



# **THE NEW BRAND OF POWERFUL**

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DISCLAIMER:



How are the needs of  
today changing?



# EVERY COMPANY IS A TECH COMPANY.

- National Science Board REPORT: Non-STEM Fields Increasingly Require STEM Skills
- Less than 4% of the U.S workforce in 2010 was classified as working in a science or engineering field, but nearly 20% of all occupations may require significant STEM knowledge and skill in at least one field.

# HOW HAVE WE JUSTIFIED STEM EDUCATION?

- 8.4% who earned their highest degree in science or engineering were working “involuntarily” out of their field
- 51% of individuals whose most advanced degree is in a science or engineering field worked in a non-science/engineering role in 2010.
- Those with STEM degrees are finding a growing number of opportunities outside of stereotypical roles.



# EVERY COMPANY IS A TECH COMPANY.

*Perhaps we ought to shift from asking:*

“How many STEM workers do we need?”

to

“What knowledge and skills do all of our workers need to be  
successful now and in the future?”



# EVERY COMPANY IS A TECH COMPANY.

- The relatively loose links between degrees and occupations are a distinctive feature of the U.S. workforce.
- STEM knowledge and skills enable multiple, dynamic pathways to STEM and non-STEM occupations alike.
- How do we ensure that all Americans have **access** to STEM knowledge and skills?
- What are the respective roles for government, educational institutions, and employers in enabling these pathways??



# WHAT'S REALLY IMPORTANT?



- Technology leaders are publicly arguing that calculation should not be emphasized.
- Students need to focus on problem solving, modeling, thinking, and reasoning.
- Real mathematics is about ***inquiry, communication, connections, visual ideas, and models***. It's multidimensional.



# THE ALGORITHMIC CEO



- “Get ready for the most sweeping business change since the Industrial Revolution.”
- “The single greatest instrument of change in today’s business world, is the advancement of mathematical algorithms and their related sophisticated software.”
- Algorithms are changing **both the structure of the global economy and the nature of business.**



# THE ALGORITHMIC CEO



- To some degree, **every** company will have to become a math house.
- Every organization and its leaders will have to make use of algorithms in decision making.



# ORGANIZATIONAL CHANGE

- Organizational change is likely to come that “flattens” organizations, in some cases cutting organizational layers by half.
- Performance metrics will be redesigned and be transparent, **enhancing collaboration** in a corporation—across departments, geographies, time zones, and cultures.
- Building trust and relationships is increasingly important when removing old command and control jobs.



# WHAT IS POWER?

- At the most general level, it is the ability to influence the behavior of others to get the outcomes one wants.
  1. Coerce with threats **Hot power**
  2. Induce with payments
  3. Attract and co-opt them **Cool power**
- We are moving from an era of hot-power leadership to an era of cool-power leadership.






# WHY IS IT CHANGING

- Technological revolution: information is power, and more have access to that power.
- When people are overwhelmed with the volume of information confronting them, it is hard to know what to focus on.
- Attention rather than information becomes the scarce resource, and those who can bring valuable information to the front gain power.
- Credibility becomes more important; You want to shape the other's preferences.





# SKILLS OF COOL LEADERSHIP

- Vision
- Emotional Intelligence
- Communication



What does research say  
about female leaders?



# COOL LEADERSHIP

- Extensive research shows women are better at this kind of leadership.
- Every one of the women on Forbes World's Greatest Leaders mastered this style.



**Christiana Figueres**

Executive Secretary, UN Framework  
Convention on Climate Change





# COOL POWER

- 20 organizations study by Business Week/Hay Group:
  - Female executives were significantly more likely than male counterparts to coach and develop others and to create more committed, collaborative, inclusive, and ultimately more effective teams.



# HOW EFFECTIVE ARE WE?

## Overall Leadership Effectiveness by Gender by Position (Percentile Scores)

	Male	Female
Top Management, Executive, Senior Team Members	57.7	67.7
Reports to Top Management, Supervises Middle Managers	48.9	56.2
Middle Manager	49.9	52.7
Supervisor, Front Line Manager, Foreman	52.5	52.6
Individual Contributor	52.7	53.9
Other	50.7	52.0
Total	51.3	55.1

