Gathering 4 Gardner 16
Presentation Directory

Speaker	Presentation	*(Tentative)* *Schedule*
Spandan Bandyopadhyay	The Number of Letters in the Answer: A Deep Dive Into A Simple Riddle	*Early Fri AM*
	"The Answer Is The Number of Letters In The Answer." It's a very simple riddle. The answer is four; and this proves to be an elegant answer because four is the only number that has a letter count equal to its value. But, what if someone were to make this beautiful riddle uglier and more ridiculous by coming up with every possible alternate answer?	
Vic Bednar *Furman University*	Paper Piecing Platonic Polyhedra	*Late Fri PM*
	What happens when you cross grandma's quilting with ancient Greek geometry? Problems (and insights) arise when English paper piecing is used to build three-dimensional shapes. Why is a dodecahedron easier to construct than a tetrahedron? Which edges are the most difficult to sew? What do different assembly techniques reveal about the dodecahedron's symmetry?	
George Bell *Rotational Dynamics, Inc.*	Cube Compound Puzzles	*Late Fri PM*
	There are many ways to assemble identical concentric cubes into an object with overall symmetry. We consider particular cases of a compound of n cubes, where n ranges from 2 to 5. These objects are dissected into interlocking pieces, creating assembly puzzles. We consider the design of these puzzles, as well as techniques for making them.	
Marshall Bern	The Mathematical Games of Mass Spec	*Early Fri AM*
	Mass spectrometry, the workhorse of analytical chemistry, identifies molecules by measuring their masses, or more precisely mass-to-charge ratios, and optionally the mass-to-charge ratios of fragments. This type of data leads to interesting mathematical and computational problems-- accessible even if you've forgotten your chemistry-- with applications in biology, medicine, and drug discovery.	
Tom Bessoir	You Can't Find Love	*Early Sun AM*
	I will screen my 2-minute experimental film "You Can't Find Love." In the late-1950s artist and writer Brion Gysin created the permutation poem. Written by hand, they contain some or all of the permutations of 4 or 5 words. This experimental film is based on a permutation poem I wrote in 1979. The film explores selective viewing by overloading the brain with multiple presentations of my poem.	
Nancy Blachman *Julia Robinson Mathematics Festival*	The Sweet Story Behind Mathematical Muffin Morsels	*Early Sun AM*
	How the Cupcake Puzzle, originally invented by Alan Frank, featured in the New York Times Numberplay blog by Gary Antonick on August 19, 2013 inspired the Muffin Puzzle (included in my G4G12 exchange gift in 2016), sparked research and collaborative efforts, culminating in the publication of the book Mathematical Muffin Morsels: Nobody wants a small piece by William Gasarch et al. in May 2020.	
Lhianna Bodiford	MATH, of the Kids, by the Kids, and for the Kids: The Growing Rebellion in Math Education!	*Early Sun AM*
	The thing that makes me the most nervous when preparing for a new math group is: will the students find my math problem/prompt/activity engaging enough?... How do you ask the best question? The hook that will lead to mathematical discovery?... You don't. Exploring what happens when you trust your students to bring the math.	
Kenneth Brecher *Boston University*	Rolloids	*Early Thu PM*
	There are a wide range of mathematically defined objects that can roll on a flat horizontal surface or down an inclined plane, either in a straight line or with a meandering motion.These include Orbiforms, Oloids, Sphericons, Femispheres, Wobblers, Two-Disk Rollers, the Orbis, Steinmetz solids and others.	
Skona Brittain *SB Family School*	Sixteen, Sixteen Everywhere, Nor Any Time to Think	*Early Thu PM*
	Sub-Title: Rooting 4 Sixteen A whirlwind tour of occurrences of 16 in mathematically significant, or interesting, or silly, places.	
Dave Buck *Art of Play*	Hands as Instrument	*Early Thu AM*

A magician and cardistry pioneer reflects on the creative power of human action through the lens of hands in art, movement, and play. This talk invites audiences to reconsider how creativity, practice, and perspective transform ideas into lived experience.

Amina Buhler-Allen	**A 120-Cell Sculpture — a 3D Shadow From the 4th Dimension**	*Early Sat AM*

The beauty & making of a stainless steel 120-cell sculpture. Although we cannot see the 4th Dimension, we can see an object's 3D shadow. Not unlike the story of Flatland we can step down a dimension i.e , a shadow of a 4D dodecahedron creates a 3D shadow which we can see. Photo documentation of the journey from start to the sculpture currently on display at the Sun ATL Gallery in Atlanta.

Vladimir Bulatov *Shapeways*	**Symmetry and Chaos**	*Late Thu AM*

Symmetry represents order, while chaos denotes disorder. We propose a framework to unify these concepts by constraining chaotic dynamics to a symmetry group's orbifold. This generates chaos with predefined symmetric properties. Tiling the plane with these images creates structures that exhibit both symmetry and chaotic complexity. Interactive demo is here https://symmhub.github.io/SymmHub

Mark Burstein *The Lewis Carroll Society of North America*	**Salvador Dalí: Math, Martin, and Alice**	*Late Fri PM*

Dalí had a lifelong fascination with mathematics; his paintings might involve the golden ratio, anamorphic art, geometric figures, perspectives, or three-dimensionality. He met with Martin Gardner twice. These strands came together my 2015 edition of Alice's Adventures in Wonderland, illustrated by Dalí and emphasizing math, co-published by Princeton and the National Museum of Mathematics.

Neil Calkin	**The Dark Secrets of "Suite" Sixteen**	*Early Fri PM*

TBA

Richard Cameron *Nonscriptum LLC*	**Mathematical Modeling in OpenSCAD**	*Early Sat AM*

OpenSCAD is an open source 2D and 3D design tool designed as "CAD for programmers". This makes it uniquely suitably among other CAD programs for mathematical modeling. As a solid CAD modeling tool, it is better at producing manufacturable than tools like Mathematica. This talk will introduce OpenSCAD and show some techniques and examples I've developed over 15 years for math modeling.

Adam Chalcraft	**A Unique Sudoku Puzzle**	*Early Sun AM*

Puzzles like Sudoku naturally live in the complexity class NP, which is the first level of a polynomial hierarchy of increasingly complex problems. Using Sudoku as an example, we exhibit a puzzle which naturally lives in level 11 of this hierarchy. We have no idea how to solve such puzzles in general, but we hope that the rules for this puzzle are amusing.

