

Gathering 4 Gardner 15 Presentation Directory

Speaker	Presentation	<i>(Tentative) Schedule</i>
Various	G4G Tributes Tributes to those we have lost since G4G14	<i>Late Thu PM</i>
Gary Antonick <i>Stanford University</i>	Stress Test Your Thinking In this interactive hands-on talk, we'll use math problems as a portal into human reasoning, exploring the interplay of heuristics, symbol manipulation, analogies, and diagrams. We'll also discover, by direct experience, why these approaches sometimes fail due to our beliefs or physiological reactions.	<i>Late Sun AM</i>
Woody Aragón	Sleight of Math	<i>Late Thu PM</i>
Spandan Bandyopadhyay <i>N/A</i>	The Egg Sandwich Problem A silly story of yet another breakfast with my family interrupted because I wanted to divide an egg sandwich equally. Followed by some interesting mathematical consequences and the physical consequence of my piece of egg sandwich getting cold.	<i>Early Fri PM</i>
Eric Bates	Passing the Spark Why do some people seem so natural on camera, while the rest of us feel awkward and sloppy? This talk will delve into the art of speaking to a camera and sharing your skills online, revealing the truth behind the lens — a well produced video is anything but "natural".	<i>Late Fri AM</i>
Robert Becker <i>HyperTile LLC, United States of America</i>	Soap Film Structures and the Invention of HyperTiles HyperTiles is a construction toy based on connecting and hinging hyperbolic paraboloids into complex polyhedrons and flexible structures and patterns that are a perfect fit for the G4G enthusiasts. The idea originated in the minimal surface area soap film configurations that can arise from dipping simple coffee stirrer frames in soapy water - and many of these will be demonstrated and discussed.	<i>Early Thu AM</i>
George Bell <i>Rotational Dynamics, Inc., United States of America</i>	Coordinate Motion Puzzles Coordinate Motion Puzzles are fascinating geometrical objects. In order to come apart, all the pieces must move together in a coordinated fashion. We discuss the mathematics of coordinate motion, the number of degrees of freedom in a coordinate motion puzzle, including many examples with videos.	<i>Early Sat AM</i>
Arthur Benjamin	The Bingo Paradox When playing Bingo by yourself, it is 50-50 whether you first complete 5 horizontally or 5 vertically. And yet, when played with a large group of people, it is more than twice as likely that the winning card will be horizontal instead of vertical. Why?	<i>Early Sun AM</i>
Tom Bessoir <i>1: none; 2: Technicolor</i>	Digits of Pi Film Tom Bessoir & Joshua Pines 2019 length 03:14 A transcendental film! Inspired by Marcel Duchamp's "Anemic Cinema," I set out to create a film composed within a circular frame. This circular composition led directly to using the number pi for the underlying structure. Having the digits of pi sung on the soundtrack is an homage to "Einstein on the Beach" by Philip Glass.	<i>Early Fri PM</i>
Nancy Blachman <i>1: Julia Robinson Mathematics Festival; 2: Gathering for Gardner</i>	Secrets Revealed by Technology In August 2023, I tested positive for COVID. While isolating, I checked my 23andMe account for new relatives. Much to my surprise, I found that I had a half brother, Bill Crane, born 6 years before my parents met and married. My experience is not uncommon since the availability of DNA ancestry testing. I feel that my life has been enriched by connecting with Bill, learning about pregnancies of unwed mothers, in particular, my mother's, and learning about others, some of who have discovered distressing information.	<i>Late Sat AM</i>
Rod Bogart <i>Self</i>	Jack in the Box Puzzle There is a famous puzzle/illusion with a square tray and four pieces that can be arranged to fill the tray, then rearranged to fill the tray with room for a fifth piece. This talk will describe a 3D version of that puzzle: a cube	<i>Early Sat AM</i>

made from eight pieces fits inside a plastic box on top of a jack shaped stand. The pieces can be rearranged along with the jack to fit entirely in the plastic box.