Source: Zenger Folkman Inc., 2011

Source: Harvard Business Review



## The Top 16 Competencies Top Leaders Exemplify Most

	Male Mean Percentile	Female Mean Percentile	T value
Takes Initiative	48	56	-11.58
Practices Self-Development	48	55	-9.45
Displays High Integrity and Honesty	48	55	-9.28
Drives for Results	48	54	-8.84
Develops Others	48	54	-7.94
Inspires and Motivates Others	49	54	-7.53
Builds Relationships	49	54	-7.15
Collaboration and Teamwork	49	53	-6.14
Establishes Stretch Goals	49	53	-5.41
Champions Change	49	53	-4.48
Solves Problems and Analyzes Issues	50	52	-2.53
Communicates Powerfully and Prolifically	50	52	-2.47
Connects the Group to the Outside World	50	51	-0.78
Innovates	50	51	-0.76
Technical or Professional Expertise	50	51	-0.11
Develops Strategic Perspective	51	49	2.79

Source: Zenger Folkman Inc., 2011

Source: Harvard Business Review



# IMPACT OF DIVERSITY

- Study after study (McKinsey and others) say that diversity at all levels improves organizational performance
  - Lower job turnover/attrition
  - Higher productivity
  - Higher satisfaction
- Why?





# WHO HAS THE BUYING POWER?



- 73% of all buying decisions are made by women
- 83% of general retail purchases made by women
- Women control \$12 trillion of \$18 trillion in consumer spending

***Lack of diversity in people is lack of diversity in THOUGHT. The products change when you change the makeup of the room.***



# WHAT IS SOCIETY MISSING OUT ON?

- Different perspectives:
