

Magnetic Pictures

Version 1.03 by Michael Snyder 06/14/2017

You draw virtual magnets and Pic2Mag draws the fields! (tm)

Windows Usage : double click magpics.exe, with myfile in the same folder.

Command Line Usage : magpics myfile, with myfile in the same folder

Quick Start: Your red and blue graphics file should be placed in the Magnetic Pictures folder. Start a command prompt, and change directory to the folder with your files, and enter the command 'magpics myfile'. or double click magpics and enter the graphics image filename.

Magnetic Pictures is a program to help students gain an intuitive understanding of magnetic fields. The idea is that a student draws a picture and the Magnetic Pictures program processes the red pixels as material with a north magnetic moments and blue pixels as material with a south magnetic moments. The program plots the magnetic fields between the magnetic materials.

The program is designed to accept most graphic file formats and will work with most shades of red and blue colors. The initial testing of Magnetic Pictures was done with CraZArt Markers.



An example test image called 'science.png'

The Magnetic Pictures program is very flexible and there are many ways to use it. The author assumes that one of the ways will be an instructor having a class of students draw pictures, and then the instructor will scan the drawings into a computer and process the drawings overnight using batch files. Anyone with command line experience can setup the needed batch files.

Another possibility is that each student has their own computer and student draws a picture in a program like MSPAINT and then double clicks on the local magpics.exe file to process it.

Another possibility is using a cell phone to take a picture of a drawing and processing the picture on a windows computer. Future versions of the Magnetic Pictures program will work directly on your cell phone. Present versions are limited to windows and ubuntu computers.