Robert Bosch <i>Oberlin College, United States of America</i>	Single-Line Drawings via Mathematical Optimization I will present two new methods for constructing single-line drawings. The first method is tile-based and requires the user to solve large-scale integer programming problems. The second method uses ideas from single-variable calculus.	<i>Early Thu PM</i>
Kenneth Brecher	Introducing the Mesmoid I have designed a new type of dynamical object: the "Mesmoid". It is a right circular cylinder with an eccentric circle cut out of it. Because of its design, it can act like a rolling pendulum. Unlike a coin or a wheel, when rolled it moves back and forth instead of in one direction only. This is the latest object to join the family of objects I have designed including the PhiTOP, PiTOP, eTOP and iTOP all introduced in the past G4G events.	<i>Late Thu AM</i>
Skona Brittain <i>SB Family School, United States of America</i>	A Collection from the Collection of Collections Just a variety of specific things collected from the 15 books of collected Scientific American columns, in honor of G4G15 of course.	<i>Early Thu PM</i>
Amina Buhler-Allen <i>Zometool</i>	Hyperspace Heroes 1: Odd Bedfellows An 'Aha' moment, in an instant can yield new discoveries from seemingly unrelated ideas and events. A high school burns down. Classes are held at the local library. Marc Pelletier finds 2 unrelated books: 'Regular Polytopes' and the 'Zome Primer'. Set on fire by their unexpected interconnections, Marc begins a lifeTime journey, hitchhiking from New Hampshire to New Mexico, barefoot....	<i>Late Fri PM</i>
Vladimir Bulatov <i>na</i>	SymSim - Creation of Natural Seamless Symmetric Patterns I've combined computer simulation of a natural patterns formation using non-linear partial differential equations with additional requirements - patterns must be highly symmetric. SimSim is an online application I've developed for that. I will present few interesting animated patterns obtained from the simulation of Gray-Scott reaction diffusion and Ginzburg-Landau equations.	<i>Early Thu PM</i>
Neil Calkin	XV: The Ides Are on Our Side!	<i>Late Fri PM</i>
Haoran Chen <i>1: Xi'an Jiaotong & Liverpool University, China, People's Republic of; 2: Tokyo University of Agriculture and Technology, Japan</i>	The Great Beetle Escape There is a beetle at each lattice point in the first quadrant of the plane, except for a triangular region including the origin at the lower left corner. The goal is to send any beetle, through a sequence of horizontal or vertical checker jumps, to the origin. We apply the invariant method to show the beetle escape is possible if the width of the triangle is less than or equal to 6.	<i>Late Thu PM</i>
Bill Cheswick <i>retired, United States of America</i>	Paul Erdos' Brain Was in Town. Paul Erdos left his coat at Bell Labs after one of his many visits to Ron Graham. I have it with me, and propose a new, imaginary portion of the Erdos number.	<i>Early Fri AM</i>
Barry Cipra <i>Freelance</i>	Color Contrast Contortions When can you color the squares of a polyomino so that adjacent squares have different colors and for each pair of different colors, there is exactly one pair of adjacent squares of those two colors?	<i>Early Sun AM</i>
David Cohen <i>Author of SCRABBLEGRAMS, published by Pentract Press</i>	Scrabblegrams Combining wordplay, puzzle-solving, and poetry, Dr. David Cohen shares the delightful artform of Scrabblegrams — messages which use each of the 100 Scrabble tiles exactly once.	<i>Late Fri PM</i>
Tantan Dai <i>World Puzzle Federation</i>	Gateway to World Sudoku Championship What does a sudoku competition entail? What kind of sudokus do you see in a sudoku contest? How fast can a top solver solve a sudoku in a competition? What do team competitions look like for sudoku? In this talk, I will introduce the scene of competitive sudoku solving and share my experience competing in the World Sudoku Championship.	<i>Early Fri AM</i>
Ingrid Daubuchies	A Quick Update on Mathemalchemy Mathemalchemy is now in its 5th exhibition venue; it has several more lined up. It has had family day events at all venues and seems to be liked by kids of all ages. Inspired by the Wellington shanty that went viral a few	<i>Late Sun AM</i>

years ago on TikTok, we have recorded our own shanty, after we learned the lyrics from the Mathemalchemy Herons; they appeared in print in the AMS Notices article written by 3 Mathemalchemists. The exhibit inspired science comic book writer Jay Hosler and his math-loving son Max to write 'Mathemalchemy: A Comic Book Adventure in Math and Art'; it led volunteers to translate it; we web-publish all vetted translations (5 so far).

Ivo David	<i>Distant Lands Studio, Germany</i>	Paradoxical Boxes	<i>Late Thu AM</i>
		The famous Czech magician, Lubor Fiedler, discovered in 1966 a pair of paradoxical boxes such that box A can fit into B while simultaneously allowing B to fit into A. This "Hen-Egg" set of boxes still today causes bewilderment in audiences around the world. In this talk I wish to take this effect to the extreme by nesting 5 boxes and showing a bit of the history and math behind its development.	
Gioia De Cari	<i>Truth and Art Inc, United States of America</i>	How I Terrified the MIT Math Department	<i>Early Thu AM</i>
		In this brief talk originally created by request of the MIT Alumnae Unconference, performing artist and "Recovering Mathematician" Gioia De Cari describes the comic circumstances in which her national hit show "Truth Values" premiered, causing anxiety in the MIT Math Department.	
Thomas Draper	<i>Brigham Young University, United States of America</i>	Monoidal Categories for Modelling Physical Systems and Language	<i>Late Thu PM</i>
		Physical systems and operations can be modeled with category theory. Language with word combination follows a similar structure, and category theory makes this correspondence explicit. Action words, like verbs, relate different nouns together. This is analogous to how physical interactions entangle quantum systems together.	
Yossi Elran	<i>Davidson Institute of Science Education, Weizmann Institute of Science, Israel</i>	Recreational Math as a Beacon of Hope: Empowering Youth and Healing Trauma Through Puzzles	<i>Late Thu AM</i>
		"Martin Gardner advocated the use of recreational math in math education. This talk explores its use in healing displaced children from the October 7 terror attacks on Southern Kibbutzim in Israel, through puzzle parties, and empowering Arab and Jewish kids in the North via a college course, changing their math attitudes. These initiatives showcase recreational math's power to heal and empower."	
Richard Esterle	<i>YOUARESPACE</i>	Still Amazing — The Windy Windy Twisty Route	<i>Late Fri PM</i>
		3 things from this year MAGNUS POPKO build with Dalhousie U architecture FREE LAB and intersection with BRIDGES 2023 SPACECHIPSDIECUT launch with CHILDRENS MUSEUM PITTSBURGH More notes on the AMAZING GEOMETRY MACHINE and ICOSA	
Robert Fathauer	<i>Tessellations, United States of America</i>	Fractal-Limit Tilings	<i>Early Thu PM</i>
		Constructs dubbed "fractal-limit tilings" (fl-tilings) are explored. These are formed by starting with a simple polygon and then strictly applying an iterative construction rule for subsequent generations. The overall fl-tilings form simply-connected supertiles; i.e., necking down to a point is not allowed. These supertiles only form in the limit of an infinite number of iterations.	
Eliza Gallagher	<i>Clemson University, United States of America</i>	9x9 Project: Building Math Identity One Digit at a Time	<i>Early Fri AM</i>
		We're working to get kids hooked on math puzzles! We'll talk a bit about the current state of the project and how others can join the network. We're actively looking for collaborators who work with youth ages 9-16 in both formal and informal learning spaces.	
Braden Ganetsky	<i>Braden Ganetsky</i>	"Bask3twork": Procedurally Generating Symmetric Celtic Knots	<i>Early Thu PM</i>
		"Bask3twork" is a program that procedurally generates Celtic knots in a square grid using any subset of D4 symmetry, that of a square, including no symmetry at all. The secret? A font! The font's glyphs can be mixed, matched, and assembled to your heart's content. However, instead of creating Celtic knots manually, we can sit back and watch Bask3twork generate infinite possibilities.	
James Gardner	<i>Martin Gardner Literary Interests, United States of America</i>	Growing Up With Martin Gardner (2024)	<i>Early Thu PM</i>
		Jim Gardner (Martin's son) will share memories and anecdotes about Martin Gardner. Like previous G4G presentations, expect some repetition and new facts/figures! There will also be time for some Q&A	
John Winston Garth	<i>Athens State University</i>	Cellular Auto-mon	<i>Late Fri AM</i>
		Cellular Auto-mons are collectible creatures in the world of mathematics.	