  - Example: Automotive industry
  - Example: Fracking
- More gender equal societies tend to be healthier and happier





So, what's the problem? Why don't we have more female leaders in general and in STEM? And what can WE do about it?



# IMPLICIT BIAS

- Faculty and mentoring
- Silicon Valley funding
- Northwestern/University of Chicago Study
- We equally exhibit implicit bias: Study From Psychology



Source: [whitehouse.gov](http://whitehouse.gov)

Source: Science Magazine: Both genders think women are bad at basic math; John Bohannon 2014

Source: Science Magazine: In Academia, women collaborate less with their same-sex juniors; John Bohannon 2014



# RECOGNIZING IMPLICIT BIAS

- Bias with Harvey Mudd College Engineering Awards





# HOW WOMEN EXPERIENCE MATH

- Memorizing
- Growth Mindset vs. Fixed Mindset
- Self perception
- Role of competition



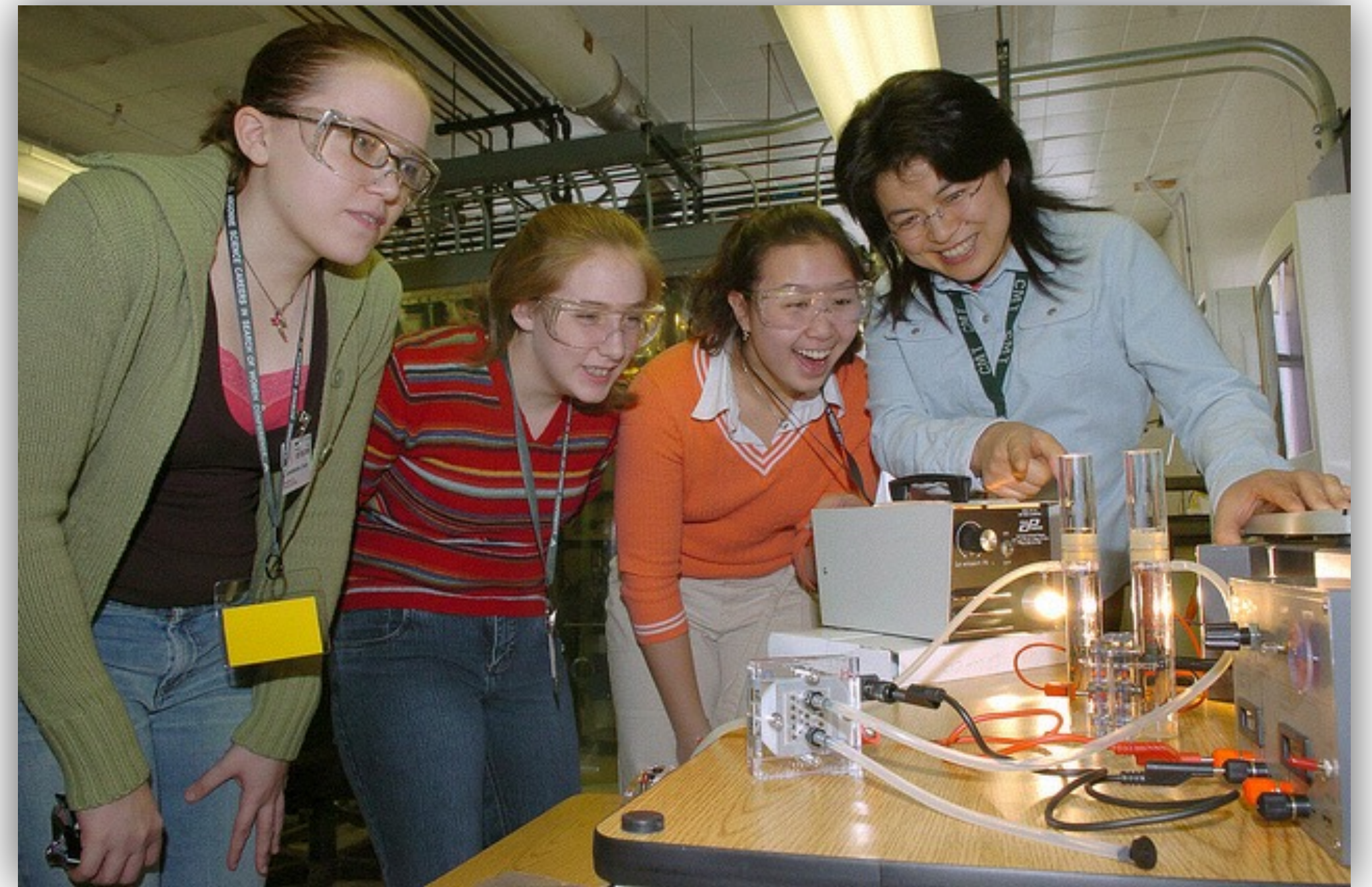
Hechinger Report: "Memorizers are the lowest achievers and other Common Core math surprises"; Jo Boaler (Professor of Mathematics, Stanford University)  
Sources: Journal of Economic Perspectives—Volume 24, Number 2—Spring 2010—Pages 129-144; Explaining the gender gap in math test scores: the role of competition.  
Sources: 5 Most Harmful Math Myths: tutor doctor Los Angeles; [phys.org](http://phys.org): Misperception discourages girls from studying math-intensive science, shows study

