



# Peter Jansen, PhD CV and Graphical Portfolio

PhD (Neural Computation and Cognitive Language Modeling), McMaster University  
BIS (Physics and Cognitive Artificial Intelligence), University of Waterloo



[pajansen@email.arizona.edu](mailto:pajansen@email.arizona.edu) // <http://cogsci.mcmaster.ca/~peter>

# Peter Alexander Jansen, PhD

---

Natural Language Processing Lab  
School of Information: Science, Technology, & Arts (SISTA)  
University of Arizona, Tucson, AZ

<http://cogsci.mcmaster.ca/~peter/>  
<http://tricorderproject.org/aboutpeter/>  
[pajansen@email.arizona.edu](mailto:pajansen@email.arizona.edu)

## Research Interests

**Self-organizing neural network models of concept, word, and grammar acquisition**

**Knowledge representation / Ontological engineering (developmentally inspired)**

**Computational linguistics and natural language processing**

**Artificial intelligence and Cognitive Robotics**

**Distributed computing**

**Tabula rasa learning**

**Cognitive science**

## Teaching Interests

**Computational models of cognitive processes**

**Computational linguistics**

**Artificial intelligence**

**Knowledge representation**

**Distributed computing**

**Cognitive science**

## Education

**Ph.D. (Neural Computation and Cognitive Language Modeling)** December 2010

Cognitive Science Laboratory, Department of Psychology, Neuroscience, and Behavior  
McMaster University, Hamilton, Ontario, Canada

Committee: Scott Watter (supervisor, Psychology), Karin Humphreys (Psychology),  
Lee Brooks (Psychology), Alex Sévigny (Communication and Media Studies)

Topics: Self-organizing neural network models, self-organizing models of grammar  
acquisition, knowledge representation, abstract and concrete grounded representations of  
concepts, representational grounding, cognitive modeling, signal processing.

Thesis title: A self-organizing computational neural network architecture with applications to  
sensorimotor grounded linguistic grammar acquisition.

**B.I.S. (Physics and Cognitive Artificial Intelligence)**

August 2005

Independent Studies, Option in Cognitive Science

University of Waterloo, Waterloo, Ontario, Canada

Supervisors: Chrysanne DiMarco (Computer Science), Paul Thagard (Philosophy/Computer  
Science)

Topics: Knowledge Representation, Computational Linguistics, Cognitive Architecture,  
Cognitive Artificial Intelligence, Children's Thinking, Astrophysics, Optics

Thesis title: Developmental knowledge representation: A proposal for the representational  
Substrate

## Professional Appointments

### **Postdoctoral Research Fellow**

Mar/2013 – Current

Natural Language Processing Lab, School of Information: Science, Technology, and Arts  
University of Arizona, Tucson, Arizona, USA

Supervisor: Mihai Surdeanu (School of Information)

Topics: Knowledge representation and natural language processing for non-factoid question answering tasks.

### **Senior Artificial Intelligence Engineer**

May/2012 – Feb/2013

Industrial Research Postdoctoral Fellowship

Scanadu Inc., NASA Ames Research Park, Moffett Field, California, USA

Topics: Knowledge representation and natural language processing (applied to automated medical diagnosis). Signal processing/algorithm development. Embedded hardware design.

### **Postdoctoral Research Fellow**

Dec/2010 – May/2012

Lab for Engineering Non-Traditional Sensors (LENS), Department of Electrical Engineering

University of Arizona, Tucson, Arizona, USA

Supervisor: Michael Gehm (Electrical Engineering / Optical Sciences)

Topics: Artificial Intelligence/Machine Learning and sequential Bayesian techniques for adaptive classification (applied to spectroscopy). High performance parallel distributed computing (applied to the DARPA MOSAIC/AWARE 10-gigapixel camera project).

## Refereed Publications

Golish, D., Vera, E., Kelly, K., Gong, Q., Jansen, P., Hughes, J., Kittle, D., Brady, D., and Gehm, M. (2012). Development of a scalable image formation pipeline for multiscale gigapixel photography. *Optics Express*, 20, 22048-22062.

Jansen, P., and Watter, S. (2012). Strong systematicity through sensorimotor conceptual grounding: an unsupervised, developmental approach to connectionist sentence processing. *Connection Science*, 24, 25-55.

Jansen, P., Fiacconi, C., and Gibson, L. (2010). A computational vector-map model of neonate saccades: Modulating the externality effect through refraction periods. *Vision Research*, 50, 2551-2558.

Jansen, P., and Watter, S. (2008). SayWhen: An automated method for high-accuracy speech onset detection. *Behavior Research Methods*, 40, 744-751.

[ <http://cogsci.mcmaster.ca/~peter/saywhen/> ]

Jansen, P. (2004). Lexicography in an interlingual ontology. *Canadian Undergraduate Journal of Cognitive Science*, 3, 1-5.

## Conference Proceedings

Jansen, P. A., Dunlop, M. J., Golish, D. R., and Gehm, M. E. (2012). Adaptive, feature-specific spectral imaging, *Proc. SPIE* 8365, (Proceedings of 2012 SPIE Defense Security and Sensing Symposium)

## Posters, Talks, and Conference Presentations

Jansen, P. (2012). The joy of figuring things out [science pedagogy]. Invited talk at TEDxBrussels 2012: Bits, Atoms, Neurons, Genes.

Dunlop, M., Jansen, P., Golish, D. R., Gehm, M. E. (2012). AFSSI-C: the Adaptive Feature-Specific Spectral Imaging Classifier. Talk presented at the Optics Society of America 2012: Imaging and Applied Optics meeting. Monterey, CA.

Golish, D. R., Vera, E., Kelly, K., Gong, Q., Jansen, P., Hughes, J., Kittle, D. S., Brady, D. J., and Gehm, M.E. (2012). Challenges in Gigapixel Multiscale Image Formation. Talk presented at the Optics Society of America 2012: Imaging and Applied Optics meeting. Monterey, CA.

Dunlop, M., Jansen, P.\*, Gehm, M. (2011). An adaptive, feature-specific spectral imaging

- classifier. Talk presented at the Optics Society of America 2011: Computational Optical Sensing and Imaging meeting (COSI). Toronto, ON.
- Rodriguez, I., Jansen, P., Dinakarababu, D., Gehm, M. (2011). Information optimal adaptive feature-specific spectroscopy for rapid chemical classification. Talk presented at the Optics Society of America 2011: Computational Optical Sensing and Imaging meeting (COSI). Toronto, ON.
- D'Angelo, M., Jansen, P., and Humphreys, K. R. (2010). Implicit learning of tip-of-the-tongue states: Assessing a Hebbian learning account. Poster presented at the 51<sup>st</sup> Annual Meeting of the Psychonomic Society. St. Louis, MO.
- Jansen, P., Watter, S., and Humphreys, K. R. (2010). Chimaera neural networks for self-organizing grammar acquisition. Talk presented at the 20<sup>th</sup> Annual Meeting of the Canadian Society for Brain, Behavior, and Cognitive Science (CSBBCS). Halifax, NS.
- Hebb Student Award (Runner up) for best paper/presentation.**
- Jansen, P., Watter, S., and Humphreys, K. R. (2009). Chimaera neural networks for self-organizing grammar acquisition. Poster presented at the 50<sup>th</sup> Annual Meeting of the Psychonomic Society. Boston, MA.
- Jansen, P. (2009). Multilayer Chimaera networks: Self-organizing neural networks for temporal sequence learning. Poster presented at the Shared Hierarchical Academic Research Computing Network (SHARCNET) Research Day 2009. Waterloo, ON.
- Jansen, P. (2008). the Tricorder project: see what can't be seen. Poster presented at the 2008 McMaster Innovation Showcase. Hamilton, ON.
- Jansen, P. (2008). Chimaera networks: Temporal self-organizing artificial neural networks for sequence learning. Poster presented at the 18th Annual Meeting of the Canadian Society for Brain, Behavior, and Cognitive Science (CSBBCS). London, ON.
- Jansen, P., Watter, S. (2008). SayWhen: An automated method for high-accuracy speech onset detection. Poster presented at the 18th Annual Meeting of the Canadian Society for Brain, Behavior, and Cognitive Science (CSBBCS). London, ON.
- Jansen, P. (2007). A PIC microcontroller cluster. Talk sponsored by the Shared Hierarchical Academic Research Computing Network (SHARCNET) High Performance Computing Day. Hamilton, ON.