Here's what they are and how to find them.

Jay Gilligan		The Future of Juggling The abstraction and conceptualization of juggling is less than 40 years old-come witness an art form being born in real time! First juggling will be examined and defined as a context instead of a technique. Juggling as an expressive art form confronts the tradition of suspending disbelief in a theatrical environment. The artist does not pretend to catch the ball, what the audience sees is actually happening. What happens then, when juggling is valued for something other than the traditional qualities of skill, difficulty, and risk?	<i>Late Sun AM</i>
Susan Goldstine		Granny Likes Regular Maps In the spirit of crochet topology and map coloring, we look at how far you can stretch granny squares and other porous polygons.	<i>Late Sun AM</i>
Chaim Goodman-Strauss <i>National Museum of Mathematics (MoMath)</i>		The Hat Aperiodic Monotile Dave Smith's discovery of the "Hat" aperiodic monotile last year stimulated many people to make the shape their own, with cookies, clothes, artwork, games, puzzles, tattoos, along with many stranger Hat-styled things, and in the fall, United Kingdom Mathematics Trust and MoMath sponsored a contest to recognize some of the best of these. We will show and share.	<i>Early Fri PM</i>
David Michael Greene <i>Crane Mountain Enterprises</i>		How Many Gliders Do You Really Need? In November 2022, an intercontinental collaboration of Lifenthusiasts successfully proved a really surprising new result. If a Conway's Life pattern can be created by colliding any number of gliders... a thousand gliders, a million, any number... then that same Life pattern can also be created starting with a fixed number of gliders that's really surprisingly small -- a two-digit number, in fact.	<i>Late Fri AM</i>
Stella Grosser	<i>self</i>	The Post Office Metric IN this talk I attempt to mathematically explain why snail mail is so, well, snail-ish. Define the post office metric on the coordinate plane: the PO distance between two points is the Euclidean distance from the first point to the origin (0,0) plus the Euclidean distance from the origin to the second. I introduce the topological concepts of open and closed sets, and conclude with the punchline.	<i>Early Fri PM</i>
David Hall		The Virtual Johnson Solids Introducing a collaborative online collection of virtual 3D models of the 92 Johnson solids	<i>Late Sun AM</i>
Raymond Hall <i>@physicsfun on Instagram and Department of Physics, California State University, Fresno</i>		The Magic Octagon The Magic Octagon: brain teaser, magic trick, and a mathematical "discrepant event" teaching tool. This talk will explore the history, math, and some preliminary findings from cognitive psychology research on this famous illusion involving three rotations.	<i>Late Thu PM</i>
John Harris <i>Furman University, United States of America</i>		Puzzle Variations From a Rod Bentley Text In this talk, we will introduce three variations of puzzles inspired by a Rod Bentley text. The puzzles involve numbers, colors, and symbols, and they are also related to puzzles by Dr. Bette Oxle and T. Dexter Lobe. While each has a slightly different look, the overall theme is the same --- and likely familiar to those paying close attention (and thinking outside the BOX).	<i>Early Fri AM</i>
Eric Harshbarger	<i>Self</i>	The Latest Improvements With "Go First Dice" I have spoken at two previous G4Gs about the search for sets of "Go First Dice". Many significant improvements have been made since my G4G12 presentation. I will present these improvements, give credit to the various discoverers, and discuss the remaining open questions about this problem.	<i>Early Thu AM</i>
George Hart		Abraham Sharp and the "Sharpohedron" The British scientific instrument maker Abraham Sharp (1653–1742) is known for his calculation (circa 1700) of Pi to 72 decimal digits. But a greater accomplishment was his 1717 book <i>Geometry Improv'd</i> with detailed mathematical calculations, handmade copperplate engravings, and practical instructions explaining how to slice twelve original polyhedra from solid blocks of wood.	<i>Early Fri PM</i>
George Hart		Hands-On Activities Saturday Afternoon A quick summary of the hands-on activities available here in the Ballroom	<i>Late Sat AM</i>

this afternoon, to help participants find ones of interest.