• Read more at: <http://phys.org/news/2015-06-misperception-discourages-girls-math-intensive-science.html#jCp>



# HIGH SCHOOL GIRLS AND STEM EDUCATION

- Higher percentages of girls are taking math classes than boys.
- 74% of high school girls across the country are interested in STEM.
- For high school girls: 88% want to **make a difference** in the world, and 90% want to **help people**.







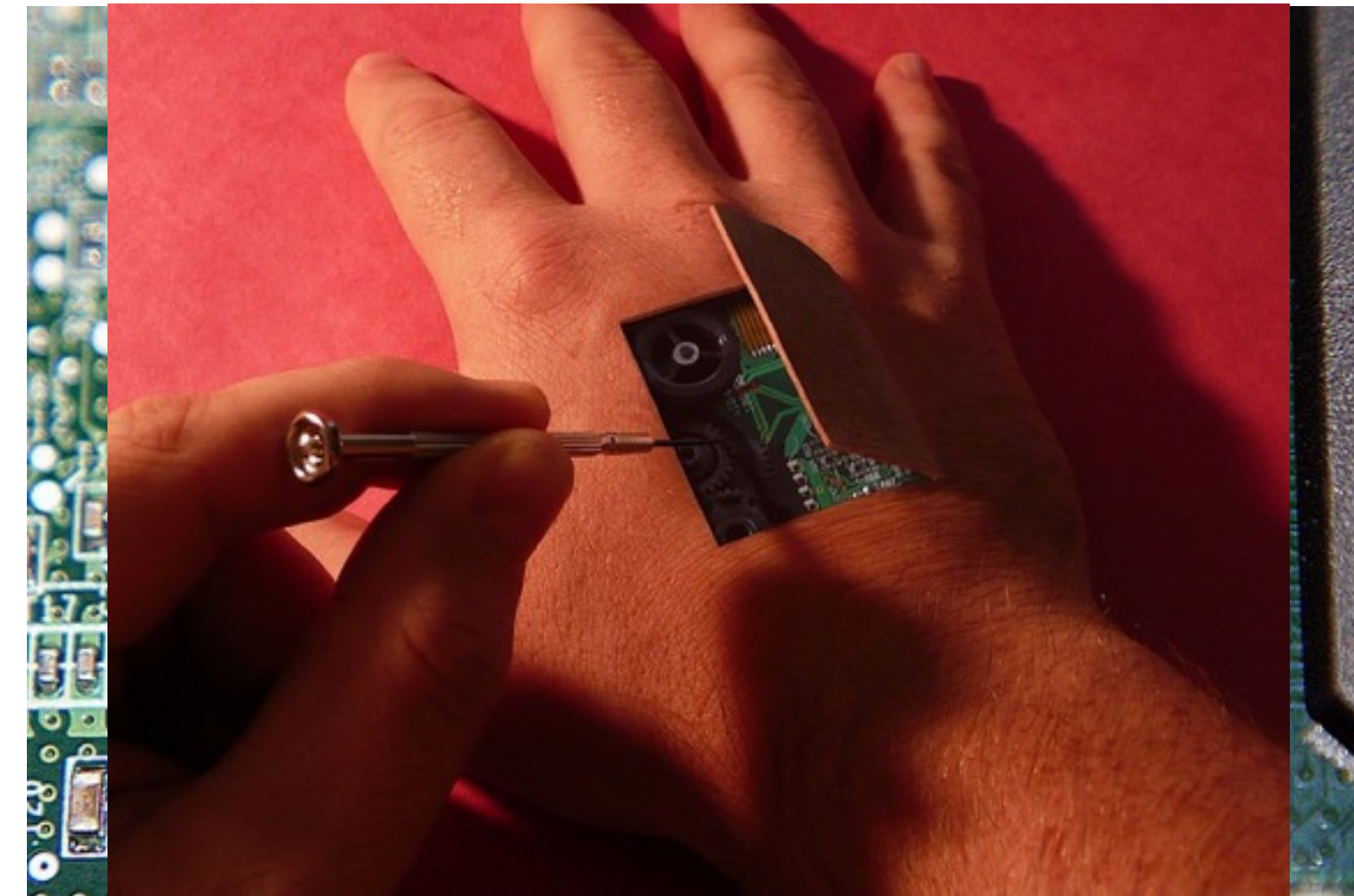
# WHICH MAKES YOU WANT TO KNOW MORE?

1. This machine is the first dynamic high-volume CT that utilizes 320 ultra-high-resolution detector rows to image an entire organ in a single gantry rotation.
2. If you enter the hospital having suffered a stroke or a heart attack, doctors will be able to make a much more accurate diagnosis in far less time and that could save your life. Our product could mean the difference between a full life or never recognizing your family again.



# WOMEN ARE MOTIVATED BY APPLICATIONS

- A higher number of men are excited about the features of technology.
- Women care more about how STEM can be used to **help others** and create **social impact**. They care about the direct applications of the technology, not the technology for its own sake.





# WOMEN PREFER LEARNING IN CONTEXT

➤ Women are motivated by seeing the concepts *in context* and getting a sense of the practical application **right up front**.

1. Carnegie Melon Computer Science Study
2. Carnegie Melon Intro to Engineering Study
  - Transformed retention from 54% to 80%
  - It's cognitive research.









# WOMEN PREFER COLLABORATION

- Studies show collaborative, non-competitive learning is powerful for women. Collaborative learning also tends to be more *applied*.
- Dr. Charlie McDowell- Professor of CS at University of CA Santa Cruz:  
*“Pair Programming Improves Student Retention, Confidence, and Program Quality”*





# WOMEN ARE MORE VISUAL LEARNERS.

- *Visualization encourages learners to consider other ways of thinking and reasoning without immediately resorting to algorithms. The evocation of a visual event also assists in retaining and in further developing knowledge.*

—Association of Teachers of Mathematics



Source: NASA

Source: Bradford, William C., "Reaching the Visual Learner: Teaching Property Through Art" (September 1, 2011). The Law Teacher Vol. 11, 2004.



