

# sample

Important:

McMaster Carr, a supplier whose part numbers are referenced throughout this document, can only ship within the United States. Builders outside of the U.S. must find an alternate supplier for the required hardware.

Hardware part numbers and availability are subject to change. Verify that all hardware or equivalents are obtainable prior to purchasing these plans.

# Nymphaea

a retro-static 3D stereogram

design by Derek Hugger

# The Basics

## Contents

These plans include all the information required to build Nymphaea. They provide an outline of the build process, tips for an accurate and successful build, lists of required tools and off-the-shelf components, a complete parts list, full scale patterns for all plywood parts, and assembly instructions.

## Before Building

Read and understand all instructions before building. Failure to do so will lead to increased frustration levels, lengthened build times, wasted material, and other vexing occurrences.

## Build Process

Always wear eye protection and any other necessary personal protective gear. Read, understand, and abide by all manufacturer instructions and warnings for all tools used.

If cutting the parts manually:

A simplified pattern is provided for builders wishing to cut Nymphaea by hand. The simplified pattern is a single layer of plywood (as opposed to the two layer original design) that will allow significant time savings.

1. Use a light duty/general purpose spray adhesive to temporarily bond the patterns to plywood. Apply the adhesive evenly and sparingly.
2. Drill the holes first, and then cut out the parts. Hole alignment between parts is important for assembly.
3. Remove the patterns from the cut plywood parts, and then sand the parts to remove rough edges and any residual adhesive.
5. Finish each part as desired, and then assemble.

If cutting with a CNC machine:

The DXF files provide two distinct ways of generating g-code. Choose the one that works best for your preferred method of cutting. The "Slots" DXF provides closed vectors to cut inside of. If this file is used, use a 1/16" or smaller bit to cut the holes. The "Lines" DXF provides open vectors to cut on. If this file is used, use a 1/16" bit to cut the holes. For a visual description of these methods, see Cutting Methods in Tips + Tactics. Once parts are cut, finish them as desired, and then assemble.

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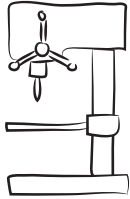
# Tools

Cutting by hand

## Power Tools



scroll saw



drill press

## General



drill bits  
1/16", 3/32"

## Drivers



phillips #1

## Supplies



sandpaper



spray adhesive

Cutting with CNC

## Power Tools



cnc router\*

## General



endmills or router bits  
1/32" or 1/16" required  
1/8" optional

## Drivers



phillips #1

## Supplies



sandpaper

# Tips + Tactics

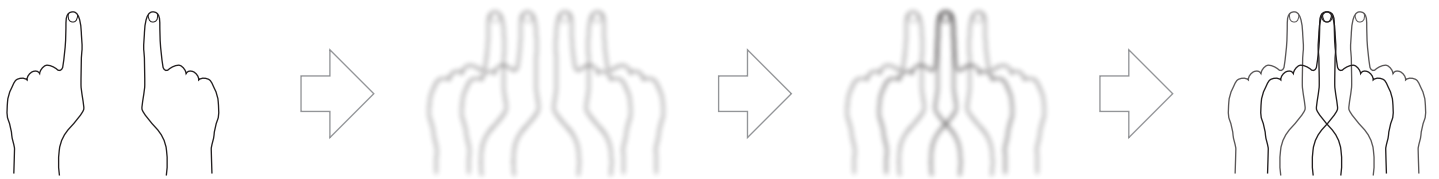
## How it Works

Nymphaea is a stereogram, a 2D pattern that reveals a 3D image when viewed correctly. The 3D image is based on a grayscale depth map. The lighter the image, the farther forward the 3D image appears. The darker the image, the farther back the 3D image appears. The 3D image is generated by variations in the spacing between a repeating 2D pattern; as the spacing in that pattern changes, so does the depth of the 3D image.

To view Nymphaea's 3D image, focus your eyes behind it, such that the patterns overlap.

To help explain how to do this:

(1) Hold up two fingers, then look at an object behind them. (2) You'll see four blurry fingers at this point. (3) Move your fingers toward each other until the four fingers you see become three fingers. (4) Slowly adjust your focus so that you still see three fingers, but they are clear.



This focus, where your two fingers perfectly overlap in your vision, is the same technique used to view stereograms. Instead of moving fingers together, move the stereogram closer to or farther from your face until you achieve the right focus, where the patterns perfectly overlap. Then, slowly move the stereogram to a comfortable viewing distance, keeping that focus and revealing the 3D image.