Sarah Hart	The Mathematics of Musical Composition	Late Sat AM
Matthew Hayden <i>Indiana University Bloomington</i>	My Degree in Enigmatology Via the Individualized Major Program at Indiana University, students can design their own curriculum to study a custom major. As one of these students, I am on the way to completing a degree in Enigmatology. I offer a retrospective on the curriculum and my guiding principles in its design, focusing on certain notions of complexity and ambiguity that play a central role in my academic trajectory.	Early Sat AM
Bob Hearn <i>Gathering 4 Gardner</i>	The Magnetic Fifty-Nine Icosahedra Coxeter et al.'s book "The 59 Icosahedra" describes all of the possible stellations of the regular icosahedron. Paper models exist in mathematics museums. I describe a magnetic kit, consisting of 413 pieces, whereby one can construct any of the stellations. The set will be available to play with in the exhibit room.	Early Fri PM
Paul Hildebrandt <i>Zome, United States of America</i>	Hyperspace Heroes 2: All You Need is Cubes Glimpses of Marc Pelletier's life and work through a '15-dimensional lens:" his blue lines, Big Zome, and 15-dimensional hyper-cubic lattices, friendships including Mike Penrose, Coxeter and Conway, and warm memories from people who loved him.	Late Fri PM
Tiago Hirth <i>1: ULisbon; 2: CIUHCT - Inter University Centre for History of Science and Technology; 3: Ludus Association; 4: Centre François Viète d'épistémologie et d'histoire des sciences et des techniques; 5: Université de Bretagne Occidentale, France</i>	Sphinx Revue Mensuelle Des Questions Récréatives: An Overview At G4G14 Maurice Kraitchik and his two international conferences on Recreational Mathematics were introduced. The Sphinx Journal which ran from 1930-39 which tied it all together will be the emphasis of this presentation showcasing some more information on the RM scene in between world wars' europe.	Early Fri PM
Akio Hizume <i>Geometric Artist</i>	El Caja de Música de Arena (The Music Box of Sand) Music Box of the Fibonacci Kekak This music box is structurally incapable of being rotated in reverse. To hear the passage you just heard again, you would have to keep turning the crank for nearly five days without sleep or rest. The title of this work is "El caja de música de arena (The Music Box of Sand)" paying homage to "El libro de aren (The Book of Sand)" written by Jorge Luis Borges.	Early Sun AM
Akio Hizume <i>Gometric Artist</i>	Demonstration of Cone-Pass At the last G4G-14 I published "Generalization of Cone-pass and Continued Fraction : Cone-puter" on the exchange book. The idea was to recursively plot the golden angle (137.5..degree) using a cone. It can be extended to any Real Number. The operation is equivalent to continued fraction. I would like to show you the plotting as demonstration.	Early Sun AM
Carl Hoff <i>Game & Puzzle Design</i>	Hazmat Cargo 2: An Even More Difficult 9-Piece Packing Puzzle At G4G13, I presented Hazmat Cargo, a 9-piece packing puzzle. The only 9-piece subset of the hexominoes to have a single solution on an 11x11 board where no 2 pieces touch, not even at a corner. This work has continued and eighteen 9-piece subsets of the heptominoes have been found which have a single solution on the 12x12 board. These 18 sets are compared and one given the title Hazmat Cargo 2.	Early Sat AM
Robin Houston <i>disorganised</i>	Polyhedra Whose Faces Meet at Right-Angles Except on One Edge A brief explanation of the mathematical lore that lies behind the curious polyhedron I'm contributing to this year's Gathering4Gardner gift exchange.	Early Fri PM
Arezoo Islami	Applicability of Mathematics: Shortcomings of Philosophy The Applicability Problem is the problem of explaining why mathematics is applicable to the empirical sciences. This problem is revived and reformulated by the physicist Eugene Wigner under the striking title "The Unreasonable Effectiveness of Mathematics in the Natural Sciences". In this seminal work, Wigner argued that the applicability of mathematics is a miracle, "a wonderful gift which we neither understand nor deserve". The reactions to this problem range from metaphysical claims about the mathematical structure of our universe to epistemic claims about the	Late Thu PM

structure of our cognition and formalist claims about the nature of mathematics as a game of meaningless symbols. These reactions are based on the philosophical views of the commentators about mathematics and the empirical sciences. None of these schools, however, seem to have succeeded in providing a satisfactory answer to Wigner's problem. In my view, one major source of the problem, our failure to find an explanation for the applicability of mathematics, lies in the absence of a defensible philosophy of mathematics. In this talk, I will present some desiderata for a desirable and defensible philosophy of mathematics.