## Patents

Device and method for measuring a quantity over a spatial region. US Patent Pending.

## Other Research Experience

### **Undergraduate Research Assistant** (Fall 2004)

Research Works! for Child Literacy, University of Waterloo

Supervisor: Kathleen Bloom (Psychology)

Project: Developing a model correlating early childhood literacy to later economic gain

## Grants and Awards

### **Hebb Student Award (Runner up) for best paper** (2010)

National award for the talk "Chimaera neural networks for self-organizing grammar acquisition" 20<sup>th</sup> Annual Meeting of the Canadian Society for Brain, Behavior, and Cognitive Science (CSBBCS).

### **Xerox Centre for Engineering Entrepreneurship and Innovation Seed Grant** (2009)

Research and Development funding for the Tricorder Project

Awarded Value: \$12,000

### **Ontario Graduate Scholarship** (2009-2010 Academic year)

Recipient of Dr. Ronald V. Joyce Award in Science

Awarded Value: \$15,000

### **McMaster University Psychology Graduate Scholarship** (2005-2009 Academic years)

Awarded Value: \$10,000 per annum

## Teaching Experience

### **Lecturer**

Linguistics 4D03: Computers and Linguistic Analysis (2008)

Description: A fourth-year, project-based computational linguistics course focused on linguistic processing, including an introduction to finite state automations, parsers, and machine translation.

[ <http://cogsci.mcmaster.ca/~peter/ling4d03/> ]

### **Professional Development**

Introduction to programming for graduate students. 3-Session Hands-on Workshop designed and delivered at McMaster University to 30 participants.

[ <http://cogsci.mcmaster.ca/~peter/presentation> ]

### **Teaching Assistant**

Courses: Psychology of Language, Behavioral Neuroscience, Fundamentals of Neuroscience, Child Development, Human Learning and Cognition, Perception Lab, Sensory Processes.

## Professional Development

Attendee, SHARCNET High Performance Computing Summer School (2007)

Topic: Cluster programming with MPI

Attendee, Center for Leadership in Learning six-week mini-course (2006)

Topic: Making Effective Presentations – Lecturing

## Community Involvement and Outreach

**The Tricorder Project** (2009-Present, volunteer/extra-curricular)

Extra-curricular and volunteer science pedagogy work aimed at grounding science education, particularly for children. Developed novel handheld instruments capable of visualizing a variety of atmospheric, electromagnetic, and spatial phenomena. Received widespread coverage in international news media including Reuters, Forbes, Wired, MSNBC, PBS, and the Washington Post.

[ <http://www.tricorderproject.org> ]

## Selected Areas of Technical Expertise

### **Programming Languages**

Postdoc: Centrally MATLAB (including distributed MATLAB), C (gcc) with MPI, embedded C

PhD: Centrally C (gcc) with MPI under linux for neural network simulations, MATLAB for signal processing of speech signals, and some Visual C++.

Teaching with Prolog.

Undergraduate: C/C++, Java, LISP, 68k assembler.

Other/Personal: some 68k/picoblaze assembly, verilog, and perl, significant embedded C.

### **Cluster/Distributed Computing APIs**

MPI / OpenMPI (hundreds of cores). Research experience in massively parallel implementations of neural networks, distributed image processing, as well as data-parallel computation in general. Some explorations into GPU-based (CUDA) and IBM cell computing.

### **Environments/Tools:**

Linux, Windows, KDevelop, Visual Studio C++, Microchip MPLAB, MATLAB, Adobe Illustrator, Google Sketchup, Processing

### **Other**

3D printing/RepRap project, optical spectroscopy, some medical/tomographic imaging



my science pedagogy work has been  
featured internationally in...

Reuters  
Wired  
Forbes  
MSNBC  
PBS  
The Washington Post  
Engadget  
TechCrunch

...and many others!



TEDxBrussels 2012 : Bits, Atoms, Neurons & Genes

# my PhD in neural computation works to make computers learn language like babies do...

specialized research-oriented undergrad in  
astro and optical physics  
cognitive artificial intelligence  
official cognitive science option

phd in neural computation  
my thesis uses a 1546 CPU supercomputer to help computers  
learn language like babies do

independent research projects in  
sensor fusion  
data visualization  
signal processing

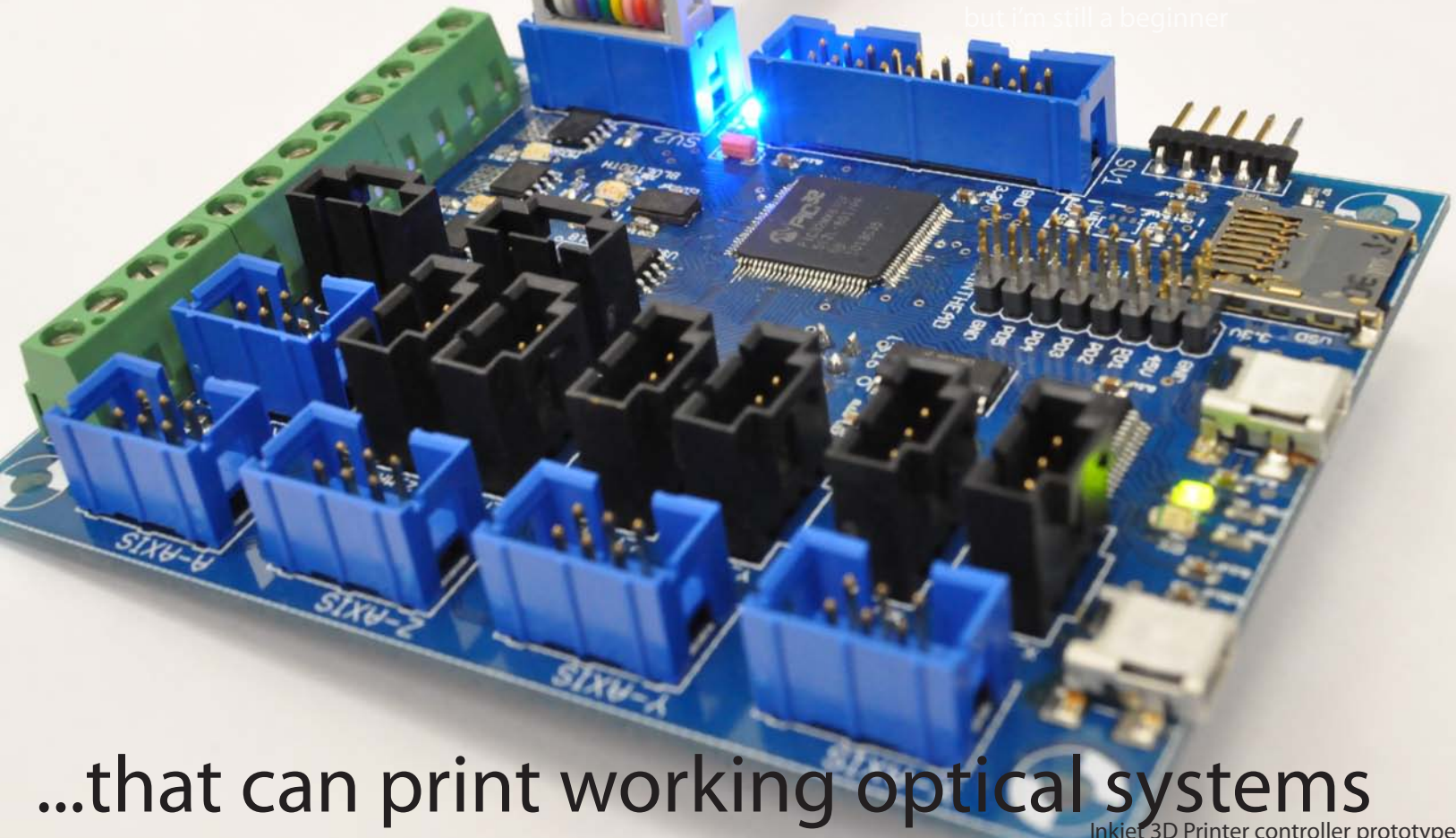
spin-off company to market tricorder research

taught  
fourth year computational linguistics  
independent workshops to learn programming for grad students



