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Media Factory

# Digital\_Fabrication\_Studio.04

## Laser cutting – (and vinyl cutter) materials, finishes, process

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<http://www.slideshare.net/openp2pdesign>





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## Today:

- \* **Laser cutting technology**
- \* **Examples**
- \* **Technical issues**
- \* **Resources**



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01.

# Laser cutting technology: how it works

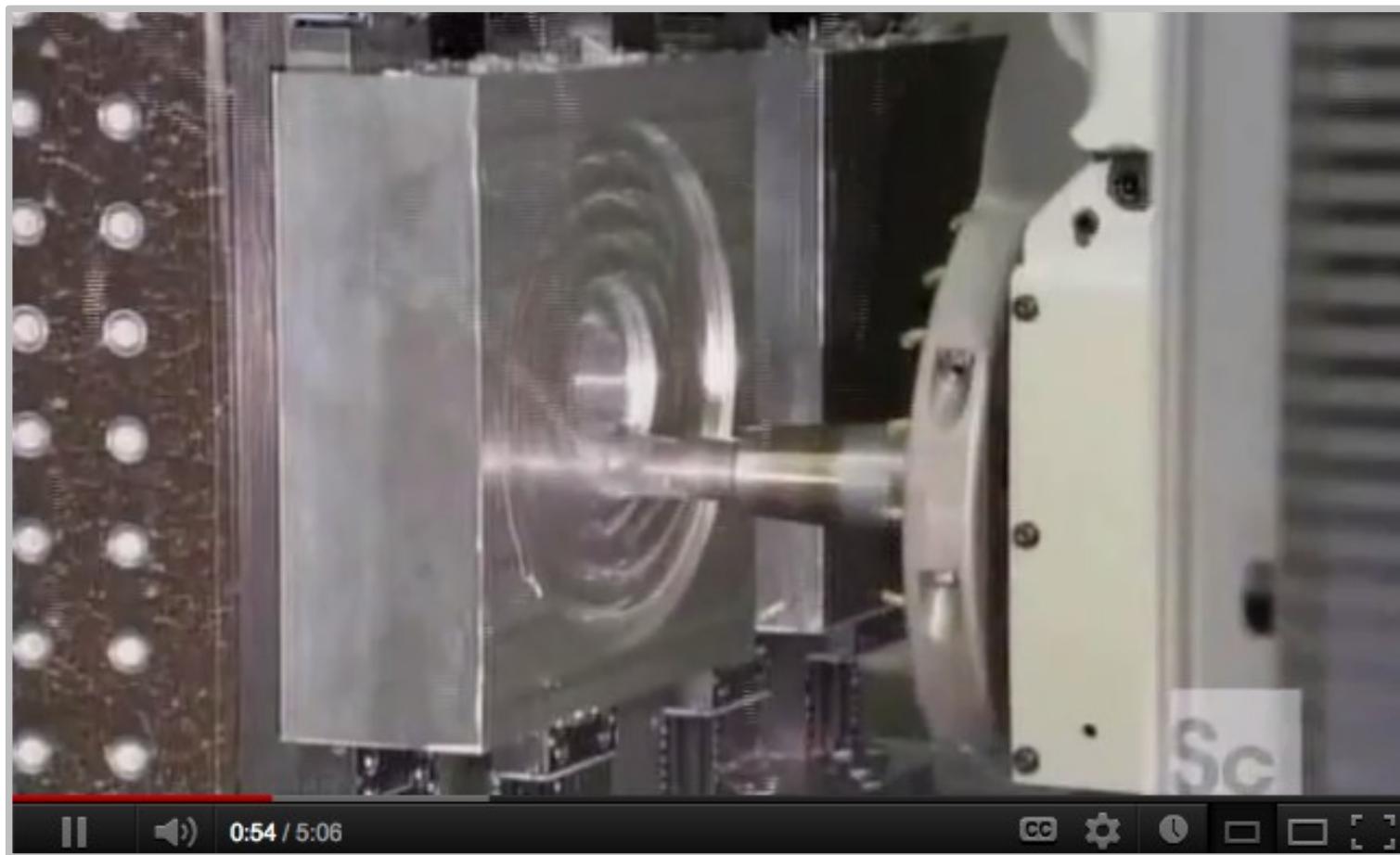
# Laser cutting or sun burning?



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There is no precise setting about depth and color, only power, speed and modulation.

# How to build a laser cutter



It is important to understand how it works,  
especially for the laser beam.

Source: [http://youtu.be/M\\_ayRAHezjM](http://youtu.be/M_ayRAHezjM)

# How to build a laser cutter

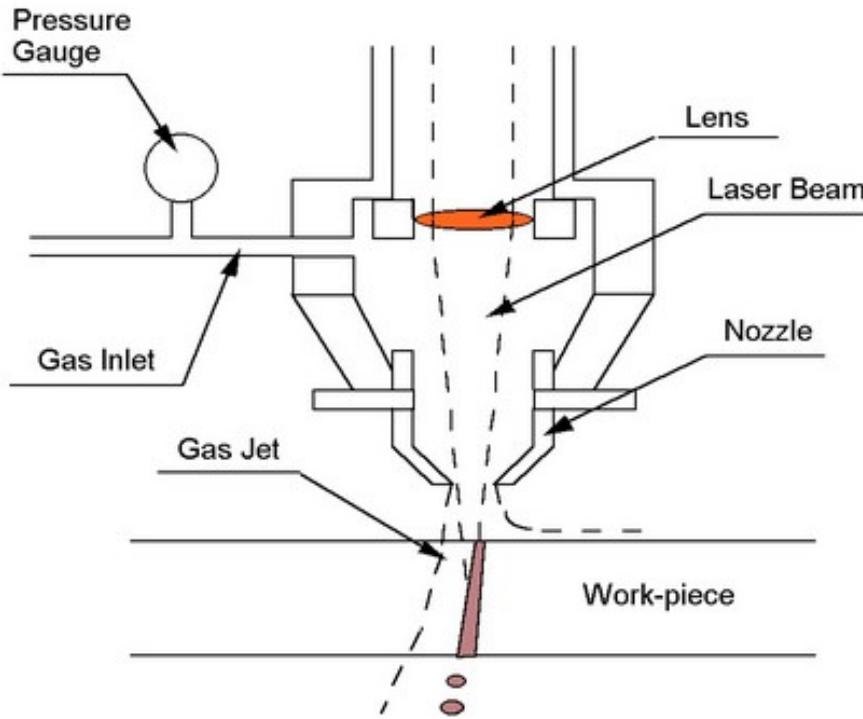


Figure 3.11 Laser cutting assisted with gas jet (Courtesy of Kai Chen)

It is important to understand how it works,  
especially for the laser beam.

Source: <http://www.mrl.columbia.edu/ntm/level1/ch03/html/l1c03s05.html>

# LaserOrigami: bending surfaces



LaserOrigami is a rapid prototyping system that produces 3D objects using a laser cutter.

Source: <https://www.youtube.com/watch?v=arjRtCjl9AQ>

# Lasersaur

## Lasersaur



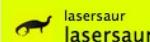
The Lasersaur is an open source laser cutter. We designed it to fill the need of makers, artist and scientist who wanted a safe and highly-capable machine. Unlike others it comes fully loaded with knowledge to run, maintain, and modify.

Who has built the machine? [Lot of us.](#)

Is anyone cutting? [Yes!](#)



The Lasersaur  
Manual



lasersaur  
lasersaur

PartSnap Just donated to the  
@lasersaur open source  
#lasercutting project  
[labs.nortd.com/lasersaur/](http://labs.nortd.com/lasersaur/)  
yesterday · reply · retweet · favorite

lasersaur another @lasersaur  
mention in @Forbes this  
month..  
[forbes.com/sites/tjmccue/...](http://forbes.com/sites/tjmccue/)  
yesterday · reply · retweet · favorite

lasersaur hal @lasersaur cut  
seaweed and sushi via  
@jamesjky at ETH Zurich.  
[yfrog.com/oeybjp](http://yfrog.com/oeybjp)  
4 days ago · reply · retweet · favorite

lasersaur nice architectural  
modeling with @jamesjky  
using his @lasersaur for the  
cure

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An open source, community-funded laser  
cutter.

Source: <http://labs.nortd.com/lasersaur/>

# Lasersaur



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An open source, community-funded laser  
cutter.

Source: <https://vimeo.com/23871399>

# Laser Open Source (LAOS)



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Development of an Open Source driver for laser cutters and a matching Mainboard, Firmware and PrinterDriver using existing technology.

Source: <http://www.laoslaser.org/?p=99>

<http://www.laoslaser.org/>

# Buildlog.net 2.x Laser



The screenshot shows a blog post titled "Buildlog.net 2.x Laser" dated February 28th, 2011, by bdring. The post includes a photograph of a blue metal laser cutter enclosure with a red power button and a small label that reads "2.x Laser Buildlog.net". The text describes the second generation open source laser cutter/engraver design from buildlog.net.

**Buildlog.Net Blog**  
Lasers, CNC, Digital Fabrication, Design and Related

« Pimp My Laser      Laser Interface/Driver PCB »

## Buildlog.net 2.x Laser

February 28th, 2011 by bdring

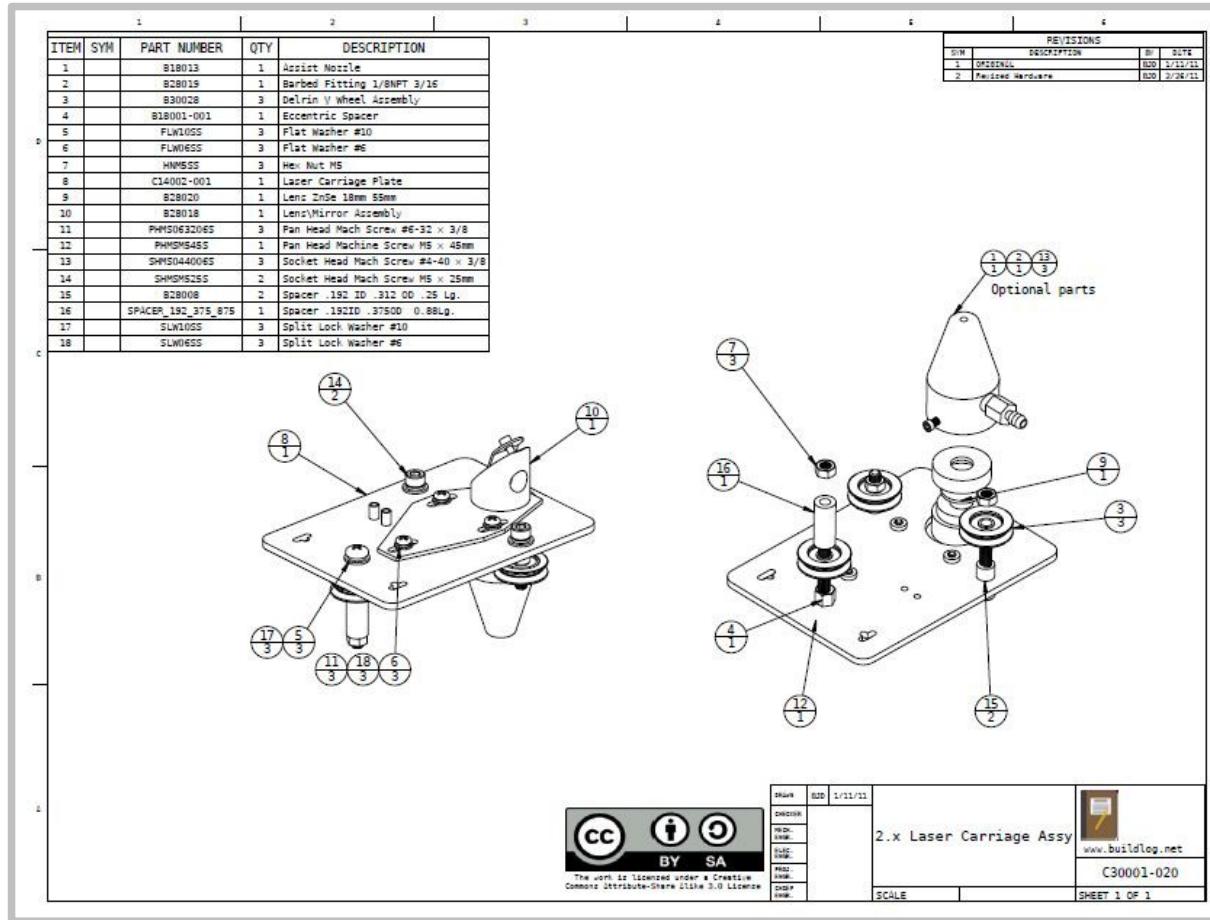


The second generation open source laser cutter/engraver design from [buildlog.net](#) is complete. The new machine is called the Buildlog.net 2.x Laser. The name comes from the fact that this is the second generation machine and it is basically a 2 axis design. The third, vertical axis, is manually controlled with an optional upgrade to digital control. The 2.x Laser takes all the optimizations learned from the first laser and all the other lasers documented on [buildlog.net](#) forum.

This machine it is basically a 2 axis design. The third, vertical axis, is manually controlled with an optional upgrade to digital control.

Source: <http://www.buildlog.net/blog/2011/02/buildlog-net-2-x-laser/>

# Buildlog.net 2.x Laser



This machine it is basically a 2 axis design. The third, vertical axis, is manually controlled with an optional upgrade to digital control.

Source: <http://www.buildlog.net/blog/2011/02/buildlog-net-2-x-laser/>

# FabCafé (Tokyo)

**springwise.com**  
YOUR ESSENTIAL FIX OF ENTREPRENEURIAL IDEAS

## In Japanese café, laser-cutting while you wait

FabCafe in Shibuya is now offering the use of a laser-cutting machine along with its range of hot drinks.



19th March 2012 in Lifestyle & Leisure.

We have already seen cafés in Japan making innovative use of customers' waiting time by providing a second service – most recently with Tokyo canteen Tanita Shokudo, which provides nutritional advice and dietary equipment. Based on a similar principle, FabCafe in Shibuya is now offering the use of a laser-cutting machine along with its range of hot drinks.

FabCafe in Shibuya is now offering the use of a laser-cutting machine along with its range of hot drinks.

Source: [http://www.springwise.com/lifestyle\\_leisure/in-japanese-cafe-laser-cutting-wait/](http://www.springwise.com/lifestyle_leisure/in-japanese-cafe-laser-cutting-wait/)  
<http://www.fabcafe.com/>

# But for stronger materials: waterjet cutting

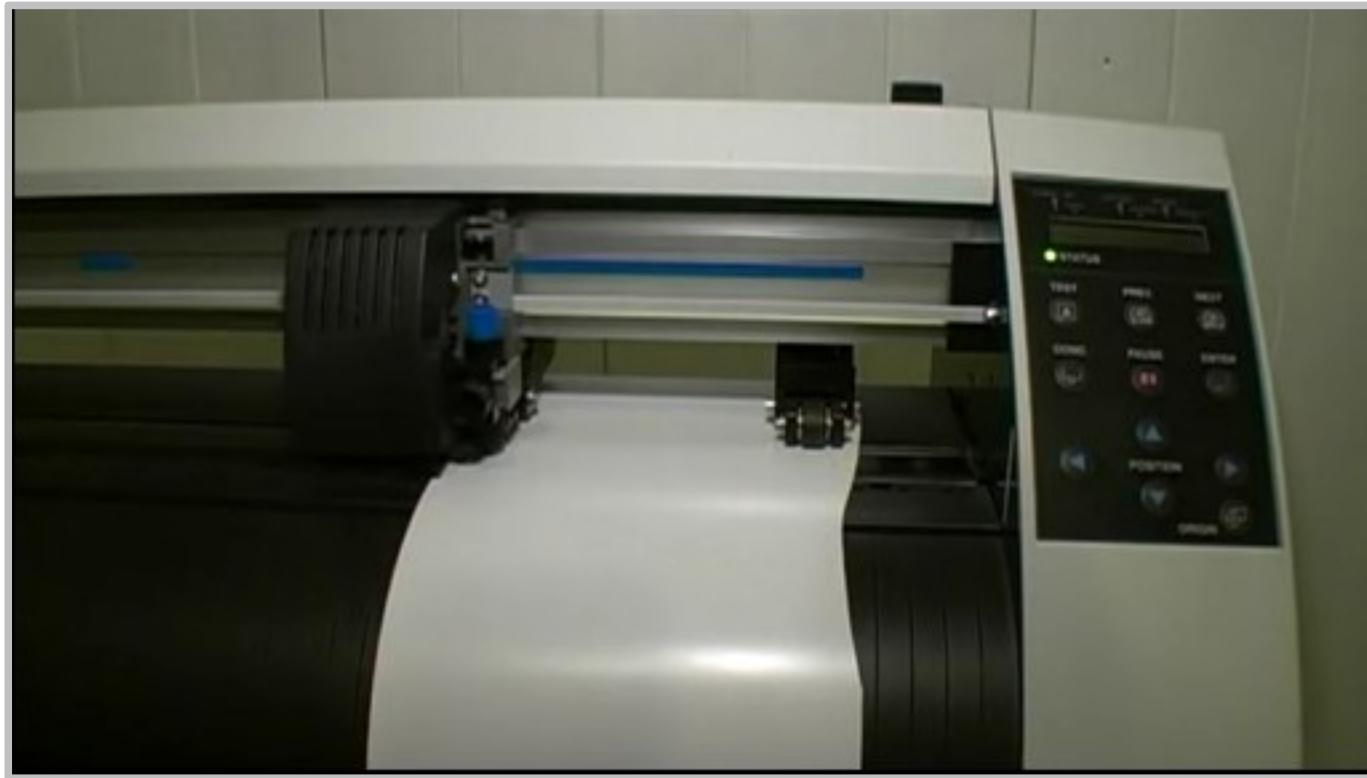


A water jet cutter is a tool capable of slicing into hard materials using a jet of water at high velocity and pressure, or a mixture of water + abrasive substance.