## Hidden Image

This is the image hidden in Nymphaea's patterns. The darker portions of the image appear farther back in the 3D image, while the lighter portions appear closer.



## Pattern Syntax

Each wood part is labeled with a part name followed by a thickness dimension.

A number next to a hole indicates the diameter of that hole.

A  $\Downarrow$  symbol indicates a hole drilled to a certain depth. Holes without this symbol are to be drilled thru. Holes with this symbol are to be drilled to the depth of the value following the symbol.

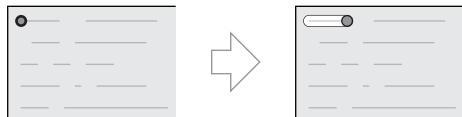
Example: the Backer is a  $3/8$ " thick part, and it has 10 holes drilled thru with a  $1/16$ " bit, and 6 holes drilled  $1/4$ " deep with a  $1/16$ " bit.

# Tips + Tactics

## Cutting Methods

### Cutting with CNC

The DXF file contains two types of vectors for cutting the pattern layers. One is open vector and one is closed vector. For the open vector pattern layers, use a 1/16" bit, and cut ON the lines. For the closed vector pattern layers, use a 1/16" or smaller bit, and cut INSIDE the lines.



1/16" bit cuts ON the lines (open vectors)



1/32" bit cuts INSIDE the lines (closed vectors)

### Cutting by hand

The two 1/8" thick pattern layers may be cut by hand using a scroll saw. Or, as an optional replacement for these more complex slotted pattern layers, a simplified single layer hole pattern for 1/4" plywood is included.

When cutting by hand, it is important that the printed pattern does not shift once attached to the wood. Even small fraction of an inch variations in hole positioning can lead to significant problems with the hidden 3D image working correctly.

## Cutting Accuracy

Due to the relatively low resolution of this stereogram cut into wood (as compared to the detail achievable with a high resolution computer monitor or a printout on paper), the accuracy of the hole placement plays a critical role in the resultant 3D image displaying correctly. The first layer depth layer of the 3D image (the lily pads) is created by an alignment offset of 1/16" between the hole patterns. So, if even one drilled hole is off by 1/32" (half the distance of the 1/16" offset), that shift will result in that hole looking as if it is half way to the first 3D layer, or half way to the next layer. As such, if cutting by hand, be sure to drill the holes carefully and as accurately as possible.

There are nearly 4,500 holes in the simplified pattern. It will take a long time to drill them all. Again, take the time to drill each hole accurately, and do not rush.

## Miscellaneous

The assembly shows rubber bumpers attaching to Nymphaea to help space it from the wall for added visual effect. These bumpers as well as Nymphaea's wall hanging scheme (using a twist tie or wire screwed to the back of the sculpture) are only suggestions. These parts may be removed or changed as desired.

The two screw bumps at the top and bottom center of the Frame have the same spacing as the sculpture's patterns. As such, these bumps may be used as guides to achieve the right focus to reveal the 3D image - think of these frame bumps as the "fingers" in the How it Works section of Tips + Tactics.

If adding color to Nymphaea, it is highly recommended to use a light stain or paint for the two pattern layers. Darker colors on the pattern layers will greatly reduce contrast, which will ultimately make the 3D image more difficult to see.

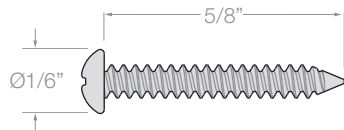
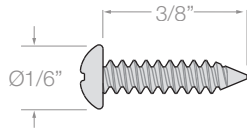
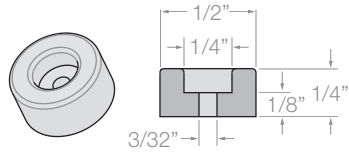
## Parts + Assemblies List

Type	Description	Qty
Hardware	Screw #2 x 3/8"	6
Hardware	Screw #2 x 5/8"	10
Hardware	Bumper	4
Hardware	Twist Tie or Wire	1
1/8" Plywood	Frame	1
1/8" Plywood	Pattern Layer 1	1*
1/8" Plywood	Pattern Layer 2	1*
1/4" Plywood	Simplified Pattern	1*
3/8" Plywood	Backer	1
Assembly	Nymphaea	1

\* The Simplified Pattern is an optional replacement for Pattern Layer 1 and Pattern Layer 2. The simplified pattern is easier to make if cutting the parts by hand.