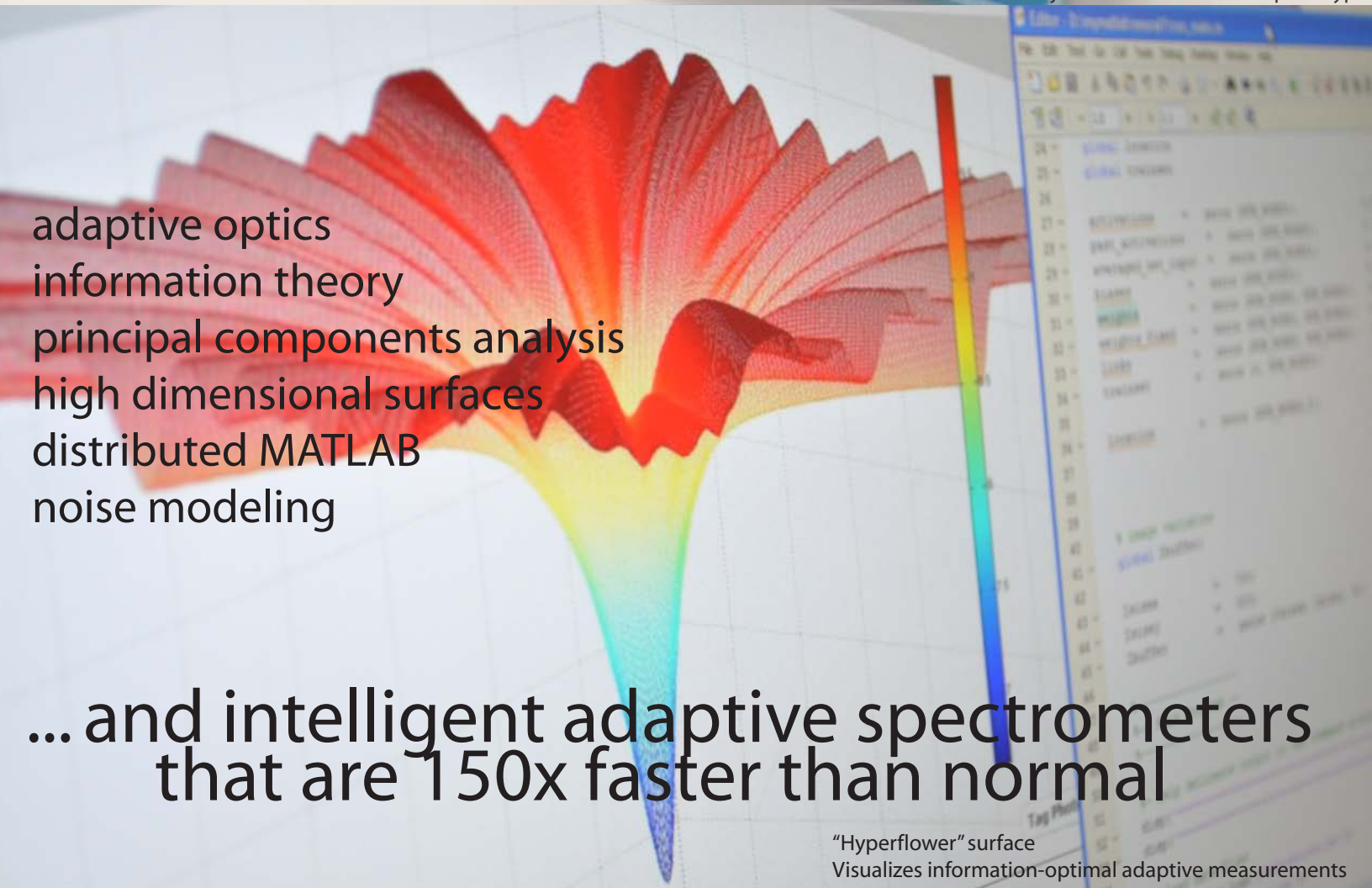
my postdoc works to create 3D printers...

but i'm still a beginner



Inkjet 3D Printer controller prototype

...that can print working optical systems

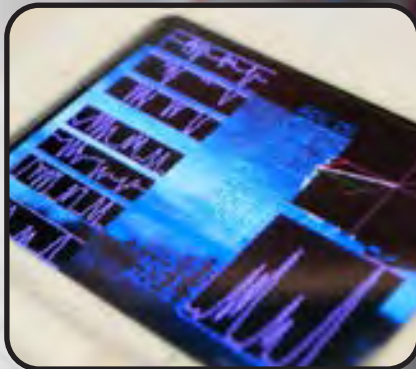


adaptive optics  
information theory  
principal components analysis  
high dimensional surfaces  
distributed MATLAB  
noise modeling

...and intelligent adaptive spectrometers  
that are 150x faster than normal

"Hyperflower" surface  
Visualizes information-optimal adaptive measurements





Debian Linux | ARM920T Core | Dual Organic LED touchscreens  
32MB SDRAM | USB (host/device) | microSD | SPI sensor board | dsPIC microcontroller

i design and build tricorders... (for real)  
<http://www.tricorderproject.org>  
open source hardware

like from star trek

atmospheric, electromagnetic, and spatial sensor suites



dsPIC prototype | colour display | SED1375  
cirque touchpad | sensor visualizations



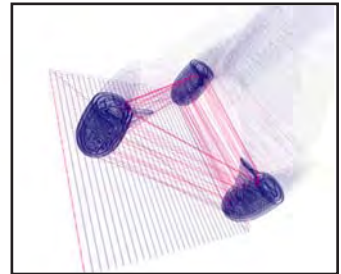
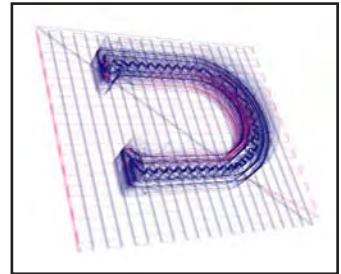
# i believe that interfaces should include intuitive visualizations...

things should be easy, and just make sense.

