Points & Angles

Bijections: Sometimes It Counts Not to Count

December Speaker Bridget Tenner

At the Des Plaines Elks Club:

Friday, December 6, 2019
Doors Open/Social Hour: 5:45 PM
Dinner & Talk: 7:00 PM

Des Plaines Elks Club
495 Lee Street, Des Plaines
$33 for Members, $38 for Nonmembers

Reserve by noon, Monday, December 2
Online at mmcchicago.org
or by phone at 847-486-4291

Counting is one of our first questions in mathematics: "How many are there?" Some objects are easy to count, while others are a lot harder. An important combinatorial technique centers on the use of bijections to give a one-to-one correspondence between a familiar collection of objects and an unfamiliar one. We will explore several examples of bijections and how they can be used to answer questions that would have been quite difficult to answer without them.

Bridget Tenner is a Professor of Mathematics in the Department of Mathematical Sciences at DePaul University. She received her AB and AM degrees in mathematics from Harvard University and her PhD in mathematics from MIT, advised by Richard Stanley. She has been at DePaul University since 2007, and her primary research focuses on enumerative, algebraic, and topological combinatorics. Her mathematical specialties relate to structural analyses of Coxeter groups and permutation patterns, and her interdisciplinary work involves redistricting issues and voting procedures.

November Dinner Meeting Talk – Eugenia Cheng
by Joyce Gajda

Dr. Eugenia Cheng began by flattering us, as teachers and librarians are her favorite audience. She followed by inducing jealousy, as she's at her dream job teaching math to art students at the Art Institute of Chicago with the autonomy to teach what she likes with no tests and no grading! She is able to "tap into what motivates" her students and that is currently social justice and politics. She's tapping into that as evidenced in her latest book *The Art of Logic in an Illogical World*. Dr. Cheng's presentation showed that abstract math thinking can help unravel anything, including current events, by illuminating it with abstract math. Pure math is a framework that can be used to find agreements. Mathematics is not simply about numbers, answers, and getting things right. There are many more interesting facets. Rather than ending in disagreement on issues, Dr. Cheng uses pure math to find common ground. While pure mathematics is typically thought to feed directly into the pipeline of applied mathematics to the STEM fields to the quantitative world, Dr. Cheng argues that pure math reaches much further, as it is ultimately based in "how to think" which is about the entire world. This resonates with artists, as this is how they view their art. Dr. Cheng then led us through a 5-pronged approach to the application of math to make logic of our world.

The first aspect Dr. Cheng discussed was analogies. She began with an example of any two objects – be it fruits or chairs – and migrated through connected, analogous levels to introduce the use of abstraction. Through abstraction, we are afforded the ability to be less restrictive. We can include more examples and thus be able to move more broadly without limiting ourselves to a singular view. Pure math eliminates ambiguity. Levels can be made clear, and illogical connections can be exposed. People can rationally be reached through analogous, logical explanations where common ground hadn't seemed possible. She demonstrated the application of this technique with the social justice issues of marriage and climate.

The next aspect she discussed was interconnectedness. A map of the London underground versus its more accurate geographic version demonstrated that accuracy is not always helpful. Abstraction can be used to temporarily make something specific clearer. When one states "it really is that simple," Dr. Cheng concluded it's never that simple. Abstraction can outline viscous circles, for example the United Airline incident of overbooking that led to a customer being forcefully dragged off a plane. Math can package events into units that can be more readily understood. United argues that people miss flights; therefore, they need to overbook, yet each customer has paid for a seat. There are many links in this chain, and we can use logic to help determine which part of this chain can be broken by illuminating this circular pathway of actions and determine which link would be most helpful to address to break the cycle. Further examples of the circular nature of both dieting and our 2016 voting engagement were also used to illuminate the power of interconnected logic.

Dr. Cheng next discussed the third aspect of relationships through the use of category theory. She introduced the concept by building on the less interesting idea of the factors of 30, connecting those factors to factors of each other until a straight-line relationship became linked into a cube. She then transformed this example into the abstract and applied it to social justice issues. She demonstrated how the factors of rich, white, and male can be used to show how people with different privileges connect and interact. If one privilege is lost, you're worse off, but levels between the same tiers can be skewed to make comparisons at an absolute level to help explain the relationships. Structural power helps demonstrate the sense in which men harassing women is not the same as women harassing men because the power structure is not the same. It is not as simple as just any people being harassed.

