

# Collaboration in Science and Technology

---

Mercè Crosas, Director of Data Science, IQSS  
Harvard University

Harvard IT Summit, June 4, 2015  
[@mercecrosas](#)



---

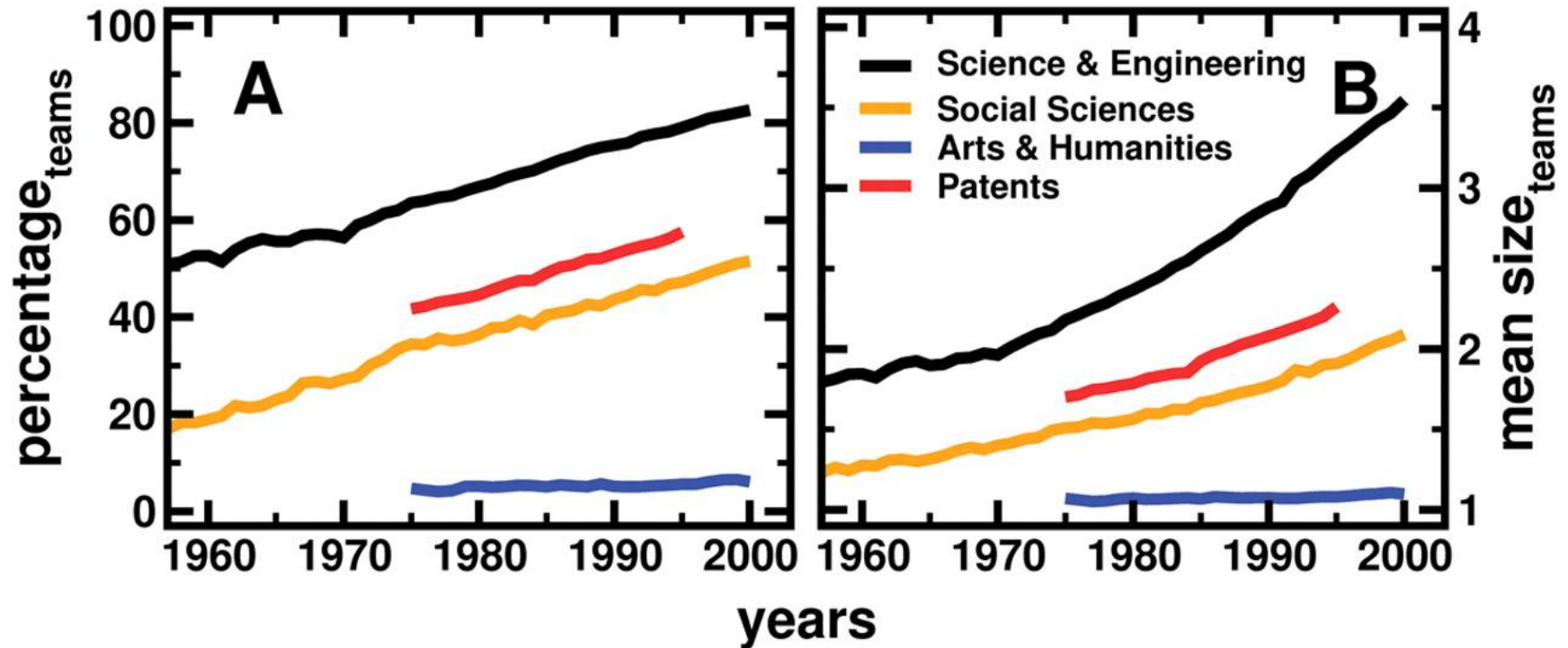
# This Talk

1. Increase in collaboration
2. What makes teams and collaborations work better
3. How collaboration relates to women
4. Why it is important for world's global progress