Once the user has the drawing scanned into their windows computer, then the rest of the process is pretty simple. You place the file in the same directory as the magpics.exe file and then you double click the magpics.exe file and enter the drawing's name at the prompt; or you could process the drawing from the command line.

```
c:\>cd c:\magneticpictures
c:\magneticpictures>magpics science.png

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Magnetic Pictures v1.01

You draw virtual magnets and Pic2Mag draws the fields!(tm)

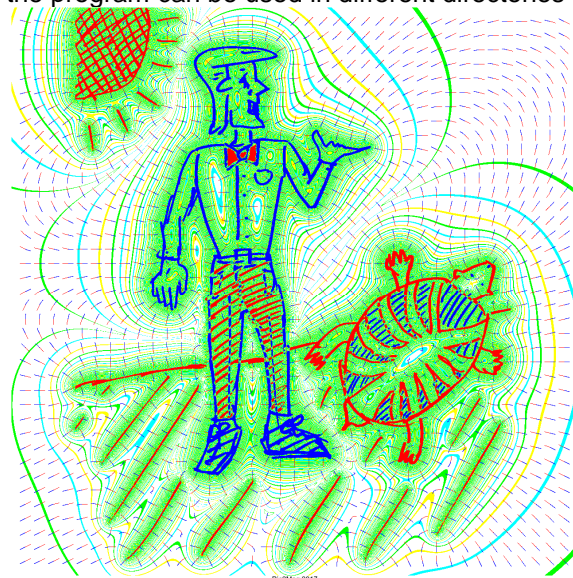
Each pixel is a 1mm cube of permanent magnet and the program
generates the vector fields 3mm above the plane

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```

In this case the program location was on the 'c:' drive in the 'c:\magneticpictures' directory.

Depending on the computer and the drawing; image processing can take 3 to 15 minutes to be processed. During public demonstrations of the program, the author uses an Intel I7 computer which can process most images in less than five minutes. On the other hand, even an older windows computer can process four to eight Magnetic Picture images per hour per computer core. Multiple copies of the program can be used in different directories on the same computer.



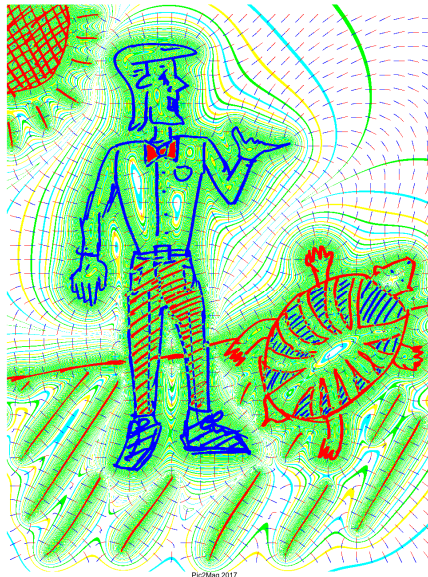
First of four output files - 'science_____magnetic.png'

The Magnetic Pictures processing produces four output files. The first file is a full sized plot of the magnetic fields defined by the red and blue pixels of the image. The three other files are variations of the full sized plot.

The magnetic field directions are shown by using small compass needles. Technically the compass needle plot is created within the program by making a streamline plot of the vector fields. Then the streamlines are plotted as compass needles with red and blue markings. The compass needles map the direction of the magnetic fields at that location.

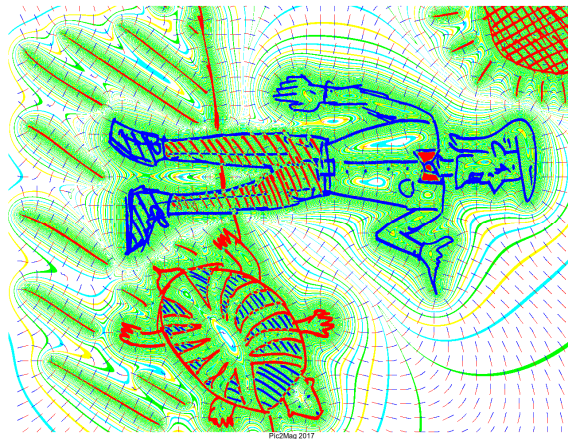
The repeating sets of yellow, teal, and green lines of the image is an isopotential plot of the vector field magnitudes. They are similar to a topographical map but are using a repeating sequence of yellow, teal, and green lines to show the field strength. This has the advantage that the strongest parts of magnetic field have the most yellow, teal, and green lines close together.

The greener the image; the stronger the field!



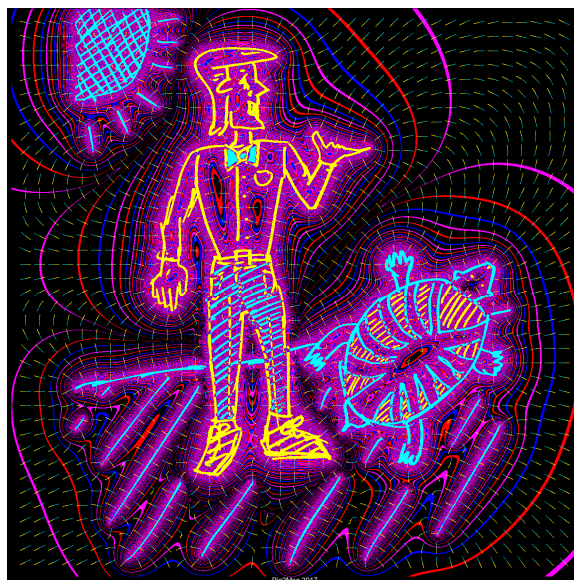
Second of four output files - 'science_____magnetic_port.png'

The second file is intended for printing and is a portrait cropped version of the first file.



Third of four output files - 'science_____magnetic_land.png'

The third file is intended for printing and is a landscape cropped version of the first file.



Fourth of four output files - 'science_____magnetic_scrn.png'

The fourth file is the inverted color version of the first file and is NOT intended for printing because it would use up all the printers black toner to print a black background.

Unpacking and Using the Magnetic Pictures Software

Once you download your software from the www.pic2mag.com website, the download will need to be unzipped. In windows, you will go to your download directory and right click on the file and choose the 'extract all' option. Basically we just need to unzip the files into a directory.

After extracting the zip file, you should see eight files.

magpics.exe	main program
magneticpictures.pdf	this software manual
science.png	test image
magick.exe	imagemagick program
colors.xml	imagemagick configuration file
configure.xml	imagemagick configuration file
type.xml	imagemagick configuration file
magic.xml	imagemagick configuration file

```
C:\>
C:\>cd c:\magneticpictures

c:\magneticpictures>dir
Directory of c:\magneticpictures

04/24/2017  07:05 AM  <DIR>          .
04/24/2017  07:05 AM  <DIR>          ..
03/25/2017  08:06 AM             1,383 colors.xml
03/25/2017  08:07 AM             875 configure.xml
03/25/2017  08:06 AM             888 magic.xml
03/25/2017  08:12 AM      14,474,240 magick.exe
04/24/2017  07:01 AM       382,464 magpics.exe
04/22/2017  10:09 AM     1,850,946 science.png
03/25/2017  08:07 AM             670 type.xml
               7 File(s)      16,711,466 bytes

c:\magneticpictures>_
```

Directory listing of the magnetic pictures files, pdf manual file not shown.

These eight files are the core files of the Magnetic Pictures program and can be moved to any directory that the user wishes. For computers with multiple cpu cores, you can make multiple directories (i.e. c:\magneticpictures01,c:\magneticpictures02,c:\magneticpictures03, etc) in order to run a concurrent copy of the magnetic pictures program per core.

The program can also be ran from a thumb drive. In one sense moving files around is so 'old school' in 2017 but on the other hand, it makes the program very portable. You literally can copy those eight files into a directory on a thumb drive and go to another computer and run the program.

The Magnetic Pictures software only does file operations within its own directory and is compatible with most or all anti-virus programs. From the anti-virus program viewpoint, the Magnetic Pictures software is very boring because it does not affect windows in anyway.

