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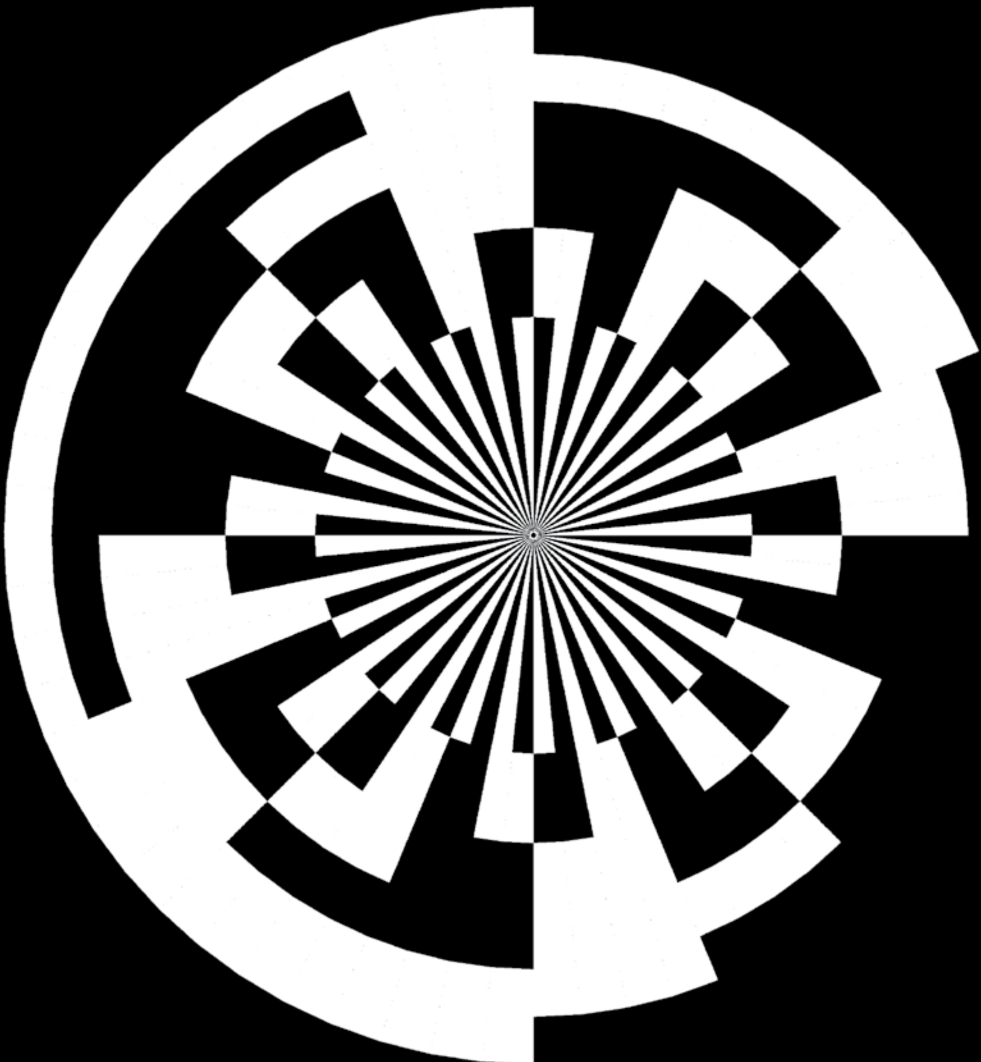

The Twisted Line

& VISUAL NUMBERS

– A Perception Challenge in Black and White

The Twisted Line & Visual Numbers

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INTRODUCTION

Erik Steenstrup Dyhr

When we think of mathematics it is rarely in the belief that the purpose of mathematics is aesthetical. But when we examine the *nature* of mathematics, it brings us beyond the ordinary understanding that math is merely a tool for calculations in science and economics.

The mathematical worldview is so deeply embedded in our lives that we hardly see its impact on our surroundings and the world. You probably read this in a house (on a computer!), sooner or later you go outside. Both places are constructs based on calculations. Your house, car, road, city, and the landscapes are all things that can be described in the language of numbers. Of course, these things existed before the discovery of mathematics, but the inner coherence of mathematics and our ability to use that is a true picture on man's ability to acquire knowledge and order in the world.

Still at its core, mathematics is a mystery. What is the foundation, what is the nature of mathematics? A nominalistic (and modern) answer tends to say that the numbers are nothing more than their use. The number is nothing more than a sign. The sequence of numbers is a practice. The truth of mathematics is nothing but a relation of safe ideas, but in itself it does not infer any judgment about reality. In its most radical empirical edition nominalism denies that abstract objects exist. It may, within this understanding, also be argued that they are a human invention which is historically conditioned.

The opposite view is found in Plato, inspired by the Pythagoreans, he was convinced that man could deduce the truth by using ideal and objective 'values'. Plato believed that the substantial forms and numbers resided in the World of Ideas and that they were more real than the things they described. This position is referred to as Platonic realism and is the belief that abstract objects exist independently of human perception.

