PAUL GAFNI

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EDUCATION:

Northwestern University, Weinberg College of Arts and Sciences · *Evanston, IL*
Bachelor of Arts in Mathematics, June 2011
Research: *Chess as a Combinatorial Game* (attached)
Kellogg School of Management Certificate Program for Undergraduates in Managerial Analytics
Departmental Honors · Magna cum laude · Dean's List
Overall GPA: 3.879

HONORS/AWARDS:

Phi Betta Kappa · Robert R. Welland Prize for Outstanding Achievement in Mathematics by a Graduating Senior · Outstanding Achievement in Mathematics by a Sophomore · National Merit Scholar

CURRENT PROJECTS:

University of Washington's Robinson Center for Young Scholars · *Seattle, WA*
Transition School Mathematics Instructor, Spring 2015-Present

Transition School is an intensive year to prepare 14 year olds to be successful as full time university students. My classroom is highly differentiated and highly interactive. Flipped classroom model: students are asked to watch lecture content in videos outside of class. Classtime emphasizes collaborative student learning using lots of vertical whiteboard space. Students are either studying pre-calculus or calculus.

Students are asked to submit a minimum of two pages written analysis in LaTeX, every three weeks. These writing assignments allow students to dive deeply into topics of their choosing—topics have included the Peano Axioms, the Mandelbrot Set, Lissajous Curves, Bezier Curves, Diffy Squares aka Difference Engines, Fourier Analysis, Logistic Map, Modular Arithmetic, etc. Some sample papers are attached.

Students learn Rhino 2D and 3D in order to do laser cutting and 3D printing as part of the Spring curriculum.

Math for Love · *Seattle, WA*
Scholastic Math Circle Instructor, Fall 2012-Present
Math Circle Coordinator, Summer 2016-Present

Responsible for all administrative, curricular, and instructional aspects of running math circles as school clubs, weekend classes, and summer camps. These groups emphasize developing a passion for mathematics through beautiful puzzles and captivating games involving various amounts of strategy, chance, and logic.

Tutoring · 2008-Present

Focused on working with the brightest minds I can find. Seven students from Epsilon/Delta Camp
Track record of turning math haters into math lovers and math lovers into mathematicians

RELATED EDUCATION EXPERIENCE:

Washington Association for Educators of the Gifted and Talented Conference · October 2016

Presentation on using extended mathematical writing assignments to remove the ceiling on highly capable students

Interlake High School · Winter 2016

IB Further Mathematics 1 and 2. Discrete Math, Graph Theory, and Group Theory.

Homeschool Teacher · Mozambique · Winter 2013

Responsible for planning and enacting a 10 week curriculum for three American children, ages 6, 8, and 10.

Championship Chess of Chicago · Fall 2008-Summer 2011 · Evanston, IL

Owner and director of a small scholastic chess instruction company with two employees

INTERESTS AND SKILLS:

Intermediate proficiency in French and Spanish
Blind chess games (US Chess Federation Rating: 1878)
Making and enjoying art (see next page)

Personal Maker Projects

Couch Armada

In 2013, I teamed up with an architect and an engineer to build a full size electric powered driving couch. We took the drive trains out of two mobility scooters and found a metal worker to help us build a steel frame out of 1x2 rectangular steel tubing. The user controls for driving worked out surprisingly smoothly. The OEM throttle mechanism is a simple 3-pin potentiometer where counter-clockwise rotation means forward and clockwise rotation means reverse. We found a 2-axis joystick where both potentiometers in the joystick matched the resistance range in the OEM potentiometers. So, NS gives forward/reverse on the left motor while EW gives forward/reverse on the right motor. Extra features include 4 speakers, a subwoofer, 15 meters of LEDs, a vinyl rain cover, a fold-out bar in the back, and an extra 110V outlet for a phone charger.

This project has been featured at the Seattle Mini-Maker Faire, the Seattle Design Festival, and the Grand Opening of the new Sound Transit light rail station at the University of Washington. Seattle's King 5 Evening News, the Seattle Times, and the Huffington Post have all run stories featuring this project, and it will be on Discovery Channel Canada's *Daily Planet* in the first quarter of 2017. This project received financial support from Ignition Northwest.

Mathematical Jewelry

I've been designing fractal art with Rhino 5 and Grasshopper, based primarily on a solution to the following problem on a 16 by 16 grid: **Given an *n* by *n* grid of dots, a simple polygon can be formed by connecting dot-to-dot and eventually returning to the original dot. In terms of *n*, what is the maximum number of sides on a polygon formed in this way?**

I've been laser cutting this 256-gon in acrylic and wood, making use of both the positive and negative space by making mixed-media earrings and necklaces: half with wood in acrylic and the other half with acrylic in wood. Further designs have been formed by applying planar transformations to this basic design. These have mostly been gifts for friends and family, but I have also sold a few. Rhino 5 has become a part of my spring curriculum, with a class trip to the Maker Space to use the 3d printers and laser cutter.

Pentaflower

I accidentally designed this project when I was playing around with paper polygons and scotch tape in 2014. It's quite a simple structure: a series of 8 concentric rings of pentagons—10 laying flat in the outermost ring and 3 in the innermost ring. In the summer of 2015, I laser cut the 3+4+5+…+10=52 pentagons out of 1/8" hardwood to make this in a 6 foot diameter scale. The flower was lit with LED ropelight and was installed underneath a Mobius-style suspension bridge called Inflection. See more about all my personal projects at www.paulgafni.com/projects

Large Group Projects

Harmoniscope

In the summer of 2016, I spent about 25 hours welding the walls for a gazebo-like structure with an intricate geometric tiling. This was my first serious application of my 25 hour welding course that I took in the winter of 2016. At this point, I have about 50 hours of welding experience under my belt.

Mazu, Goddess of the Empty Sea

This piece was a stunning combination of elegant woodwork steelwork to construct a temporary Buddhist temple to the Goddess Mazu. Complete with a lotus flower with 12 foot petals and 8 fire breathing dragons, each about 10 feet tall. I dove headfirst into this project, helping out on a daily basis for about six weeks in the summer of 2015.

Mt. Infinity and POSIWID (The Purpose of Seattle Is What It Does)

In 2013 and 2014, I ran the finances for a group called the Seaweed Artist Collective. Each year, I handled about $30,000 incoming and outgoing, with the vast majority of that spending over about 5 weeks. This role also included a full audit and reconstruction of the previous year in order to settle 4 digits worth of unexplainable transactions.

Experience with: Welding and other metal work, soldering, circuit design/construction, prototyping, electronics and electrical troubleshooting, Arduinos, Beaglebone Blacks, addressable LEDs, 2D and 3D CAD design software (AutoCAD, Rhino 5) and functional algorithm focused CAD design software (Grasshopper for Rhino 5), 3D printing, and laser cutting