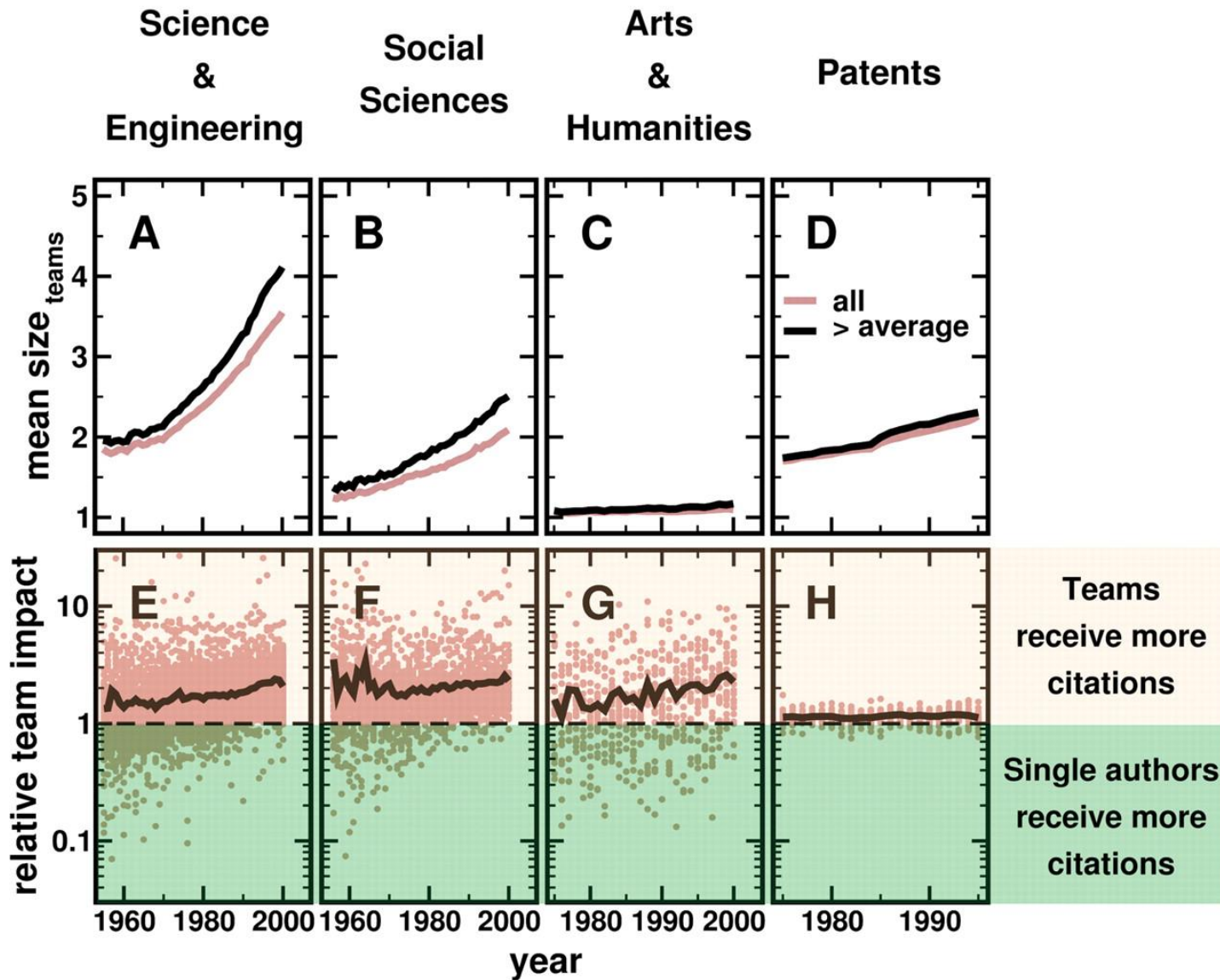
# **Increase in Collaboration**

---

## More and Larger Teams than ever Before

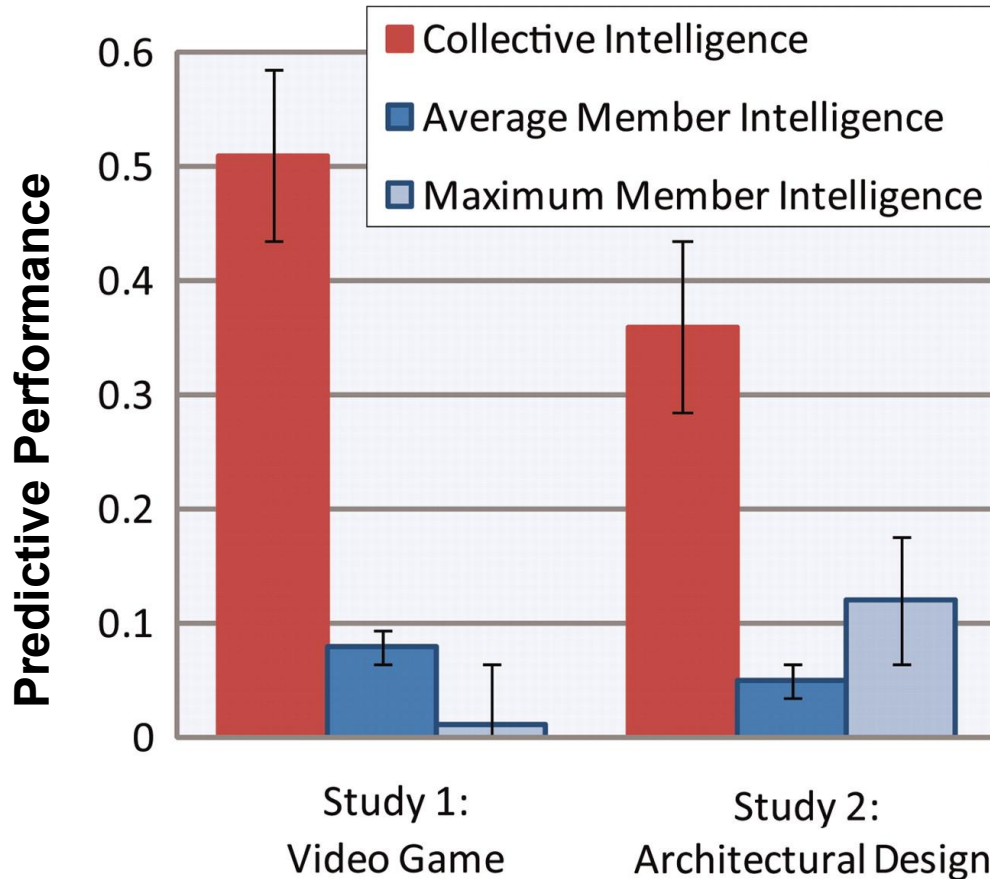


Study used 19.9M papers and 2.1M patents over 50 years



Source: Wuchty, Jones & Uzzi, 2007. *The Increasing Dominance of Teams in Production of Knowledge, Science*

