

(That's "Stereogram Maker" in case you don't have your red-green glasses handy.)

Copyright © 1993  
by John Baro  
All rights reserved

## About the Program

Stereogram Maker is a little program that will generate random-element stereograms from any black and white picture. All you have to do is provide the black and white picture (just about any will do, so long as it doesn't contain a lot of very thin lines) and in the blink of an eye you will have a lovely stereogram (like the one above). Just put on your handy red-green glasses (red goes on the right, please) and wondrous shapes will pop right out of the screen at you! If you like the program, or think it is even somewhat cool, please let me know – my address is listed below.

Some people may have to look at these images for a few minutes before anything pops out, but once it does, it won't go away and it'll be much easier to see the next time. It helps if you stand directly in front of the screen and are about arm's length away. If you don't have red-green glasses, colored cellophane or just about anything that is colored and transparent will do.

## About Depth Perception & Stereograms

We perceive depth, in part, because each of our eyes views the world from a slightly different perspective. This slight difference between the image striking the flat, two-dimensional surface of each retina is used by our visual system to construct a three-dimensional perception of the world. This difference between the two eyes' images is called **binocular disparity**. With stereograms, a slightly different image is presented to each eye, thus creating binocular disparity and fooling the visual system into perceiving depth where none exists.

On the computer, stereograms can be created by using two colors to draw the image and then viewing the image with special glasses. The images, called **anaglyphs**, are made up of red and green portions, and the glasses contain a red filter in one eye and a green filter in the other. The red filter blocks out the green portion of the image and the green filter blocks out the red portion of the image. In this way, each eye sees only one part of the image and each of the two parts is slightly different, producing a binocular disparity and the perception of depth.

**Random-element stereograms** are a special type of stereogram made up of two grids of randomly-placed elements, which are usually small dots. For most dots, there is a red dot in one image that exactly corresponds to a green dot in the other image; the remaining dots are slightly different in the two images. In one of the images these dots are shifted over a few dot diameters relative to the positions of the corresponding dots in the other image. This shift in location of some of the dots creates a disparity between

the images of these dots seen by the two eyes. When viewed with the red-

green glasses, this group of dots appears to “float” in depth above the rest of the background dot pattern. The more the dots are shifted, the greater the disparity and the “higher” above the background the image appears to float. This type of pattern is especially interesting to vision scientists because when viewed with either eye alone, only a random pattern of dots is seen. The “form” is created by the visual system (i.e., the brain), which performs the complex calculations necessary to match up corresponding dots viewed by each eye and create the perception of a form where no form exists.

(The preceding description was adapted from the following source: Baro, J.A., Lehmkuhle, S. & Sesma, M.A. (1991). InSight 2 – InColor [computer program]. Santa Barbara, CA: Intellimation.)

## How To Use the Program

File	
Open Mask...	⌘O
Save Composite...	⌘S
<hr/>	
Quit	⌘Q

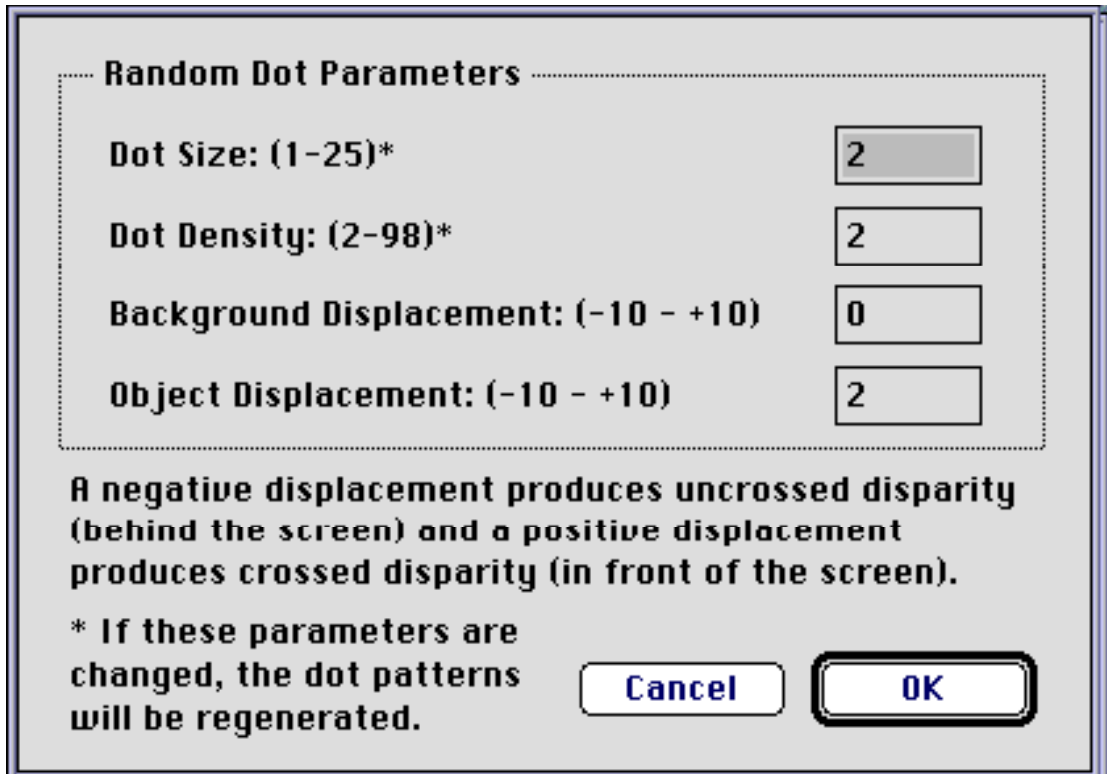
**Open Mask...** Opens a mask image, saved in PICT format, to be used in creating the random-element stereogram. Be sure that the image contains only black and white – colored or gray-scale images will produce unpredictable results. The white regions in the mask will make up the background in the stereogram, and the black regions in the mask will make up the object.