Jim Conant *Gemological Institute of America*	**A Fractal Gasket Construction**	*Early Thu AM*

I will explain the construction and origin of a fractal I discovered in the early 2000s which Neil Sloane has named "The Conant Gasket."

Abhigyan Dasgupta	**Color Code Cryptography**	*Early Sun AM*

A method for encoding plaintext into colored grids is presented such that 3 algorithms (RGB blocks, steganography, and QR codes) can simultaneously encode multiple strings into a single image. The mathematics of RGB, ASCII, least significant bits, and QR codes demonstrate mutual independence as well as practical limitations of the method. Open source software to produce these images is released.

Ivo David *DistantLands.Studio*	**Another Strange Village**	*Early Sun AM*

One classical puzzle asks the proportion of boys to girls in a village where each family has children until they have a boy. It trurns out that this village contains many interesting and unnexpected mathematical properties. And, with one small twist, the neighbouring village may be even more paradoxical. In this talk we show new puzzle variants, paradoxes and maths from another strange village.

David desJardins *Institute for Defense Analyses*	**Counting Tilings with Efficient Dynamic Programming**	*Late Thu AM*

I have written a program for counting tilings, especially of regions in the square grid with polyominos (but which could also be used more generally for any instance of the "exact cover" problem), which uses a number of familiar and novel tricks to be quite efficient even for large regions with 10^{20} tilings, or more. It can be useful in formulating or verifying conjectures. I will give a brief explanation of some of the methodology, and some examples.

Shiying Dong	**Crafting a punctured Lawson's Klein Bottle**	*Early Thu AM*
	In this talk, I'll briefly discuss my method to create a punctured Lawson Klein bottle using the topological crochet technique. I began by making a punctured Sudanese Möbius band and then performed a connected sum operation on two copies. As a fun project, I further twisted some elements in the design to create a different, twice-punctured Klein bottle exhibited in JMM 2026.	
Tracy Drinkwater *Seattle Universal Math Museum*	**Seattle Universal Math Museum (SUMM) Update FY26**	*Early Fri PM*
	SUMM's Founder, Tracy Drinkwater, and Executive Director, Jenny Quinn, demonstrate how SUMM's mission to inspire each and every person to love math is fueled by enthusiastic engagement, collaboration, and generosity. Making math accessible and engaging, SUMM brings playful math to humans of all ages in a variety of classrooms, libraries, other museums, and community spaces in the Seattle region.	
John Edmark *Stanford*	**Forms in Flux: Two Geometric Sculptures**	*Late Fri AM*
	I will present the design and fabrication of two works. Dahlia, commissioned for the Atlantis the Royal hotel in Dubai, is based on the golden angle found in many plant forms and uses programmed light to create continuously changing surface patterns. Confluence, commissioned for the Stanford University d.school's 20th anniversary, is a large hyperboloid structure whose form physically transforms over time.	
Scott Elliott	**Modular Division on 6502 by Casting Out 11111111s**	*Late Thu PM*
	On 8-bit processors that lack instructions for division it can be cumbersome to implement John Fletcher's 16-bit checksum, but a normally-inconvenient shortcut in the subtraction unit of the 6502 microprocessor empowers it to compute Fletcher's Checksum in fewer than a dozen instructions -- with help from 10th century mathematician and almost-computer-programmer, Āryabhaṭa II!	
Yossi Elran *Davidson Institute of Science Education, Weizmann Institute of Science*	**AI puzzle-a-day**	*Late Thu PM*
	A puzzle a day is a great polyomino tiling problem with multiple solutions for each day. In this talk, we will survey a few of these puzzles, consider the problem of creating a puzzle a day that has a unique solution for each day, and show how we used AI vibe-coding and BurrTools to study these puzzles.	
Alex Engelberg	**The Math of Improv Comedy**	*Early Fri PM*
	Improvisational theatre, like solving a math puzzle, relies on pattern recognition and extension. I explore the puzzle-solving mindset I use to build a scene with no script, and why inside jokes are like the game SET.	
Andrew Farkas	**Estimating God's Number in 4 Dimensions**	*Late Sat AM*
	God's Number is the smallest number of moves that is sufficient to solve any state of an ordinary 3x3x3 Rubik's cube. We propose an estimate for God's Number for a 3x3x3x3 (4-dimensional) Rubik's cube based on empirical performance of a computer search algorithm that generalizes 3D fewest-moves techniques.	
Frank Farris *Santa Clara University*	**Phantom Symmetry of Curves**	*Late Thu AM*
	Years ago, I published a paper about constructing smooth curves with any desired rotational symmetry. Last year, two engineers wrote from Taiwan to show me a curious example: A curve that violates the symmetry condition, and yet appears to have perfect 5-fold rotational symmetry. We solved the mystery and now can explain how to construct curves with any desired "phantom symmetry."	
Robert Fathauer *Tessellations*	**Iterating Polyforms to Create Fractal Self-replicating Tiles**	*Late Thu AM*
	A method is described for creating self-replicating fractal tiles based on iterating tessellating arrangements of polyformss. In general, while these tiles will tessellate at every stage, they will only be self replicating in the limit of an infinite number of iterations. A wide range of fractal forms result, based on polyominoes, polyhexes, polyiamonds, and other polyforms.	
Danielle Feinberg *Pixar Animation Studios*	**The Art of Math and Science: Bringing Pixar's Imagined Worlds to Life**	*Late Sat AM*
	Danielle Feinberg, Visual Effects Supervisor at Pixar Animation Studios, reveals how math and science secretly power the magic of animation. Take a journey behind the scenes to see how mathematical curves grew the lush forests of Brave, how math brought the robots of WALL-E to life in	

