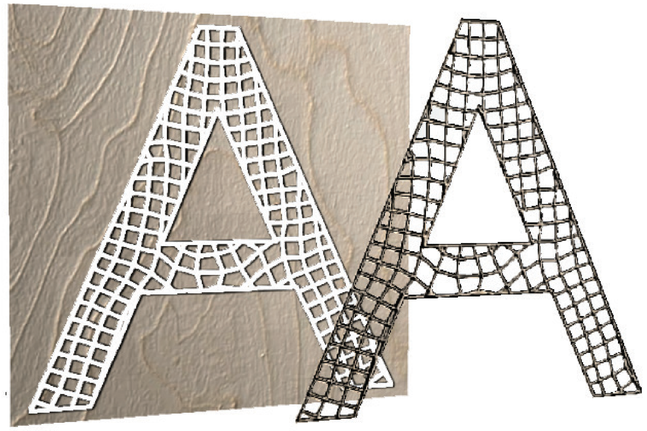
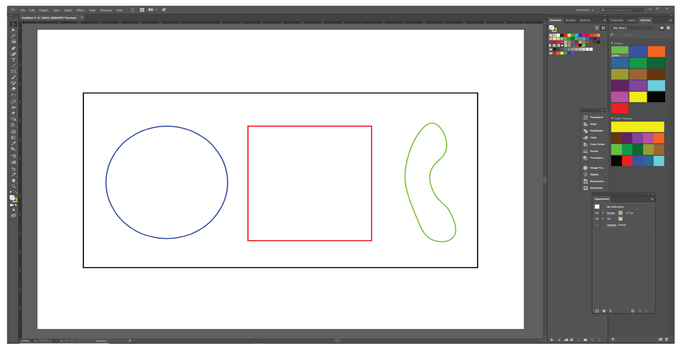
What You See Is What You Cut: Example-Based Print Preview for Laser Cutting

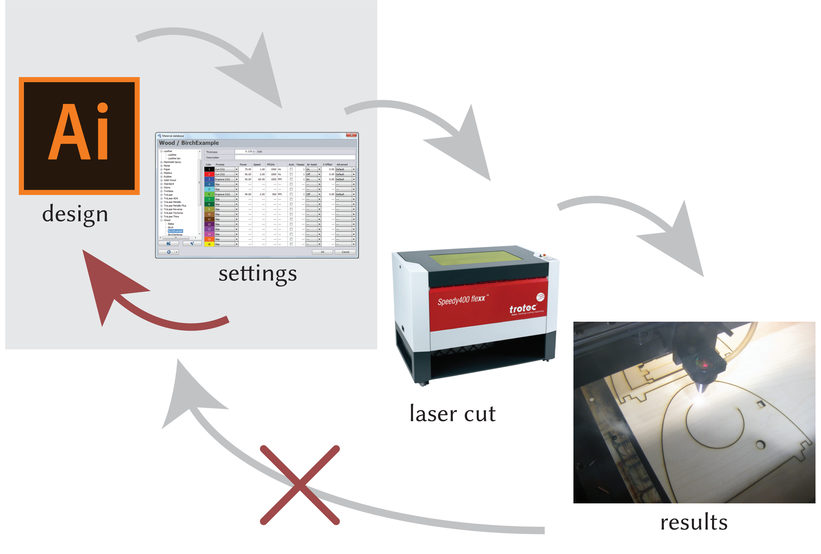
SARAH KUSHNER, ALEC JACOBSON
sak@cs.toronto.edu *jacobson@cs.toronto.edu*



Problem
Laser cutting is unintuitive.
How can we aid users in designing and cutting?



Let's tighten the design loop.



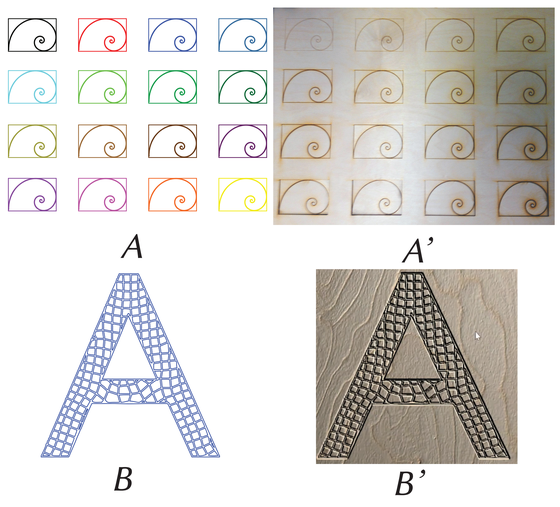
Method
A new system will help the user visualize what their cut will look like, along with the errors or unexpected effects their design or settings might give.

Calibration
Finding a design to cover the space of possible visual effects

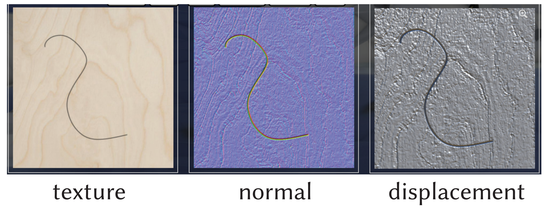
Drawing & Preview
2D & 3D Effects

- Image analogies for texture map

$A : A' :: B : B'$

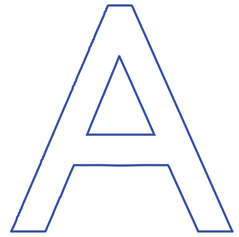


- Texture map inform normal and displacement map



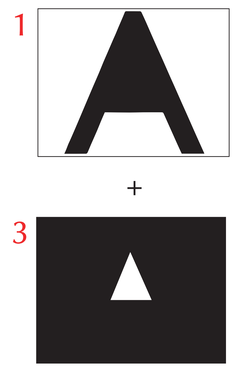
- Lighting changes as mouse moves, showing a 3D preview of the cuts

Explode View
Sometimes a design which cuts pieces of material out leaves unwanted or hard to point out artifacts.



We flood-fill starting from the top left corner of the design image, alternating black and white.

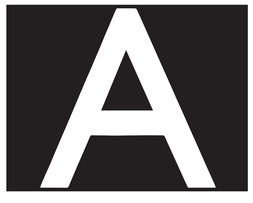
These components of the image are effectively ordered as a graph their graph distance from the background of the design image.

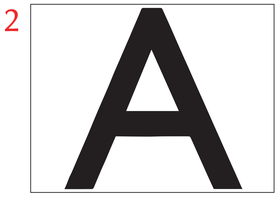


We go until the design image is fully black or fully white (all the pixels are RGB = (0, 0, 0) or RGB = (255, 255, 255)).

Then we add all the odd distance images together and all the even distance images together to get two layers.

They become alpha maps in the 3D view.


odd components



even component(s)

Parameters
- Goal: sliders to control visual aspects of design which will generate more concrete laser cutter settings
  - power (Watts)
  - frequency (Hz/PPI)
  - speed (m/s)
  - # of passes
  - z-offset

Future Work
- Vector graphics optimization
  - removing invisible and repetitive lines in the design
  - in turn, making fewer cuts and saving time
- Material optimization
  - nesting and squeezing cuts and curves into a smaller amount of space

dgp Dynamic Graphics Project
University of Toronto
www.dgp.toronto.edu
Computer Science
UNIVERSITY OF TORONTO
NSERC CRSNG