Source: <http://youtu.be/tJYSn9yDSzg> [http://en.wikipedia.org/wiki/Waterjet\\_cutter](http://en.wikipedia.org/wiki/Waterjet_cutter)

<http://science.howstuffworks.com/environmental/energy/question553.htm>

# For stickers and vinyl: vinyl cutter



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Uses the same principle, but cuts with a blade instead of a laser beam.



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Examples:

what you can do with a laser cutter  
(and vinyl cutter)

# Invitations

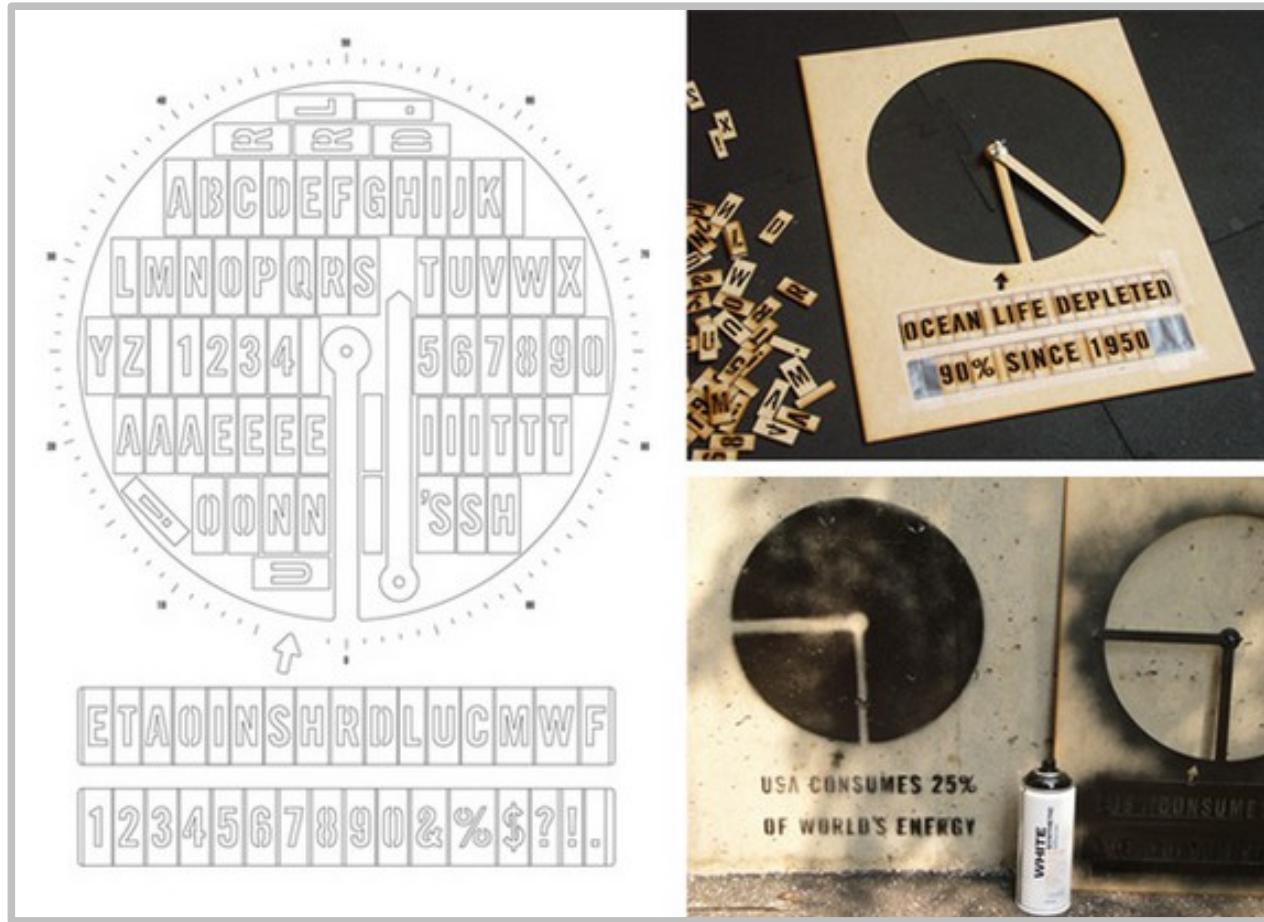


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Just an example of the very precise details you can get with a laser cutter.

Source: <http://blog.ponoko.com/2011/08/28/laser-cut-silhouettes/>

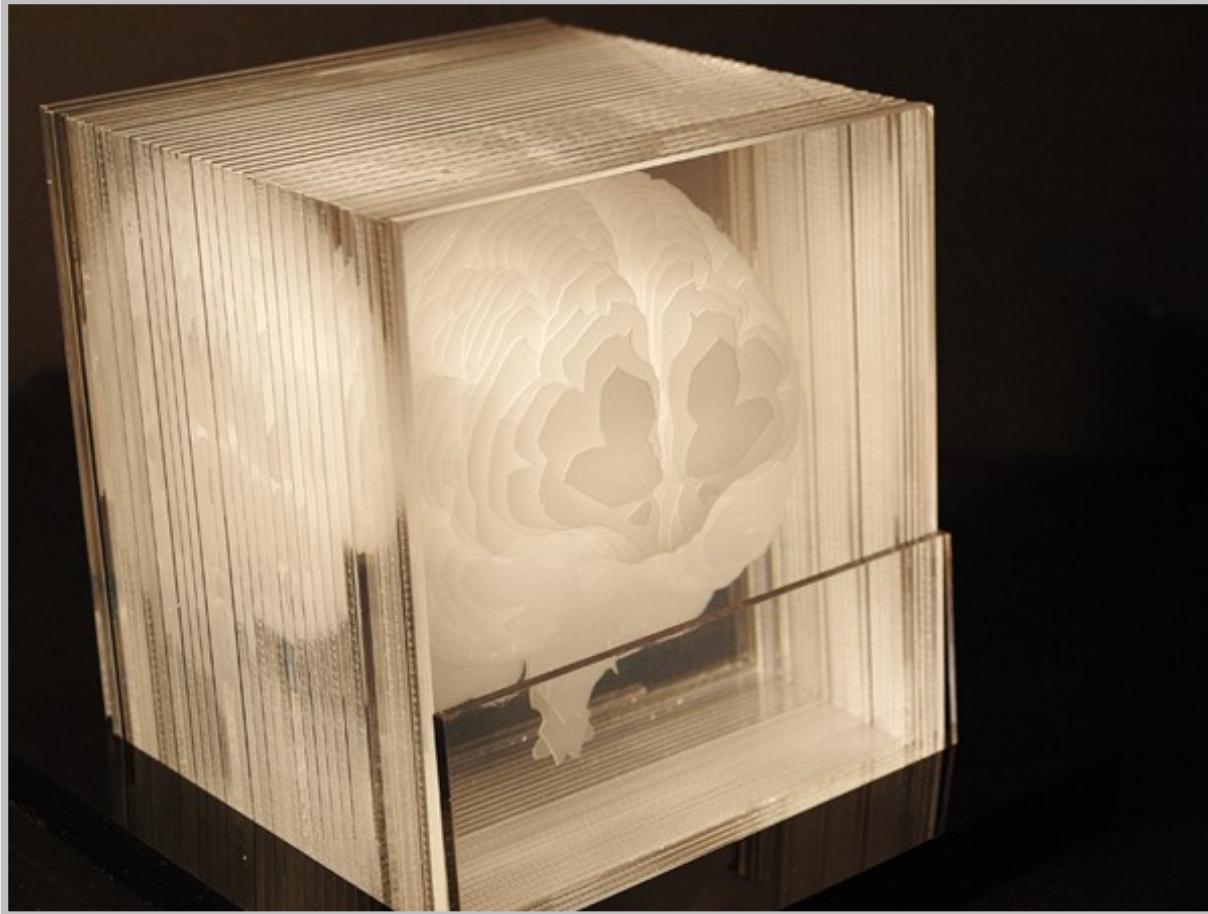
# Lasercut stencil for adjustable infographic graffiti



An adjustable lasercut stencil pattern for pie-chart graffiti. The pattern includes a complete set of re-arrangeable letters and numbers.

Source: <http://fffff.at/infoviz-graffiti-stencil/>

# Laser etching a 3D model



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Using the transparency of each panel as a layer in the 3D space...

# Alphabet Topography



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In this monotype typeface, the height of the letterforms is determined by how often a letter is used. This typeface maps the rhythmic ebb and flow of English.

Source: <http://www.synopticoffice.com/project.php?projectid=1&selectedcol=1>

# Survival Kits



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You can laser cut shapes that then the user will cut out by hand...

Source: <http://blog.ponoko.com/2012/04/25/survival-kits/>

# ... and food



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But please ask us if it's ok to laser cut a material, whatever it is!

Source: <http://blog.makezine.com/2010/12/26/laser-cut-gingerbread/>

<http://blog.makezine.com/2007/08/30/how-to-laser-cut-and-cook/>

<http://blog.ponoko.com/2011/11/24/happy-thanksgiving-%E2%80%94-a-digitally-fabricated-feast/>

# Laser cut folding ukulele



Brian Chan has created the laser cut folding ukulele: the 3D object consists of multiple flat pieces that need to fit together precisely.

Source: <http://www.designboom.com/weblog/cat/8/view/17771/laser-cut-folding-ukulele-by-brian-chan.html>

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# Laser cut folding ukulele

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Folding Ukulele – Soprano size, Finished Instrument  
USD \$375.00 [Buy now >](#)

Price excludes shipping costs

  
**FINISHED INSTRUMENT**



**Folding Ukulele** designed by Brian Chan

 chosetec aka Brian Chan

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Ponoko experience:

Joined: 10 Sep, 11  
Currently selling: 4 products

Tools:

 Contact designer

 Get Showroom RSS Feed

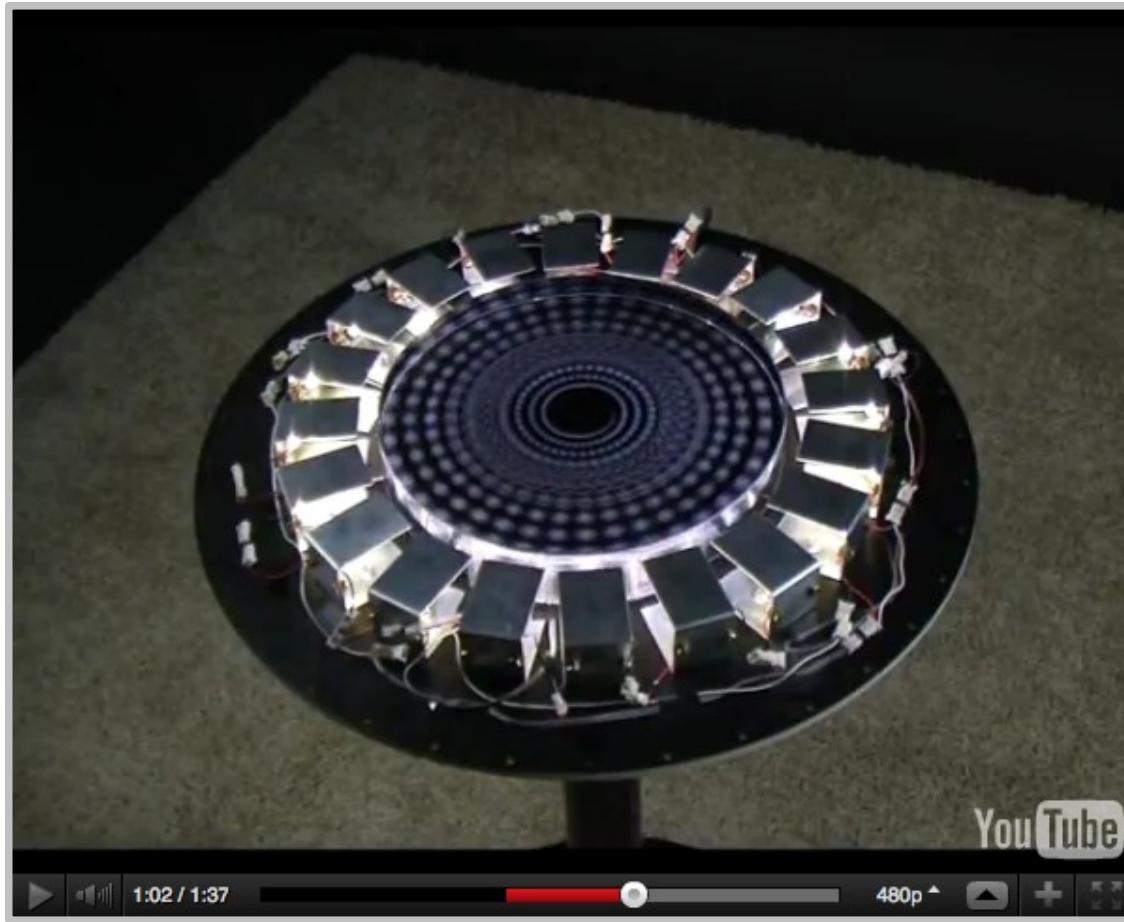
Tags:

[hawaii \(all\)](#)  
[Instrument \(all\)](#)  
[music \(all\)](#)

The kit is available for purchase online at:  
<http://ponoko.com/showroom/chosetec>

Source: <http://www.ponoko.com/design-your-own/products/folding-ukulele-soprano-size-finished-instrument-6586>

# 3D laser-etched acrylic zoetrope



This “crystal zoetrope” technology involves spinning a cylinder of acrylic with internally etched 3D designs and an array of flashing LEDs.

Source: <http://blog.makezine.com/2009/12/15/3d-laser-etched-acrylic-zoetrope/>  
<http://youtu.be/eqYUYXY3cbk>

# Cardboard Columns With 16 Million Facets



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It contains almost 16 million polygonal faces -- too complex for even a 3D printer, so it is made out of 2700 1mm-thin slices of cardboard.

Source: <http://www.michael-hansmeyer.com/projects/columns.html?screenSize=1&color=0>

<http://www.fastcodesign.com/1663306/the-worlds-most-complex-architecture-cardboard-columns-with-16-million-facets#>

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# Not laser cut, but similar design technique

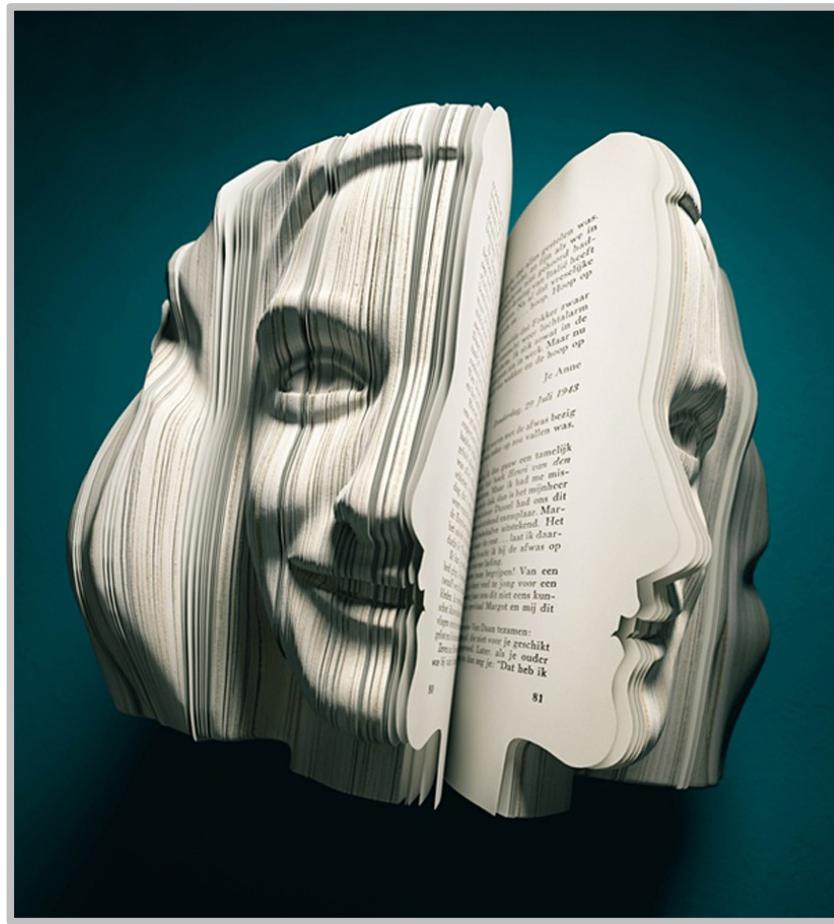


The structure can be scaled to suit specific requirements of various spaces, and will retain its form without any need for additional framework or supports.