# Hardware

Description	Qty	McMaster Carr P/N *
Bumper	4	9540k662
Screw #2 x 3/8"	6	92470A097
Screw #2 x 5/8"	10	92470A101

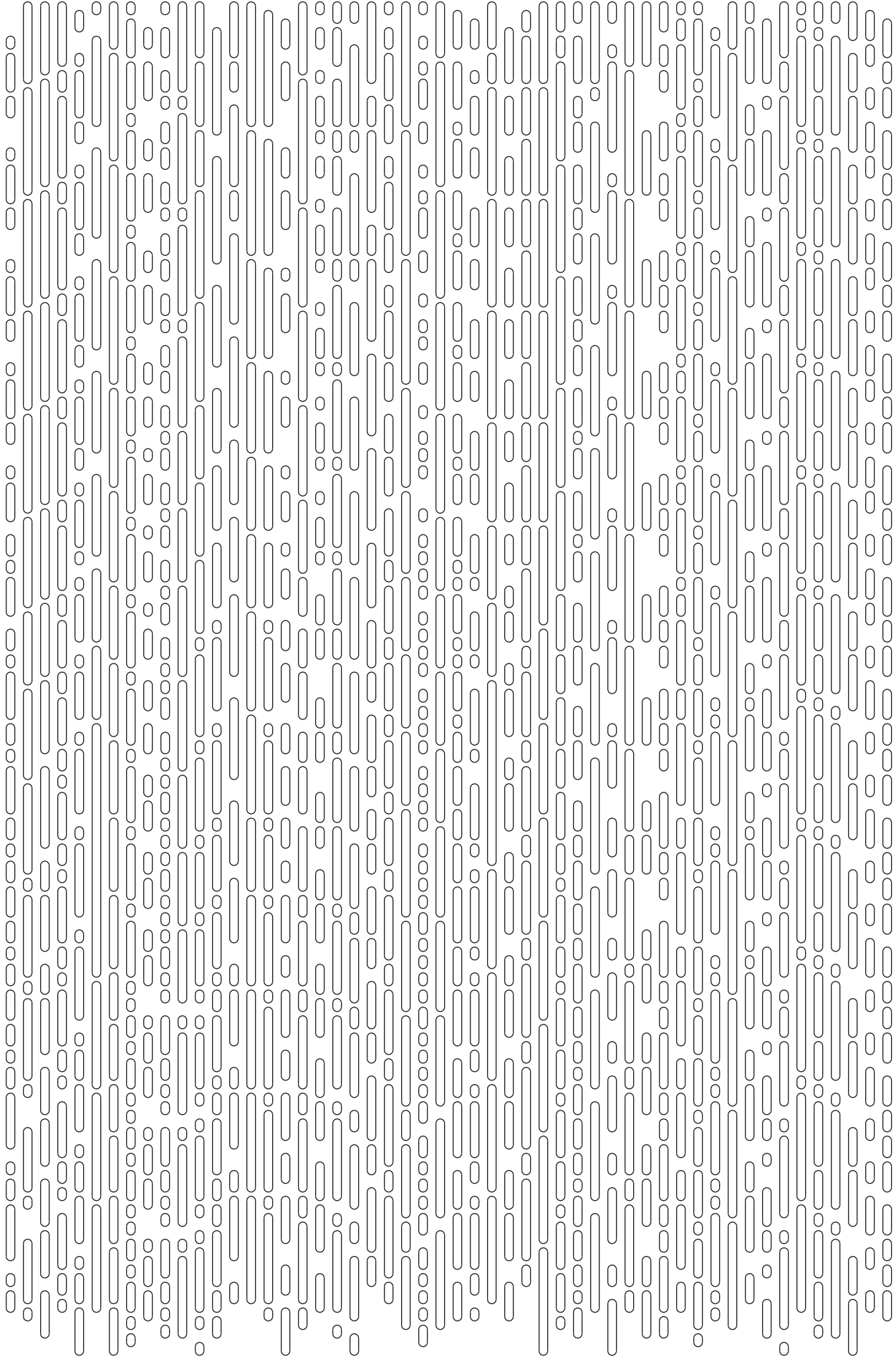


\* Part numbers referenced are from [www.mcmaster.com](http://www.mcmaster.com).

# Pattern Sample

10x 3/32

Pattern Layer 1 1/8



Scale reference. To measure exactly six inches when printed.