The fourth property Dr. Cheng discussed was pivots - what's not at the top in one context can be at the top in another. For example, there is a relative nature to privilege. Men are more privileged than women, and some women are more privileged than others when viewed by race. When adding in the factor of economics, further pivots can occur. By removing the emotions, the structure becomes visible and easier to make sense of.

The final aspect Dr. Cheng discussed was intelligence through a 3-pronged view. Intelligence is reasonable, powerfully logical, and helpful. When we pit logic and emotion against each other, emotion wins.

November Dinner Meeting Talk (cont.)

Through the use of mathematical axioms, we can work to understand someone else's logic stem that uses different starting points and likewise draws different logical conclusions. Understanding one's "why" provides a path for logic to clarify and create a virtuous circle. Dr. Cheng closed with a discussion of Cipolla's theory of stupidity as the quadrants stemming from the benefit of others versus the benefit to yourself. Intelligence is when both benefit. Dr. Cheng is most proud of her personal transition from one where she benefitted to one that benefits herself and others.

We ended with a few questions, which included the discussion of the impact of independent variables. Ambition, for example, is generally deemed helpful, while ambition paired with women is not always considered helpful. Gray areas come when some variables, such as privilege, are not binary and instead have gradations. Explore the examination of factors with your students, then use the abstract to introduce topics they care about to show the power of mathematics in a context that truly resonates. This was a captivating and thought-provoking presentation that left us all with much to ponder. Please follow Dr. Cheng on social media for more wisdom and inspiration.

Points from the Interior

by Matthew Moran

Greetings MMC Members,

Well, it is November. Is there a better month to give some thanks? I am very thankful for the Chicago Teachers Union for standing up and fighting for students, teachers, workers, and the middle class. As I am writing this, the CTU members are back in school after a long (11 school day) strike where they held out for a contract that would address some key issues. This was not just about fair pay, though that is important and worth fighting for, but also class size, appropriate support personnel, and the privatization of our community schools.

These certainly are interesting times for labor. I saw some data a couple weeks ago that said to be in the top 1% of American taxpayers you need to have an individual income over $500,000 annually. The middle class is going the way of the dodo. Don't worry though, things are so cheap on Amazon, you don't need $500,000 a year.

The other interesting labor story I am following is that of the California Assembly Bill 5 (AB 5). This law will take effect on January 1, 2020, and will require rideshare apps like Uber and Lyft to classify their drivers as employees rather than contractors.

AB 5 has serious implications for these companies, and the "gig economy" in general, and they are fighting it vehemently. The law aims to close the loophole that allows these rideshare giants to classify drivers as contractors because the driving they do is outside the scope of their usual business. They are a platform for ridesharing, not a taxi service. This allows them to avoid paying benefits, shirk minimum wage laws, and leave drivers on the hook for all of the maintenance costs on the vehicles, not to mention the vehicles themselves. It also prevents the drivers from unionizing and collective bargaining because they are not employees.

I know I've talked about the sky falling before with the rise of AI and robots taking over teaching jobs. Don't worry about that for now, but note that I am looking for some VC for my new substitute teacher platform, SUBr. It's like Uber, but for substitute teaching openings. The school will provide a plan, and the contractor would come and "teach" the plan. If things go well with the substitute teachers, we can contract out ALL of the teaching positions. We can just script all the lessons, and put a national curriculum in place. So we get consistent teaching across the country for less than half of the current cost. Sounds like a win-win. Happy Thanksgiving!

In MMC news, don't forget to mark your calendar for Friday, December 6, as MMC will be hosting Dr. Bridget Tenner for a talk on Bijections: Sometimes it Counts not to Count. This should appeal to your love of mathematics without getting too technical. While you have that calendar out, make sure to clear April 1 - 4, 2020 for the NCTM Centennial Meeting at McCormick Place.

NCTM Centennial Annual Meeting & Exposition
100 Years—Looking Back and Moving Forward

NCTM turns 100 in 2020! Join your peers in Chicago as we celebrate our 100th anniversary at NCTM's Centennial Annual Meeting & Exposition. In addition to compelling sessions, networking opportunities, and enriching content, they're planning some special events and surprises to mark the occasion. Join thousands of math education professionals in Chicago as NCTM embarks on its second century.

Topics:
- Implement effective teaching practices
- Experience the depth and excitement of mathematics
- Look Back and Move Forward: A Centennial View
- Create positive change
- Build student agency, foster student identity, and promote social change

When: Where:
April 1 – 4, 2020   McCormick Place, Chicago

Registration is open at www.nctm.org/100.
Early bird registration rates are currently available! Group rates are also available!