Source: <https://vimeo.com/32265418>

<http://blog.ponoko.com/2011/12/08/expandable-surface-pavilion/>

# 3D written portrait books

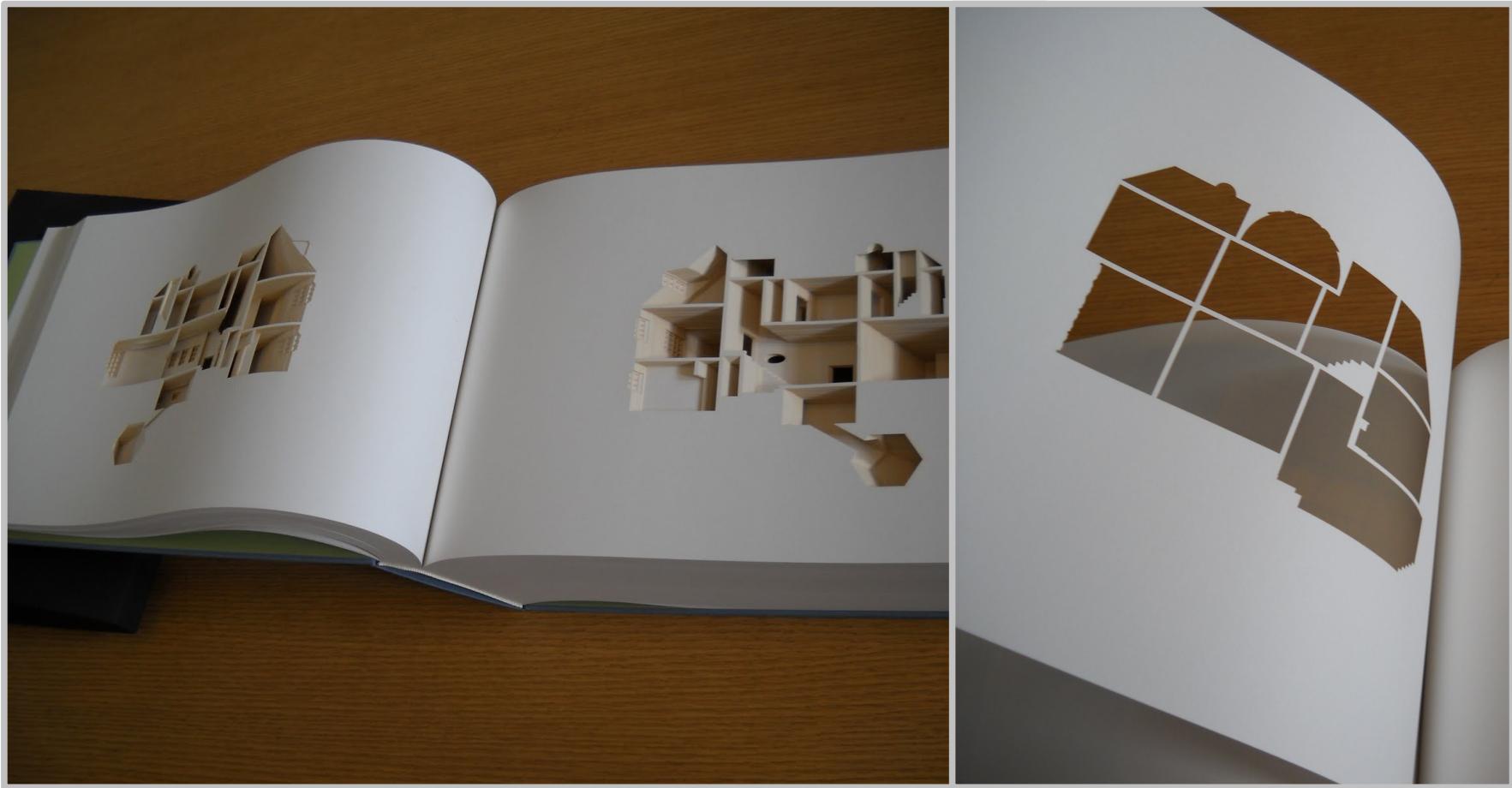


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Created by dutch agency van wanten etcetera, was conceived by markus ravenhorst and maarten reynen as part of dutch book week under the theme of (auto) biography.

Source: <http://www.designboom.com/weblog/cat/8/view/18645/3d-written-portrait-books.html>

# 3D sculpted art books



---

A commission by The Museum of Modern Art in New York, *Your House* is a limited-edition artist's book by Eliasson with a laser-cut negative impression of his house.

Source: [http://www.olafureliasson.net/publications/your\\_house\\_1.html](http://www.olafureliasson.net/publications/your_house_1.html)

<http://raunerlibrary.blogspot.com/2011/06/your-house.html>

# Laser cut intaglio printing



---

Did you know that you can cut letter press relief or intaglio plates on a laser cutter? The laser cut acrylic holds a decent edge and is far less expensive than copper plate.

Source: <http://www.nycresistor.com/2012/01/21/laser-cut-letterpress/>

<http://www.flickr.com/photos/osr/6739977451/>

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Source: <http://www.nycresistor.com/2012/01/21/laser-cut-letterpress/>

<http://www.flickr.com/photos/osr/6739259179/>

# Fashion design



Fashion Designer Diana Eng uses a laser cutter to elevate the simple t-shirt to elegant fashion.

Source: <http://blog.ponoko.com/2011/07/13/surprisingly-beautiful-laser-cut-t-shirts/>

# Fashion design

Friday Roundup: Laser Cut Fashion

Posted by [Syuzi](#) on July 29, 2011 at 1:30pm [View Blog](#)

The image is a collage of three fashion items. On the left is a close-up of a tan Burberry trench coat with a subtle floral laser-cut pattern. In the center are two circular, pinkish-red laser-cut earrings with intricate mandala-like designs. On the right is a white high-top sneaker with black laser-cut patterns on the toe and side, labeled 'philip lim'.

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Much more examples...

# KDS-POTO2: DIY open source laser cut camera



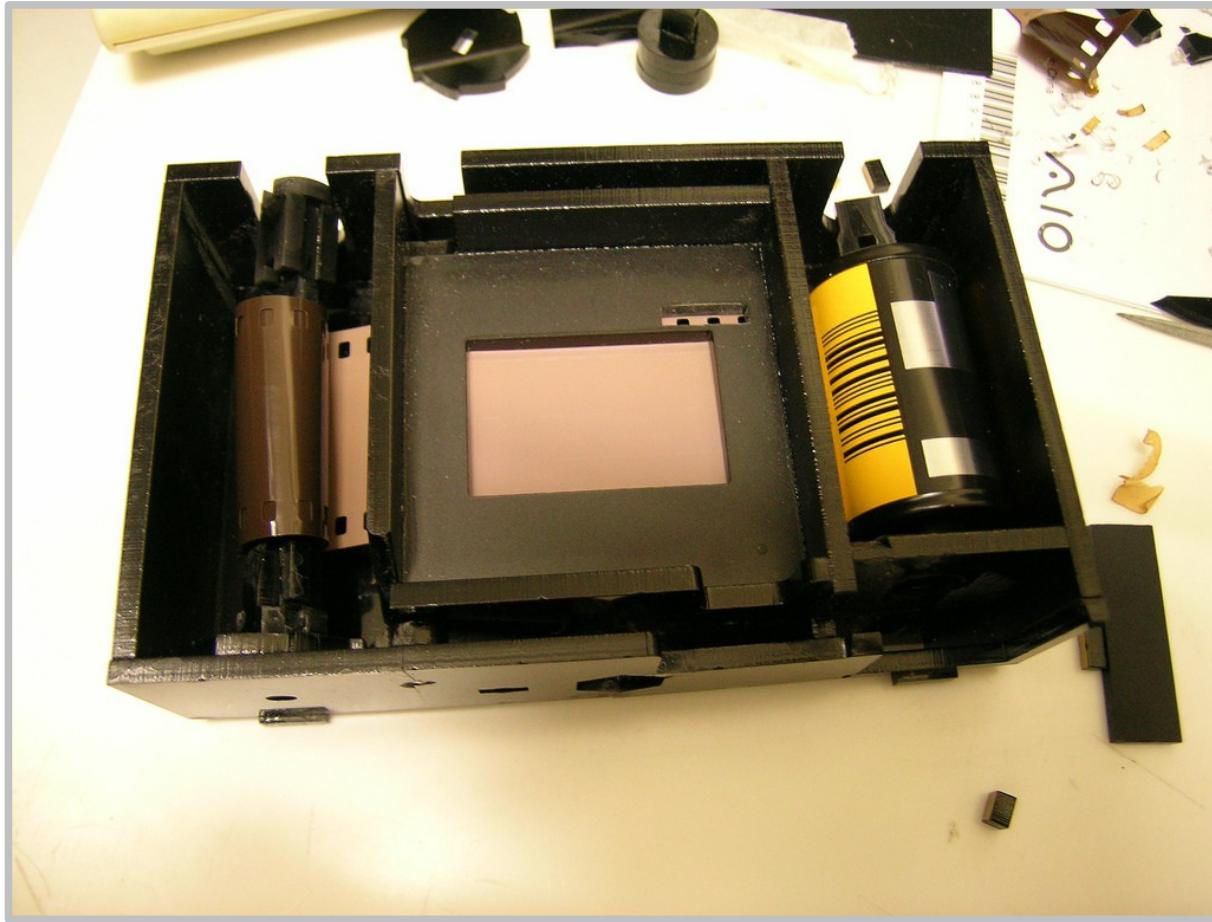
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It has a film winder, a frame counter, two shutter modes, and uses everyday off-the-shelf film. The AI file for the parts is available for download from [DIY Photography](#).

Source: <http://www.kitdastudio.com/?p=6> <http://www.diyphotography.net/the-kds-poto2-a-diy-super-plastic-camera>

[http://www.diyphotography.net/files/images/4/shell\\_cut%206\\_03\\_ai3.ai](http://www.diyphotography.net/files/images/4/shell_cut%206_03_ai3.ai)

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[http://www.diyphotography.net/files/images/4/shell\\_cut%206\\_03\\_ai3.ai](http://www.diyphotography.net/files/images/4/shell_cut%206_03_ai3.ai)

# 3D objects from 2D laser cut models



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Bert Simons: Portrait of Harry Hamelink (2007)  
Done with the open source cad program Blender.

Source: <http://www.bertsimons.nl/portfolio/papersculptures/>

# 3D objects from 2D laser cut models



---

"for Harry's portrait I used the 'dot per dot' reference method to reconstruct his face in 3d. I hope to speed up the next portrait by using my laser scan setup.."

Source: <http://www.bertsimons.nl/portfolio/papersculptures/>

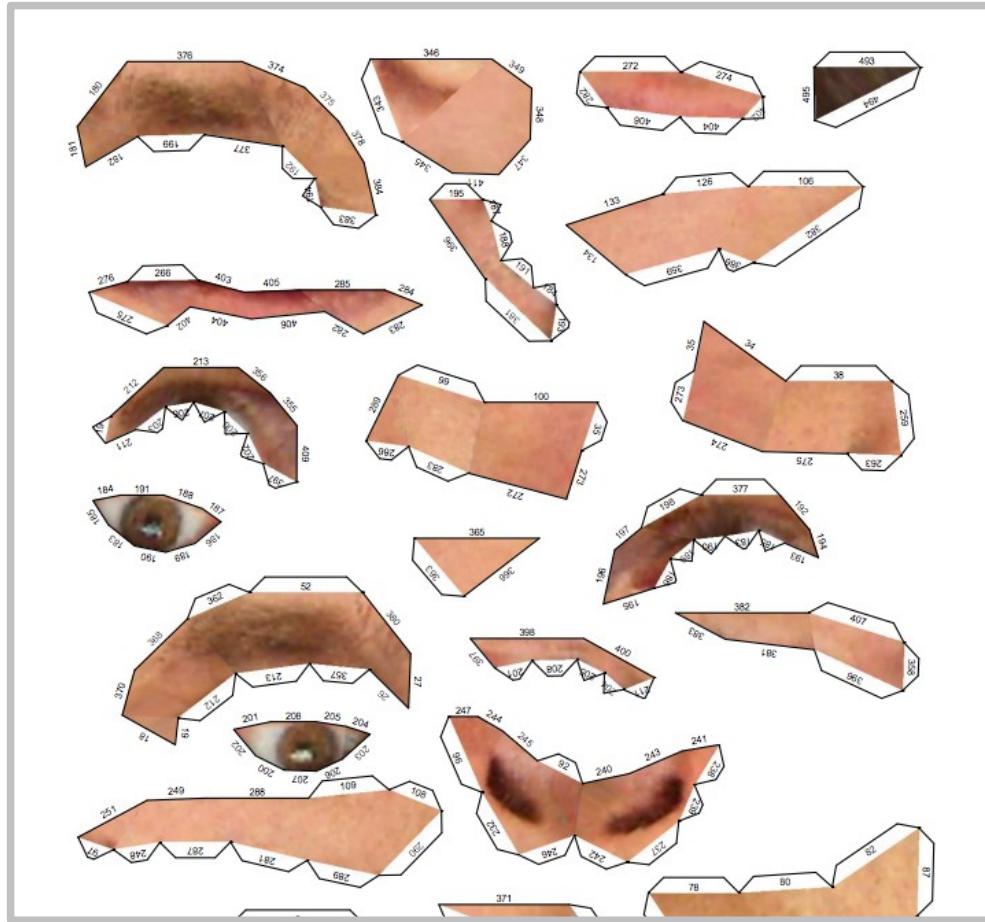
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“for Harry's portrait I used the 'dot per dot' reference method to reconstruct his face in 3d. I hope to speed up the next portrait by using my laser scan setup..”

# Lasercut nori for designer sushi



Developed by international ad agency I&S BBDO for the umino seaweed shop, 'design nori' is a series of intricately laser-cut seaweed for rolling sushi.

Source: <http://www.designboom.com/weblog/cat/8/view/20710/lasercut-nori-for-designer-sushi.html>

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# Generative puzzles

**nervous system** [SHOP](#) [BLOG](#) [ABOUT US](#) [TOOLS](#) [STOCKISTS](#) [JOBS](#) [CONTACT](#)

## Generative Jigsaw Puzzles

These puzzles marry the artistry of traditional wooden jigsaw puzzles with the possibilities of new technology. Custom software generates a different cut pattern and image for every puzzle. The images are printed on archival paper, mounted on birch plywood and laser cut at our studio in Somerville, MA.



Generative jigsaw puzzles  
from Nervous System

01:30

HD

Custom software generates a different cut pattern and image for every puzzle. The images are printed on archival paper, mounted on birch plywood and laser cut.

Source: <https://vimeo.com/41450718>

# You can etch your own MacBook



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Have a look at this tutorial, and don't blame us, you did it!

<http://blog.makezine.com/2008/02/29/how-its-made-laser-etchin/>

Source: <http://www.flickr.com/photos/landersen/301812211/>

# Corrugated Cardboard Artwork



The waves inside a piece of corrugated cardboard translate into visually arresting textures in the works of Ohio artist Mark Langan (not laser cut, but could be).

Source: <http://blog.ponoko.com/2011/02/10/corrugated-cardboard-artwork/>

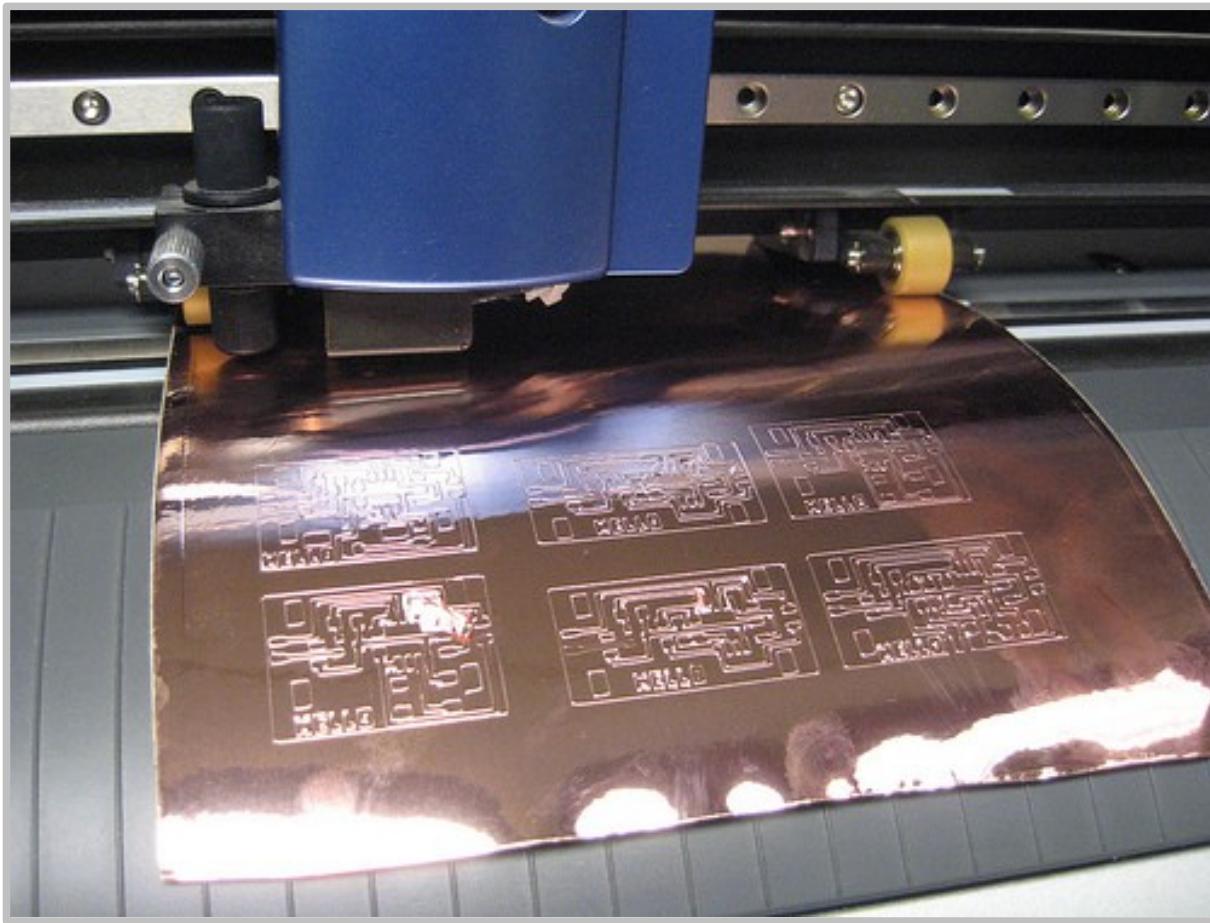
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# Vinyl cutter and flexible circuits