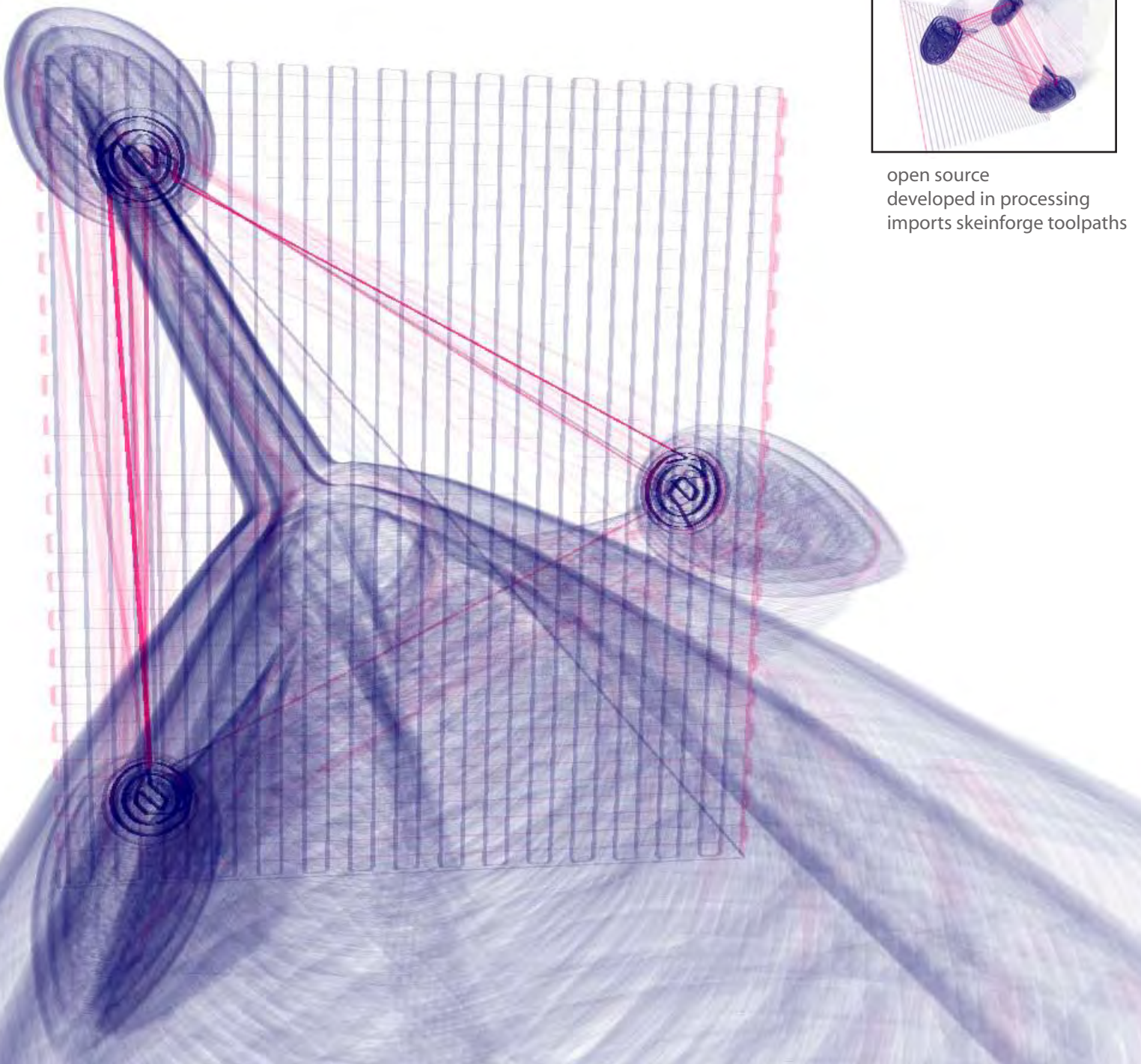
gcode visualization tool

for all things in science, I strive to create particularly good or intuitive ways to both talk about them, teach them, and visualize them

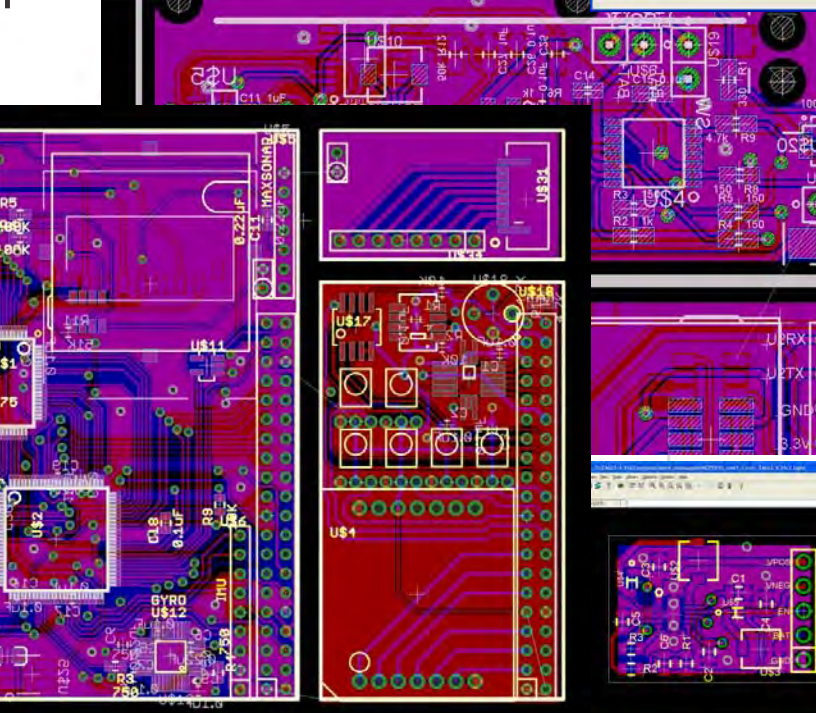
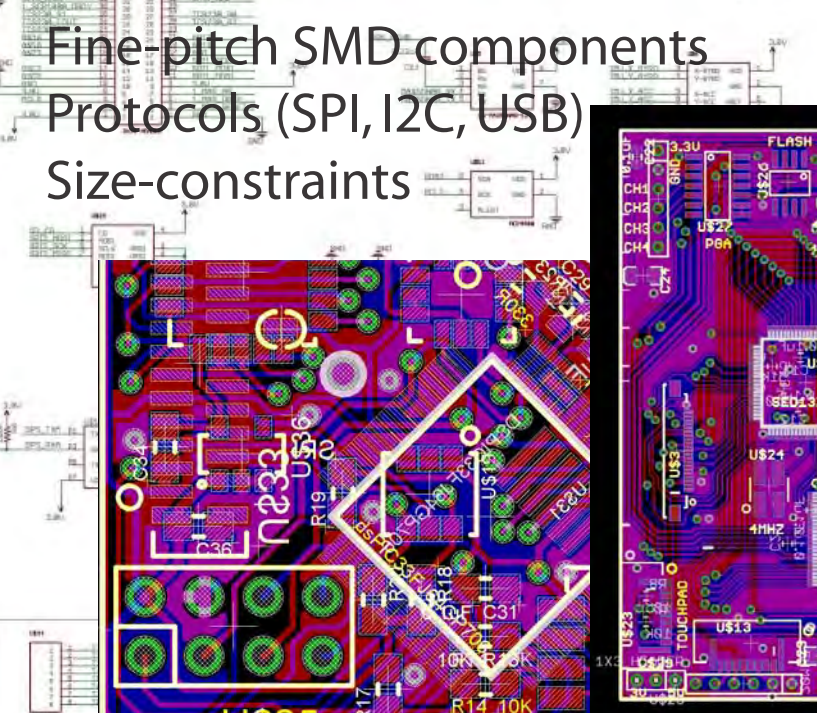
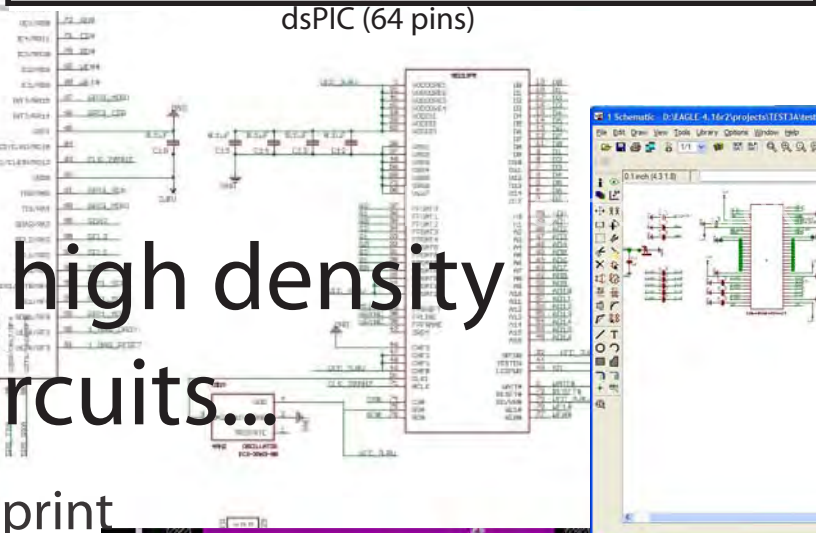
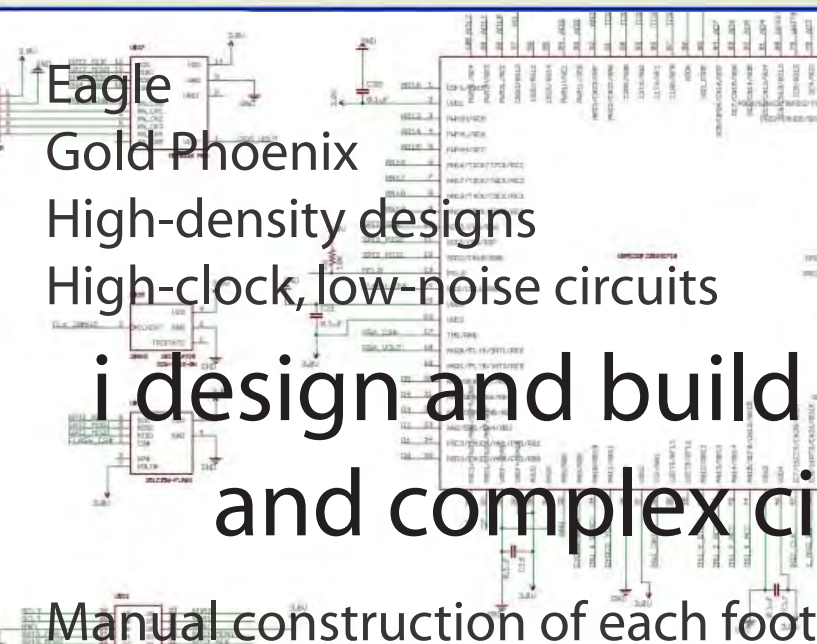
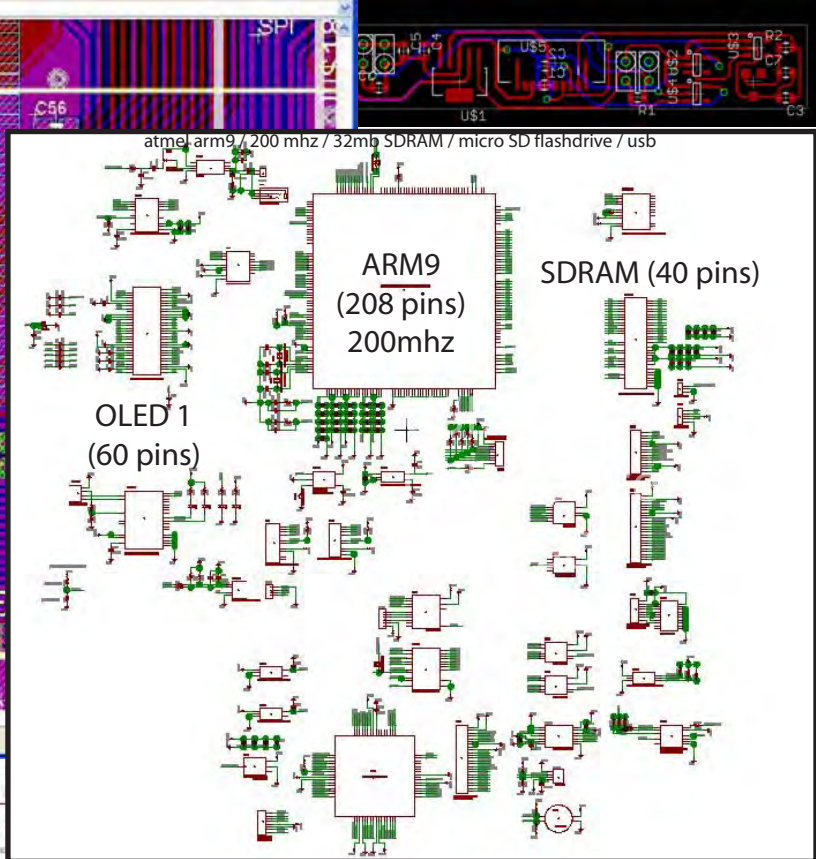
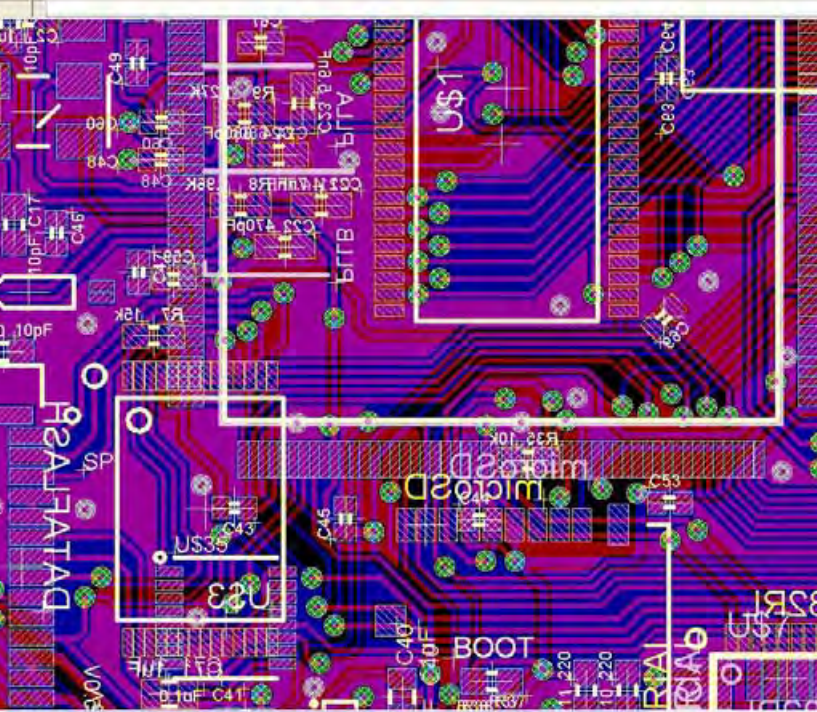
because, when you develop new tools, and new methods of visualizing a problem, you help nurture a deep understanding and incubate future development