	an unexpected way, and how physics created the shimmering colors of the underwater world in Finding Nemo. In the spirit of Martin Gardner, discover how play, puzzles, and problem-solving make math and science the true heroes of Pixar's storytelling.	
Gwen Fisher	**Beading with Algorithms: Cellular Automata in Peyote Stitch** A new mathematical art book describes how to use algorithms, called one-dimensional cellular automata (CA), to make beaded artwork including jewelry, boxes, and key chains. Beaded peyote stitch creates a staggered grid of beads. Many mathematical notions arise from using CA on a staggered grid, including symmetry, reversibility, periodicity, modulus, automorphism, isomorphism, and counting.	*Early Sat AM*
Mark Fisher *Springville CSD*	**Martin Gardner's Impact on Teaching Probability in High School.** A presentation of work influenced by Martin Gardner. Specifically, linear algebra and discrete mathematics topics arising in board games (Monopoly, Chutes and ladders and Risk). The paper describes work done by juniors and seniors in rural high schools. The original paper was presented in fulfillment of the requirement for a graduate degree in school mathematics at Iowa State University.	*Early Thu PM*
Sandra Fox-Sohner *Fox Screenwriting*	**The Pioneering Mind Behind the Kovalevskaya Top** Sofia Kovalevsky, born in 1850 in Russia, was a self-taught mathematical genius. This presentation explores the mathematical elegance and historical significance of her work, as well as her personal courage and the overwhelming challenges she faced. Sandra Fox-Sohner is a mathematics educator and author of Mathematical Mermaid, an award-winning screenplay based on Sofia Kovalevsky's life.	*Late Sun AM*
Fumiko Futamura *Southwestern University*	**Updates from the Mathematical Art Manifesto Group** A group began meeting in July at the Bridges Conference in Eindhoven to discuss writing a mathematical art manifesto, focusing on the intersection of math and art that can be considered art according to the definition developed by the art critic and philosopher Arthur Danto. We meet every month to discuss various relevant topics. This talk will be a brief update on our progress.	*Late Thu PM*
Douglas Gaffin *University of Oklahoma*	**What can scorpions teach us about navigation?** We think sand scorpions use matrices of sensors on their bellies to "memorize" and retrace chemical and textural paths through their environment. Our computer program emulates their "navigation by familiarity" approach as it moves across a patterned surface. This model not only informs scorpion navigation but also could help guide driver-less vehicles and assist visually impaired individuals.	*Late Thu PM*
Braden Ganetsky	**Finding the Dihedral Angles of Non-jumbling Twisty Puzzles** A twisty puzzle is considered "jumbling" if it cannot be unbandaged without turning into infinite dust. Although most twisty puzzles are jumbling, it turns out that there exist an infinite family of geometries that produce non-jumbling twisty puzzles. This talk animates a derivation of how to find these dihedral angles, given the desired behaviour.	*Early Thu AM*
James Gardner *Martin Gardner Literary Interests*	**What's New in the Martin Gardner Universe since G4G15** Jim (Martin Gardner's son) will share anecdotes about life in the Martin Gardner Universe. This may include recent events/locations/stories he has experienced which have a MG theme, as well as memories/anecdotes. There may be some repetition from previous G4G talks, mostly because Jim never tires of mentioning certain things (plus he knows there will be new attendees).	*Early Thu PM*
John Winston Garth	**Life as Art** An overview of a year of exhibiting Conway's Game of Life patterns as art.	*Early Thu AM*
Susan Goldstine *St. Mary's College Of Maryland*	**Adventures in Hyperbolic Fashion** Inspired by the annual Bridges Math + Fashion show, I have recently funneled my fascination with non-Euclidean geometry and the Poincaré disk into my wardrobe. This has led me to new experiments with crochet, sewing, upcycling, coding, and quilting, and to my first and second turns as a model on the runway. In this talk, I will share my interpretations of hyperbolic tilings in clothing form.	*Early Sat AM*
Uttam Grandhi	**F, E, & V** An exploration of 2D and 3D forms through origami, electronics, and	*Late Sat AM*

augmented reality.

| Linda Green | Mutant Soccer Balls | *Late Sun AM* |
| *Proof School* | | |

A standard soccer ball is made of pentagons and hexagons with three faces around each vertex. What happens if we use triangles instead of pentagons and allow any number of hexagons? When we color the triangles and unfold these polyhedra, we get interesting patterns on the plane. The number of polyhedra that can be built from H hexagons can be found by factoring (H+2) and using modular arithmetic.

| Shyam Sunder Gupta | Arithmetic Puzzles based on Geometric Statement | *Early Fri PM* |
| *Self* | | |

It is demonstrated that a simple geometric statement, which can be explained using algebraic identity, can be used to solve arithmetic puzzles. For example, the geometric statement, "For a given perimeter, the area of the square is larger than a rectangle," can be used to find two numbers formed using each digit from any number of given digits, such that their product is the largest or smallest.

| Raymond Hall | Physical Constants in Context | *Early Thu AM* |
| *@physicsfun on Instagram and Facebook* | | |

Our physical laws often feature constants, particular quantities that define and shape our universe. Developing an intuition for such constants is often challenging yet also essential in learning many aspects of science. Here I present a few artifacts that can be handled and manipulated by hand, and allow for some critical intuition about some important constants of nature.

| John Harris | Right (or Left) Turn Only! | *Late Fri PM* |
| *Furman University* | | |

You need to travel from point A to point B in a city grid, and you are only allowed to make right or left turns at each intersection --- no going straight across! If your route is also not allowed to cross itself at all, can you do it? This talk will examine cases when this is possible. We'll also see what happens when you add further restrictions (like intermediate stops between A and B).

| Matthew Hayden | Ambiguity in Language | *Late Sat AM* |

Ambiguity is a hallmark of natural language. Linguists have identified many phenomena related to ambiguity—grammatical illusions, polysemy, quantifier scope effects, garden paths, zeugmaticity, and many more besides. This talk gives an overview of the myriad types of ambiguities found in English and in language in general, which form a basis for much of our humor, wordplay, and figurative writing.

| Barry Hayes | The Joys and Sorrows of work Done and Not Done | *Late Sat AM* |

In preparation for G4G14, I began working on proving that the 14-vertex Szilassi polyhedron was unique, or finding a second example. After more than two years of work -- almost all of which was joyful and most of which was unnecessary -- I was disappointed to reach the end of what could have been a week's work. Was the disappointment of finishing worth the joy of exploring? Why?

| James Marston Henle | The Art of Exact Ideas | *Early Sat AM* |
| *Smith College* | | |