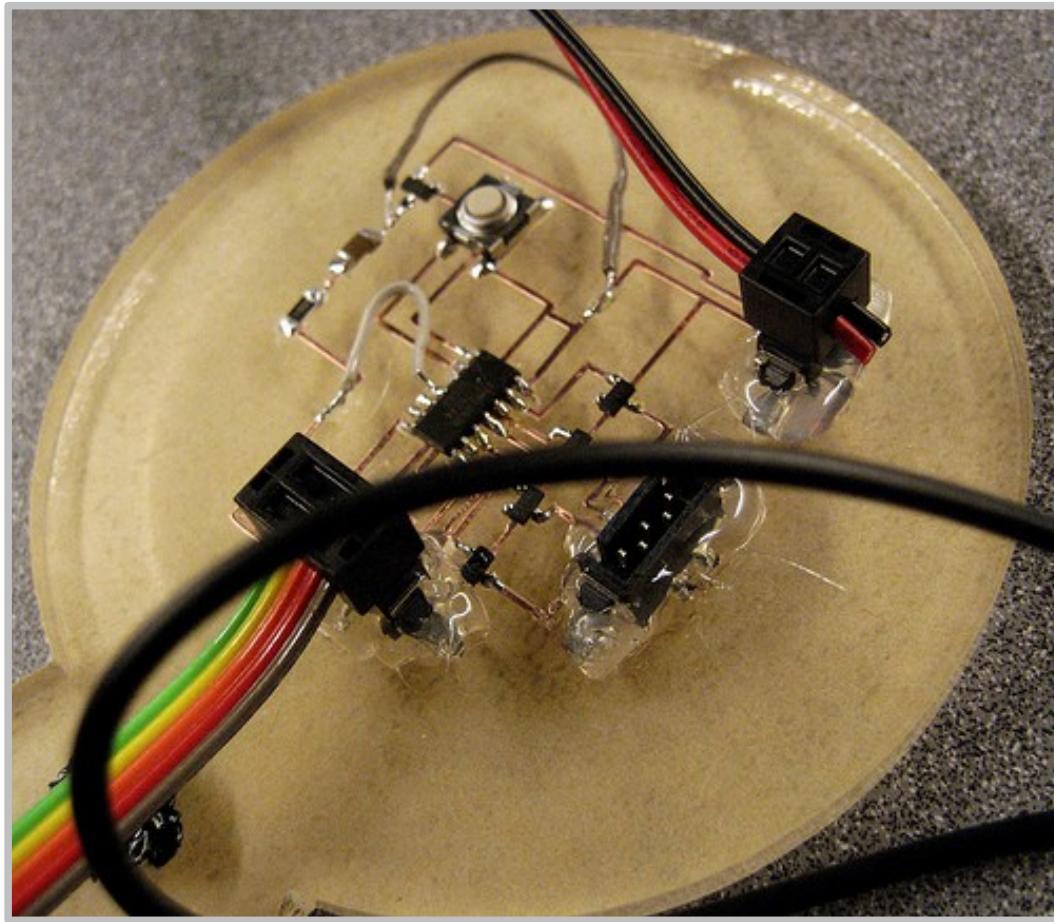


---

The circuits that you can cut on the Roland are limited by the width of the pen knife.

Source: <http://fab.cba.mit.edu/content/processes/PCB/vinylcut.html>

# Vinyl cutter and flexible circuits



---

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Source: <http://fab.cba.mit.edu/content/processes/PCB/vinylcut.html>

# Vinyl cutter and silk screen (and QR Codes)

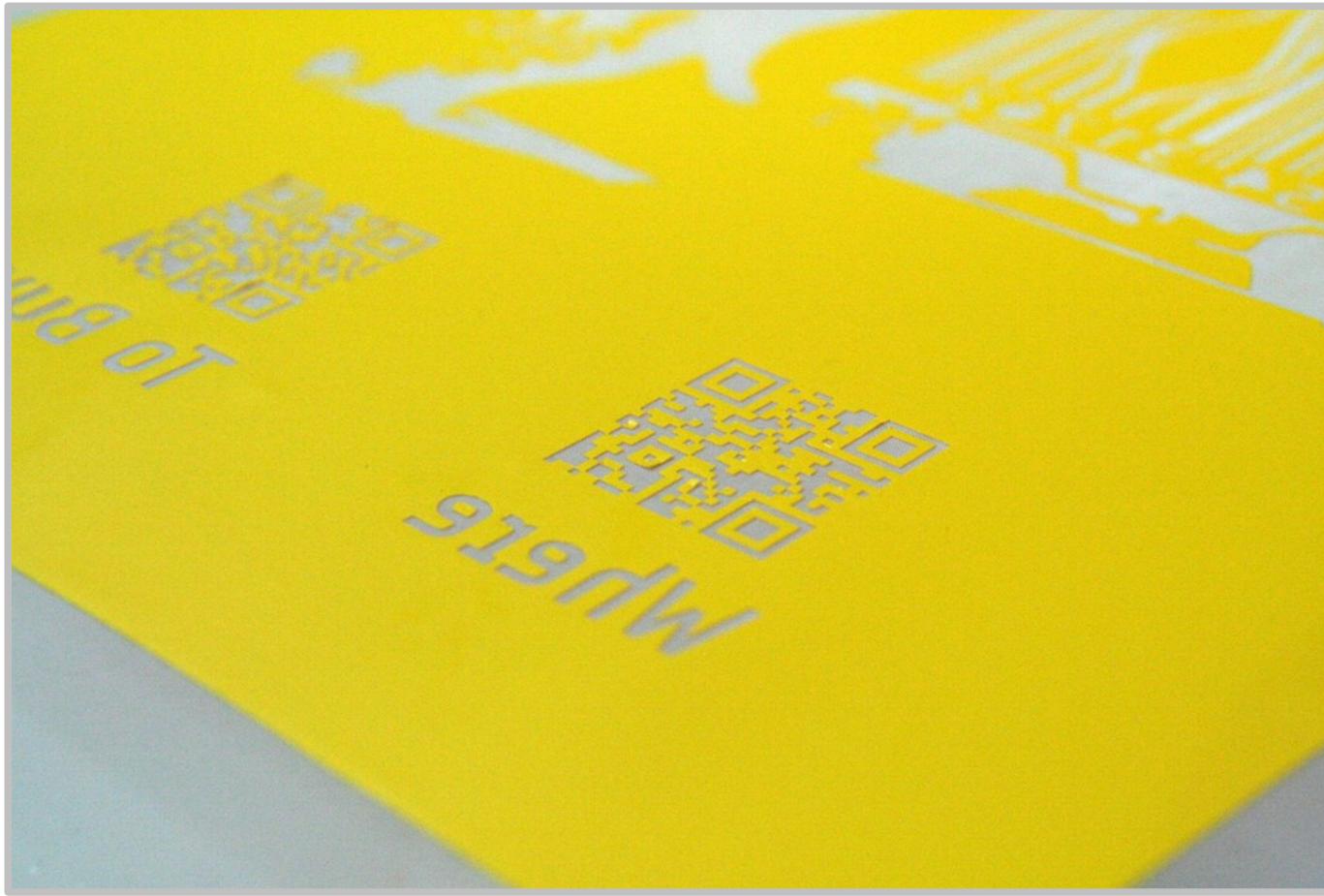


---

The vinyl cutter can be used also for silk screen printing, but you will have to clean the shapes manually, so beware of too small details.

Source: [http://www.flickr.com/photos/massimo\\_menichinelli/6765885607/in/photostream](http://www.flickr.com/photos/massimo_menichinelli/6765885607/in/photostream)

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Source: [http://www.flickr.com/photos/massimo\\_menichinelli/6765886761/in/photostream](http://www.flickr.com/photos/massimo_menichinelli/6765886761/in/photostream)

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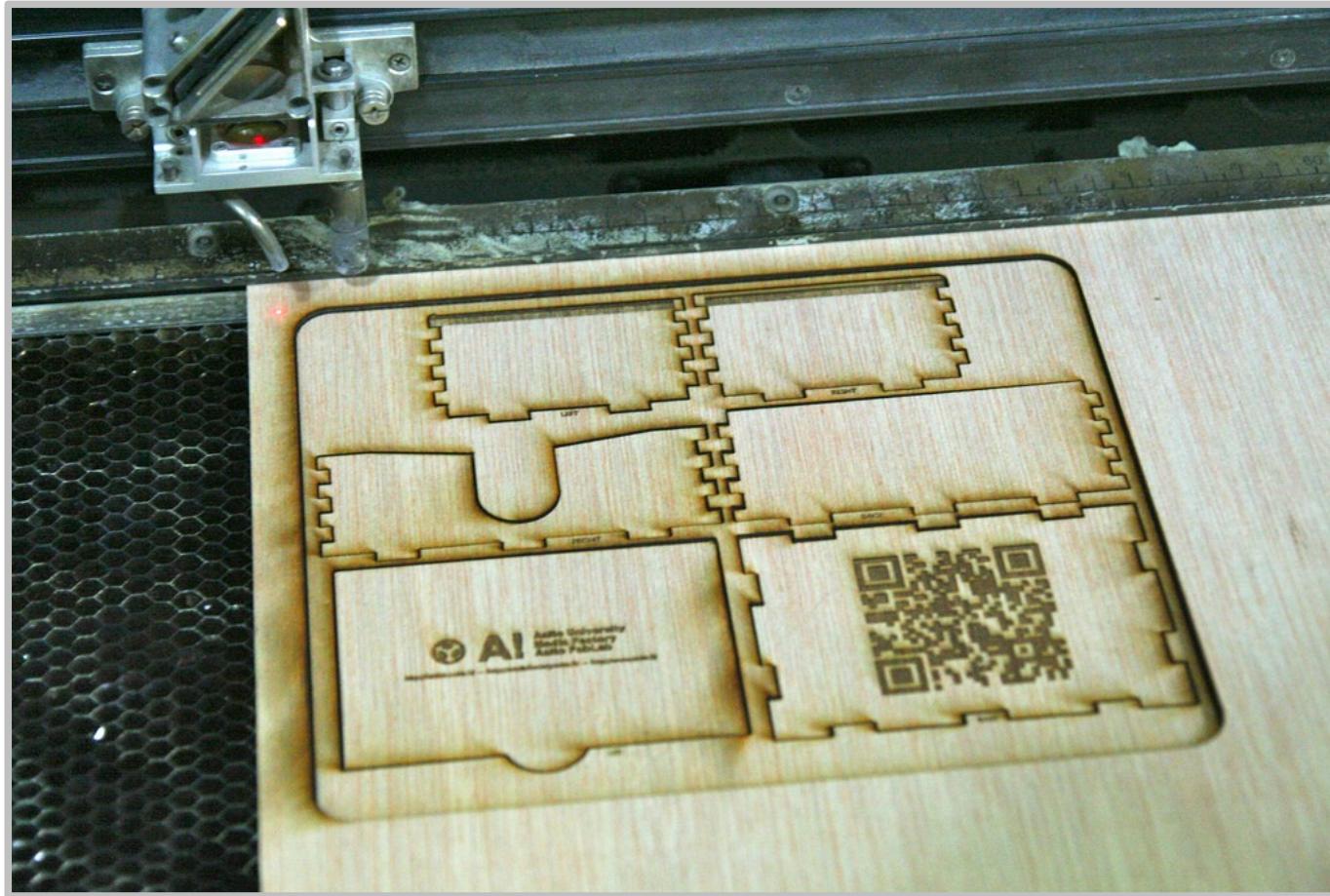


---

The vinyl cutter can be used also for silk screen printing, but you will have to clean the shapes manually, so beware of too small details.

Source: [http://www.flickr.com/photos/massimo\\_menichinelli/6765893441/in/photostream](http://www.flickr.com/photos/massimo_menichinelli/6765893441/in/photostream)

# Laser cutter and QR Codes



---

You can laser cut QR Codes, but you need a material that keeps the black and white contrast, like plywood (or you will have to paint the code).

Source: [http://www.flickr.com/photos/massimo\\_menichinelli/6675806219/in/photostream](http://www.flickr.com/photos/massimo_menichinelli/6675806219/in/photostream)

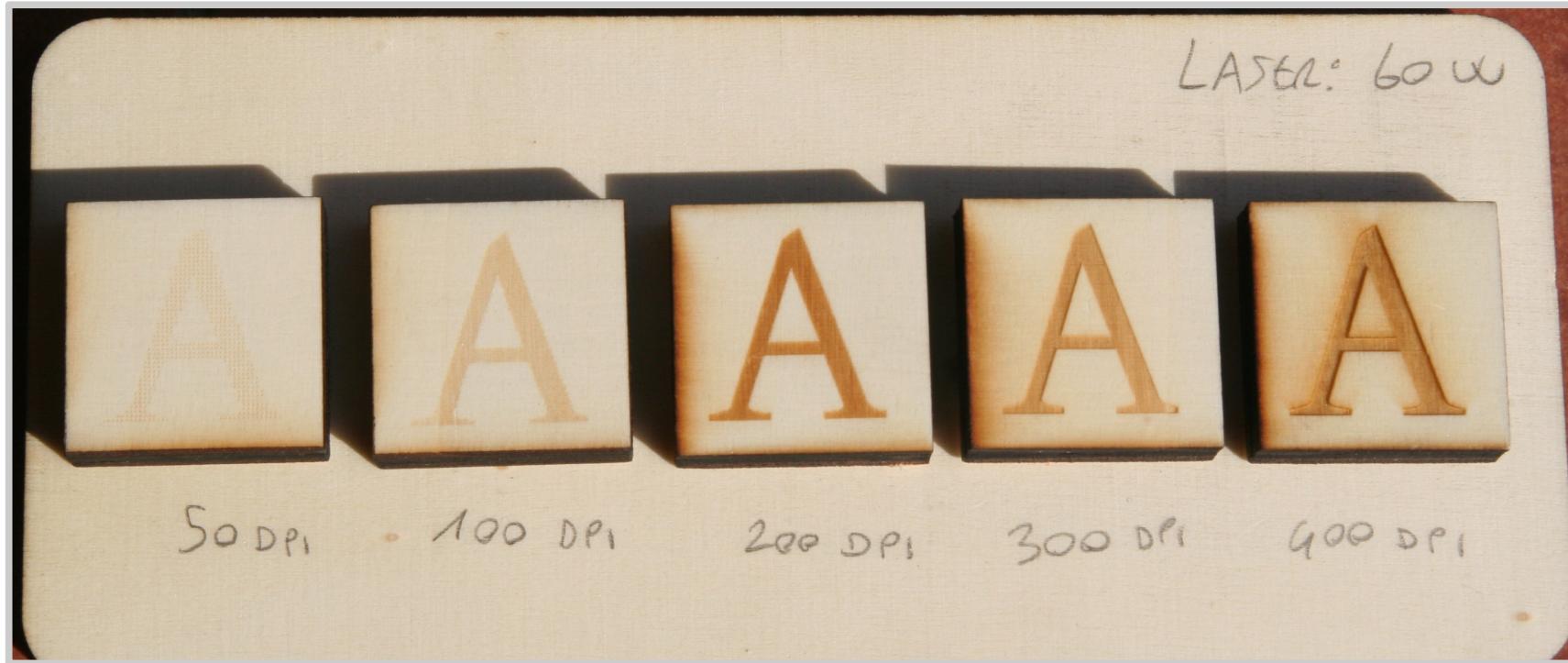


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# Technical issues: how to design for a laser cutter

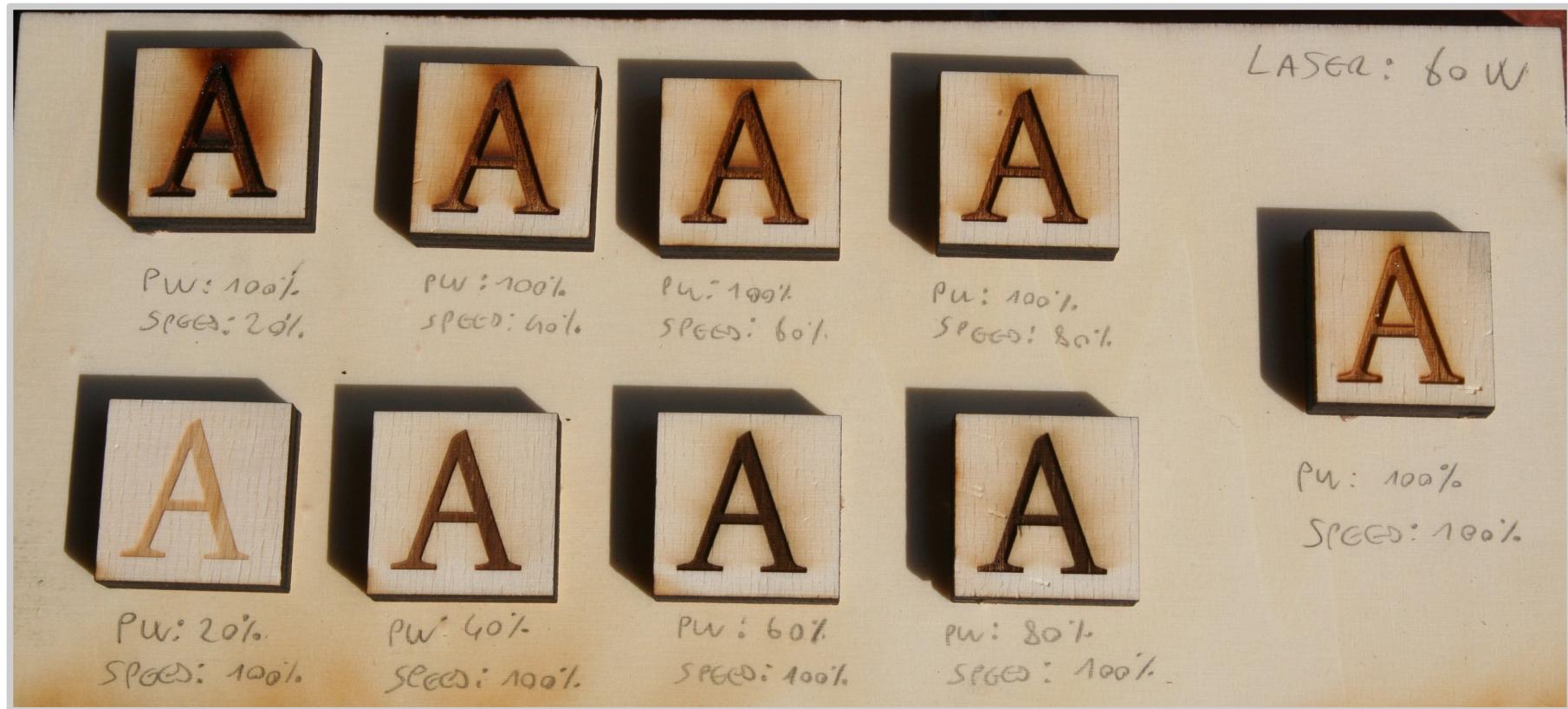
# Settings: resolution



---

Learn how to use the right settings for the right material.