# TEACH MODELING. WHY?

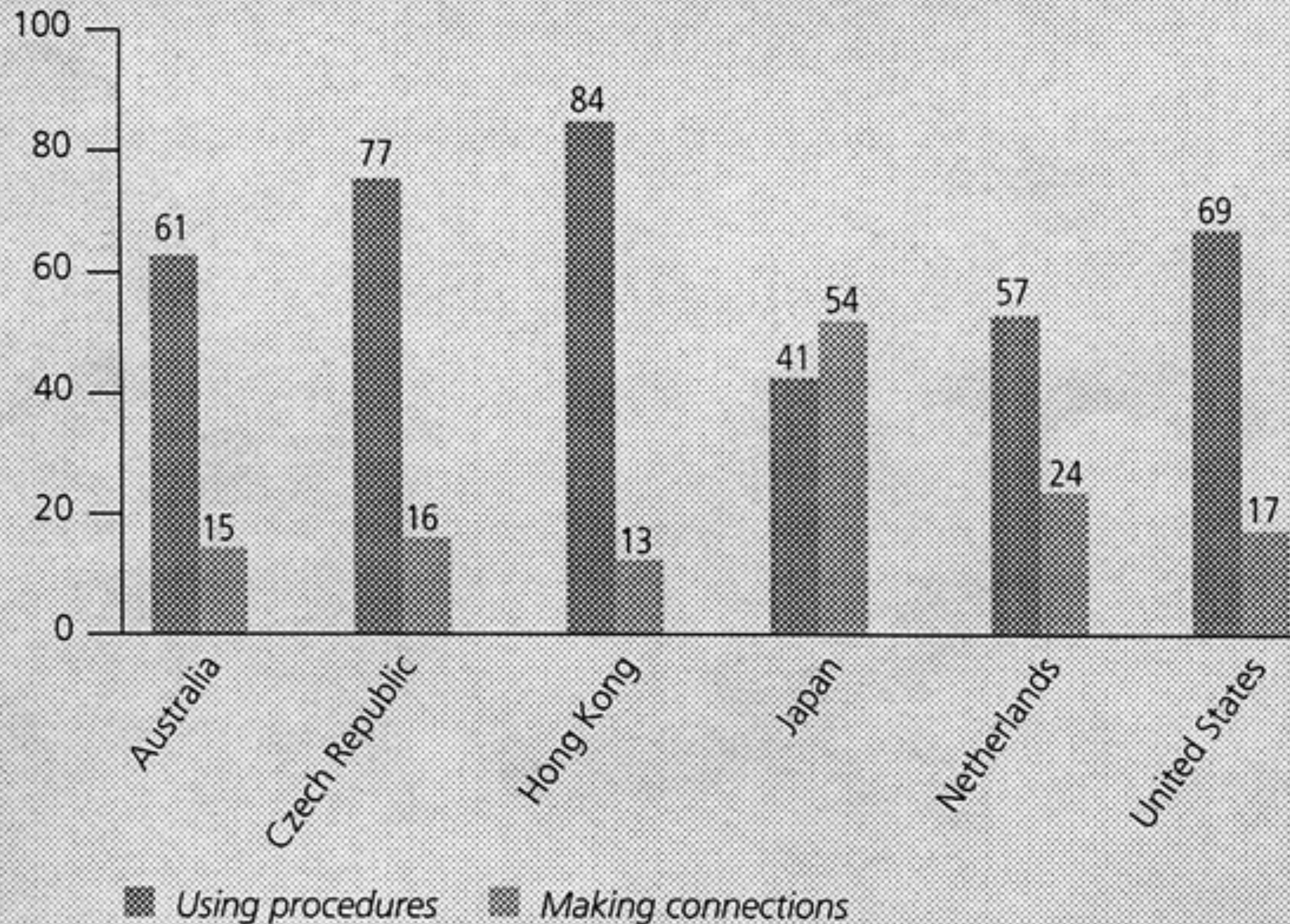
1. It involves making genuine choices, like real life.
2. There's no perfect right or wrong. Finally there's "good enough" in math.
3. Modeling presents math as a creative, iterative process.
4. Modeling is inherently a team sport.