**Save...** This menu changes, depending on what is currently being displayed. You can save whatever is currently displayed into a PICT file. (Note: The “Save Mask...” option is always dimmed, since you can’t modify the mask image.)

**Quit** Self-explanatory.

Image	
Set Parameters...	⌘P
<hr/>	
Show Mask	
Show Red Dots	
Show Green Dots	
Show Composite	
<hr/>	
Generate New Dots	
Generate Sequence	

**Set Parameters...** Displays the following dialog box, in which you can set a number of parameters:



**Dot Size.** How big each of the random-element dots is, in pixels. If you change this setting a new set of dot patterns will be generated, which may take a few minutes. The smaller the dots size, the longer it takes – because it has to generate more dots.

**Dot Density.** How close together the dots are. These numbers indicate a probability (sort of) – 2 indicates that, on the average, 1 in 2 positions on the grid contains a dot, 98 indicates that, on the average, 1 in 98 positions on the grid contains a dot. In other words, smaller numbers mean more dots. If you change this setting a new set of dot patterns will be generated, which may take a few minutes.

**Background Displacement.** How much the background portion of the stereogram will be displaced (in pixels). The white regions in the mask are used to generate the background. A displacement of zero means that the background has no depth (relative to the screen). A negative displacement produces a background that appears behind the screen, and a positive displacement produces a background that appears in front of the screen. The greater the absolute displacement value, the greater is the apparent depth.

**Object Displacement.** How much the object portion of the stereogram will be displaced (in pixels). The black regions in the mask are used to generate the object. A displacement of zero means that the object has no depth (relative to the screen). A negative displacement produces an object that appears behind the screen, and a positive displacement produces an object that appears in front of the screen. The greater the absolute displacement value, the greater is the apparent depth.

**Show Mask** Shows the mask image.

**Show Red Dots** Shows the red portion of the stereogram.

**Show Green Dots** Shows the green portions of the stereogram.

**Show Composite** Shows the entire stereogram.

**Generate New Dots** Generates a new, random sequence of dots. Please be patient, this may take a few minutes (the smaller the dot size, the longer it takes).

**Generate Sequence...** Generates and saves a series of stereograms, each one containing a different random pattern of dots. You will be prompted to enter the number of frames in the sequence (how many separate stereograms you want to create) and a name for the sequence. A period and a number indicating the stereogram's position in the sequence will be added to each of the stereogram file names (e.g., My Stereogram.1). The files are saved in PICT format. Please be patient, this may take a very long time, depending on how many frames you create and how big the dots are.

The reason for including the Sequence feature is so that you can create what are called **dynamic random-element stereograms**. This is essentially an animated sequence of stereograms in which the positions of the dots change from frame to frame, but their correlations remain the same. Even though all the dots appear to be moving around, the perception of a solid, stationary object floating in depth is still very vivid. I recommend a little program called ConvertToMovie (free from Apple Computer, Inc.) for making QuickTime movies out of these sequences. This program will take any number of consecutively numbered PICT files and generate a QuickTime movie with them. It works well and the results are very cool.

## System Requirements

You will need a color Macintosh, System 6.0.7 or later (32-Bit QuickDraw must be installed if you're using System 6.xx), and a color monitor. Be sure your monitor is set to at least 16 colors. Stereogram Maker requires a memory partition of about 2000 K, which means you should have at least 4 MBytes of system memory. (Please Note: Although the program should run under System 6, I haven't tested it – so if you have System 6 and it doesn't run, I'd recommend upgrading to System 7. Isn't it about time you did anyway?)

## Update History

1.0.1 – Fixed a bug in the Generate Sequence routine where a portion of a dialog gets saved in the pictures if the dialog window overlaps the image window.

## Legal Stuff

Stereogram Maker is released as freeware. That means that it is not in the public domain – I retain all rights, but it can be freely used and copied as long as this document accompanies it and each remains intact. This program may not, however, be distributed as part of any commercial, for-profit exchange without the authors' express written permission.

Stereogram Maker was written in Think Pascal, therefore portions of it are probably copyright © 1991 by Symantec Corporation.

## **Disclaimer**

Stereogram Maker is distributed "as is", solely for the purpose of entertainment; any educational content is purely accidental. The program has no warranty, express or implied, so use it at your own risk. Please report any bugs or other problems you encounter in as much detail as possible (however, since I wrote this program just for fun, I'm not likely to devote too much time to fixing it).

### **Please address correspondence to:**

John A. Baro  
NASA Classroom of the Future  
Wheeling Jesuit College  
Wheeling, WV 26003  
Internet: JABARO @ WVNVMS.WVNET.EDU  
AppleLink: JABARO.COTF

Thank you.

Version 1.0.1, November, 1993