```
c:\magneticpictures>magpics science.png

-----
Magnetic Pictures v1.01
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Usage: magpics myfile.png

Each pixel is a 1mm cube of permanent magnet and the program
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+Calculating Vector Fields for Z layer 3 (1/1) +
Processing Step 16 of 16
+Calculating Isopotential Contours+
+Calculating Magnetic Streamlines+
+Writing Stream & Contours File+

c:\magneticpictures>
```

Running Magnetic Pictures magpics.exe for the first time.

The first time that you run the Magnetic Pictures software, it will create data cache files with pic2mag names. The reason that the cache files are called pic2mag is because of the computational engine that the software uses. The pic2mag engine creates the files so that the same differential equations do not have to be solved again for each new image. This speeds up the image processing and it takes my computer about 10 minutes to create the cache files.

```
c:\magneticpictures>
c:\magneticpictures>
c:\magneticpictures>dir
Directory of c:\magneticpictures

04/24/2017 07:26 AM <DIR> .
04/24/2017 07:26 AM <DIR> ..
03/25/2017 08:06 AM 1,383 colors.xml
03/25/2017 08:07 AM 875 configure.xml
03/25/2017 08:06 AM 888 magic.xml
03/25/2017 08:12 AM 14,474,240 magick.exe
04/24/2017 07:01 AM 382,464 magpics.exe
04/24/2017 07:15 AM 78,889,152 Pic2Mag_Z5003_1001000.dat
04/24/2017 07:15 AM 78,889,152 Pic2Mag_Z5003_1002000.dat
04/24/2017 07:14 AM 78,889,152 Pic2Mag_Z5003_1003000.dat
04/24/2017 07:14 AM 78,889,152 Pic2Mag_Z5003_1004000.dat
04/24/2017 07:14 AM 78,889,152 Pic2Mag_Z5003_1005000.dat
04/24/2017 07:13 AM 78,889,152 Pic2Mag_Z5003_1006000.dat
04/22/2017 10:09 AM 1,850,946 science.png
04/24/2017 07:26 AM 511,007 science_____magnetic.png
04/24/2017 07:26 AM 458,681 science_____magnetic_land.png
04/24/2017 07:26 AM 458,668 science_____magnetic_port.png
04/24/2017 07:26 AM 510,422 science_____magnetic_scrn.png
03/25/2017 08:07 AM 670 type.xml
17 File(s) 491,985,156 bytes
```

Showing the created pic2mag cache files.

The easiest way of running the Magnetic Pictures program for the first time, is to double click 'magpics.exe' in the directory and enter 'science.png' at the graphics filename prompt, or you could do it from the command line with the 'magpics science.png' command in the Magnetic Pictures directory. The science.png file is the included test file that comes with the program.

The ImageMagick software is included within the Magnetic Pictures software because it is used to do the image resizing and cropping. ImageMagick is wonderful software and the author highly recommends it. Everything you can do in Photoshop, you can do with ImageMagick!

Marker Colors

How does a user know if a certain color is compatible with Magnetic Pictures? The easiest way is to put a small circle of the color in question on a blank image and process it. A small circle of a color only takes a few seconds to process. If you need a certain color marker to work, please email me a sample image and I will compile a version of the program to work with your colors.

Educational Licensing

Anyone who is directly affiliated with the licensee may use the software and take home the printouts.

The licensing model is that an instructor can buy a Magnetic Pictures license for \$19.95, and this license includes all the instructor's students. The students can use the software at school and/or take it home on their computers while they are a student of the instructor.

The cost for individuals or individual instructors or small organizations is \$19.95.

For example if the St Louis Makers organization wanted to have a booth at the Maker Faire that printed out Magnetic Pictures for the attendees of the faire; their text at the bottom of each page could be something like 'St Louis Makers Faire 2017'.

Schools can buy a \$49.95 school license that covers all the Instructors and students of the school.

When I receive an order, I will sent the customer a Paypal invoice, and compile a version of the program with the desired image text, and email the customer a download link for their software.

This version of the software, which is a single threaded win32 command line program is free to use as long as there is a pic2mag text on each processed image. The author is working on a multithreaded windows version which is over three times faster!

In other words, you can use the slower edition of the software for free with the pic2mag text printed on each page; or you can upgrade to a newer Magnetic Pictures version that is over three times faster, and has your own message text on each page for \$19.95

For questions about the Magnetic Pictures software or orders or licensing or support, please email me at msnyder@pic2mag.com