# Settings: power and speed



Learn how to use the right settings for the right material.

# Settings: power and speed



Learn how to use the right settings for the right material.

# First thing: materials

- \* **Non-reflective materials:** you probably don't want to reflect a laser beam that cuts all around.
- \* **Thickness:** it depends on the power of the machine; our laser cutter cannot cut metals.
- \* **Safety:** PVC is forbidden! It is carcinogenic and it damages the machine!
- \* **Materials:** if you use something that's not in the lab, please ask us before!

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If you want to be sure, check what Ponoko is using:  
<http://www.ponoko.com/make-and-sell/materials>

## Second thing: the kerf

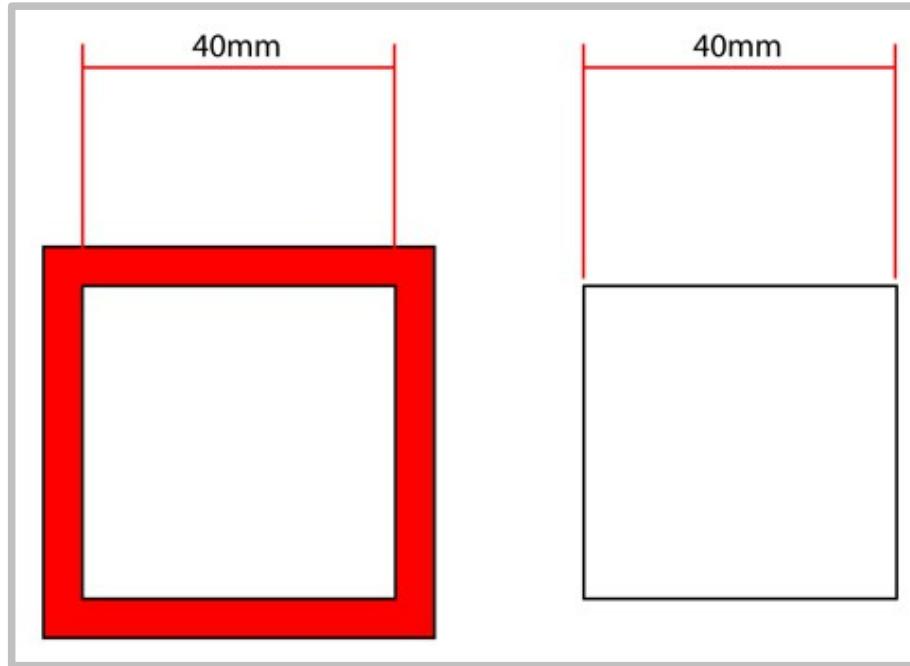
\* **Kerf:** the width of material removed during the cutting process. Kerf is determined by material properties and thickness, the focal length of the lens and the gas used while cutting. Also, kerf widths can vary even on the same material sheet, depending on whether you're cutting a straight or curved line, or the laser head is moving on the x or y axis.

---

Source: <http://en.wiktionary.org/wiki/kerf>

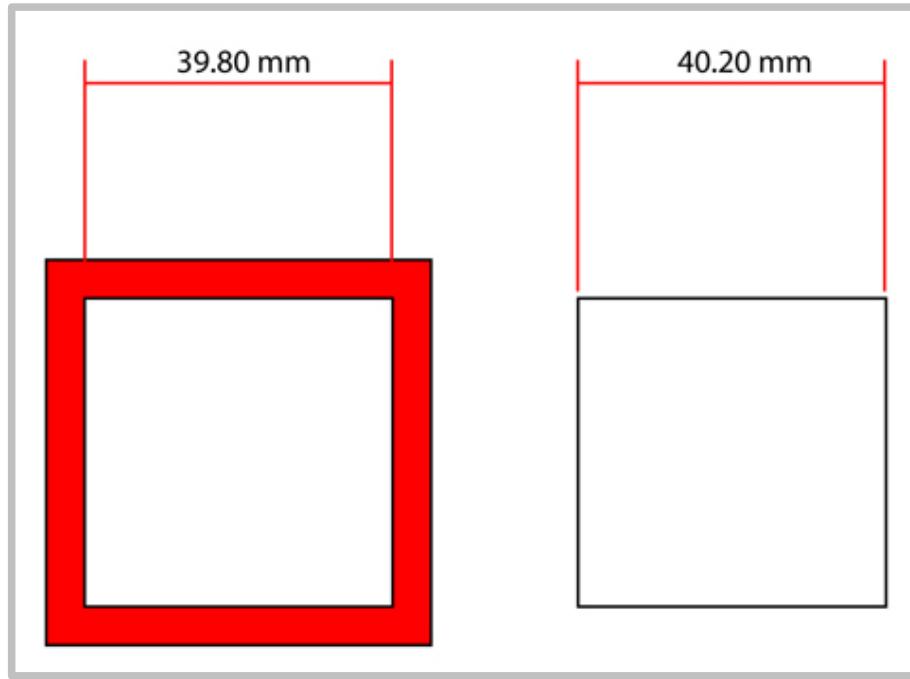
<http://blog.ponoko.com/2011/07/12/figuring-out-kerf-for-precision-parts/>

# Kerf and press-fit: the problem



Actually, the white square on the right would end up at 39.80mm and the hole in the middle of the red square would be 40.20mm.

# Kerf and press-fit: the problem



However if they are dimensioned with kerf in mind, both the hole and the white square will come out at 40mm and they should fit together.

# Kerf and press-fit: the problem



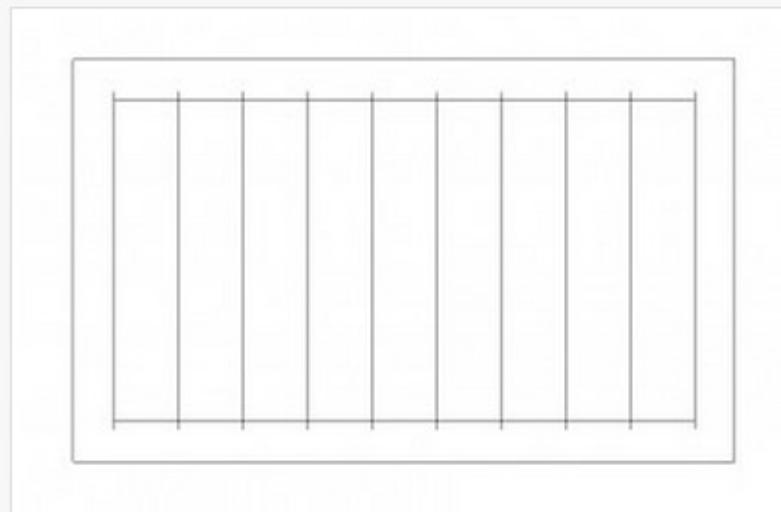
Here you can see how it works in practice.

# Kerf and press-fit: how to measure it

## Method:

By cutting a rectangle of material and then cutting 9 rectangles within it you get 10 cuts. When these 9 rectangles are pushed together at one end of the "frame", the resulting gap at the other end is the sum of the kerfs. Dividing this gap by ten gives the average kerf for that material and material thickness.

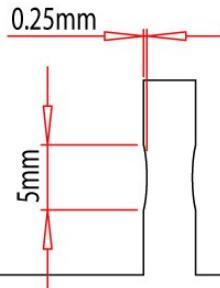
The image below is a screenshot of the Alibre drawing. The vertical lines extend past the inside border of the frame so that the cut has time to penetrate the material before it crosses into the inside border of the frame. Some laser cutter software will compensate for penetration time, ours was cheap and so doesn't.



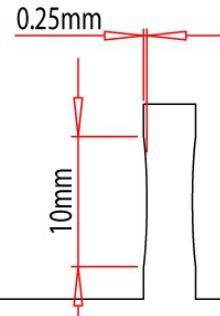
A simple way for measuring the kerf of a material: always do a test before cutting the final object!

Source: <http://www.redtorope.com/2011/07/laser-cutter-kerf-measurement/>  
<http://blog.ponoko.com/2011/07/12/figuring-out-kerf-for-precision-parts/>

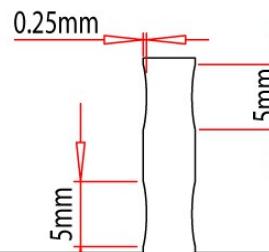
# Node and interlocking wood designs



1 short node



1 long node



2 nodes

A node is typically used if your design has multiple parts that need to join together either by slotting or with a tab and hole joint.

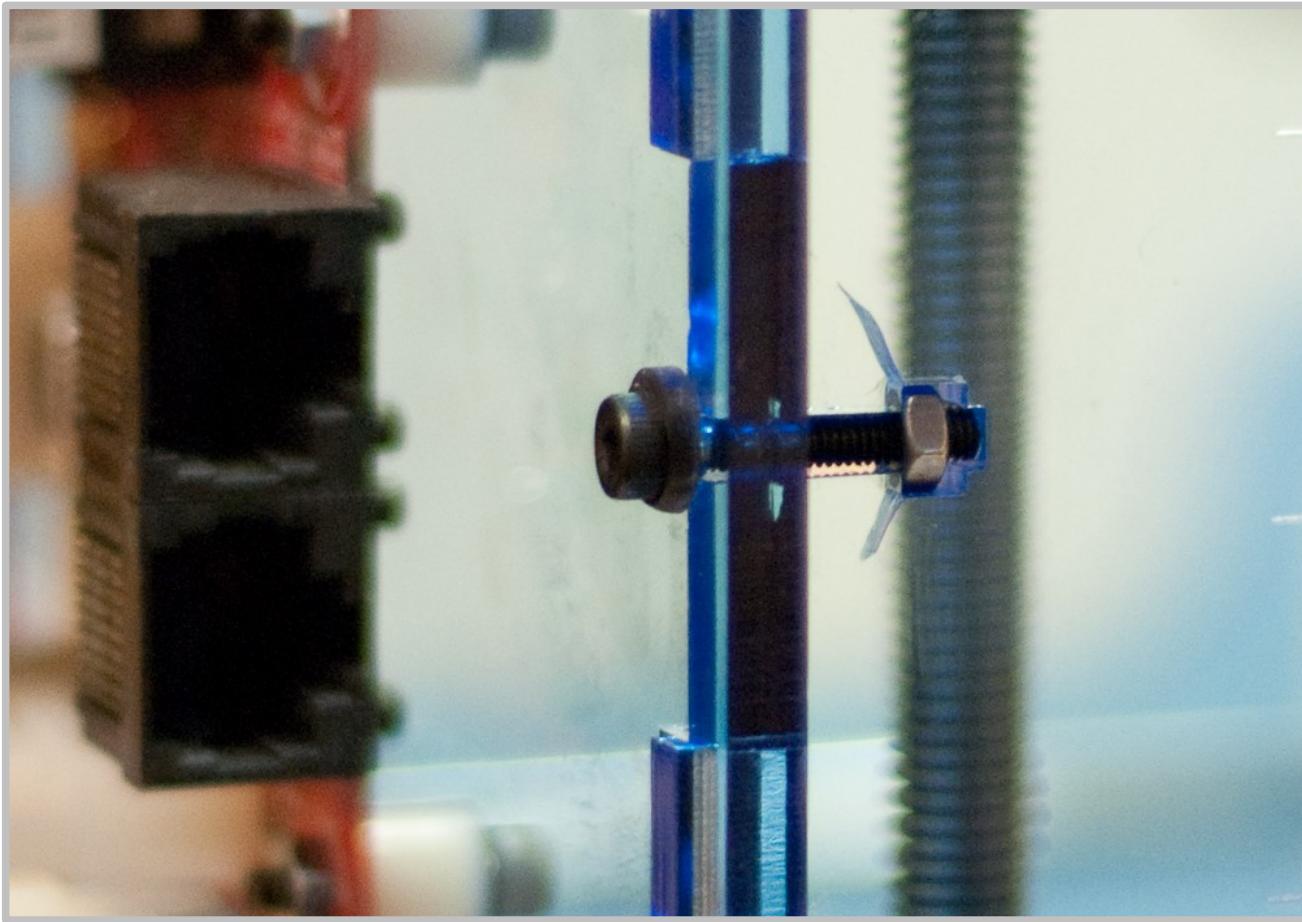
# Node and interlocking wood designs



Nodes are little bumps located in the slots or on tabs in your product that are there to help compensate for material thickness variations and the laser kerf.

Source: <http://support.ponoko.com/entries/498853-get-the-best-results-from-interlocking-wood-designs>  
<http://youtu.be/6abrz0ikHak>

# Press-fit and plastic: beware of tensions

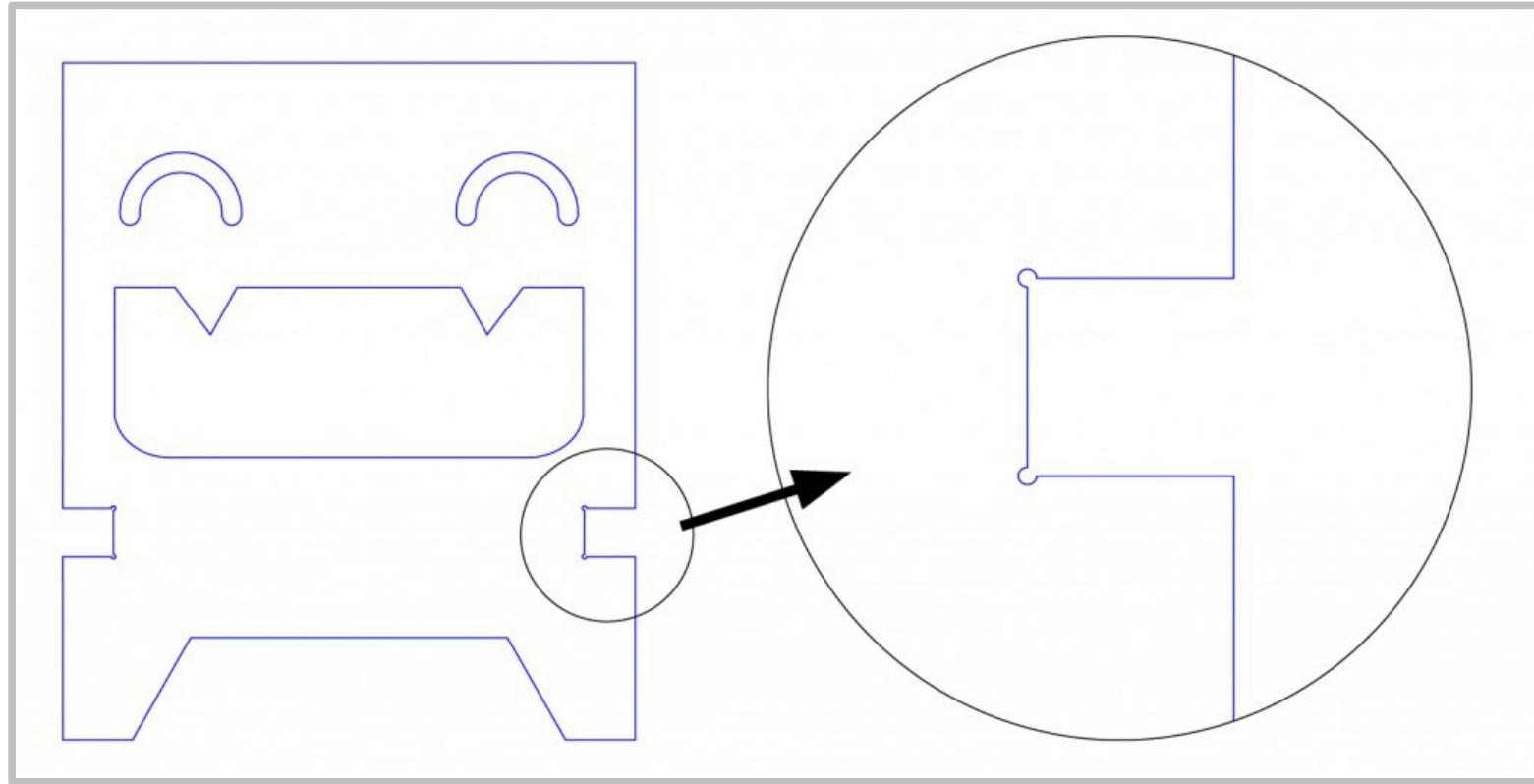


---

You will have to learn how every material behaves!

Source: <http://support.ponoko.com/entries/498833-get-the-best-results-from-interlocking-acrylic-designs>  
<http://academy.cba.mit.edu/2012/students/lubsen.astrid/Assignment4.html>

# Press-fit and plastic: beware of tensions



A small radii in that corner does wonders to transfer the forces from one face of the hole or slot to the other and reduces the risk of the material splitting at the corner.

