Material Deformations of Penrose Tiling

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Publication date
2022

Document Version
Final published version

Published in
w/k - Between Science & Art

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Material Deformations of Penrose Tiling

Text: Teresa Hunyadi and Dave Murray-Rust

Abstract: The heart of this work is exploring Penrose tiling. Penrose tilings are ways to completely cover an infinite plane with perfectly fitting shapes, in a pattern that never repeats – they have moments of local symmetry, where it may look like they are regular and ordered, but on a larger scale, this order is always disrupted. We use a technique that changes the shape of the tiles while keeping the underlying pattern to create a rich, generative space for artistic exploration.

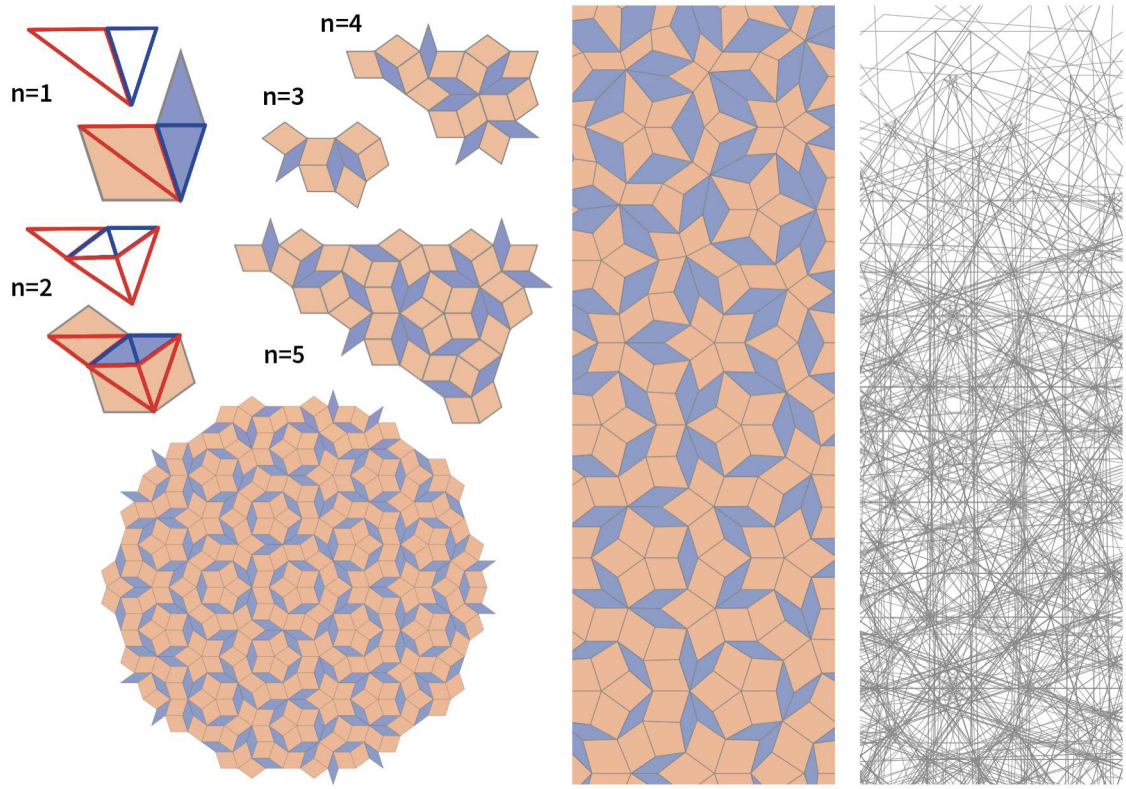

Figure 5: Dave Murray-Rust: *Construction of Penrose tiling* (2020). Screenshots: Dave Murray-Rust.

Introduction

Roger Penrose created the original tiling (P1) in 1974, but it required six different, complex shapes to fill the plane. This was later reduced to two shapes – a kite and dart (P2) and two rhombuses (P3), the version that we explore here. While one might think of adding tiles to the edge of a growing pattern, it is easier to write a program that carries out inflation – starting from an initial set of shapes and repeatedly dividing them to create finer and smaller patterns (Figure 5).

Motivation

This project sprung from a shared investigation of patterns – in particular, simple patterns with long range complexity – but also from adapting and making use of our situation during the first lockdown. At that time, we found ourselves with access to a Computerized Numerical Control (CNC) mill and looked for patterns that would fit the possibilities of this machine and our interests. Finding code for Penrose tiles (Hill, 2015), then discovering Welberry's process of deforming the tilings and seeing a connection to Teresa's work (*Heaven and Earth*, 2020), we moved onward. Working together gave us space for mutual surprise, as we sparked ideas in each other.

Teresa's background is that of a wood sculptor, paying attention to the grain and character of wood as a partner in the engagement with form. Dave works between algorithms and people and looks at what happens when computational ideas meet the world (Murray-Rust and Jungenfeld 2017, Hemment et. al 2019). Teresa is intrigued by relations between pattern and organic growth (*Windows*, 2019), whereas Dave has invested time playing with iterative rules that generate images from simple shapes. Both of us enjoy a sense of zooming in and zooming out, connecting details to the whole, and bridging different ways of understanding the world.

Medium

We think of code, tools and material as the factors of this work. The code and data shaped the concepts into machine geometries. The cutting processes (applied tools) between the metal bit and the wooden sheet added its own language to the type and geography of lines. The varieties of materials themselves and what they can do opened further directions to the work.

To start with we needed a light and readily available CNC suitable material. Working with various plywood offcuts which have infinite variations of (growth) pattern visible, evoking its origin, made sense to us. This became especially exciting when we found that it could be cut thinly enough to be translucent while remaining connected, adding even more of its own,

inherent, visual agency which gets reflected in its properties – a journey of translation from a concept to a digital file to something tangible.