In mathematics and in the work of Gardner, there is a distinct art with a distinct aesthetic. The art includes puzzles, games, patterns, magic, paradoxes, even dance. An idea is exact if it can be expressed completely and unambiguously. Math is the study of exact ideas. An exact idea is great art if it is simply expressed, but reveals a captivating world. GFG celebrates exact art.

| Paul Hildebrandt | Zome Art | *Early Sat AM* |
| *Zome* | | |

A survey of of various artists and architects whose works have been informed by Zome geometry, like Olafur Eliasson, Jean Baudoin, Fabien Vienne, Jean Soum, Clark Richert, Roger Penrose, Steve Baer, Marc Pelletier and Amina Allen.

| Tiago Hirth | The Nakane / Tait Counter Puzzle | *Early Fri AM* |

In 2024 Lisa Rougetet and I presented about the SPHINX Revue, a recreational Mathematics Journal. One of the topics shared on the fly was a six counter problem that baffled multiple attendees at the time. This gathering we will take a closer look at this and several other problems of the kind and their origins.

| Akio Hizume | Poly-Twistor of Precessed Elliptical Orbit | *Early Thu PM* |

Poly-Twistor is a study of 3D Torus classification that began in 1997. I have continued this research while producing countless 3D printer models. From late December 2024, for two months, I installed Schwarzschild precession and Keplerian elliptical orbits to Poly-Twistor. Poly-Twistor can

be interpreted as a formal model of the gravitational field from the macrocosm to the microcosm.

Joan Horvath *Nonscriptum LLC*	**Teaching Calculus with LEGO Bricks and 3D Prints** Calculus is usually presented as the culmination of learning lots of scary algebra. However, many concepts can be presented with no algebra at all. We will do a demo of the Fundamental Theorem using LEGO bricks and 3D prints, and show how this can be used to teach students that are younger or learn differently. Talk based on our book "Make: Calculus". See nonscriptum.com/projects for more.	*Early Sat AM*
Robin Houston	**Caltrops** The caltrop is an ancient defensive weapon, traditionally made with four spikes in a regular tetrahedral arrangement so that, however it rests, one spike is always pointing directly upwards. What other arrangements of spikes have this property? Joint work with Oskar van Deventer and Diogo Sousa.	*Early Fri PM*
Tom Howell	**A Problem with Pseudorandom Binary Sequences** Binary sequences generated by certain linear recurrences are called pseudorandom. They are widely used in applications. They share many properties with truly random sequences. They also have some properties that are decidedly not random. This talk introduces a class of interesting examples. An accompanying paper gives the mathematical details.	*Late Sun AM*
Max Hughes *MathsWorldUK*	**Your Brain on Puzzles** Over the last two years Max Hughes, Manager of MathsWorld UK, has been visiting major UK music festivals to scan festivalgoers' brains whilst trying out some mathematical puzzles! What happens in your brain when solving a good puzzle? Are certain puzzles better than others at eliciting a decent brain response? How do neuroscientists think Gardner's favourite puzzles stack up against others?	*Early Fri PM*
Christian Hummert *Agentur für Innovation in der Cybersicherheit*	**Spotted It! - New Insights into Dobble** Dobble or Spot It! is a game created by Blue Orange Games for two up to eight players. In the game the players have to find symbols in common between cards. The mathematics of the game is surprisingly interesting. This talk describes a psychological effect while playing and a statistical strategy to win the game, additionally it describes some new insights about variants.	*Late Sun AM*
David Jackson *Dickinson College*	**A Surprising Extension to the Slinky Problem** Martin Gardner contributed a "Physics Trick of the Month" to The Physics Teacher, a journal focused on improving the teaching of introductory physics. In February 2000, he pointed out a trick that highlighted a surprising and interesting behavior of a slinky. In this presentation, I will provide a brief demonstration of this slinky trick and then show an extension that is truly remarkable!	*Late Thu PM*
Peter Kagey *Cal Poly Pomona*	**Polyominoes on Polyhedra** In a 1957 Mathematical Games column, Martin Gardner popularized a "Pentominoes" puzzle, and gave an example of how to pack the twelve 5-celled polyominoes into a 6×10 grid. We generalize this puzzle from the square grid to the faces of a polyhedron, and give new puzzles based on the same principle.	*Early Sun AM*
P. Justin Kalef *Rutgers University Philosophy Department*	**A Puzzling Examination** At the 15th Gathering, I presented the motivation and outline of the 'Thinking Through Puzzles' course I teach at Rutgers University. In this presentation, I will explain the system I devised for the final exam. The unique structure of the exam brings in optional hinting, fun and collaborative solving, and the freedom to choose difficulty levels, while being rigorous and (apparently) cheat-proof.	*Late Thu PM*
Sara Kapasi *Georgia Institute of Technology*	**Roaming for Domes: City Planning to Analog Astronaut Missions** This talk is about my cross-country search for Buckminster Fuller's geodesic domes, from Massachusetts to California. I will cover lessons learned from literature and historical events, and how the domes and analog astronaut missions I encountered inspired me to build a geodesic dome inspired by CHARAS, a community organization that aimed to create publicly accessible geodesic domes.	*Late Fri PM*
Lou Kauffman	**Topological Rope Magic**	*Early*