open source  
developed in processing  
imports skeinforge toolpaths







Eagle  
Gold Phoenix  
High-density designs  
High-clock, low-noise circuits

i design and build high density  
and complex circuits...

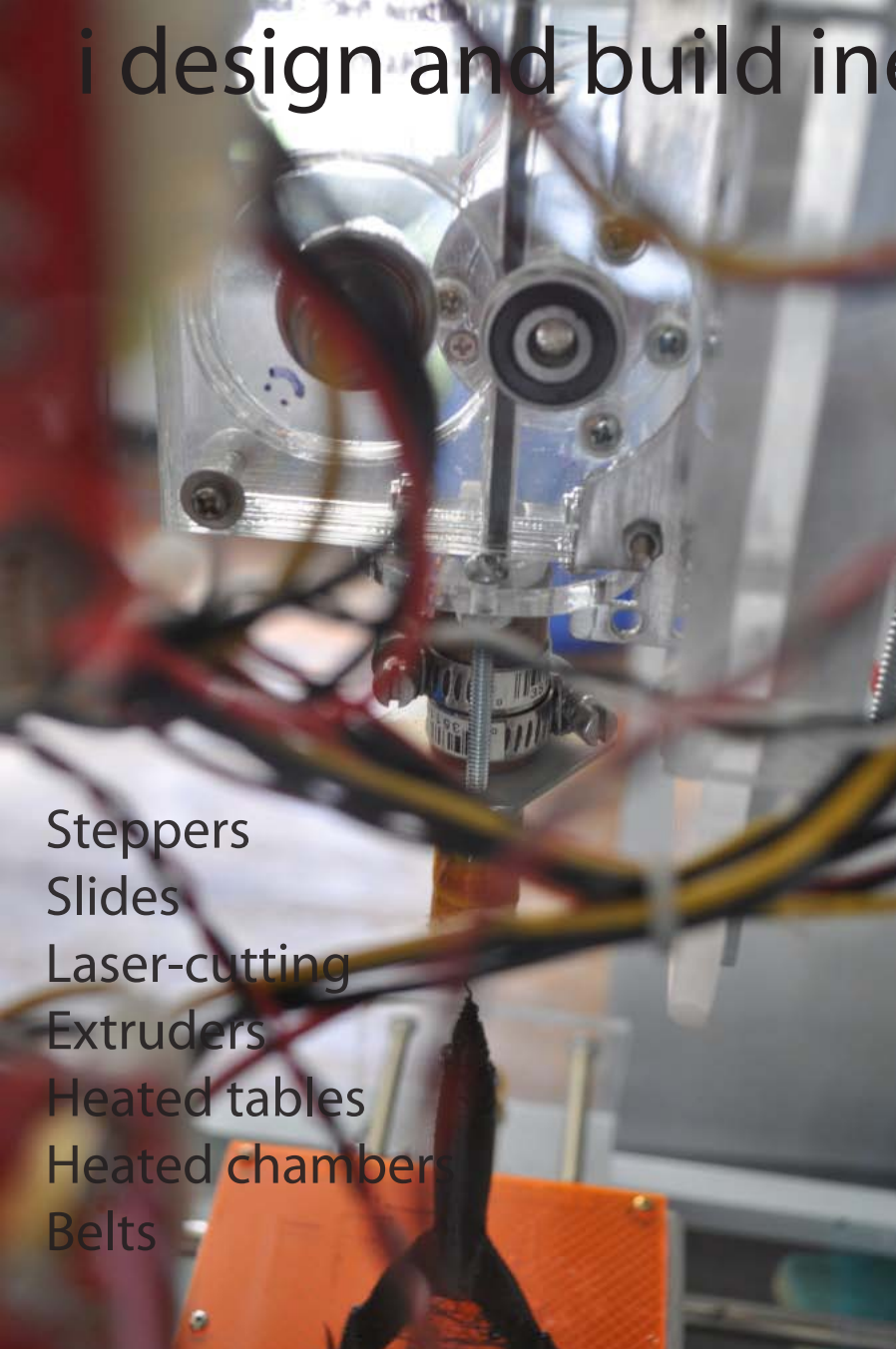
Manual construction of each footprint  
Fine-pitch SMD components  
Protocols (SPI, I2C, USB)  
Size-constraints