Kate Jones		Our World Premieres at G4G15 — 2024	Late Sun AM
Peter Kagey		Spinning Switches on a Wreath Product In February 1979, Martin Gardner wrote about a puzzle in his "Mathematical Games" column about a rotating table, and suggested that many generalizations of this puzzle were unknown. In this talk, I'll characterize large families of puzzles based on whether or not they are solvable.	Late Sun AM
P. Justin Kalef	Rutgers University Philosophy Department, United States of America	A Puzzle Course at Rutgers University I have recently started teaching a course at Rutgers that uses every kind of puzzle to help cultivate students' minds along many different axes. I believe this may be the only university course of its kind. In my presentation, I will discuss the very unusual structure of the course, and how the students (and administration) have reacted to it.	Early Sat AM
Louis Hirsch Kauffman	University of Illinois at Chicago, United States of America	Rope Magic and Topology This talk demonstrates astonishing variations on the Chefalo Rope Trick. This venerable vanishing of an apparent knot has been in the magician's repertoire since the nineteenth century. We give it a topological boost by discussing how it works, and by giving infinitely many variations of the trick. This demonstration is part of a magic and topology project with Allison Henrich.	Early Sun AM
Margaret Kepner	None	Tumbling Blocks, Doubling Cubes I will discuss my digital artwork titled "Tumbling Blocks, Doubling Cubes." It is based on a classic puzzle using the 30 MacMahon color cubes. Martin Gardner explained the puzzle and presented an elegant solution method due to John Conway in one of his columns. My work presents Conway's solution in the visual framework of the traditional Tumbling Blocks quilt pattern.	Early Thu AM
Tanya Khovanova	MIT, United States of America	My Favorite Math Jokes I've been collecting math jokes for many years. I will talk about some of my favorite ones.	Late Fri PM
Peter Knoppers	Buttinius Puzzles & Plastics	YA15PP — Yet Another 15-Piece Puzzle I present a 15 Piece - complete-set - puzzle that has some interesting problems. The pieces can be folded from laser-cut paper. Of course, this is also my gift exchange.	Early Thu AM
Josh Laison	Willamette University, United States of America	Graphs of Rectangles Looking Diagonally Starting with some rectangles in the plane, we get a rectangle visibility graph by making a vertex for each rectangle, and an edge if the corresponding rectangles see each other vertically or horizontally. In this talk I'll tell you about a new version of these graphs my students and I introduced, where the rectangles instead each view from an eye in one of their corners.	Late Thu AM
Steven Landsburg	University of Rochester, United States of America	How To Organize a Waiting Line In a mathematically precise sense, the worst way to organize a waiting line is the way almost everybody uses --- newcomers go to the rear. I will explain why we'd all be happier in a world where "cutting in" is expected, and will reveal the optimal set of rules.	Late Sun AM
Roy Leban	Almanaq	Markov Algorithms and Life Russian mathematician Andrey Markov has a lot of things named after him! One of the lesser known things is the Markov Algorithm, a deterministic string manipulation and rewriting system. Like Turing Machines, they aren't very powerful or useful. It takes 5296 rules to do Pig Latin! But they're cool. I've created 2D Markov Algorithms and now I can do Conway's Game of Life.	Late Fri AM
Stephen Macknik	SUNY Downstate Health	Champions of Illusion	Late Thu AM

Vanessa Madu	A Chaotic Series of Mathematical Accidents	Late Sun AM
	Some of the best science (and scientists) happen by accident — here are some that are close to my heart.	
Roger Manderscheid <i>Time Travelers League of Intrigue</i>	Human Compatibility for Time Travel	Early Thu AM
	I am the director of the Time Travelers League of Intrigue. I have been authorized to qualify individuals for time travel compatibility. I will confirm this by using one of several instruments of time travel. Those who align themselves to mutual vibrations and frequencies will be able to perform what may look like "magic." They will receive confirmation certificates from the TTLI with privileges.	
Sabetta Matsumoto <i>Georgia Institute of Technology</i>	Bending Seams — How to Create Couture Curves	Early Sat AM
	Seams not only hold clothes together but also give them some of their 3D geometric shape. In this work, we take seams in flat scarves and bend them so that the resulting scarf has negative curvature. We also discuss the methods and materials used for constructing versions in both wool and polyester.	
Douglas McKenna <i>Mathemaesthetics, Inc., USA</i>	Fibbinary Zippers, Frozen Wedding Cakes, and Self-Avoiding, Hilbert-style, Squace-Filling Curve Motifs	Early Thu PM
	Self-avoiding, order-n, Hilbert-style, square-filling curve approximations are toroidal Hamiltonian paths of two types. The lesser known type have boundaries governed by Fibbinary ("Fibonacci binary") zipper modes that emanate enumeration-enabling constraint into the square subdivision's interior. The number of such modes for the order-n square subdivision is the Fibonacci number $F((n - 3) / 2)$.	
Alexa Meade <i>ALEXA MEADE ART</i>	Wonderland Dreams	Early Thu AM
	Wonderland Dreams is an illusion-filled art exhibit by Alexa Meade. She will be talking about her inspiration from Alice's Adventures in Wonderland in creating this larger than life work of art.	
John Edward Miller <i>Time Haven Media, United States of America</i>	15 Geodesics Between Buckminster Fuller and Martin Gardner	Late Sat AM
	DRAFT! Here we consider connections between MG and R Buckminster Fuller. We contrast their lives. Martin mentioned Fuller a number of times in his columns and books, so we visit those topics (list). In addition - Bucky Balls, Tensegrities, Dymaxion Map. Finally, a personal recollection of hosting Fuller on his visit to Lewis & Clark College (Portland Oregon) in 1979.	
Stuart Moskowitz <i>CalPoly Humboldt</i>	Math Where You'd Least Expect It, but Then, It's From Lewis Carroll	Late Sat AM
	"To repeat your arguments....will simply lead to his doing the same; and so you will go on, like a Circulating (repeating) Decimal. Did you ever know a Circulating Decimal come to an end?" Lewis Carroll had a way with words and math. But not just in the Alice books. We'll look at examples from essays & letters showing how he infuses math into everything he wrote. Number sense helps!	
Bjoern Muetzel <i>Eckerd College, Florida, United States of America</i>	Apollonian Dream	Early Fri PM
	Water drops fall into a lake and create ripples. For a fleeting moment these rings show an Apollonian gasket. The corresponding video was created using the 3D software Blender.	
Alexandre Muñiz <i>Puzzle Zapper</i>	Mixed Connections: Polyominoes, Piece by Piece	Late Thu AM
	Variant chess piece notation provides a language for describing polyominoes with different types of cell connections. Mixing connection types within and between shapes leads to new forms of polyomino tiling puzzles.	
Audrey Nasar <i>FIT, United States of America</i>	Symmetry Card Game	Early Fri AM
	This presentation will showcase "Symmetry," a deck of cards that can be used to teach rosette symmetry groups in a fun and interactive way. The cards were inspired by a geometry course for undergraduate students at FIT. In "Symmetry," each card features a character interacting with an object, which can be classified according to the symmetry group it belongs to.	
Douglas O'Roark <i>Math Circles of Chicago,</i>	Recreational Math at Scale: Math Circles of Chicago	Late Thu AM
	Math Circles of Chicago (MC2) has become the largest math circle program	