University of Illinois at Chicago	A key concept in topology is that a knot is a pattern that acquires its existence from the substrate (such as rope) on which it lives. That pattern can move about, change shape and even disappear. It is guaranteed that knots will appear and disappear according to their topological nature in this talk. It is not guaranteed that the speaker will not disappear.	*Sun AM*
Michael Keith	**How Many NxN British-Style Crossword Grids Are There?**	*Early Thu PM*
	In a British-style (cryptic) crossword grid, the placement of white and black squares is quite different from an American-style puzzle, with a lattice-like arrangement satisfying certain placement rules. We wish to find all possible distinct NxN grids for various N. We'll also highlight special grids such as those with the fewest/most words or letters, nice word lengths, and various symmetries.	
Margaret Kepner	**Snake in a Crate**	*Late Thu PM*
	In my past artwork, I have presented infinite math sequences (such as the integers) in various ways. In several cases, I created artist's books in a paper strip format that could be coiled up for compactness (a "snake" book). Recently, I have explored ways to display the same content in a box format, while preserving mathematical integrity and creating visual interest. A simple game is suggested.	
Scott Kim	**How To Make a Hypercube out of String**	*Early Thu PM*
	The logo I made for G4G16 is a hypercube, because a hypercube has 16 vertices. For many years, Karl Schaffer and I have been exploring how a group of people can make polyhedra out of one or more loops of string. So for this year's presentation, we'll make the G4G16 logo with 8 people and one big loop of string.	
Jonathan Kirk	**Intuiting a New CRF Polychoron**	*Late Fri AM*
	Methods for finding 4D or higher dimensional polytopes are usually purely mathematical. However, it is also possible to discover them using more intuitive methods. In my talk, I will describe what I believe to be a new convex regular-faced (CRF) polychoron that I discovered intuitively using the geometric software vZome. I will further describe some of the geometric intuitions that allowed this discovery.	
Donald Knuth *Stanford University*	**All Questions Answered**	*Late Fri AM*
	In this impromptu session, Donald Knuth will take questions directly from the audience. Drawing on decades of experience in mathematics, computer science, and problem-solving culture, he will do his best to provide answers that are thoughtful, illuminating, and enjoyable for all in attendance. Having led many such open-format discussions in the past, Knuth finds the exchange rewarding for both speaker and participants—a chance to explore curiosity in real time at G4G16.	
Imre Kokenyesi	**Blocker-Based Abstract Puzzles and Abstract Strategy Games**	*Late Sun AM*
	The ToGo line offers compact, self-contained puzzles and two-player strategy games designed for affordable, high-quality play. Using innovative sliding cases, code-based challenges, and material-saving packaging, the system delivers 99-challenge puzzle sets and fast, engaging gameplay in a portable format. Or puzzles in math learning	
Ronnie Kon	**Word Cubes, Hypercubes, etc**	*Early Fri PM*
	A word square is a very old form of wordplay, a square with words running across and down; either the same set of words in both directions, or a different set of words in each direction. I will expand the concept to word cubes, and then to hypercubes and beyond, discussing the combinations of coordinates that underly the symmetries.	
Rodolfo Kurchan	**ONE UP puzzle**	*Early Fri AM*
	ONE UP is a number-placement puzzle in which a grid is divided by walls into horizontal and vertical segments of varying lengths. In each segment, the numbers from 1 up to the segment's length must appear exactly once. Each cell belongs to both a row and a column segment, creating rich logical interactions from simple rules.	
Josh Laison *Willamette University*	**Polycube Perception**	*Early Sat AM*
	Visibility graphs start with a collection of geometric shapes, and record which shapes can see each other. We investigated polycubes (shapes made by gluing cubes together), looking in 6 directions from their cube faces. We discovered that you can make all graphs this way! We also have some Python code that generates the polycube shapes for any graph.	

Lew Lefton *Georgia Institute of Technology*	**Math in Makerspaces** Makerspaces are places where people create things using shared tools and knowledge. They are often located in universities and communities. In this talk, the author, who is also the founder of a community makerspace, provides examples of mathematically-inspired maker projects and a case study of how they developed a culture of curiosity and exploration which sustained the makerspace over time.	*Early Fri PM*
Shawn Ligocki	**Busy Beaver** The Busy Beaver problem is a recreational math problem connected to some of the deepest results in Computer Science and Meta-mathematics like the halting problem and Gödel incompleteness. It explores the edges of unknowability. BBChallenge is an international group of amateur researchers who solved the problem for 5-state Turing machines in 2024, the first major result in 40 years.	*Early Thu PM*
Terry Ligocki *None*	**Experiencing Symmetries: Inflatable Swim Rings, Origami, 3D Printing, and Topology** I've often had the experience making 3D objects - via unit origami or 3D printing - where I was surprised by some aspect of the object I hadn't anticipated. When it was in my hands, something magical happened. I'll be discussing two examples of this that are related to each other and topology.	*Late Thu AM*
Dana Mackenzie *self-employed*	**Cyclic Permutation Cryptarithms** In this fun talk, I will discuss cryptarithms of the form A*BC = CAB where * denotes multiplication and the letters A, B, C are strings of digits. Equivalently, the product should be a cyclic permutation of the digits in the multiplicands. The smallest example is 8*86 = 688. I will explain a nice method for generating examples and give some as puzzles for the audience, such as T*APAS = PASTA.	*Late Thu PM*
Gary Mar *Stony Brook University*	**Gödel's Philosophy: An Incomplete Journey** This talk is about a project to make Gödel's ideas accessible using Magical (Mathematically Alluring Gardneresque Illustrations of Computational, Algorithmic, and Logical) Thinking.	*Early Fri AM*
Nelson Max	**Constructing and Visualizing Uniform Tilings** This talk describes a system which takes user input of a pattern of regular polygons around one vertex and attempts to construct a uniform tiling with the same pattern at every vertex by adding one polygon at a time.	*Late Thu AM*
Douglas McKenna *Mathemaesthetics, Inc.*	**An Unexpected Triple-Armed Spiral in the Square** An infinite sequence of globally self-avoiding, generalized, Hilbert Curve motifs comprises four connected, double-spirals, one in each quadrant of the square. Remarkably, each motif's "orthodual" graph, formed by rotating each motif line segment by 90 degrees, comprises a triple-armed spiral in the square's center, surrounded (toroidally) by three double-armed spirals.	*Late Thu PM*
Rebecca Mercuri	**Martin Gardner and Communications Technology** As a Radio Ham (K3RPM Extra Class) I wondered if Gardner had any experience with Morse Code and other communications methods. In my talk, I'll connect the dots (or dits and dahs) with what I've uncovered. Attendees and those who share in the G4G16 gift exchange will also learn how to sign up for a FREE U.S. Amateur Radio License Technician course. MORE information is at .	*Late Fri PM*
Yuriy Mikhaylik	**Can a Plumber Build a Dodecahedron? Classic Figures with Incompatible Connectors** Plumbers often use 45° or 90° fittings to navigate space. Forcing these rigid angles to make complex "Platonic Solids" creates fun and beauty. The author presents an exploration into mimicking and transforming some of the classical geometry figures with industrial PVC pipes and connectors. Physical models will be displayed to demonstrate these geometric workarounds.	*Late Fri AM*
John Edward Miller *Time Haven Media, United States of America*	**LangTominoes** LangTominoes are a physical representation of Langford's Problem that work for planar solutions, but also some non-planar solutions. We explain and explore their properties.	*Late Sun AM*
Joseph Miller	**The Founding of the World Puzzle Center**	*Early*