Interested in joining the MMC Board of Directors?

If you have been a member in good standing for at least two years,
MMC wants you to run for the board.
Contact Mary at mwiltjer@glenbrook225.org for more information.

Follow MMC on Social Media!

Do you have a student who is interested in becoming a math teacher?

MMC Scholarship for High School Seniors

The Metropolitan Mathematics Club of Chicago is offering a $2,000 scholarship for a high school senior who will pursue a career in the teaching of mathematics. In addition, up to two Filliman Scholarships may be awarded for the same amount (funded by a gift from the Filliman estate). The selected students, their parents, and their sponsoring teachers will be invited to the May 15th MMC dinner meeting, at which time the scholarship recipients will be honored.

A selection committee of MMC members appointed by the Board of Directors will determine the scholarship awards. To be eligible, an applicant must be sponsored by a current member of MMC, submit the application, have an official transcript sent, request a letter of recommendation from a mathematics teacher, and respond to the prompts in point E below. All materials must be received by March 6, 2020. Feel free to email your submissions. You will receive a reply, so you know that it is being considered. The committee will evaluate applications and will make a recommendation to the Board of Directors as to the awarding of the scholarship.
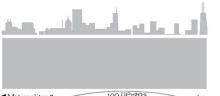
The guidelines used for selection shall be:

A. Demonstration of overall academic scholarship with an inclusion of at least eight semesters of college preparatory mathematics (A minimum cumulative grade point average of 3.0, where A = 4.)

B. A statement of the intention to pursue a career in mathematics teaching

C. Indication of participation in extra-curricular activities, especially those that may have a positive influence on a teaching career

D. A letter of recommendation from a math teacher who is familiar with the applicant's academic performance and his or her potential as a mathematics teacher (The teacher must be an MMC member.)

E. A short response from the candidate (1-2 paragraphs) to each of the following prompts:

    a. What qualities do you possess that will help you in a teaching career?

    b. Describe a teacher who has had an impact on your education.

    c. Was there a time when you struggled with a concept in a math (or other) class? What did you do?

    d. What was your favorite math class? Why?

    e. Describe your favorite math problem. What makes it so great?

    f. What excites you about mathematics?

    g. Why do you want to teach mathematics? *This response may be longer than the others if necessary.*

In addition to the application form (at mmcchicago.org), applicants must also send:

    1. A letter of recommendation from a mathematics teacher, p*referably not sent through the applicant**

    2. A current transcript for seven semesters of high school*

    3. Responses to the prompts in point E above

*Letters of recommendation and transcripts may be sent by separate mail or email.

> Send to: Carrie Fraher
> Glenbrook South High School
> 4000 West Lake Avenue
> Glenview, IL 60026
> (cfraher@glenbrook225.org)

MMC CONFERENCE OF WORKSHOPS 2020

Choose from a variety of workshops, including:

TASKS THAT PROMOTE COLLABORATIVE LEARNING
WHAT CAN KNITTING TEACH STUDENTS ABOUT MATH?
DESMOS AND THE 5 PRACTICES
KHAN ACADEMY 2.0 (EXPERIENCED USERS ONLY)
MATH TEAM PROBLEMS YOUR STUDENTS (AND YOU) SHOULD KNOW HOW TO DO
PROBABILITY JEOPARDY

7 OF OUR FAVORITE PROBLEMS FOR AP CALCULUS
INTEGRATING SOCIAL JUSTICE IN STEAM
ASSESSMENT: FRIEND OR FOE?
WORD PROBLEMS OVER SEVERAL MILLENNIA
"MATCH THE GRAPH" WITH ROBOTS
TEACHING FOR SUCCESS! MATHEMATICS INSTRUCTION IN 2020 AND BEYOND

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MATH TEACHER WITH A CAMERA
POWERFUL TEACHING STRATEGIES TO MAKE LEARNING STICK
HELPING STUDENTS TO MAKE THE TRANSITION TO HIGH SCHOOL ALGEBRA
FUN WITH FRACTIONS
READY, SET, MATH!

