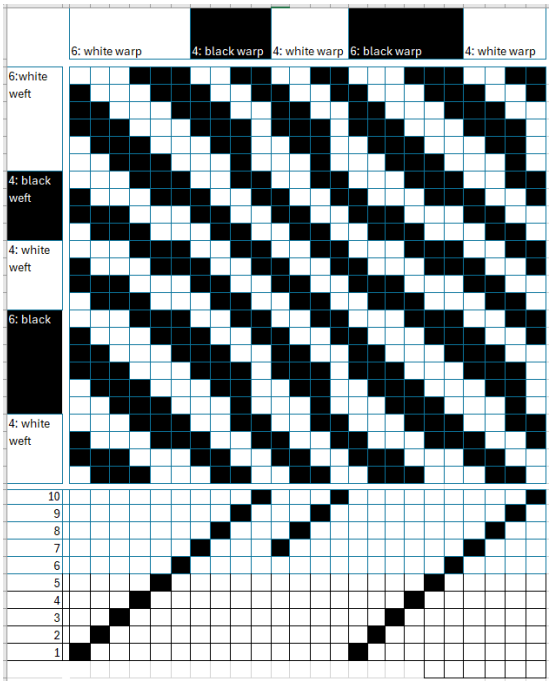
- In the tail-blocks, which are at the intersection of differently colored weft and warp bands, the B and C patterns dictate the weave. The *square* B and C patterns were chosen the same as in the classical Pied-de-poule, no vagueness in deciding what Pied-de-poule like means (the *non-squares* are new).
- I made the obvious choice that 4×4 core blocks have a weave which is precisely that of the core block in a classical 4×4 pied-de-poule. This holds both for the white and the black versions. Similarly, the 6x6 core blocks have a weave which is precisely that of the core block of a classical 6×6 pied-de-poule. Again, the same for the white and the black versions.
- The 4×4 tail blocks get the same weave as the 4×4 core block (as they are all copied from the classic). Similarly, the 6×6 tail blocks also have the same weave as the 6×6 core block.
- The non-square tail blocks are more ad-hoc, but once I had decided on the visual appearance of the two non-square tail blocks (notably B and C), the weave was forced! Also note that the black-tail block is the inverse of the same-size white-tail version.
- There is freedom in choosing the weave of the non-square core blocks (as both weft and warp have the same color, it does not matter who goes over and who goes under). Thus, I exploit that freedom, viz. by choosing their weave to be a copy of the tail block (of that size).

The following images hopefully illustrate a bit of the terminology. These are a core block of size 6×6 ("black version"), a tail block of size 6×6 ("black tail"), a core block of size 4×6 ("black version"), and a tail block of size 4×6 ("black tail"), respectively:



Putting it all together we get the following:





In the weaving draft (second diagram), the threading area (the lower rows labeled 1–10) indicate which warp yarns have the same behavior. Behaviors 1–6 are for wide (=6) bands, 7–10 for narrow (=4) bands. As it happens, warp yarn 1 behaves the same as 7, and 2 behaves the same as 8. This means that there are 8 different behaviors. Same-behavior warp yarns can have their heddles fixed to one shaft. If I am correct to assume that it is practical to distribute the load evenly over the shafts, then 10 shafts would be good (as shown in the weaving draft). Otherwise, 8 could work. A Jacquard loom gives individual control over each warp yarn, so that is an even better idea.

Disclaimer: the analysis is done to the best of my knowledge, but I am not an experienced weaver, nor did I weave the described construction (I turned to an LCD screen instead).