	The founding of the World Puzzle Center which houses the world's largest puzzle collection with approximately 120,000 unique manipulative puzzles.	*Fri PM*
Saad Mneimneh	**Living on a Random Torus**	*Early Thu PM*
	In a 2D torus, make each point land with probability p, or water with probability q=1-p. Define islands as maximal sets of land where we travel N, S, E, and W without touching water, and similarly pools where we travel N, S, E, W, NE, NW, SE, and SW without touching land. Then the expected numbers of islands and pools are equal when p/q=phi, the golden ratio. This is a novel way of exhibiting phi.	
Stuart Moskowitz	**Lewis Carroll in MathematicsLand**	*Late Thu PM*
	Lewis Carroll wanted to be remembered as a mathematician. And if not for the Alice books, he probably would be remembered for his photography. But he did a lot of math, too. Oxford U's Math Institute has created 6 posters summarizing his mathematics. The posters are packed full of info and can be downloaded for free. We will show highlights so all attendees will want to download their own.	
Alexandre Muñiz	**Polyform Arithmetic**	*Late Sun AM*
	We define operations for adding and multiplying sets of polyominoes and other polyforms, and look at some tilings of the compound polyforms produced by these operations.	
Audrey Nasar *FIT*	**A Course in Math and Papercraft**	*Late Fri PM*
	For the past two years, I've been teaching a course called "Math, Paper, Scissors" to art and design students at The Fashion Institute of Technology. The course uses a variety of puzzles and problems to inspire students to explore the mathematics that emerges through paper folding and cutting. In my presentation, I'll discuss the key ideas for the course, students work and some takeaways.	
Craig Newswanger *Resonance Studio*	**Spontaneus Order - The Rhythm of Fireflies**	*Late Sun AM*
	Spontaneous Order - the Rhythm of Fireflies is a light-art installation first installed at the Pittsburgh Children's Museum in 2024 . It was inspired by the unusual synchronization behaviors of some fireflies. The installation is composed of 200 battery-powered electronic fireflies in jars hanging from the gallery ceiling. The work was inspired by The book SYNC by Steven Strogatz.	
Chris K. Palmer	**Rob Bell Zome Bones**	*Early Sat AM*
	Lost Friend - Lost Art Remembering and Recovery The story of Rob Bell's CNC Zome puzzle pavilions in the aftermath of his passing in 2019. An account of what was lost and what was resurrected in the form of a parametric software tool to faithfully produce new zomes with his CNC joinery system.	
Matt Parker	**Update on Ridiculous Calculations of Pi**	*Early Thu AM*
	Matt Parker is known for attempting to calculate pi in ridiculous ways. Here he will present a serious update on the current state-of-the-art silly pi calculations. Including the 2026 mission to calculate pi on the surface of the Moon and attempts to break the pi-by-hand world record.	
Ivars Peterson	**Statistical Wear and Other Visual Puzzles**	*Late Thu PM*
	Human activities can leave telltale marks on their surroundings. These marks, in turn, can provide clues about the nature of the activities that created them or about the settings themselves. Examples abound, from elevator buttons and door handles to pathway shortcuts and sharp corners.	
Joshua Pines	**A Brief History of Motion Picture Aspect Ratios**	*Early Sun AM*
	over the century-long history of motion pictures, the geometrical aspect ratio of the cinema screen has gone through an evolution directed by technical constraints and artistic convention. this talk will present a brief history of these motion picture aspect ratios, along with a demonstration of the surprising aspect ratio of a very common object.	
Jim Propp	**Shuffling Connections**	*Late Thu PM*
	Shuffling the sixteen words in a Connections puzzle can help you ignore red herrings and spot relevant patterns among the words. How many shuffles are needed to ensure that each of the sixteen words appears next to each of the other fifteen words at least once? What if you're really lucky? A number system invented by a French mathematician two centuries ago guides us towards the answer.	

Peter Rasmussen *Classical Chinese Puzzle Project (C2P2)*	Traditional Chinese Puzzles and Their Stories At the 1994 IPP in Seattle, Jerry Slocum gave Wei some pages from an old book of Chinese wire puzzles. We soon set out to find the puzzle maker in Suzhou and spent the next 25 years criss-crossing China in search of antique puzzles and their stories. These adventures led to two richly illustrated volumes, published in Beijing, and we invite you visit us in the Sales Room to take a close look.	*Early Thu PM*
Debbie Denise Reese *Zone Proxima, LLC*	Aha! Moments: A Key to Nurturing a Young Child's Mathematics Discovery and Mathematical Mindsets A young child's joy and insight during foundational mathematics discovery can be guided by adults (parents, childcare providers, and early childhood educators) who both knowledgeably integrate sound manipulatives within an effective curriculum and recognize Aha! moments. This Zone Proxima Math case study illustrates Aha! moments in the discovery and the mindsets that support math proficiency.	*Late Thu PM*
Vincent Reynolds *Davidson College*	The Knotting-Unknotting Game Knot Theorists study the deformation of circles, which provide inherently tangible objects, perfect for games. The knotting-unknotting game is a two-player game played on a knot pseudodiagram. Players take turns deciding crossing information, yielding a nontrivial knot, or the unknot. Our research looks at determining the outcome on different pseudodiagrams, playing lots of games along the way!	*Early Fri AM*
Andrew Rhoda *The Lilly Library, Indiana University*	Update on the Slocum Mechanical Puzzle Collection at the Lilly Library My talk will update the community about recent news about The Jerry Slocum Mechanical Puzzle Collection at the Lilly Library. After a brief introduction, I will focus on notable developments since the last Gathering. I will conclude with information about upcoming events for the collection, especially those taking place in 2026 in Bloomington that will include the Slocum Puzzle Collection.	*Late Sun AM*
Dana Richards	Sweet Sixteen TBA	*Early Fri PM*
Dana S Richards *gmu*	Chautauqua and Mishawaka Martin Gardner was influenced by his experiences at summer camps, which are explored here.	*Late Fri PM*
David Richeson *Dickinson College*	Number Tricks from Simple Dynamical Systems We discuss a class of deterministic dynamical systems on the natural numbers, focusing on those for which every orbit eventually lands on a fixed point or a periodic cycle. Such systems can be used as the basis for numerical "magic tricks": think of any positive number, apply this rule a few times, and I'll predict the outcome.	*Early Thu AM*
Alex Romero	Crypto Tiles: Playful Cryptography from Preschool to PhD Crypto Tiles is an educational activity that brings the spirit of Martin Gardner to learners of all ages. Using simple geometric tiles, participants create and/or solve artistic, visual cryptographic puzzles—from simple A1Z26 ciphers to challenges with complex rules. This talk features work by people of many ages, then invites the audience to create their own Crypto Tiles in Tile Farm Studio.	*Late Thu AM*
Adam Rubin *Art of Play*	Wonder You Can Touch For the 18 months I have been the proprietor of a curiosity shop in Brooklyn, NY. I have seen thousands of visitors of all ages engage with puzzles, games, illusions and mathematical sculptures. Physical objects delight and fascinate in ways that on-screen entertainment cannot. I would like to share some of these works as well as the experiences that give me optimism for the future of play.	*Early Fri AM*
Smita Saxena *Maestro*	Centaur Mindset: Skepticism in the Age of AI Martin Gardner championed healthy skepticism: the habit of questioning authority without losing wonder. In his time, that authority was textbooks, experts, and elegant proofs. Today, it increasingly includes AI systems that produce confident, fluent answers on demand. This talk explores why Gardner's skepticism is more essential than ever—not as resistance to technology, but as protection of intellectual agency. I introduce the "Centaur Mindset," a modern extension of Gardner's philosophy, where humans and powerful AI tools work together without outsourcing judgment. Drawing from puzzle culture, actual classroom practice, and	*Early Fri PM*