Source: <http://support.ponoko.com/entries/498833-get-the-best-results-from-interlocking-acrylic-designs>

<http://academy.cba.mit.edu/2012/students/lubsen.astrid/Assignment4.html>

# Press-fit and plastic: beware of tensions



---

The larger the radii the stronger it will be so you will need to make an aesthetic decision on how big you can go.

Source: <http://support.ponoko.com/entries/498833-get-the-best-results-from-interlocking-acrylic-designs>

<http://academy.cba.mit.edu/2012/students/lubsen.astrid/Assignment4.html>

# Creating a 3d round object with the laser cutter

 fablab  
waag society

What you can do at Fablab Amsterdam ▾ projects

**creating a 3d round object with the 2d laser cutter**  
because the laser cutter always cuts straight down, it is hard to create non cubic 3d shapes

however, with the use of gradients one can engrave cornered edges.  
with this technique this was created:



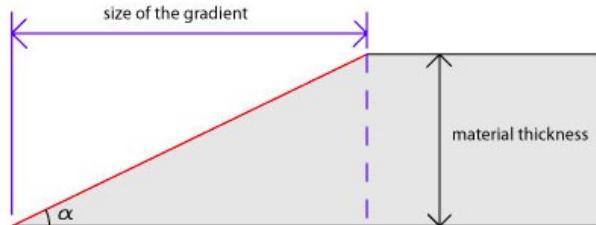
a wooden dome created out of 19 wooden pieces and a ground plate.

---

A simple technique involving laser cutting gradients.

# Creating a 3d round object with the laser cutter

To create a cornered edge you must first find the proper size of the gradient  
the size of the gradient is created like this:



where the size of the gradient is calculated as follows:

$$\text{The size of the gradient} = \text{the material thickness} / \text{tangent of corner } \alpha$$

the next step is to create the gradient. We use a black to white gradient, where black is the outer end of the shape. In illustrator the gradient tool can be used to change the direction



and the size of the gradient



---

A simple technique involving laser cutting gradients.

# Laser cut hinges in plywood



We can create "living hinges" that take advantage of the slight degree of bend of rigid materials.

Source: [http://www.snijlab.nl/?page\\_id=358#](http://www.snijlab.nl/?page_id=358#)

# Laser cut hinges in plywood



---

Kerfing is in simple terms the act of cutting a series of kerfs (cuts) in a piece of wood in close proximity, so the wood can be curved.

Source: <http://blog.makezine.com/2009/06/13/kerf-bending-for-cnc-millers/>

<http://stusshed.com/2007/07/17/kerfing-bending-wood-on-the-tablesaw/>

# Open Source Laser cut hinges in plywood

a MakerBot Industries website

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Created by  
**SNIJLAB**

Created on Oct 19, 2011

Featured on Oct 20, 2011



**Folding Wood Booklet**

Recently we discovered a re...  
flexible. This is so cool we...

We designed wooden book...  
made from a beautiful birch...  
clear varnish. The hard wood...  
the back side for comfortat...  
made from the same materi...  
block.

The booklets come in a ho...  
Actually they not only look...  
digital production is all abo...  
techniques like this it is po...

We can create "living hinges" that take advantage of the slight degree of bend of rigid materials.

Source: [http://www.snijlab.nl/?page\\_id=358](http://www.snijlab.nl/?page_id=358) <http://www.thingiverse.com/thing:12708>

<http://www.thingiverse.com/thing:12708>

# Laser cut hinges in plywood: flex box

a MakerBot Industries website

# THINGIVERSE

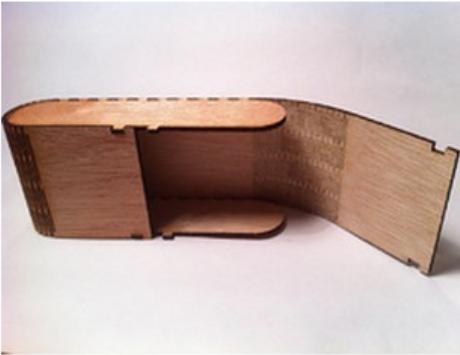
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## Flex box

Created by **hudson**

Created on Dec 4, 2011

Derived from [Two new kind of flex-boxes](#) by [FdS](#)

I modified the design to use less raw material when cut and also adjusted the cut order to do the hinge first, then the outline to avoid having the laser focus go out when the box drops out of the piece.

[Tweet](#) 3   [Like](#) 0   [Pin it](#)   [Reddit](#)

**Downloads**

 **simplebox-type2.svg**  
48 kb / 225 downloads / 5 months ago

**Comments**

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**Latest From The Thingiverse Blog**

**You Know You're Onto Something...**  
..when you're having

A box with flexible living hinges laser cut in plywood (and open source).

Source: <http://www.thingiverse.com/thing:14267>

# Flex box generator: an open source Perl script

a MakerBot Industries website

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## Parametric flex box

Created by  Juerd

Created on Feb 10, 2012

Derived from [Flex box](#) by [hudson](#)

Derived from [Two new kind of flex-boxes](#) by [FdS](#)

Generate it in any size.

Has an experimental feature to include an extra set of inner walls to protect the hinges from the contents. By drawing the hinge lines in a zig zag pattern, plotting time is reduced significantly.



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[submit](#)

### Downloads

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-  **speelkaarten.svg**  
4 kb / 95 downloads / 3 months ago
-  **test.svg**  
7 kb / 79 downloads / 3 months ago
-  **doosje.pl**  
9 kb / 55 downloads / 3 months ago

### Instructions

Change doosje.pl and run it.

Newest version and instructions can be found at [github.com/Juerd/doosje](#)

Change the parameters for height, length, width and material thickness. These are the inner dimensions, so just measure the thing you want to store inside. The script will output the outer dimensions.

Other customizable parameters include "finger" width and kerf compensation. Read the source code to discover more parameters.

**Latest From The Thingiverse Blog**

**You Know You're Onto Something...**

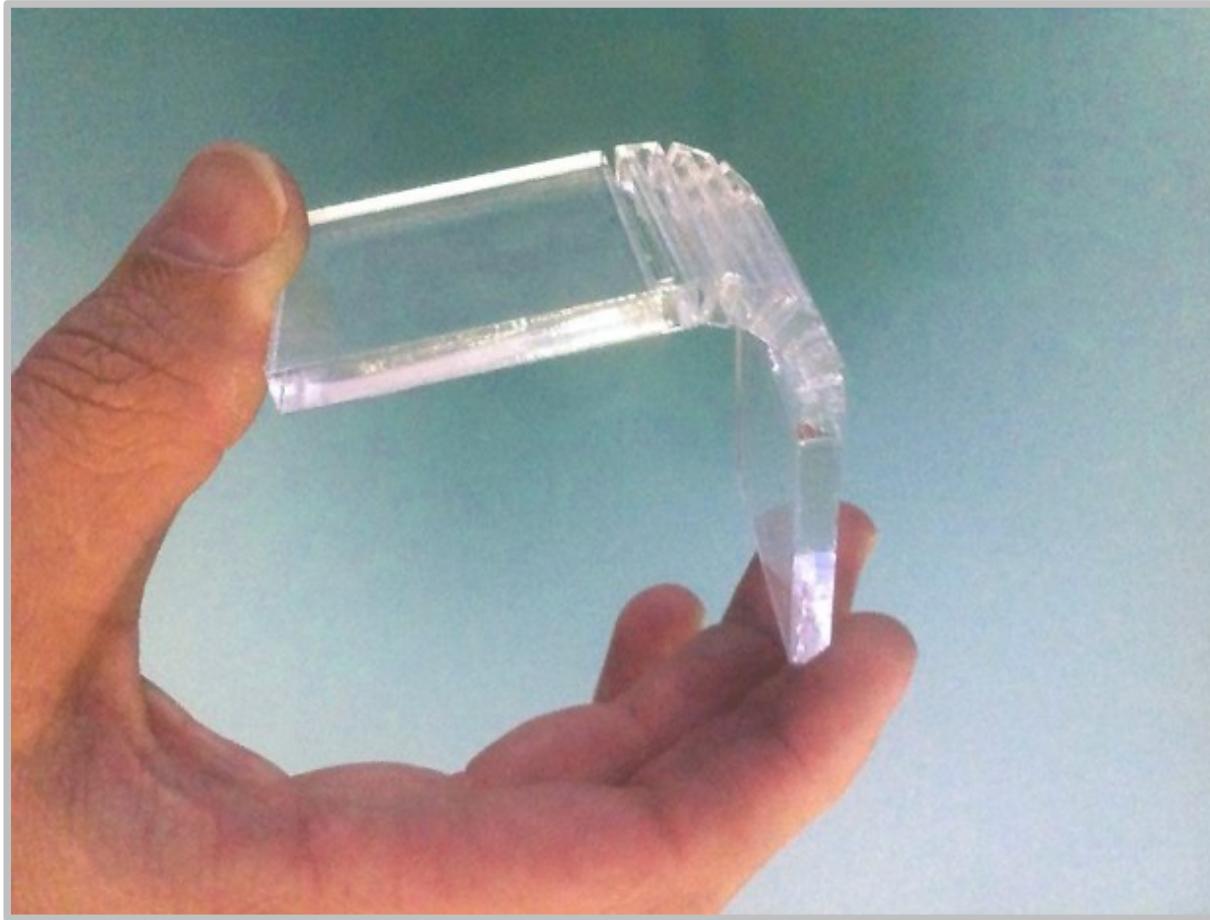
...when you're having electron microscopes take the final photos of your 3D prints. This car is a little under 300 microns long, or just about the right size to sit inside the more fine-pitch extruder nozzle tips you can get these days for your thermoplastic printers. Atoms are the

Change the parameters for height, length, width and material thickness, "finger" width and kerf compensation. Read the source code to discover more parameters.

Source: <http://www.thingiverse.com/thing:17327>

<http://github.com/Juerd/doosje>

# Laser cut hinges in acrylic

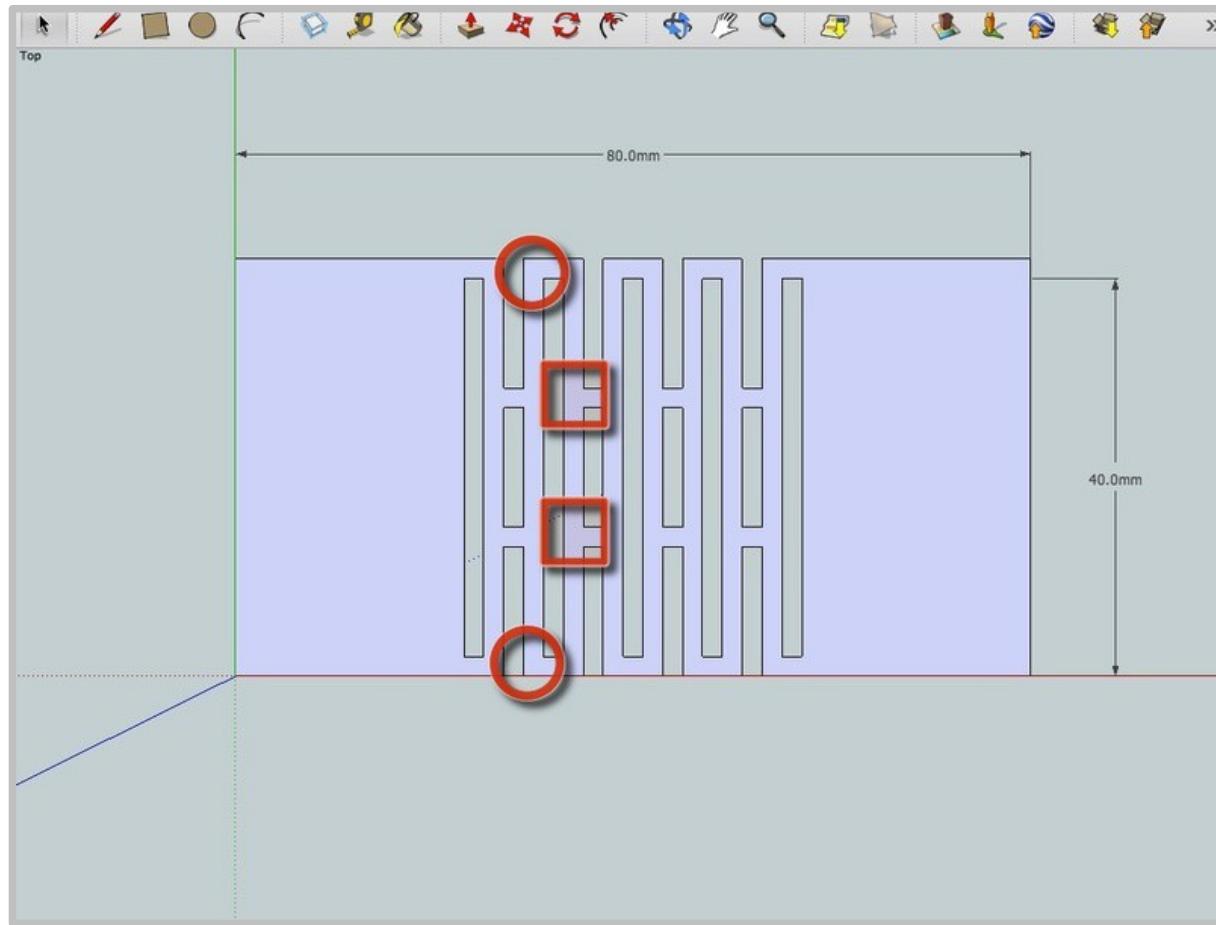


---

We can create "living hinges" that take advantage of the slight degree of bend of rigid materials.

Source: <http://blog.makezine.com/2011/12/08/designing-sninges-in-laser-cut-acrylic/>

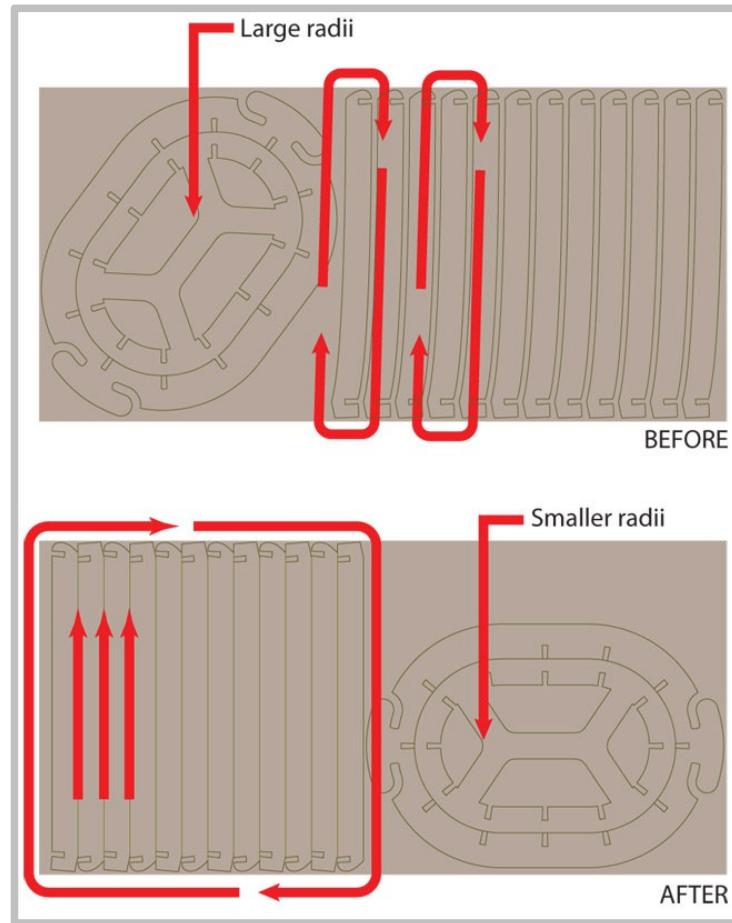
# Designing Sninges in Laser Cut Acrylic



We can create "living hinges" that take advantage of the slight degree of bend of rigid materials.

Source: <http://makeprojects.com/Project/Creating-Living-Hinges/1683/1>

# A guide to laser cut optimisation

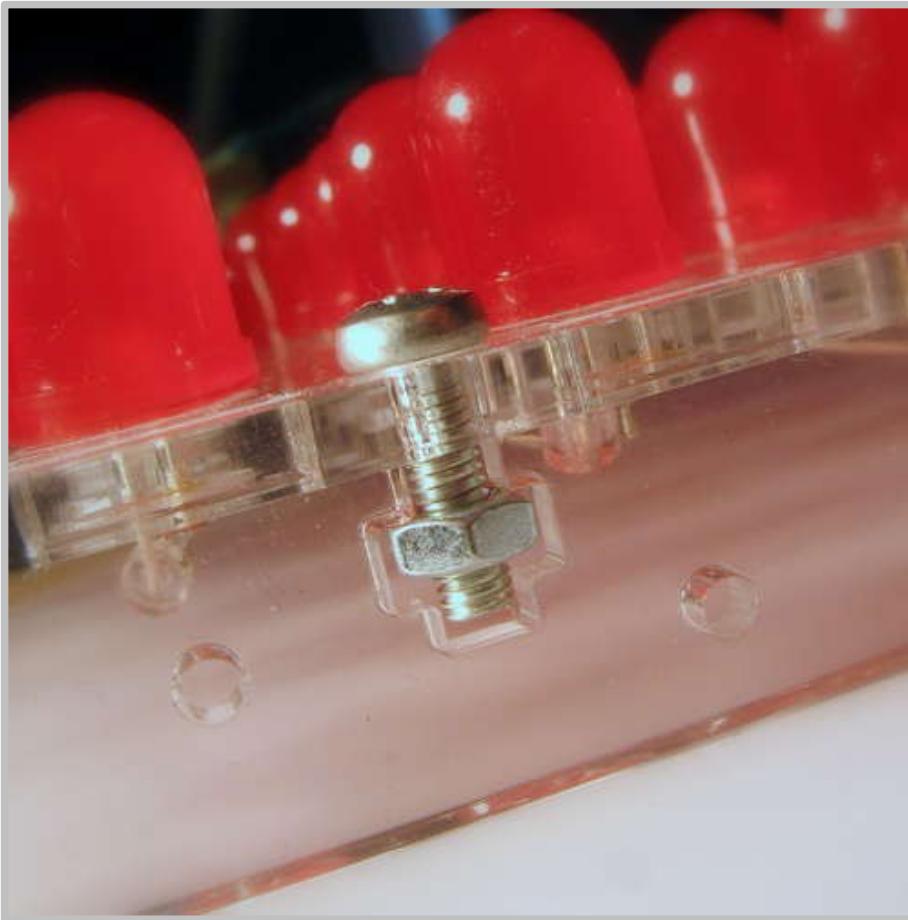


---

Various suggestions for improving the speed and quality of a laser cut.