in the country, and it is inspiring other organizations around the US to adopt some of its practices. This talk will give a quick overview of the aspects of MC2 that make it unique with the hope of inspiring others to implement programs that are equity based and encourage all children to participate.

Matt Parker	<i>Stand-up Maths</i>	The campaign to fix geometrically impossible UK traffic signs The traffic signs in the UK for a sport stadium show a geometrically impossible soccer ball: one made entirely of hexagons instead of a mix of hexagons and pentagons. Matt Parker has run a major campaign to correct this issue but despite overwhelming public support, the government has refused to address the concerns. Matt will provide a re-cap on the campaign so far and outline future strategies.	<i>Early Sun AM</i>
Eleftherios Pavlides	<i>1: Roger Williams University, Architecture, United States of America; 2: Brown University, BioMedical Engineering, United States of America</i>	Polymorphic Elastegrity (PE): From Recreational Paper Folding to the Tree of Polymorphisms The PE originated from art assignments based on Josef and Annie Gropius Bauhaus's Design Theories. We will examine how the PE was discovered through art and show how further folding gives rise to 15 polymorphisms: the 5 regular solids at various scales, objects symmetrical to the 6, 12, and 60 bar tensegrity, the transformation from the 2D cube, to 3D, to 4D and other novel shapes.	<i>Early Fri AM</i>
Roger Penrose		On the Escherization of David Smith's "SPECTRE" Einstein, and Related Topics	<i>Late Thu AM</i>
Ivars Peterson	<i>Santa Fe Botanical Garden</i>	Patterns in a Botanical Garden Mathematics can help illuminate and enrich our understanding of the many patterns found in a botanical garden. Instances of symmetry, tilings, fractals, Fibonacci numbers, and spherical geometry, all among Martin Gardner's favorite topics, appear among the plants and structures of the Santa Fe Botanical Garden.	<i>Early Thu PM</i>
Jim Propp	<i>Mathematical Enchantments</i>	Industrious Dice, or, Pip-Pip Hooray! I'll discuss dice that perform the same job as a standard die (generating a random number between 1 and 6) using just 7 pips rather than the usual 21, as well as other curious dice.	<i>Early Fri AM</i>
Debbie Denise Reese	<i>Zone Proxima, LLC, United States of America</i>	ROOT(Math Success) = Childhood + Concrete Analogs + Challenges Many USA students lack math proficiency. Solution: concrete, early childhood math preparation. Zone Proxima Math's embodied learning challenges effectively guide young children to experience joy discovering & applying foundational mathematics concepts. Mentor children to manipulate concrete objects that embody math concepts, self-regulate, and enjoy rewards of effortful cognitive engagement.	<i>Early Sun AM</i>
Andrew Rhoda	<i>The Lilly Library, Indiana University, United States of America</i>	Update on the Slocum Mechanical Puzzle Collection at the Lilly Library I will update the community about recent developments related to The Jerry Slocum Mechanical Puzzle Collection at the Lilly Library. After a brief introduction, I will talk about notable recent projects, including newly processed materials and outreach events. I will conclude with information about upcoming events for the collection, including IU's preparations for the eclipse in April.	<i>Early Sat AM</i>
Dana Richards		Beware the Ides of Math	<i>Late Fri PM</i>
Dana S. Richards	<i>gmu, United States of America</i>	The Works of Martin Gardner I will discuss the breadth of Gardner's output through the lens of completing my The Martin Gardner Bibliography.	<i>Early Sat AM</i>
David Richeson	<i>Dickinson College, United States of America</i>	How Much String to String a Cardioid? It is well known that it is possible to make a string art cardioid. Begin with n equally-spaced numbered nails in a circle, and run a piece of string from each nail k to $2k$ (modulo n). We get different designs by changing the multiplicative factor. In this presentation, we discuss the surprising answer to the question: How much string will we need?	<i>Early Thu PM</i>
Tom Roby	<i>UConn</i>	Jeu de Taquin: The Fifteen Puzzle in Research Mathematics The French name for the Fifteen Puzzle is "Jeu de Taquin" (the "teasing game"). M-P Schützenberger generalized this notion of sliding to help explicate the "Knuth relations" on permutations (or "words"), proving	<i>Early Thu AM</i>

some amazing properties and connecting it with important parts of combinatorics and representation theory. Applications and new variations still regularly appear in the research literature.