tool design, I'll argue that the most important mathematical skill today is not solving problems faster, but knowing when—and how—to question the answers we're given.

Karl Schaffer *MoveSpeakSpin*	**Recycling the G4G16 Logo** After the conference the sixteen vertex G4G16 logo of the hypercube may be taken apart and reassembled into other useful polyhedra or polytopes. We apply ways of decomposing such figures that are inspired by string loop polyhedra developed with Scott Kim over the years and by geometric representations by props or body parts in dance performances, These ideas can also be used to construct fun paper and pencil (or tablet and stylus) puzzles and proof problems.	*Early* *Thu PM*
Laura Schaposnik *University of Illinois at Chicago*	**Nature Through Geometry: Symmetry, Growth, and Self-Assembly** Many natural patterns are shaped less by design than by constraints. In this short talk I connect snowflakes and viruses as geometry in action: ice lattices enforce sixfold symmetry while growth instabilities drive branching; viral shells self-assemble from repeated parts, and closure on a sphere favors icosahedral order-like a geodesic dome.	*Late* *Thu AM*
Eric Severson *Proof School*	**Visualizing Complex Functions** This fall, I designed a visually driven Complex Analysis class to show high schoolers how calculus functions extend to to the complex numbers. A complex function's graph is a 2d surface in 4d space, but we can use motion and color to peer into higher dimensions. We will visualize complex quadratics on a 2d screen, generalizing how we could explain a parabola to a 1-dimensional "linelander".	*Late Fri PM*
Jeanette Shakalli *Republic of Panama*	**Panamanian Rubik's Cube Mosaics** At the Math Circle Institute 2025, I learned about Rubik's Cube Mosaics and made my first two designs. When I went back to Panama, FUNDAPROMAT's graphic designer Nicole Hazera and I worked on creating 6 new models of Rubik's Cube Mosaics inspired by Panamanian wildlife and culture. In this lightning talk, I will share these 6 designs so that others can go forth and spread the joy of mathematics!	*Early* *Fri AM*
Scott Sherman	**Flexagon Computers** A demonstration that flex sequences on flexagons are Turing-complete	*Late Fri AM*
Lauren Siegel *MathHappens Foundation*	**Recreating Math in Museums and Public Spaces** MathHappens Foundation has set up staffed Math Rooms with carefully sourced and sometimes original math models and activities in 18 museums in 14 states in addition to sending our Open Play Kits to 20 additional museum locations. I'll share some examples of our work and show how "recreational math" or math for the fun of it meets "recreating math", making models you can touch and play with.	*Late Fri PM*
Joshua Socolar *Duke University*	**Phason Symmetry and the Formation of Penrose and Spectre Tilings** Can a Monte Carlo algorithm that employs only local tile rearrangements transform a random tiling into an ordered Penrose or Spectre tiling? Phason symmetry is a crucial concept for understanding such processes in quasiperiodic tilings. I will show how spatial phason variations can be removed from the system by assigning energy costs to local tile configurations and making only local moves that lower the system's energy.	*Late* *Thu AM*
Stacy Speyer *Cubes and Things*	**From Weaving to Geometry - Knowing what you will make** I will show a range of my art work, beginning with large scale installations made of hand woven and hand dyed sewing thread. Then onto a series of geometric experiments from the last 10 years. This will be my first time presenting my art work at G4G. My talk will be more about a few experiences as a maker than technical explanation of my art work.	*Early* *Sat AM*
Jon Stadler *Capital University*	**Using the Floor to Catch a Dropped Juggling Ball Theorem** In the 1980s, several jugglers independently developed a notation system for juggling patterns, called "juggling sequences" or "siteswaps." A juggling sequence is a list of nonnegative integers representing the duration of time balls are in the air. The Average Theorem states that the number of balls is the average of the sequence values. We present a new formula for the number of balls.	*Late* *Sun AM*
Rodi Steinig	**My Evolutionary Stages toward Becoming a Magician**	*Late Fri AM*