Since the Middle Ages, there has been an ongoing discussion between platonism and nominalism. What is the real object of knowledge – universals or particulars? Without enumerating all the positions and problems in the Philosophy of Mathematics it should be mentioned that many philosophers have argued that we can't have knowledge without assuming transcendental conditions, such as logic rules (eg. the law of the excluded middle).

We do not find the whole number out there in nature. The axioms of Euclidean geometry appear to be a human invention. The definition of a Fibonacci series comes from number theory axioms, but the relationship between two Fibonacci numbers is the golden section: app. 1.618, and it describes relations found in real things like snail shells and spiral galaxies. It raises the question, how can it be that we, as beings who arose from the physical world can create mathematical models that exist only in consciousness? It seems that there is a correspondence between the knowledge we can possess, as mathematics and logic, and the world out there.

If this assumption is correct, there is a close correlation between what is true *for us* and what is true *in itself*. Precisely this is the idea of this book. The aesthetics of mathematics is not a superficial property in relation to an ideal Platonic reality, nor can it be reduced to only that, which can be proved or for what is simply useful. Through an aesthetical and a mathematical consideration we behold nature into a direct consideration – this is exactly the true nature where we are direct participants.

In other words (and now we come to this book), *The Twisted Line & Visual Numbers* is a picture book of graphic patterns to fill the void between the theoretical and empirical efforts in science by focusing on what you can really see. The challenge for the imagination is both a pleasure and sublimation of perception. Catch a point or a circle, and feel the irresistibility of these patterns. See this point, this line being repeated, you can't avoid being drawn into this world. You are now a prisoner in a visual universe filled with beauty and strange connections. At this level we repeat old archaic structures they compel our ability to solve the puzzle and decipher the sign. But often we must give up and leave everything as it is, with its alternation between black and white, being and non being, causing the impression of an impossible condition: movement in a static image. Our capacity for true belief being suspended, we are walking on the edge of what is possible. We enter the realms of an unknown order, which stretching our imagination and conception at risk of inspiration as well as madness, but most importantly as a source of amazement.

The patterns in this book bring us directly to the point: the fact that our world is a place of things and facts worth contemplating as a reality. Furthermore, we don't leave you as a spectator, because you can repeat these figures by using simple mathematics and programming. These patterns refurbish mathematics with its visual and aesthetic appearance for a direct assessment and revive sight as an important part of knowledge. The positive feedback is that rationality as the core of modern society no longer lacks a visual body in a full aesthetical understanding – it demonstrates *again* the ability of mathematic to be the language in which the world is written.

CONSTRUCTION OF A PICTURE

Michael Barfod

All figures in this collection have been programmed.

They consist of simple elements which are repeated and moved around in a simple manner – so simple, that it is easy to formulate the movements mathematically.

All figures are made from a collection of straight lines – some very short – some long. The reason for this is that mathematically a straight line only needs a definition of two points. Further it gives the possibility of defining the thickness of lines individually, and when more lines are put together to vary the thickness of compound lines gradually. When the line is rotated around a point arches and circles are created. Other lines follow the spiral of a snail, also called the logarithmic spiral. Additionally some simple numerical relations are used:

1 2 3 4 5 6 7 8
1 2 4 8 16 32 64
1 2 3 5 8 13 21

Most of the figures are variations over:

- Triangles, hexagons and spirals.
- Mandalas – figures with an even and balanced distribution of dark and light
- Circular patterns where a simple charac ter is varied
- Twisted layers of parallel straight lines

When a mathematical program for a figure has been written, some variables are included.

The variables are numbers that can be changed. When a number is changed, the whole visual output also changes. In this way a glimpse of eternity is created, because it is always possible to add one to any number.

The figures are inspired by holistic thought – the idea that the whole universe is best described by parts with opposite characteristics. In a pictural representation black and white is one such opposition.

Even when the mathematical basic pattern, e.g. the circle or the triangle, is simple, a little added information, e.g. the twist or parallel movement of the basic pattern, creates a complex and infinite universe.

In my search for the mathematical foundations I have been especially inspired by **Leonardo Fibonacci** (1170-1240), who is said to have introduced the modern numbers to Europe, not only did he use the Indian figures 1 2 3 4 5 6 7 8 9 but just as important the 0. He also invented the Fibonacci sequence: 1 1 2 3 5 8 – where the next figure in the sequence can be found by addition of the two former. These numbers are often found in nature e.g. in sun flowers – where the number of right and left spirals in the flower head always will be a number of two subsequent Fibonacci-figures. Further the ratio between two subsequent Fibbonacci-numbers comes closer and closer to the Golden Ratio – also called phi ~ 1.618 – a figure that the Old Greeks also spent a lot of time wondering about.

Rene Descartes (1596-1650) invented the coordinate system. It is told that once, when he was sitting in a room, he was watching a fly buzzing around. Suddenly he realized that he could describe the position of the fly at any time by assigning three distances to it – the distance from the door, the distance from the window, and its distance from the floor. And so – the story goes – he invented the coordinate system. The coordinate system is the foundation for all figures in this collection. I'm only using two coordinates or dimensions (2d), because I only want to make „flat“ illustrations. Descartes wrote a book; „Discourse on method, optics, ge-