# i design and build inexpensive

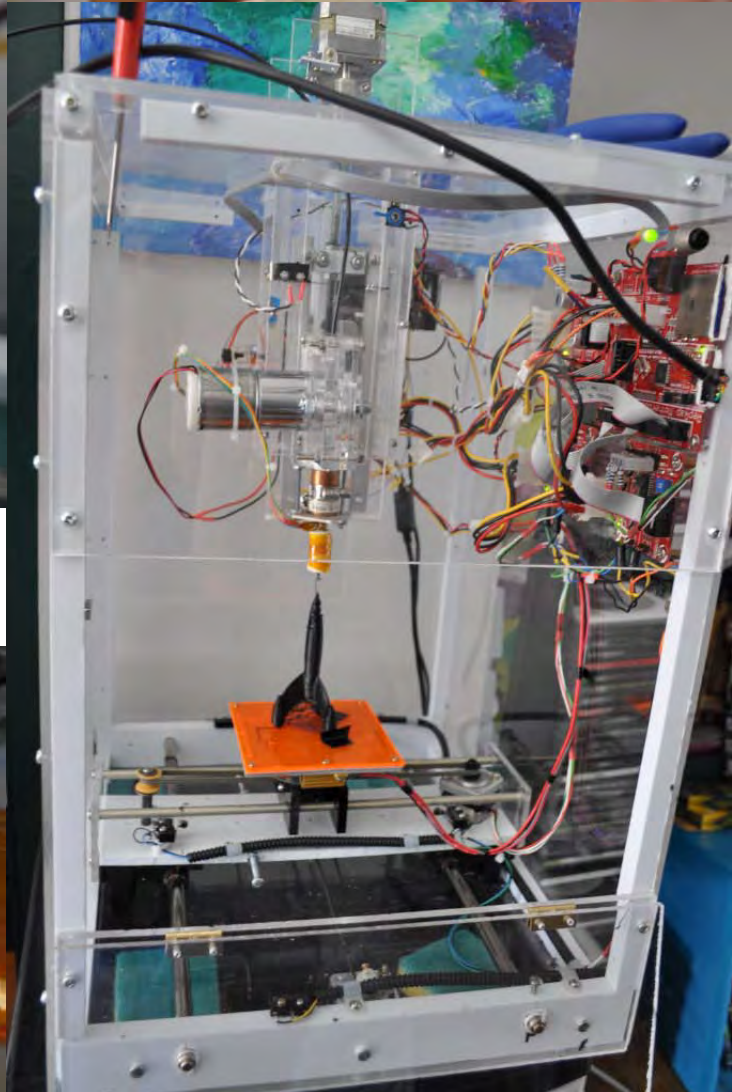
with my dad... we bond...

## 3D printers...

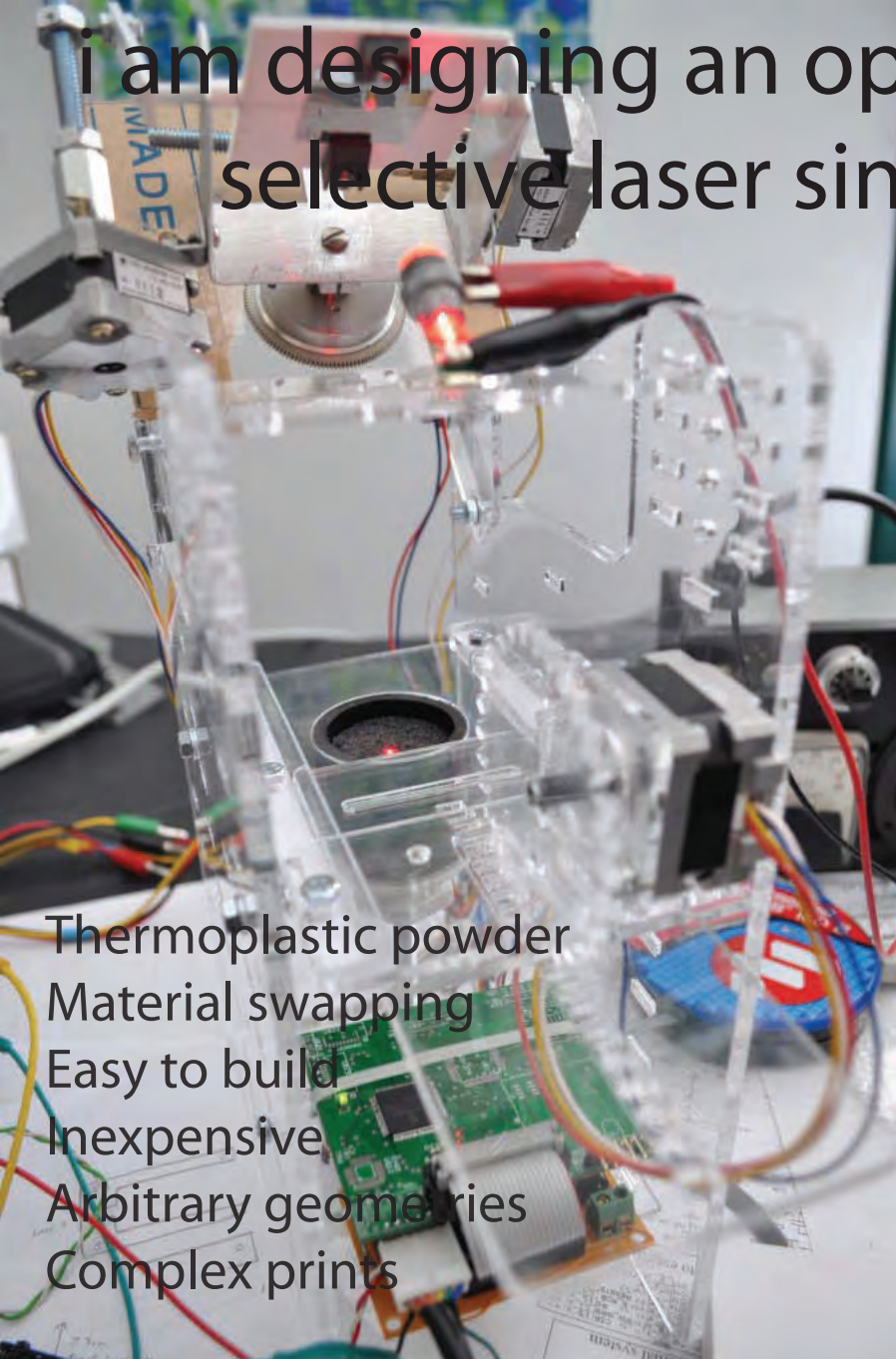


Steppers  
Slides  
Laser-cutting  
Extruders  
Heated tables  
Heated chambers  
Belts

CNC Mill Printer (our first printer)  
Acrylic Makerbot Clone printer with heated table and chamber  
Simple pinch wheel extruder design







# i am designing an open source selective laser sintering 3d printer...

it's kind of my obsession.