Tom Rokicki		The Speed of Light in the Game of Life	<i>Late Fri AM</i>
		It is well known that the fastest diagonal speed in Conway's Game of Life is $c/4$ diagonally, and $c/2$ orthogonally. But can these speeds be attained? More precisely, if a life pattern exists strictly in the lower left quadrant of the plane, what's the earliest generation for which cell (x,y) can be set, among all possible patterns? Knuth poses this question in <i>The Art of Computer Programming</i> , volume 4B Part 2, section 7.2.2.2, exercises 82 and 83. We give the known results (specifically, the existence of patterns that reach all cells reachable in 50 or fewer generations).	
Adam Rubin	<i>Art of Play</i>	An Informal Poll	<i>Late Fri PM</i>
		Get to know your fellow Gardner enthusiasts and connect with those who have similar interests.	
Karl Schaffer		Movement Games, Folk Dance, Billiard Paths, Lace Shirtwaist Buttons, and (A, B)-Step Hamiltonian Graphs	<i>Late Sun AM</i>
		What might movement games, salsa rueda and other folk dance forms, billiard paths in polygons, and lace shirtwaist buttons have in common? They all sometimes exhibit patterns known as (a,b) -step Hamiltonian cycles. These are sequences of the vertices of a graph in which each vertex appears once and such that the graphical distance between successive vertices in such a sequence alternates between a and b , including from the last to the first vertex. We briefly note the ubiquitous appearance of such cycles.	
Ann Schwartz	<i>Fantastic Flexagons, United States of America</i>	Guess What ... I'm a Flexagon!	<i>Early Sun AM</i>
		A funny thing happened while I was packing the Martin Gardner themed hexa-hexaflexagon for the last G4G. As I folded each straight strip into a shape that could slip into an envelope without adding additional folds, a flexa-friend (Scott Sherman) happened to tell me that that the very shape I was making was itself a flexagon! I'll show two versions of it and their fascinating characteristics.	
Henry Segerman	<i>Oklahoma State University, United States of America</i>	Variants of the 15-Puzzle and the Effects of Holonomy	<i>Early Thu AM</i>
		I'll discuss some variants of the classic sliding tile 15-puzzle that involve holonomy - the phenomenon of traveling around a loop in a curved surface and coming back rotated. I'll demonstrate physical puzzle designs with positive and with negative curvature, and discuss design considerations and consequences.	
Jeanette Shakalli	<i>FUNDAPROMAT</i>	FUNDAPROMAT: A Free Source for Math Enthusiasts	<i>Early Fri AM</i>
		The mission of the Panamanian Foundation for the Promotion of Mathematics (FUNDAPROMAT) is to change the world's perception so that one and all can experience mathematics as accessible, relevant and inherently joyous. In this talk, I will briefly introduce FUNDAPROMAT, summarize our efforts to spread the joy of mathematics and share how those who are interested can get involved.	
Aaron Siegel	<i>(no affiliation)</i>	Losing at Hackenbush	<i>Late Fri PM</i>
		The study of partizan combinatorial games in misère play (last player losing) has advanced substantially in recent years. In this talk, I will consider Hackenbush, one of the most familiar of all partizan combinatorial games, in misère play. I will show that even very simple Hackenbush positions - sums of monochromatic stalks - reveal a surprisingly rich and mysterious structure.	
Tali Siegel, Lila Siegel, Aaron Siegel	<i>The Siegel Family</i>	Combinatorial Jenga	<i>Late Thu AM</i>
		Jenga has been a classic since its creation in the 1980s. It's often a test of dexterity, but if Jenga is played between two players with perfect coordination, it becomes a combinatorial game. We'll show you how to reduce combinatorial Jenga to simple mathematics and walk you through how to play it perfectly---so that all you have to do is develop flawless dexterity, and you can win every time!	
Jorge Nuno Silva	<i>University of Lisbon, Portugal</i>	Lewis Carroll's Game of Logic	<i>Early Fri AM</i>
		The Game of Logic is the title of a book published by Lewis Carroll in 1886. In it he presents a board-game for (at least!) one player designed to perform logical deduction. We will describe it and comment on its relation with other systems of deduction known to Carroll, as Euler's Circles and Venn's Ellipses. What makes Lewis Carroll's invention a game?	

