

A Penrose Tiled Shower

The attached image (see below) is that of a shower stall in my home that was installed using a Penrose tiling. For those unfamiliar with the concept, a Penrose tiling solves the longstanding question of whether it is possible to tile a plane surface with a pattern that repeats irregularly. The two types of Penrose tiles are the **rhombs** (thin and thick) and their dual (**kites** and **darts**). The wall tiles in the image were made from the two types of rhombs, the floor tiles used the kites and the darts.

Penrose tiling is fundamentally a 5-fold symmetry (thought to be impossible until quasi-crystals were discovered in nature) and the tiles are not manufactured commercially, so each had to be handmade. I used porcelain clay with a shino glaze for the thick rhombs, and, to obtain a contrasting colour for the thin rhombs, experimented with a variety of iron oxide additives. The tiles were fired to cone 10 in a reduction kiln over a period of several years, thus explaining the colour variation, because any reduction firing is always dependent on many things such as air temperature and pressure during the firing, and what else is in the kiln. A contrasting blue (cobalt) glaze was used for the kites and perimeter tiles; these were fired in both reduction and electric kilns, again to cone 10.

Three main difficulties presented themselves during the installation. Each tile had to be ordered and oriented according to very strict rules; an error in one place will later produce a defect (hole) somewhere far away. Since each tile was cemented in place, errors could not be allowed to happen. The solution was to lay out the pattern for an entire wall on the floor, photograph the pattern and proceed with the installation according to the photograph. Since each tile had to be laid at an angle to the vertical, numerous spacers were necessary while the cement set, and the pattern had to be laid from the bottom upwards, also at an angle, in spite of the tiles tendency to slide sideways. This made it very difficult to follow the photograph. Although Maple does have a Penrose tile command, it lacks the full-colour area fill required for this application and so could not be used.

A second difficulty arose at the wall edges, since it was necessary to continue the pattern across the junction of two perpendicular planes. Again, Maple could benefit from the introduction of a “cutting surface” command so that the precise outline of a truncated edge tile could be computed. Lacking such a facility, I went with simplicity and, using cardboard cut-outs to determine the shape of the hole at each edge location, constructed a tile of the correct shape to fit. Since clay shrinks when fired, each tile so-made was of exactly the right size to allow for the grout lines.

Thirdly, it is a sad fact of building construction that no wall surface is exactly flat, so as the installation progressed, small discrepancies arose due to the curved metric. Mostly this could be compensated for by careful adjustment of the grout lines (chosen to be very wide for this reason), but eventually the non-Euclidean nature of the problem could not be overcome, so one special slightly irregular (non-Penrose) rhomb was created to soak up the accumulated errors. It is virtually indistinguishable.

Finally, and according to the instructions for this submission, I would like to point out that although it is obvious that this installation made minimal use of Maple, there were times when Maple did not react as expected while I was working on other projects, and it became therapeutic to muck about in the clay when that happened. To that extent, Maple contributed to the completion of this artwork.

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