re-inventing the design process  
for devices that can make copies of themselves

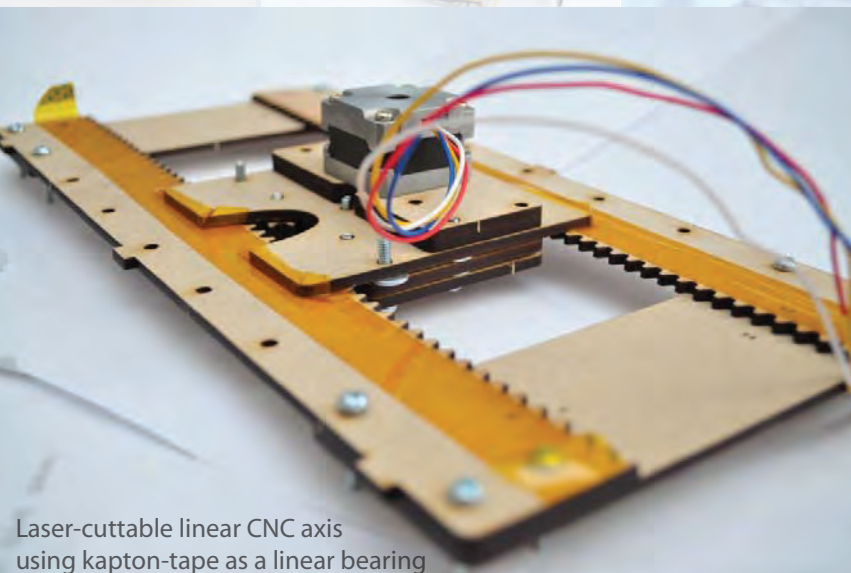
my open 3d printer design returns to basics,  
developing innovative and self-replicating  
methods of computer controlled motion

using only a handful of nuts and bolts as vitamins,  
the design is extremely inexpensive

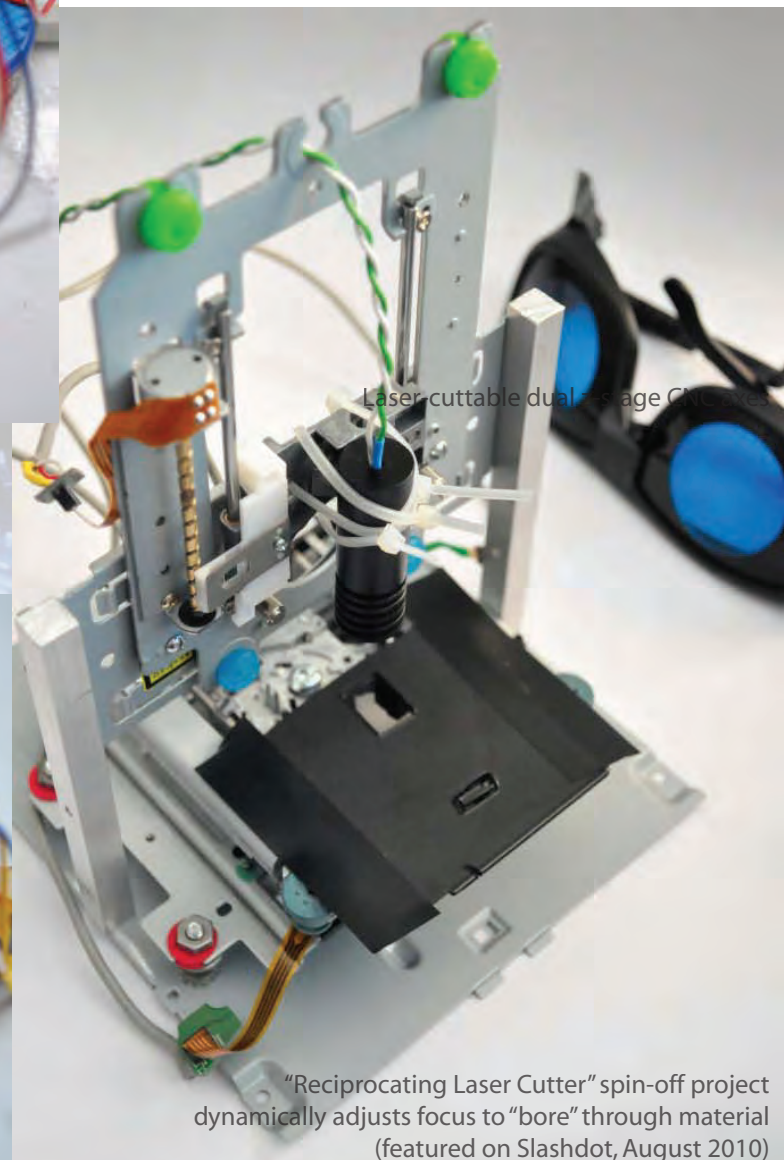
consisting of a 1W IR laser diode,  
almost entirely laser cut x / y / z1 / z2 axes designs,  
separate feed and build chambers,  
and extremely inexpensive stepper motors

Thermoplastic powder  
Material swapping  
Easy to build  
Inexpensive  
Arbitrary geometries  
Complex prints

aiming for a \$200 printer  
supporting arbitrary geometries with complex overhangs  
very low vitamins — almost entirely laser cut acrylic  
hybrid design, with dual-use for very thin laser cutting (slowly)



Laser-cuttable linear CNC axis  
using kapton-tape as a linear bearing



Laser-cuttable dual-stage CNC

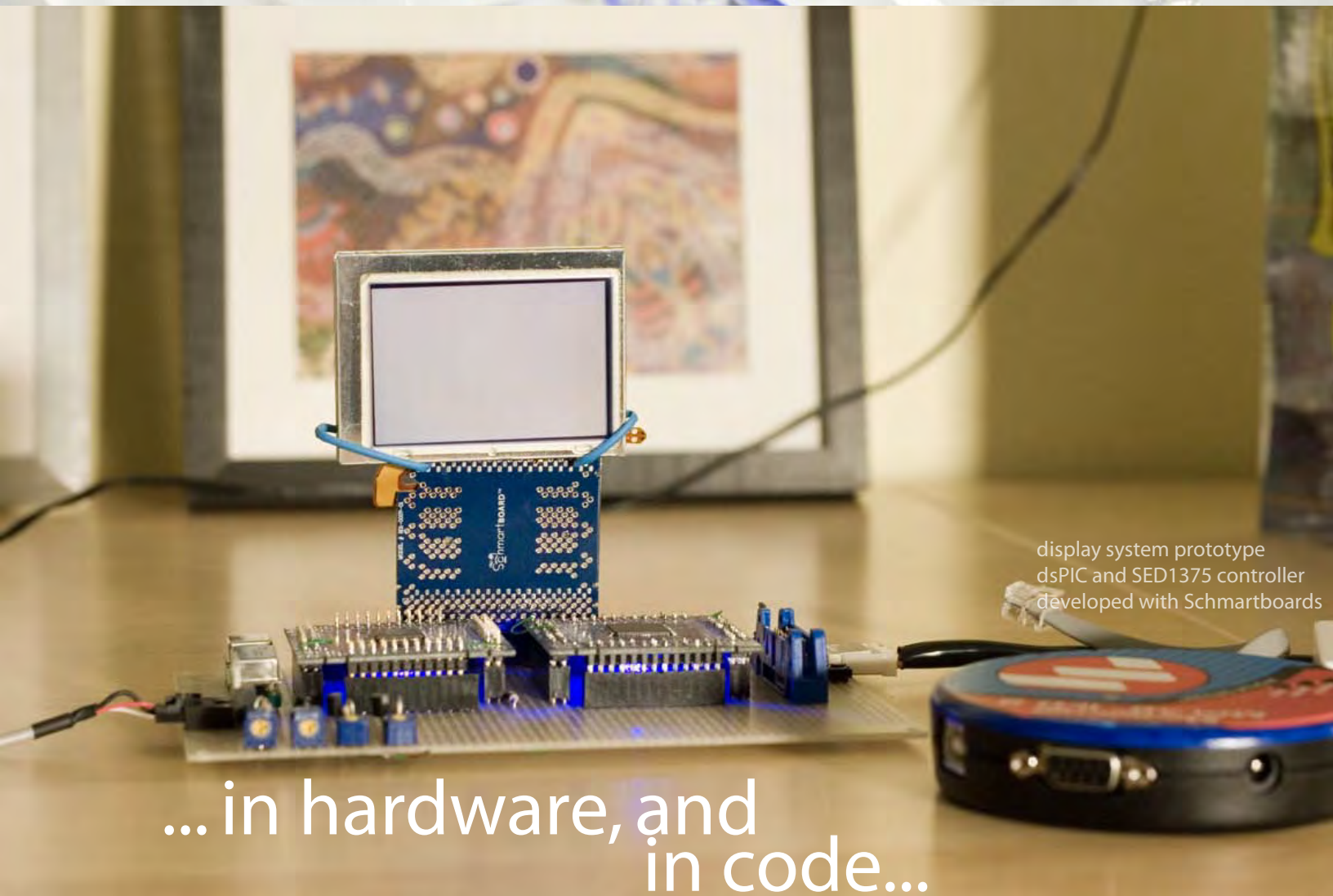
"Reciprocating Laser Cutter" spin-off project  
dynamically adjusts focus to "bore" through material  
(featured on Slashdot, August 2010)



i sketch in plastic...



chess set  
laser cut acrylic  
developed in one afternoon



display system prototype  
dsPIC and SED1375 controller  
developed with Schmartboards

...in hardware, and  
in code...