Alvy Ray Smith	What Do the Theory of Computing and the Movies Have in Common?	Late Fri AM
Timothy Snyder <i>Slowpoke Games</i>	Correspondence between Projective Geometries and Regular Polytopes Projective Geometries are intriguing incidence structures with many practical applications, including game mechanics. This talk will explore the correspondence between several finite projective geometries and the rotational axes of symmetries of regular polytopes. Visualizing the structures in this way can help lead to a more intuitive understanding, unlocking their secrets.	Late Thu AM
Gilryong Song <i>Pickagram.IIc, United States of America</i>	Pickagram = Tangram x Golden Ratio Pickagram is the world's first magnetized 3D art puzzle designed by bringing a whole new dimension to the ancient Tangram puzzle, utilizing the geometry of the golden ratio to inspire its iconic shape and proportions. Pickagram puts creativity, exploration, and problem solving in the hands of any user who picks it up. Let's explore geometry and spatial thinking through play.	Late Fri PM
Richard Stanley <i>University of Miami, United States of America</i>	A Fibonacci Array We will discuss an array of numbers, analogous to Pascal's triangle, with many connections to Fibonacci numbers.	Early Thu AM
Rodi Steinig <i>Math Renaissance</i>	Bringing G4G to Children I brought the actual G4G14 gift bag to my Math Circle and shared the items in it with my students (ages 9-12). I'd like to tell you of their reactions and encourage you to do the same.	Early Sun AM
Michael Stranahan <i>Zometool</i>	Hyperspace Heroes 3: Love is All You Need This is a revolution, and we are putting power into children's hands worldwide. They are directing it; we are not. It gives children of every walk of life, every culture, and every age a tool to talk to each other. The revolution's leaders are the young people whose minds are being opened up to a whole new world of knowledge and who have eager minds and eager fingers. Zometool is their tool.	Late Fri PM
Michael Tanoff	A Selection of 15 Meter Stamps for G4G15 At G4G12, in my guise as Clancy O'Gara, son of Martin Gardner's Mathematical Postman, I presented 73 philatelic items (mostly postage stamps with a few postal cancellations) among 12 mathematics categories, illustrating the richness of mathematics on postage. At the following gathering, G4G13, I provided a gift paper illustrating new mathematical philatelic issues released during the ensuing two years since G4G12. In this presentation, I continue to illustrate the entertaining world of mathematical philately by showing 15 instances in which mathematical themes have turned up in metered postage.	Late Sun AM
Ryuhei Uehara <i>1: Japan Advanced Institute of Science and Technology, Japan; 2: Nagoya University; 3: Kyoto University</i>	Common Shape Puzzles We investigate the common shape puzzle for forming the same shape for given two sets of polyominoes. We show that the puzzle can be polynomial time solvable, NP-complete, and undecidable. Nevertheless, certain concrete instances can be solved in a practical time. We provide tuples of polyominoes and outline concrete results, which improve on the previously known results in puzzle community.	Early Sat AM
Daniel Valente-Matias <i>Center for Theoretical and Computational Physics, Faculty of Sciences of the University of Lisbon</i>	Database of Common Nets of Polyhedra Polyhedra can be unfolded to form nets. Counterintuitively some nets can be folded to form different polyhedra by changing the way we fold the same net. This phenomenon has been extensively studied for some types of polyhedra (usually with regular faces) but barely touched for more complex examples. In this talk we introduce a database we created with examples of this behaviour.	Late Sat AM
Robert Pope Vermillion <i>Ace Hardware, United States of America</i>	The Impossomatic 3000.1 A ridiculous exercise in asininity with an impossible machine, questionable mathematics, dodgy science, and general mayhem in large measure. Really though it's a comedy performance with gags aplenty for every aficionado of math, science, and all things weird, wacky, and, I hope, funny and memorable.	Late Thu PM
Scott Vorthmann <i>vZome, United States of America</i>	The Virtual Fifty-Nine Icosahedra I describe an online version of Bob Hearn's Magnetic 59 Icosahedra model, freely available for all.	Early Fri PM

<p>Jim Weinrich <i>San Diego State University</i></p>	<p>On Spinning and Toppling Coins — Did Martin Gardner Change His Mind?</p> <p>When you spin a penny and let it fall, is there a bias toward heads or tails? Martin Gardner claimed over the years that there is a heads bias, or a tails bias, but didn't explain why he changed his mind. He consistently maintained that there was probably a slight bevel to the edges of pennies minted in the U.S. I've tested hundreds of pennies for such a bias and have surprising results to share.</p>	<p><i>Early Thu PM</i></p>
<p>Greg Whitehead</p>	<p>Nerd Sniped by the Hat Tile</p> <p>In this talk I will share my experience making two different puzzles out of aperiodic monotiles.</p>	<p><i>Early Fri PM</i></p>
<p>Glen Whitney <i>studioinfinity.org, United States of America</i></p>	<p>Restoring Lost Digital Mathematical Treasures</p> <p>Already in the short history of the Internet, numerous remarkable interactive mathematical illustrations have been created only to become inoperable as the technological platform of the web rapidly mutates. This talk will discuss the development, and illustrate the outcome, of tools to revive several wonderful websites suffering from such problems.</p>	<p><i>Early Sun AM</i></p>
<p>Alyssa Williams, Christian Scott</p>	<p>Learning to Solve and Set Variant Sudoku</p> <p>We believe sudoku can be an excellent tool for teaching logic and reasoning skills, as well as facilitating a lifelong love of math. When we were first introduced to variant sudoku, we were totally blown away to learn that the puzzles are often set by actual people. It didn't even seem like a possibility that we could learn to do it ourselves. Turns out, anyone can set a puzzle! A year later, we've become regular setters and solvers, and we want to show others how to do it, too!</p>	<p><i>Early Fri AM</i></p>
<p>Colin Wright</p>	<p>Incircles of Primitive Pythagorean Triangles</p> <p>Recently someone pointed out to me an interesting fact about incircles of Pythagorean Triangles, which was nice, but not too deep. Then I got a surprise.</p>	<p><i>Early Fri PM</i></p>
<p>Carolyn Yackel <i>Mercer University, United States of America</i></p>	<p>Depicting Catalan Solids on Temari Balls</p> <p>We discuss the project of depicting Catalan solids on temari balls. This includes projecting the wireframe of the Catalan onto a not quite ideal sphere in the real world and considering the best embroidery methods to bring a naive viewer into conversation with the mathematics. This work originated as part of the Mathemalchemy project.</p>	<p><i>Early Fri PM</i></p>
<p>Meir Yedid</p>	<p>Amazing Kreskin Celebration</p> <p>Due to unforeseen circumstances, The Amazing Kreskin is not able to join us this year, but he has graciously agreed to let his friend Meir Yedid present a short retrospective of his life and career, and even reveal previously unknown facts about him.</p>	<p><i>Late Thu PM</i></p>
<p>Inna Zakharevich <i>1: Cornell University, United States of America; 2: Franklin and Marshall College</i></p>	<p>Computing with Paper</p> <p>What do you need in order to build a computer? It turns out that any computer program running on any input can be modeled using Conway's Game of Life: a simple two-dimensional grid of points that turn black or white based on simple rules. In this talk we'll talk about another way of modeling such a computer, using origami: just like Life, it turns out that paper folding flat can model computation.</p>	<p><i>Early Fri AM</i></p>