

Queen Maxima Portrait, by Epenko. Information about the Epenko setup and strategy.  
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This portrait is painted by Epenko. A painting robot developed by Sander Idzerda.  
<http://www.epenko.com/>

Epenko could not have existed without friend Floris van Manen.

**The machine:**

This is the 5th or so machine used for drawing or painting. At first a penplotter was used, a small robot arm, and several xyz table style machines. Important advantages compared to a robot arm are: low cost but speedy and precise.

Now i've used the openbuilds system. It is easy to change and reuse for a new setup.

Smaller components are designed using Freecad and printed with a 3d printer (reprap huxley and more recent a lulzbot mini)

Stepper motors and belt are chinese Control board is now a smoothieboard, but also a tinyg and others have been used with succes earlier.

**Feedback loop:**

For camera feedback an old canon a520 camera is used. The camera is controlled by the system via gphoto. The resolution of the camera is not that great compared to more modern camera's, but it has manual controls, a decent lens and sensor and for now it still is good enough. Corrections for lens error are applied to the images also.

**Programming language:**

Python is used mostly via a anaconda environment. Python is great and I wish I started programming python much earlier (only programming python for +-3 years now.) I had some programming experience in other languages.

**Paint:**

Acrylic paint is used, its diluted with water and medium. I tried several strategies but for now I'm getting best results using diluted paint (both black and white) and make much more small changes. offcourse a feedback loop is necessary for the system to determine if it is going towards the 'goal' image.

**Strategy:**

First a lot of layers with the darker paint are painted, more towards the end the lighter white diluted paint is permitted to correct those region that were painted too dark. Between layers and before switching paint the brush is automatically 'washed' just by dipping and stirring it in water. Canvas is used to paint on, but because canvasses are never exact the same, before painting a calibration is run, so that the brush touches the canvas at the right height. (only a 3 point measurement is used now)

**Tone over color:**

Yes i would like to use color, for sure, but tonal valus are more important than color. We all can enjoy a black and white photograph. The idea is to master tonal value first and then start mixing those flesh colors :)

**What i would like to develop now:**

- Some sort of simple mechanical but reliable automatic tool / brush changer.
- Starting mixing and experimenting with color.
- Now the system is using a reasonably simple approach to paint towards the goal, (depending on the phase of the painting smaller brush strokes are allowed and later on white is permitted) and although i'm starting to learn AI techniques it is not used yet in this system for the painting itself. It is adaptive off coarse but does exactly what ii is programmed to do, so it is still predictable if you know the program. For image generation some AI techniques are used but not yet for the painting itself.

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