Source: <http://support.ponoko.com/entries/20621872-a-guide-to-laser-cut-line-optimisation>  
<http://support.ponoko.com/entries/20559897-tips-on-optimizing-your-design-file-for-lower-costs>

# Boxes with acrylic and machine screws

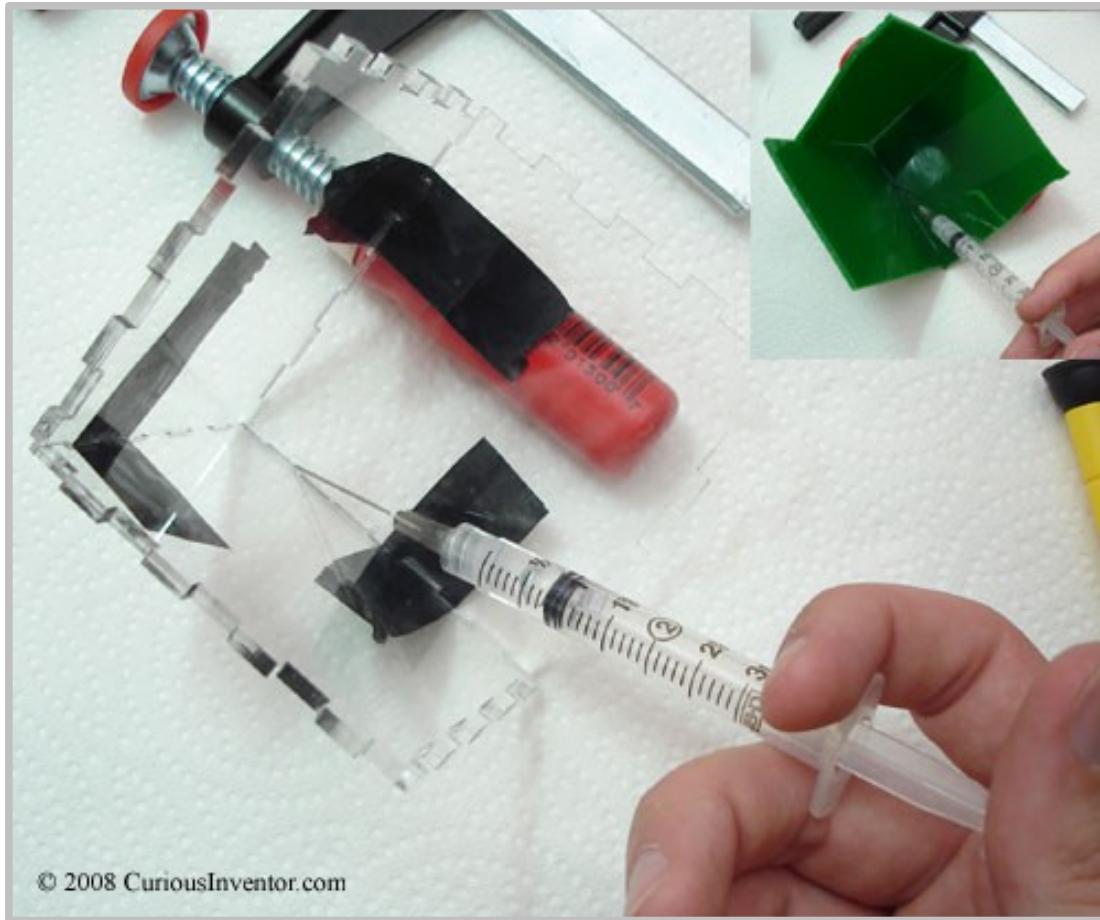


---

*Interlocking T-Bolt Construction:* a T-cutout in a piece of acrylic and a receptacle in another piece to be bolted in a secure 90 degree joint.

Source: <http://www.instructables.com/id/How-to-Make-Anything-Using-Acrylic-and-Machine-Sc/>

# But it is a more complex technique

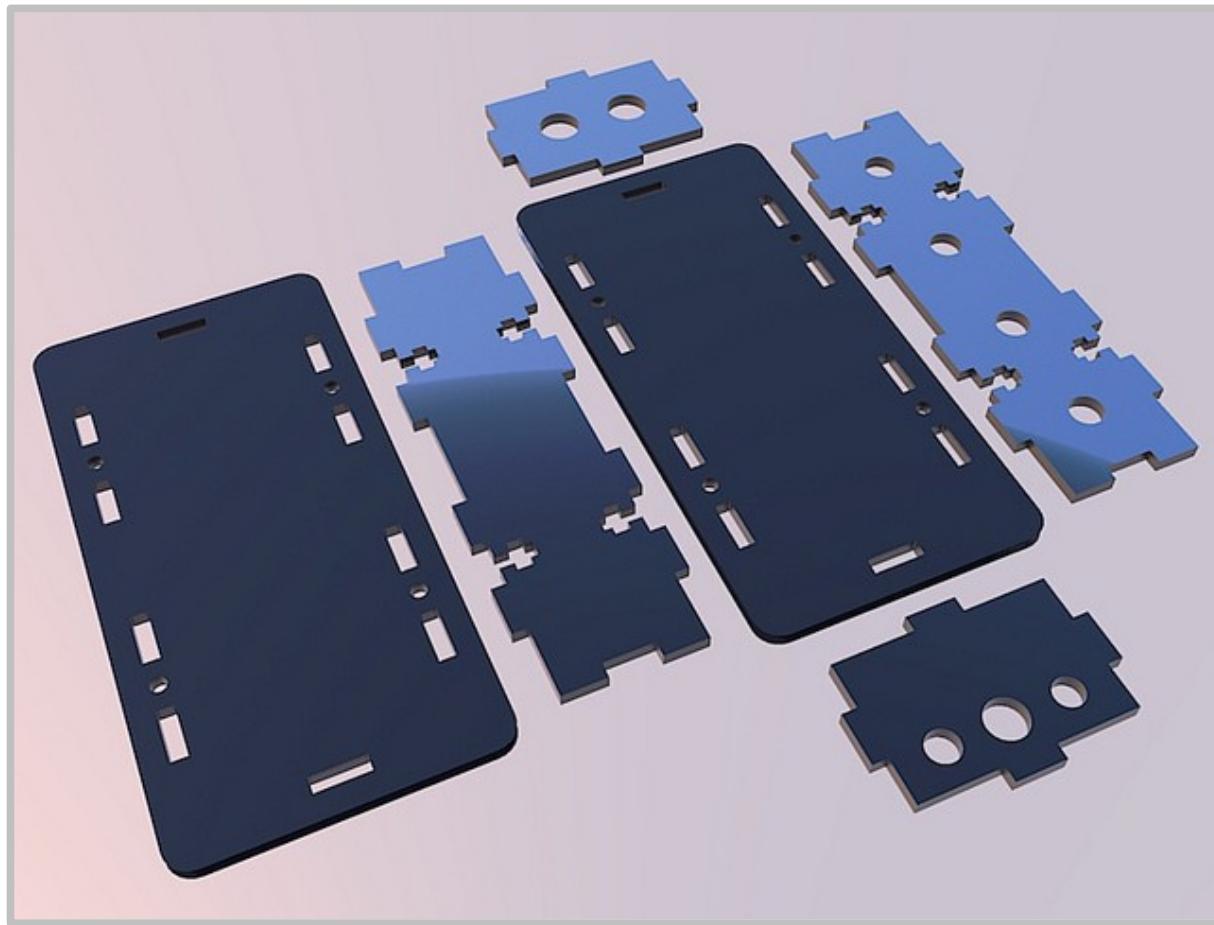


© 2008 CuriousInventor.com

You can achieve the same results also with normal interlocking designs, without screws and chemicals (and this is what we do in a FabLab).

Source: <http://store.curiousinventor.com/blog/how-to-make-cheap-lasercut-custom-boxes-for-your-diy-electronics/>

## ... with many tutorials



---

You can achieve the same results also with normal interlocking designs, without screws and chemicals (and this is what we do in a FabLab).

Source: <http://support.ponoko.com/entries/20344437-laser-cut-project-box-tutorial>

# A technique for coloring laser engraving

## The finishing touch: filled laser engraving tutorial



Rich Decibels

posted this on October 24, 2011 14:14

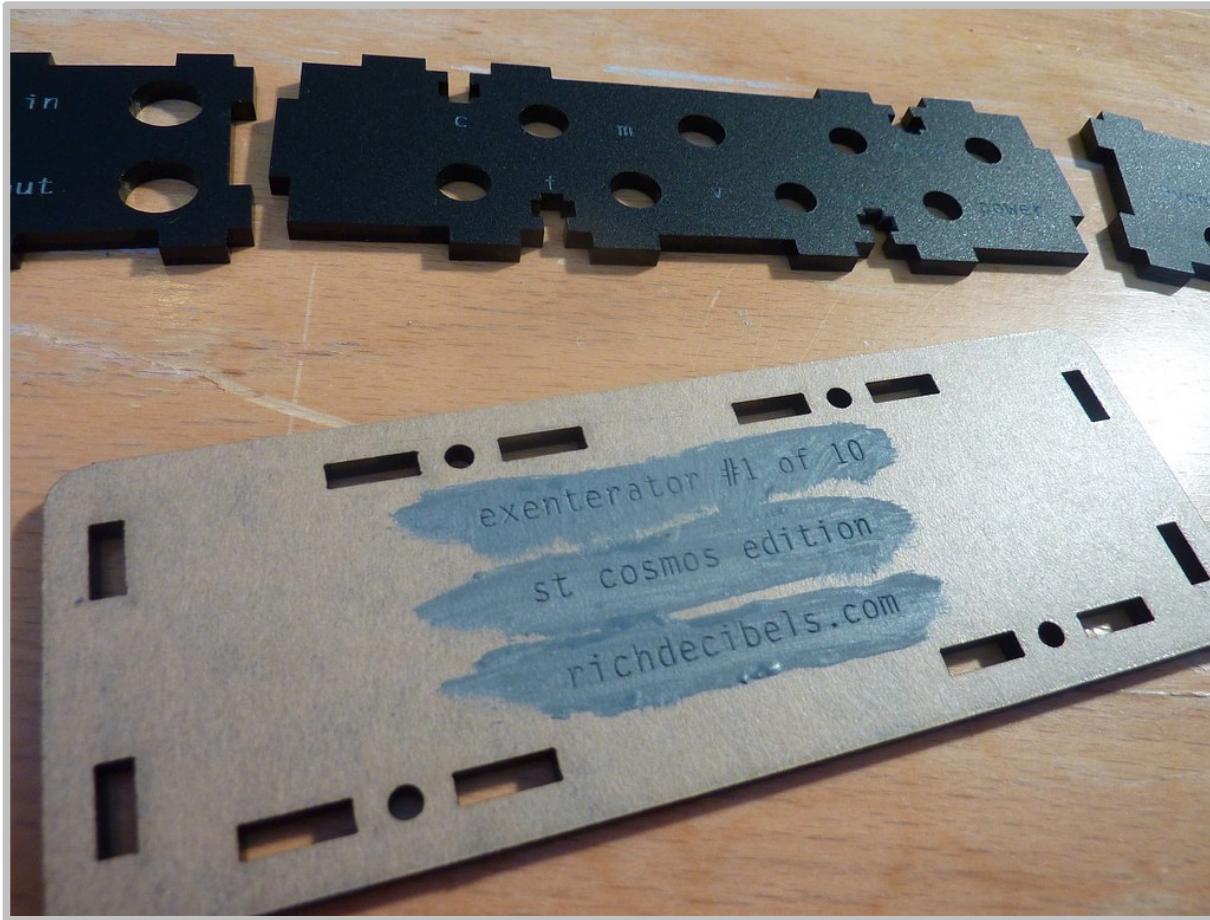
A simple technique for making your laser engraving stand out



You can paint on the surface if it still has its protective paper backing still attached.

Source: <http://support.ponoko.com/entries/20581412-the-finishing-touch-filled-laser-engraving-tutorial>

# A technique for coloring laser engraving



---

You can paint on the surface if it still has its protective paper backing still attached.

Source: <http://support.ponoko.com/entries/20581412-the-finishing-touch-filled-laser-engraving-tutorial>

# ... and more details here:



---

Paint filling and masking laser engraved parts.

Source: <http://blog.ponoko.com/2010/11/25/add-colour-to-your-laser-cut-detail/>

# How to reduce burn marks on acrylic



Cut with paper on both sides if there is no raster engraving in the design,  
or if all raster engraving is of the heavy variety.

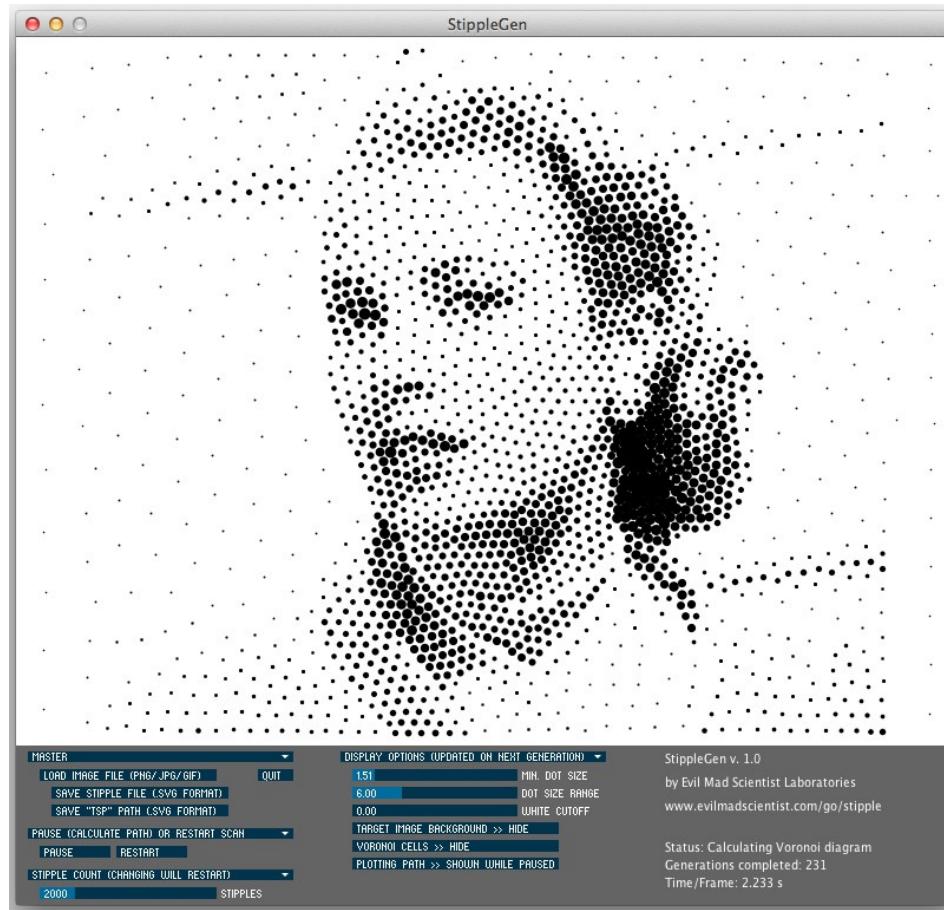
Source: <http://blog.ponoko.com/2010/08/27/how-to-reduce-burn-marks-on-acrylic/>



Aalto University  
Media Factory

# 04. Resources: interesting softwares and services

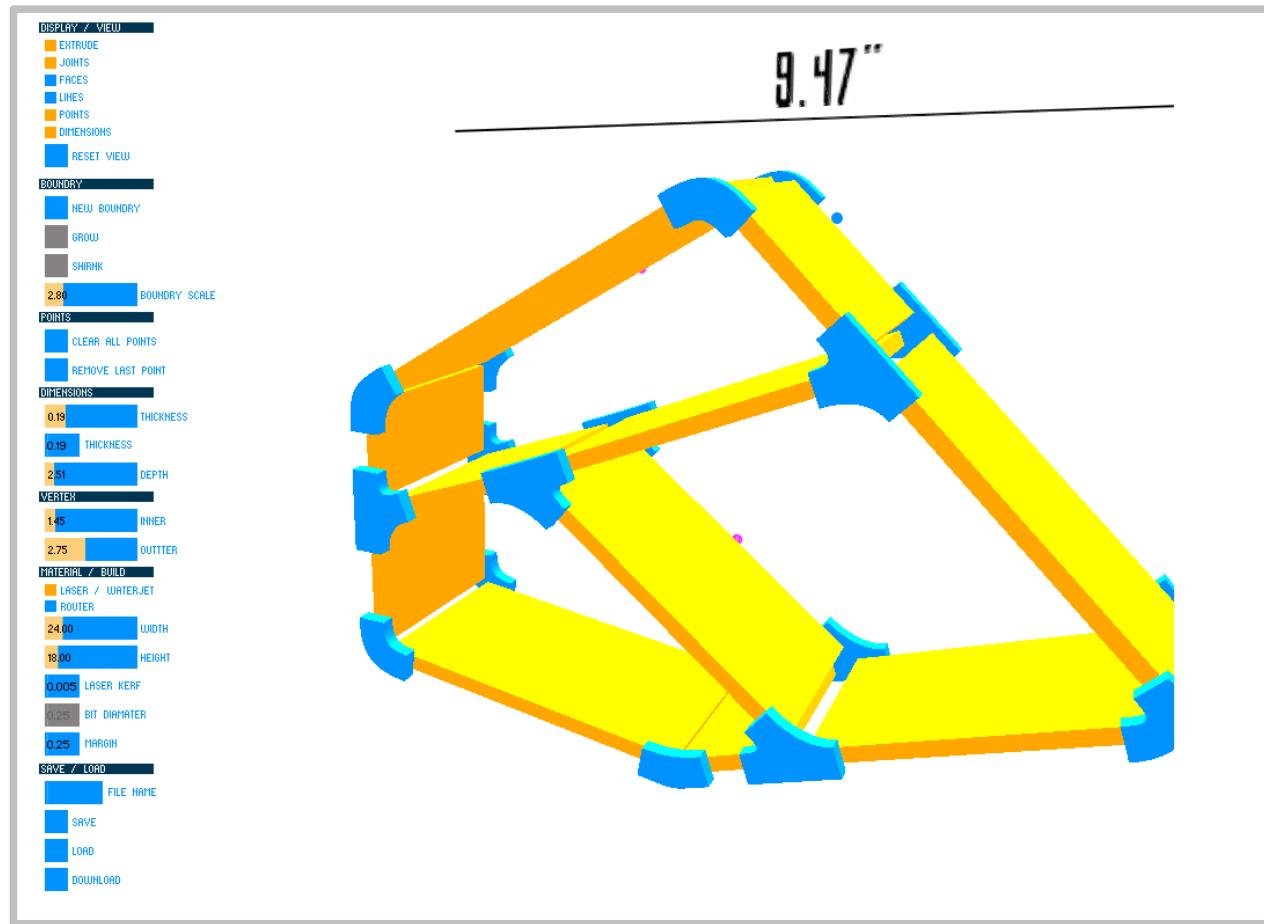
# StippleGen: from image to laser in Processing



StippleGen, a stand-alone program that converts any image into CNC-friendly SVG format.