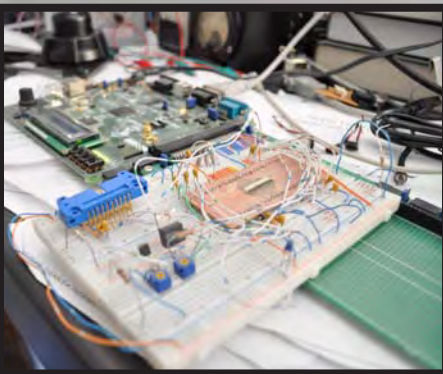


# i believe FPGAs are really cool...

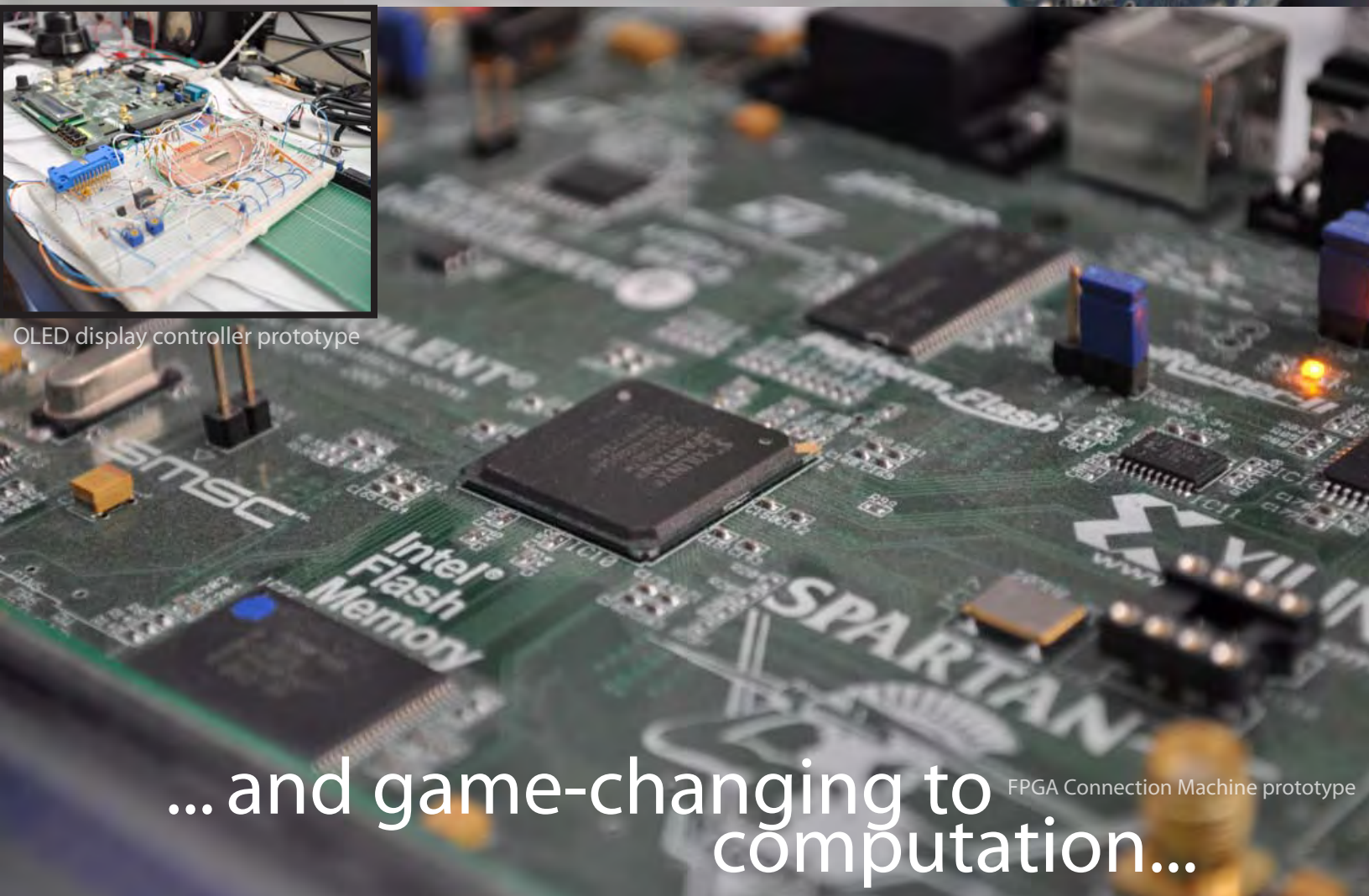
but i'm still a beginner

picoblaze soft-core processor  
single-chip massively parallel (256+ core) computation  
embedded CMOS cameras  
external display control  
verilog  
picoblaze assembly

FPGA CMOS camera prototype



OLED display controller prototype



# ...and game-changing to computation...

FPGA Connection Machine prototype



# i sometimes develop games...

karawachi (sherman3d studio)

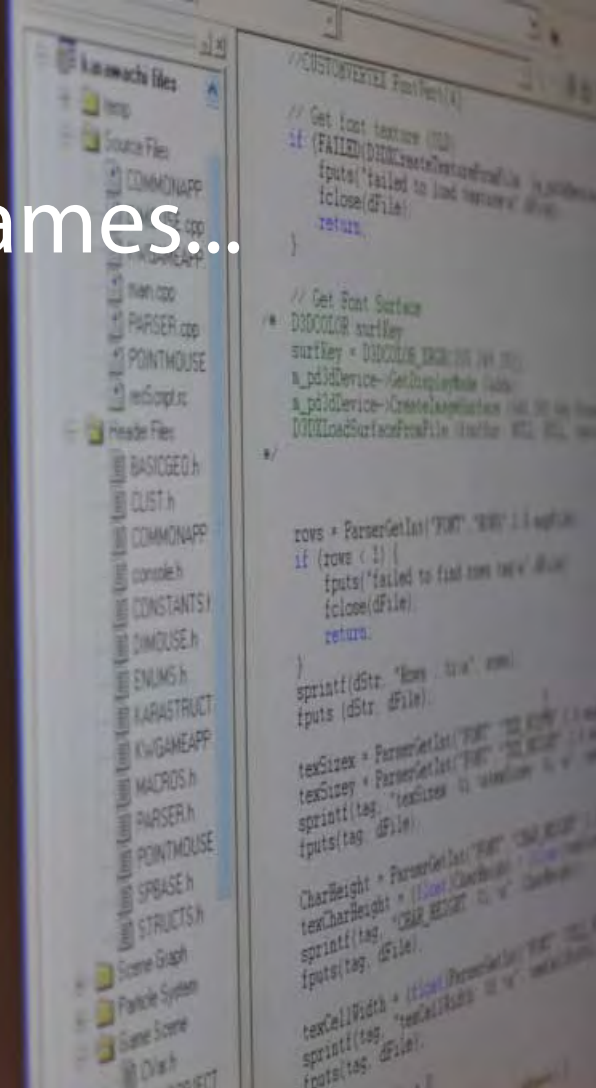
ludumdare competition

bulrushes

paramecium

visual c++

adobe illustrator



## ...and compete in the ludumdare 48-hour game competition...

B  
U  
L  
R  
U  
S  
H  
E  
S



midwinter



Bulrushes screenshot (LD13: Roads)  
Placed for graphics and innovation



Paramecium (LD10: Chain Reaction)