PICKING UP STEAM TO BUILD A STUDENT-LED MATH CLASSROOM
ALGEBRA & GEOMETRY ACTIVITIES WITH THE TI-INNOVATOR ROVER
COMPARING LINEAR, EXPONENTIAL & QUADRATIC FUNCTIONS IN ALGEBRA
WHO WANTS PANCAKES? GOOD TASKS INTO RICH LEARNING EXPERIENCES
ACCESSIBLE ALGEBRA FOR FINE MOTOR FRUSTRATIONS
CREATING ENGAGING ACTIVITIES IN DESMOS

COUNTING COLLECTIONS: A POWERFUL ROUTINE YOUR STUDENTS WILL LOVE
PARENTHESES, CHUNKING, AND VARIABLE EXPRESSIONS
MATH, READING, AND CONSEQUENCES: FIRSTHAND ACCOUNT OF GATEKEEPING
UNLOCKING THE BEAUTY OF MATHEMATICS THROUGH STUDENTS' PASSIONS
DESIGNING A TEXTBOOK-FREE COURSE (OR UNIT)
STEM TO STEAM: ENGAGING ALL ALGEBRA STUDENTS WITH ORIGAMI

and many, many more!

For more information, including the full program book,
or to register for the conference, see
www.mmcchicago.org
or contact

Peter DeCraene (mmcconfregistrar@gmail.com)
Nicolette Norris (nickianorris@gmail.com)
Rose Sterr (rsterr@benet.org)

Don't miss out – February 1, 2020

Registration opens in November 2019
Workshop placement is done in the order in which registration is
received, so register early for the best selection!

2019-2020 MMC Dinner Meeting Incentive Programs

"Bring a Friend" Nights: Bring someone who has never attended an MMC dinner meeting, and introduce them to MMC! Both you and your guest(s) will receive $5 off your dinner costs. There is a limit of 2 guests per meeting for the reduced cost, but you can still invite more people to come with you! This incentive is good for the following meetings:

December 6 (Bridget Tenner)   January 24 (Douglas O'Roark)

"New(er) Teacher" Program: Are you a teacher in your first 5 years of teaching? If so, you can take advantage of this incentive! Pick up a new(er) teacher card at registration and bring it back to be verified each time you attend a dinner meeting. Attend 3 meetings this year, and get your 4th meeting at half price!

Thank you to our generous members who are sponsoring this program.

Please be sure to register all attendees using the reservations link on the website.
Mention the incentive when you check in at the meeting to take advantage of these programs.

Is your membership current? Check your mailing label to see when your membership expires.
You can renew by mail with the form below or renew in person at the next dinner meeting.

MMC Membership and Change of Address Form

Mail completed form and check to:

MMC
7339 W. Ibsen St.
Chicago, IL

Field	Value
NAME	
PREFERRED CONTACT Check one:	☐ Home ☐ Work
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CITY	STATE	ZIP
WORK PHONE	WORK E-MAIL

ELECTRONIC-ONLY MEMBERSHIP
Check the box below for electronic-only membership. You will receive an email with a direct link to each issue of *Points & Angles* when it is posted on the web site, often before paper copies are mailed. You will no longer receive *Points & Angles* by mail.

☐ Electronic-Only Membership

FORM USE Check one:
☐ New Membership   ☐ Renewal
☐ Former Member   ☐ Change of Address

* The student and 1st-year teacher memberships are only available as electronic-only.

MEMBERSHIP TYPE Check one:
☐ 1 year ($35)   ☐ student*, 1 yr ($22)
☐ 2 years ($65)   ☐ 1st yr teacher*, 1 yr ($22)
☐ 3 years ($90)   ☐ retired, 1 yr ($28)

MEMBERSHIP COST $ _____

DONATIONS

SCHOLARSHIP FUND $ _____

SPEAKER FUND $ _____

Make check payable to _MMC_

TOTAL AMOUNT OF CHECK $ _____

Upcoming Events

Fri., Dec. 6	Bridget Tenner	**Bijections: Sometimes It Counts Not to Count**
Fri., Jan. 24	Douglas O'Roark	**The Future of Math Enrichment**
Sat., Feb. 1		**MMC Conference of Workshops, Lincolnshire**
Fri., Mar. 6	Eli Luberoff	**Creating Interesting Ways for Students to be Right and Wrong**
Sat., Mar. 7	Eli Luberoff	**Desmos Workshops**
Wed.-Sat., April 1-4, 2020		**NCTM Centennial Annual Meeting: Celebrate 100 Years—Looking Back and Moving Forward, Chicago**
Fri., May 15	Zalman Usiskin	**Some Great Middle and High School Mathematics Lessons Few People Teach**

Send upcoming event items to sburnett_308@yahoo.com no later than the date of the MMC dinner meeting preceding the issue in which the item should appear. All items are subject to editing.

Your membership renewal date appears in the upper right corner of the label

MMC
7339 W. Ibsen St.
Chicago, IL 60631