Source: <http://www.evilmadscientist.com/article.php/stipple>

# Parametric voronoi bookshelf in Processing



The software allows users to determine variables and then automatically generates the 3D geometry which can also be saved in 2D for laser cut.

Source: <http://www.hero-design.com/2012/03/22/voronoi-bookshelf-prototype-experiment-generative-design/>

# Processing: Exporting PDF Files for Lasercutting

The screenshot shows a blog post on a website. At the top, there's a navigation bar with a logo (a white plus sign inside a black circle), 'Home', 'Blog' (which is bolded), 'About', and a search bar with a magnifying glass icon. Below the navigation, a breadcrumb trail says 'You are here: Vormplus > Blog > Processing Month, Day 19 - Exporting PDF Files for Lasercutting'. The main content starts with the date '19 May 2011' and the author 'Jan Vantomme'. To the left of the main text, there's a section for 'Tags' with the words 'processing' and 'rapid prototyping'. The main title of the post is 'Processing Month, Day 19 - Exporting PDF Files for Lasercutting'. The post content discusses using the PDF library to export sketches for lasercutting, mentioning colors for cutting and engraving. It includes a snippet of Processing code for defining colors:

```
color cutColor = color( 255, 0, 0 );
color engraveColor = color( 0 );
```

It also notes that the PDF library needs to be imported into the sketch. The bottom of the post ends with a snippet of code:

```
import processing.pdf.*;
```

“how we can use the PDF library to export our sketch for  
lasercutting”

Source: <http://vormplus.be/blog/article/processing-month-day-19-exporting-pdf-files-for-lasercutting>

# Laser Cut Studio (Helsinki)

LASER CUT STUDIO

home services process materials showcase **Blog** contact



Laser cutting solutions for the creative Helsinki

Laser Cut Studio is a brand new laser cutting company and new way of thinking. Recently moved into their new studio in the centre of Helsinki. Laser Cut Studio is a low cost manufacturing solution for the creative people of helsinki. Based around the process of laser cutting, which can be applied to many different creative fields, from architecture models to jewellery production, there is almost no limit to what a laser cutter can be used to create.

Laser Cut Studio is a brand new laser cutting company recently moved into their new studio in the centre of Helsinki.

Source: <http://www.lasercutstudio.com/home.html>

# Laserle (Helsinki)

Valuraudantie 25  
00700 Helsinki  
Finland  
Phone +358 9 3509 380  
Fax +358 9 3509 3850



## Main

Laser cutting 2D  
Laser cutting 3D  
Water jet cutting  
Costs and quotation  
Contact info



## Welcome to our laser and water jet cutting pages

### We do:

- Fast and reliable cutting of logos, gobos, signage, mechanical components and art work
- Precision cutting with water or laser!
- Laser welding
- CAD & CAM services
- Batch size from 1 to 5000+ pieces
- We can work from your CAD file or free-hand drawings
- World-wide service

Laser cutting, water jet, batch size from 1 to 5000+ pieces.

# Merocap (Helsinki)



The screenshot shows the homepage of Merocap OY's website. At the top, there is a navigation bar with links: MUOVISTA OSAMISTA, MEROCAP OY Thermoforming, Etusivu Aloita tästä, Yritys Tietoa meistä, Uutiset Ajankohtaista, Palvelut Kokemuksella, Tuotteet Laadulla, Galleria Kuvat & videot, and Ota yhteyttä Laita meille viesti. The main content area features two large, modern lampshades, one black and one white, hanging against a white background. Below the lamps, there is a small navigation indicator showing two dots, with the second dot being larger. A large, light gray callout box contains the text "Tervetuloa Merocapin sivuille!" (Welcome to Merocap's pages!).

Laser cutting, thermoforming, ...

# Parametric Box Generator

a MakerBot Industries website

# THINGIVERSE

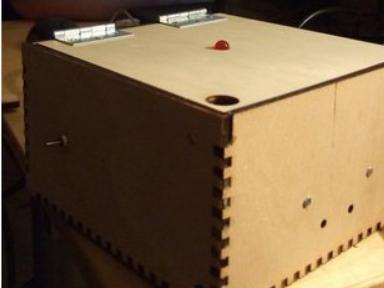
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## Parametric Box Generator

Created by  clifford

Created on Jan 7, 2010

I wrote a script to generate lasercut boxes. The script reads a config file with the box dimensions and generates a DXF file and an OpenSCAD model. We use the script for all types of cases here at metalab. The example file attached is the case of our electronic door lock system.

The script can be found here:  
[svn.clifford.at/handicraft/2009/boxgen/](http://svn.clifford.at/handicraft/2009/boxgen/)

You might need to install SPL (the scripting language I've used for the script) before you can use the script:  
[clifford.at/spl/](http://clifford.at/spl/)

[Tweet](#) 1   [Like](#) 0   [Pin It](#)   [submit](#)   [Flattr](#) 0

**Downloads**

Sort By [Date](#) [Popular](#) [File Type](#)

 <b>metalockbox.dxf</b> 115 kb / 259 downloads / 2 years ago	 <b>metalockbox.scad</b> 1 kb / 203 downloads / 2 years ago
--	---

**Instructions**

Create A \*.box file with the box dimensions:

w = 180  
l = 180  
h = 100  
t = 5  
door = 1

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**You Know You're Onto Something...**

..when you're having electron microscopes take the final photos of your 3D prints. This car is a little under 300 microns long, or just about the right size to sit inside the more fine-bladed nutcracker nozzle.

The script reads a config file with the box dimensions and generates a DXF file and an OpenSCAD model (written in SPL language).

Source: <http://www.thingiverse.com/thing:1541>

# FreeCAD script for parametric project enclosures



The screenshot shows a GitHub Gist page with the title "gist: 1361643". The description is "FreeCAD script for generating parametric project enclosures". The public clone URL is <git://gist.github.com/1361643.git>. Below the description, there are buttons for "download", "fork", and "star". The file name is "ProjectEnclosure.py". The code is as follows:

```
1  from __future__ import division # allows floating point division from integers
2  from FreeCAD import Base
3  import Part
4  import math
5
6  # Run this macro to create a generic project enclosure box
7  # You can change all the parameters by selecting the object in the tree view and tweaking values in the "Data" tab
8
9  # Possible additions/improvements
10 #   counterbore bridging .4mm
11 #   screwpost corner ribbing on/off
12 #   screwpost edgeNormal ribbing on/off
13 # lid:
14 #   make lid lip more like a border?
15 #   alternatively inset lid in body, have tabs to make it grabbable
16
17 # rewrite to accept any polygon (not just rectangles) for box shape, when viewed from top.
18 # tabbed enclosures? (ex http://www.amazon.com/Electronics-Enclosure-Plastic-Project-Tabs/dp/B003EAHOYS)
19 # extra standoffs for boards?
20
21 # sanity checks:
22 #   SideRadius < width / 2 and < length / 2
23 #   ScrewpostInset > ScrewpostOD / 2?
24
25 class BoxEnclosure:
26     def __init__(self, obj,
27                  OuterWidth=100, OuterLength=150, OuterHeight=50, Thickness=3,
```

---

FreeCAD script for generating parametric project enclosures.

Source: <https://gist.github.com/1361643>

# Parametric Project Enclosures (FreeCAD)

a MakerBot Industries website

# THINGIVERSE

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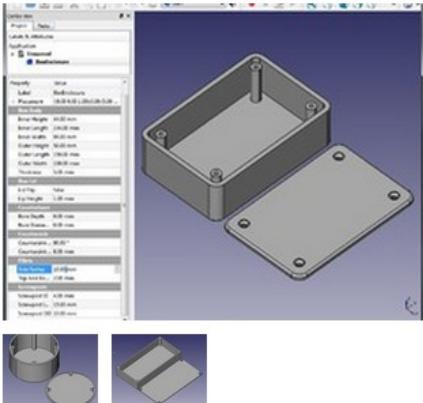
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SEARCH

Digital designs for real, physical objects. A Universe of Things!

UPLOAD A THING

This thing is a Work in Progress. Expect the files and instructions for this thing to change.



## Parametric Project Enclosures

Created by [thehans](#)

Created on Nov 16, 2011

This is a Python script for FreeCAD which generates parametric project enclosure boxes. All the dimensions and various other features of the box are completely configurable.

Source also available on gist: [gist.github.com/1361643](https://gist.github.com/1361643)

[Tweet](#) 2   [Like](#) 0   [Pin it](#)   [submit](#)

### Downloads

 [ProjectEnclosure.py](#)  
12 kb / 159 downloads / 6 months ago

### Instructions

Save the ProjectEnclosure.py file to your FreeCAD macros directory.

From the FreeCAD interface, you can use the "Tools -> Macros..." menu to view or change your macro directory. Once the macro is in place, you can execute the macro

### Latest From The Thingiverse Blog

**You Know You're Onto Something...**  
...when you're having

This is a Python script for FreeCAD which generates parametric project enclosure boxes. All the dimensions are completely configurable.

Source: <http://www.thingiverse.com/thing:13655>

# Box-o-tron 1.0 (Python box creator)

a MakerBot Industries website

# THINGIVERSE

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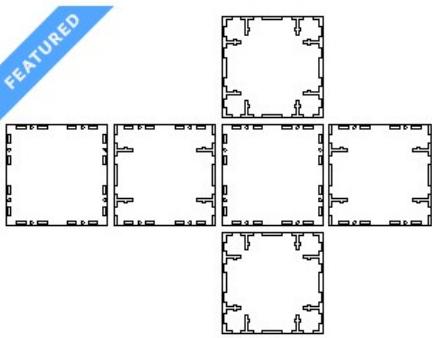
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**FEATURED**



**Box-o-tron 1.0**

Created by [zignig](#)

Created on Mar 29, 2009

Featured on Mar 29, 2009

Box-o-tron 1.0

Python box creator

Now with extra Awesome. boxotron now includes, command line interface and stored config files.

Does tab and slot and "Cupcake" style T joins  
Usage: `boxotron.py [options]`

Options:

- h, --help show this help message and exit
- l LENGTH, --length=LENGTH  
Length of box in mm
- w WIDTH, --width=WIDTH  
width of box in mm
- d DEPTH, --depth=DEPTH  
depth of box in mm
- t THICKNESS, --thickness=THICKNESS  
thickness of material in mm

CLEARANCE   CLEARANCE

Includes, command line interface and stored config files. Does tab and slot and "Cupcake" style T joins.

Source: <http://www.thingiverse.com/thing:404>

# Box generator (Processing box creator)

## Traces of Touch

### Box generator

with 12 comments

For my final outcome I'm going to be in the need of a whole bunch of small boxes in different sizes. Normally I would attack this with Sketchup and draw each of them out but since I might need 10+ boxes that would take too much time. So I sat down and wrote together an application that I have been thinking of doing for 1,5 years. A box generator that creates all the tabs with the correct material thickness and so on. If you want to try it out it can be found at [here](#). Be aware though that it hasn't been tested in real life yet with a laser but as it is now it seems to fit when putting the pieces together in Illustrator...

\* Update\* I have now cut 10+ boxes and it works nicely with different kinds of material and sizes. I need to add a press fit option but that will be a later addon. Now I will just stick to superglue and woodglue.



A box generator that creates all the tabs with the correct material thickness and so on.

Source: <http://tracesoftouch.wordpress.com/2010/08/21/box-generator/>

# Boxmaker (Java box creator)

The screenshot shows the GitHub repository page for 'rahulbot / boxmaker'. At the top, there's a search bar, navigation links for Explore, Gist, Blog, Help, and a user profile for 'openp2pdesign'. Below the header, the repository name 'rahulbot / boxmaker' is displayed with a smiling emoji. To the right are buttons for Unwatch, Fork, Issues (0), and Graphs. A banner message reads: 'The engine underneath http://boxmaker.rahulbotics.com/. Give us dimensions, and we'll generate a PDF you can use to cut a notched box on a laser-cutter. — [Read more](#)' followed by the URL 'http://boxmaker.rahulbotics.com'. Below the banner are download links for 'Clone in Mac', 'ZIP', 'HTTP', and 'Git Read-Only' (with the URL 'https://github.com/rahulbot/boxmaker.git'). There's also a 'Read-Only access' button. The main content area shows a dropdown for the 'branch: master' (selected) and tabs for 'Files' (selected), 'Commits', 'Branches (1)', 'Tags', and 'Downloads (1)'. A commit message from 'rahulbot' dated 8 months ago says 'ignore rendered pdfs in the main directory'. Below this is a table titled 'boxmaker /' showing file commits:

name	age	message	history
bin	8 months ago	ignore generated compilation files [rahulbot]	
doc	8 months ago	ignore generated documentation [rahulbot]	
examples	8 months ago	first checkin of command line version of BoxMaker for github [rahulbot]	

BoxMaker is a simple little Java application that can generate the outlines for a box to be out of some material with a cutting device.

Source: <https://github.com/rahulbot/boxmaker>

# Boxmaker: available also online

The screenshot shows the BoxMaker interface. On the left, there's a sidebar with a video player showing a laser cutter in action, a message about viewing Flickr photos, and a navigation bar with small thumbnail images. The main area has a yellow background with orange text for dimensions. It includes fields for Units (inches), Width (4), Height (5), Depth (6), and Material Thickness (0.1875). To the right of each dimension is a descriptive text block. Below the input fields is a link to [ADVANCED OPTIONS] and a "Design it!" button.

UNITS

WIDTH **4**

HEIGHT **5**

DEPTH **6**

MATERIAL THICKNESS **0.1875**

The width you'd like your box to be (outer dimension).

The height you'd like your box to be (outer dimension).

The depth you'd like your box to be (outer dimension).

The thickness of the material. This is needed in order to properly size the notches.

[ ADVANCED OPTIONS ]

Design it!

Give us dimensions, and we'll generate a PDF you can use to cut a notched box on a laser-cutter.

Source: <http://boxmaker.rahulbotics.com/>

# Another online box generator...

The screenshot shows a web-based application for generating wooden box templates. On the left, a sidebar has a bird icon at the top, followed by a 'HOME' button, a 'Design your own box template!' button with a person icon, and two links: 'Design your Box' (with registration requirements) and 'Fingerbox' (free to use). Below that are links for 'Paperbox-1' and 'Paperbox-2', both free to use. At the bottom is a 'ZURÜCK' button. The main area on the right displays a red dashed line pattern representing a box template. At the bottom, there are input fields for 'Boxwidth: 10 fingers x 10 mm', 'Boxdepth: 5 fingers x 10 mm', 'Boxheight: 5 fingers x 10 mm', and 'Thickness: 3 mm'. A 'Download as SVG' button and a help icon are also present.

Boxwidth: 10 fingers x 10 mm   Boxdepth: 5 fingers x 10 mm   Boxheight: 5 fingers x 10 mm

Thickness: 3 mm   Download as SVG ?

Design your own box template!

# 123D Make



Transform 3D models into a pattern for assembling real artful creations.

Source: <http://www.123dapp.com/make>  
<http://youtu.be/jo5TxtKLmjM>



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05.

**Exercise:**

**create a 10x10x5 cm. Perfect snap-fit box (mdf or playwood).**

**Document it on GitHub, I will create  
the repository for you.**

# A”

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Media Factory

# Thank you!!

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<http://www.slideshare.net/openp2pdesign>