# TIMMS 10-YEAR VIDEO STUDY

The Trends in International  
Mathematics and Science Study

Types of math problems  
presented



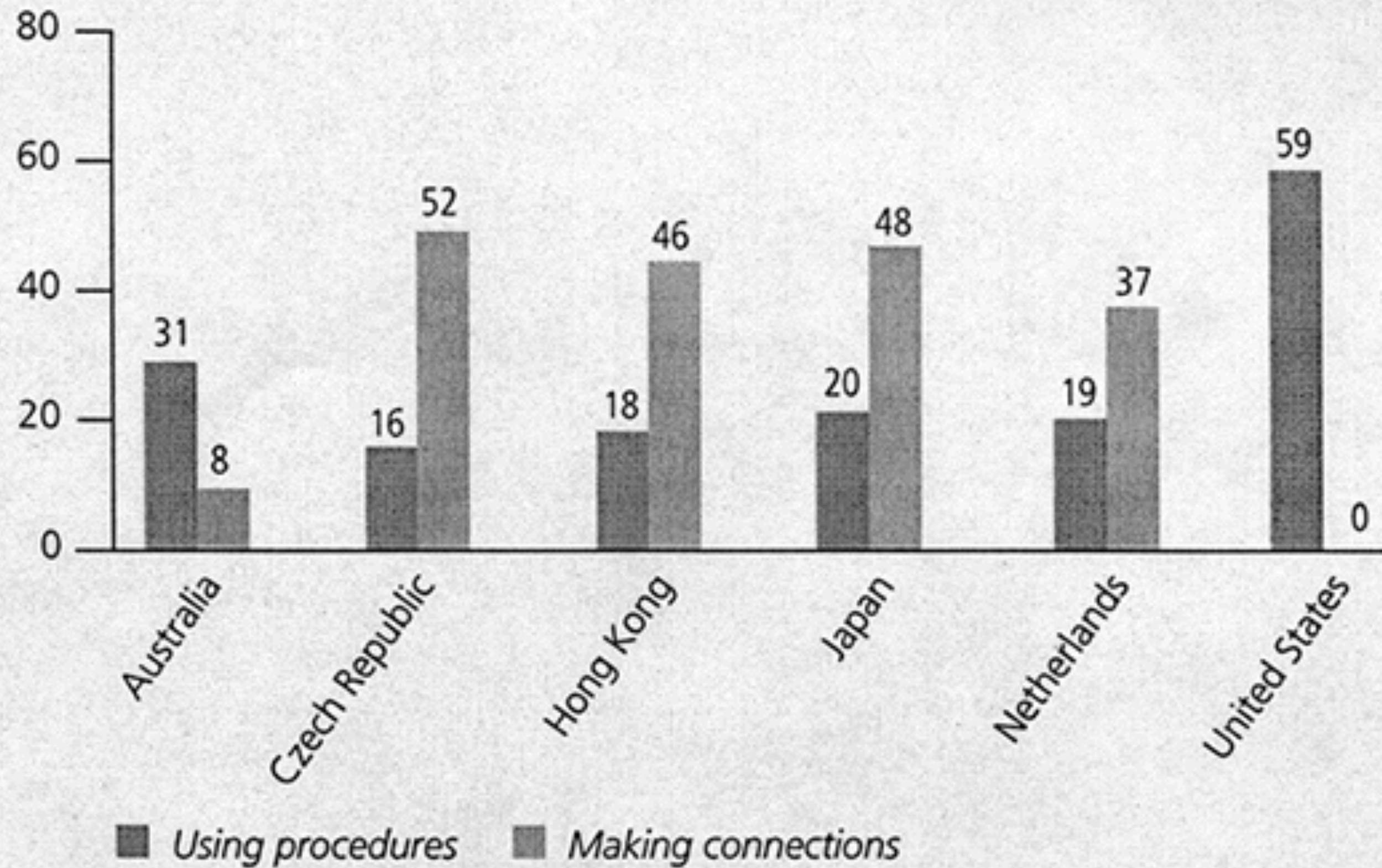
The percentage of math problems that focused on *making connections* varied greatly among high-scoring TIMSS countries.

Note: Switzerland was not included in this analysis because this feature of teaching was coded only by English speakers and English transcripts of the Swiss lessons were not available.



# TIMMS 10-YEAR VIDEO STUDY

How teachers implemented the "Making Connections" problems



High-scoring TIMSS countries implemented a higher percentage of *making connections* problems as *making connections* problems. U.S. teachers tended to turn these problems into procedural exercises.

Note: Switzerland was not included in this analysis because this feature of teaching was coded only by English speakers and English transcripts of the Swiss lessons were not available.





# **SLIPPAGE BETWEEN ACTUAL POLICY, AND CLASSROOM REFORM**

- Teaching is cultural...it's implicitly learned. And it's hard to change.
- We often attain no results or unintended results from reform.
- We often run up against formidable challenge- We don't have a role model of how to implement new methods effectively



Ok long-winded lady...  
what's your point?



# THE NEW BRAND OF POWERFUL

- Women care about people, communicating, and collaboration. These interests, combined with STEM skills, and a changing technological world— are a powerful combination, not only for the advancement of women, but for our society as a whole.
- This is a win-win-win.





Now, what do you  
think?





# **BUILD THE KNOWLEDGE BASE**

- Instructors decide how they can integrate new methods into their own practice and analyze what happens in their own classes.
- Instructors have a central role to play in building a useful knowledge base for the profession.



# THANK YOU FOR ATTENDING!

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