Constructive Fine Art

Josef Kühner

Abstract

Explain how I made some graphics with MetaPost.

1 Introduction

I own a graphic created in 1978 by the French artist Jacques Mennessons. It is called "SMACKS dans L'ESCALIER"; on the backside of the picture used materials and size are indicated: "papier, encre, couleur, 27,5 x 11,5". In this picture I see shapes of steps colored in plain blue, yellow and red, shifted, scaled or rotated and put together to construct SMACKS stairway. Proportions of shapes and colors seem to follow an elegant rhythm: SMACKS must have danced on his stairway.

One day Jacques explained me that he worked with graphics based on simple geometric shapes. These original shapes are modified by various geometric transformations to produce more complex shapes and can be joined together to a final well proportionate ensemble. An important constraint for these modulations was that classical aesthetic relations like "proportion divina" or "sectio aurea" should be respected.

Occasionally I write mathematical texts; although a lot of work is still done with paper and pencil, the papers are now written down on a computer with a software called TEX. This tool allows for creation of high quality mathematical texts, It was first developed by the mathematician and computer scientist Donald E. Knuth. (cite)

Not satisfied with the quality of available computer fonts, Knuth also developed an tool called METAFONT, which allowed him to design and create high quality families of fonts, so called sets of Computer Modern Fonts. These font families are appropriate for the writing of beautiful mathematical texts with TEX. Although any kind of geometric shapes can be in principal be produced with METAFONT, the focus is the design of bitmap fonts.

So it turned out that John D. Hobby, researcher in computer science from Bell Labs, created MetaPost, a graphics language based on METAFONT, which produces PostScript output and can be used to create high quality graphics. The resulting graphics can easily be included into text produced

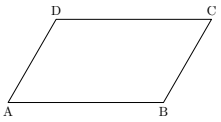

Figure 1: Parallelogram

with TEX, a feature which is highly appreciated by authors of mathematical and technical papers.

With the constructive character of graphics like "SMACKS dans L'Escalier" in mind, why not use TEX and MetaPost to design fine art graphics? The recipe is given by artists like J. Mennessons: Take a very basic geometric shape, apply affine transformations like shifts, rotations, scales and enjoy the result.

The graphics presented in this paper were produced on a laptop with operation system "Fedora Linux" and TEX and MetaPost installed. The source code (plain text files) is available.

2 Base Shape and Transformations

I started with a parallelogram $ABCD$ with sides $a = 0.5 + 0.5\sqrt{5}\,\text{in}$ and $b = 1\,\text{in}$ and angle $\alpha = \pi/6$. This shape is depicted in figure 1.

To give an idea of the kind of phrases which have to be written in MetaPost to achieve this drawing, I produce the source code.

```
z0 = (0,0); 2*z1 = ((1 + sqrt 5)*72,0);
2*z2 = (72,(sqrt 3)*72);
z3 = z1 + z2;
path p;
p := z0--z1--z3--z2--cycle;
draw p;
```

The pairs z0, z1, z2, z3 represent the points A, B, D, C in respect to an appropriate coordinate system. The code `z0 − −z1 − −z3 − −z2 − −cycle` represents the closed path starting from A through B, C and D and back to A. The last line draws the parallelogram on the computer screen.

The resulting parallelogram was scaled by factor $\Phi = 0.5+0.5\sqrt{5}$, shifted by $\overrightarrow{AC}$ and finally rotated around C by angle $\varphi = \pi/3$. Putting the parts together results in the picture represented in figure 2.

The third step is to translate the first parallelogram to join the top of picture 2. We obtain what I have called a folding, see figure 3.

We can add color to our picture, see figure 4.

We can now play with our folding; this is demonstrated in figure 5. As an example we colored the parts of the folding with different tones and inserted a rotated copy over the original folding.

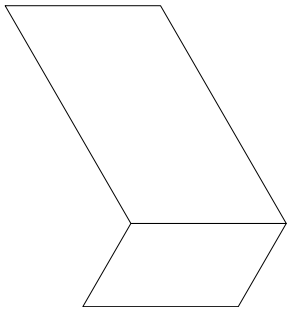

Figure 2: Transformed Parallelogram

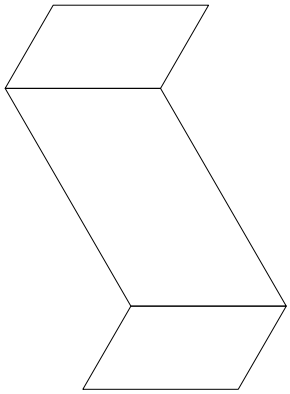

Figure 3: Folding

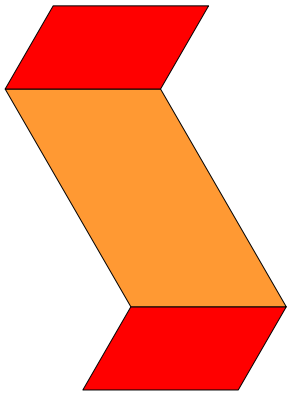

Figure 4: Colored Folding

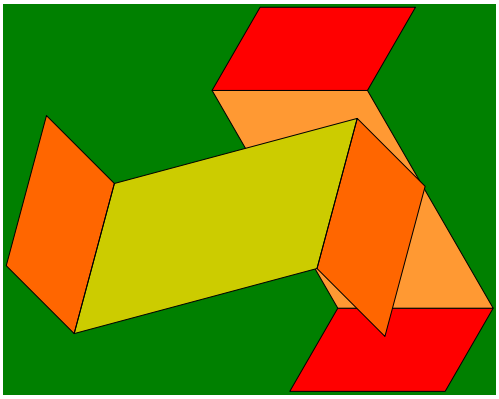

Figure 5: Play with Folding i

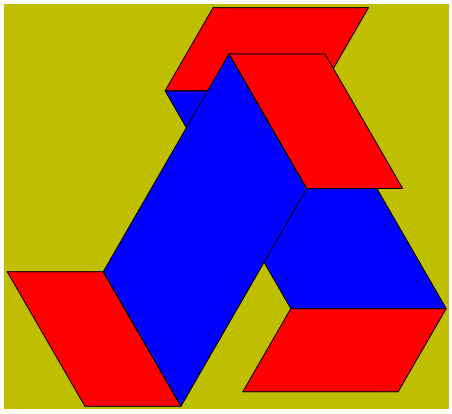

Figure 6: Play with Folding ii

Another example is shown in figure 6.