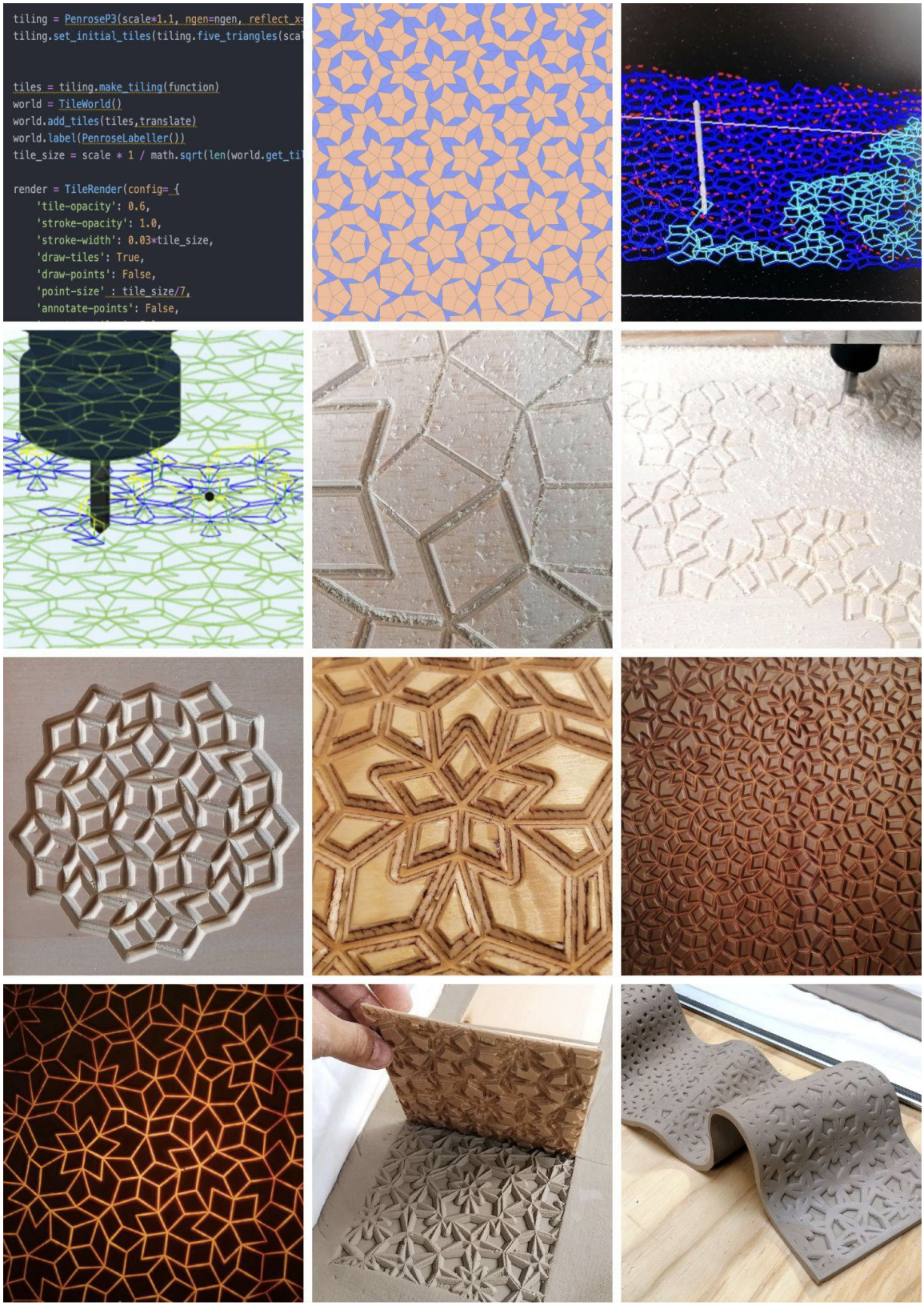

Figure 6: Teresa Hunyadi & Dave Murray-Rust: *Sequence images of the process* (2020). Photos: Teresa Hunyadi.

Outcome

One of the most exciting parts to come out of this collaboration was the interest in transforming and translating patterns from one place to another (Figure 6). The diagrams on

screen read very differently to the valleys and ridges carved into wood – the geometry of the cutting tool negotiates with the underlying mathematics. The pattern has a different feel as it moves from concept to code, from 2D visuals to an ordered sequence of motions for the machine, and then into 3D objects.

Lessons and Outlook

We were surprised by how much the materialisation changed the sense of pattern; in some of the pieces, the non-repeating nature of the Penrose tiling doesn't come through as strongly as the simple geometry of the pattern. In others, the deformation is a larger part of the visual story, and the sense of symmetry is less clear. Exploring different materials, tools and light allowed different relations to emerge between pattern, perception and space. Some of the more extreme deformations that break geometric constraints would translate well to paper based works, where the crossing lines give depth. Moulding with clay seems to be a rich space, where additional spatial deformations can be added. Looking ahead, we are particularly interested to see how the patterns can be expanded to fill more space.

Links to Artworks:

Teresa Hunyadi, *Windows* (2019): https://teresahunyadi.com/portfolio/windows/

Teresa Hunyadi, *Heaven and Earth* (2020): https://teresahunyadi.com/portfolio/heaven-and-earth/

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Details of the cover photo: *Wooden Mathematics* (2022). Copyright: The authors.

How to cite

> Milena Damrau, Martin Skrodzki, Nicholas Bruscia, Aaron Fenyes, Teresa Hunyadi and Dave Murray-Rust. (2022): Wooden Mathematics – Making abstraction tangible. *w/k – Between Science & Art*.