Math Renaissance	G4G has helped me overcome preconceived notions about magic and to develop appreciation for it. In this talk, I'll explain my former buy-in to stereotypes, my three turning points, and my current evolutionary stage toward becoming a magician myself.	
James Stephens	I've Got 99 (Boulder) Problems: Puzzle Solving in Rock Climbing	*Early Fri PM*
	Rock climbing requires strength, coordination, and technique. However, puzzle solving is also a major element of climbing. Indoor climbing gyms take the puzzle aspects to the extreme by using arrangements of holds that force climbers to solve a series of movements to complete a route. Route setters are the puzzle masters, and climbers share "beta," or tips on climbing puzzling routes.	
Cliff Stoll	Hot Glass for Hot Math	*Early Thu AM*
	Glass Klein bottles? Sure. How about a triple Klein bottle? Or Seventeen linked together? Or a Boy's Surface? But low-dimensional topology gets even hotter! Check out simple and complex knots, including links, braids, and torus knot complements ... all made from glass. And, weather permitting, you'll see the hyperbolic (-2,3,7) knot with SEVEN exceptional slopes.	
T. Arthur Terlep *Rose-Hulman Institute of Technology*	Generating Binary Cyclic Codes with Polygons	*Late Sun AM*
	This visual approach to codeword generation for binary linear codes. If you can rotate a shape and know that $1+1 = 0$, then you too can create (your own) error control codes!	
Hideki Tsuiki *Kyoto University*	3D Projections of 4D Self-Similar Fractals	*Early Fri PM*
	I found unique 3D self-similar space-fillers by projecting 4D versions of H and T-fractals. Unlike the 16-cell fractal, these yield volumetric solids with tetrahedral symmetry when projected along the (1,1,1,1) vector. Their fractally structured bumps and hollows allow these strange objects to interlock and fill space without a gap. I will present 3D-printed models to share their attractive appearance.	
Ryuhei Uehara *Japan Advanced Institute of Science and Technology*	Dudeney's Dissection is Optimal, But...	*Late Fri PM*
	In 1907, Dudeney posed a puzzle: cut any equilateral triangle ... into as few pieces as possible that will fit together and form a perfect square. He demonstrated a great 4-piece solution, remaining the most famous example of dissection. We prove that they have no common dissection with 3 pieces. I, however, introduce a 3-piece that form both a square and a equilateral triangle with some trick.	
Rick Van Iterson	Fairy Chess and the Problem of Nonattacking Nightriders	*Early Fri AM*
	There are many chess problems in mathematics. For example, the N-queens problem asks how to place N queens so that none attack one another. For years, enthusiasts have been creating fairy chess pieces. These variants of traditional chess pieces offer interesting twists to classical problems. In this talk, we explore the nightrider, which can make any number of knight moves along one direction.	
Jeffrey Ventrella	Fishing for Fractal Curves: Optimizing the Search with Number Theory	*Early Thu PM*
	Fractal curve generators are puzzles, inviting the curious mind to fractalize in the mind's eye. Math insights accumulate in the path from eye to brain. I will describe a technique that uses the Gaussian and Eisenstein integers to classify fractal curves of infinite variety. Number theory can reduce the search space for finding new space-filling curves. fractalcurves.com	
Scott Vorthmann *vZome*	Hands-on Activities Overview	*Late Sat AM*
	I will provide a brief teaser for each of the activities being led during the afternoon Hands-On Activities session.	
Scott Vorthmann *vZome*	Un-projecting 4D CRF Polytopes	*Early Sun AM*
	Any projection from 4D to 3D necessarily loses information. However, if the data being projected are the edges and vertices of a *convex, regular-faced* (CRF) polytope, and the projection is orthogonal, in some cases it is possible to recover the full 4D coordinates. I'll outline an algorithm that does exactly that, and define the constraints on the 3D projections that support it.	
Phil Webster *Phil Webster Design*	Construction Methods for Islamic Geometric Patterns, From Ancient to Modern	*Late Thu AM*

Islamic Geometric Patterns go back many hundreds of years. Due to the fierce competition between different studios, construction techniques were rarely documented. I will present a few possibilities for how these patterns may have been constructed originally, and contrast that with modern construction methods on the computer.

Mark Welsh *markiedoodle*	The Span Series - Kinetic Artwork Reflecting on the Attention Economy	*Late Fri PM*
	My practice explores the intersections of technology, behavior, and perception. Drawing on a background in engineering and art, I create conceptual mixed-media work that provoke reflection on how technology reshapes human experience. I was inspired by @physicsfun. The Span kinetic sculpture series conceptual focus is about human attention span and how it has been altered by app culture.	
Greg Whitehead	Moby-Dick in 10,395 Scrambled Word Puzzles	*Early Sun AM*
	The story of OMBY and how making Moby-Dick harder to read got us to #7 in Paid Word Games in the App Store	
Ana Wright *Davidson College*	Mosaic Knot Puzzles	*Early Fri AM*
	Knot theorists are interested in different ways to represent knots and define invariants. One way to do this is to represent knot diagrams using a small collection of square mosaic tiles. These square mosaic tiles can place knots on puzzles with shifting square pieces like a sliding puzzle or Rubik's Cube. This leads to interesting mathematical questions, and (of course!) to actual puzzles!	
Carolyn Yackel *Mercer University*	Friezing in Various Situations	*Early Sat AM*
	We will consider designing one- and two-color Frieze patterns for knitting using both mosaic knitting and stranded colorwork and one-color Frieze patterns for temari.	
Joseph Yudovsky	Designing Rules, Not Results: When Symmetry and Motion Are Invited	*Late Thu AM*
	In art and mechanics, symmetry and motion are usually designed directly: symmetry by copying patterns, oscillation by restoring forces. This talk combines two works that take a different approach. Instead of designing results, the author designs rules. Symmetry emerges from geometric constraint, while sustained motion emerges without potential energy, equilibrium, or forcing.	
Inna Zakharevich *Cornell University*	Anomalous Cancellation in Different Bases	*Early Sun AM*
	Anomalous cancellation is a phenomenon where a fraction can be correctly reduced by "cancelling digits." For example. $16/64 = 1/4$, which can be obtained by "cancelling the 6s." We consider this problem in cases other than ten. For example, it is known that in prime bases no such examples can exist. We will explain this result, and also present several new families of examples of anomalous cancellation.	
Wei Zhang	Come to Celebration of Mind 2026 in Beijing!	*Early Fri AM*
	Beginning in 1997, we began sponsoring Chinese puzzlers to G4Gs and IPPs. After G4G4 in 2000, we all visited Martin Gardner in NC, which was the highlight of the trip. Gardner's books are available in China, and he is highly respected. Celebration of Mind has been held every year in Beijing, now at the National Science and Technology Museum. Chinese puzzlers invite you all to attend CoM in 2026!	