# Collective Intelligence



- Collective Intelligence (group ability) **MORE PREDICTIVE** of group performance than individuals IQ
- Collective intelligence **≠** average member IQ
- Higher collective intelligence **≠** groups with high IQ members

# **What Makes Teams and Collaborations Work Better**

---

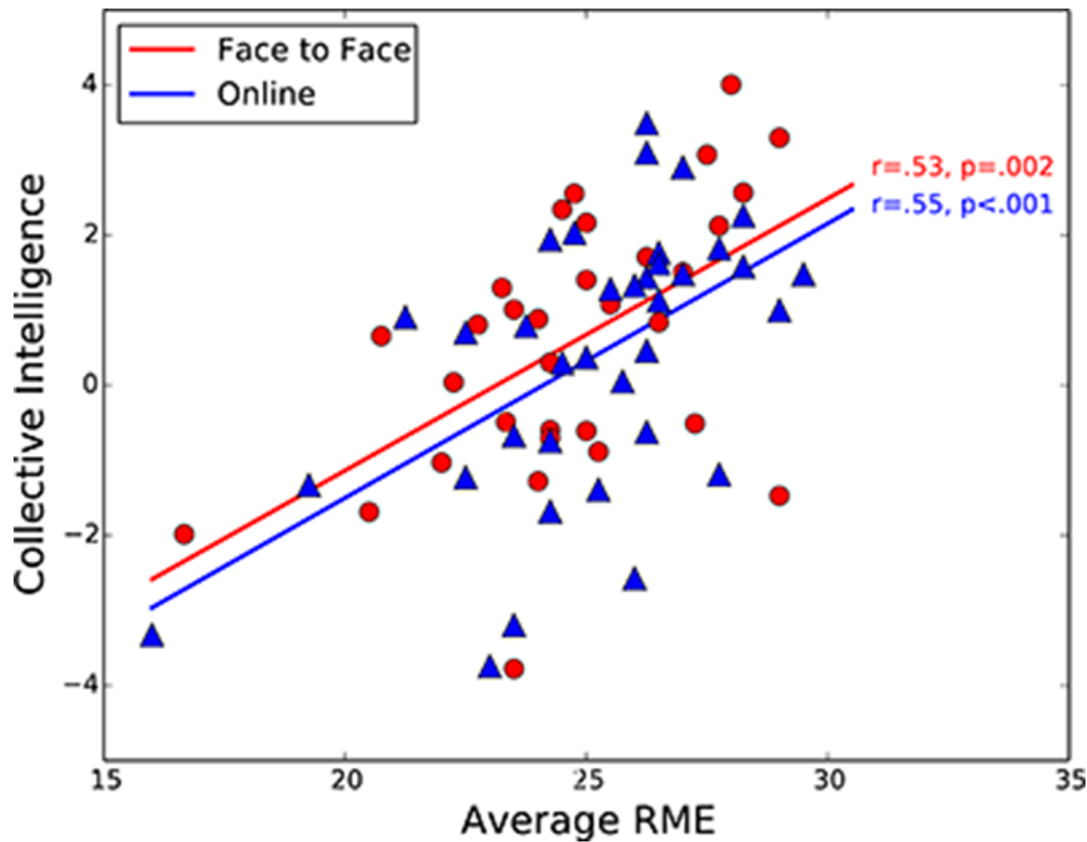
# What Optimizes Collective Intelligence

---

Study shows that teams perform better with:

- **Shared Discourse:** Members contribute more equally to team, rather than a few members dominate
- **Social Cognition:** Members have the ability to read and respond to social cues
- **More women in the team**





Follow up study shows:

- Collective intelligence results are similar for face-to-face and online teams.

---

## Social Connection

---

“We all work as a family because she treats us as such.”

“She knows everyone in the office and has a personal relationship with each one of us.”

“She does not get upset when we make mistakes but gives us the time to learn how to analyze and fix the situation.”

“less emotionally connected” = “less likely to be productive”

(About Archana Patchirajan, founder of technology startups)

# What Lies at the Root of Social Connection

---

**authenticity and vulnerability** = replacing “professional distance and cool” with awareness of uncertainty, risk, and emotional exposure

Source: René Brown study with thousands of interviews

Harvard Business Review, Dec 2014: <https://hbr.org/2014/12/what-bosses-gain-by-being-vulnerable>

---

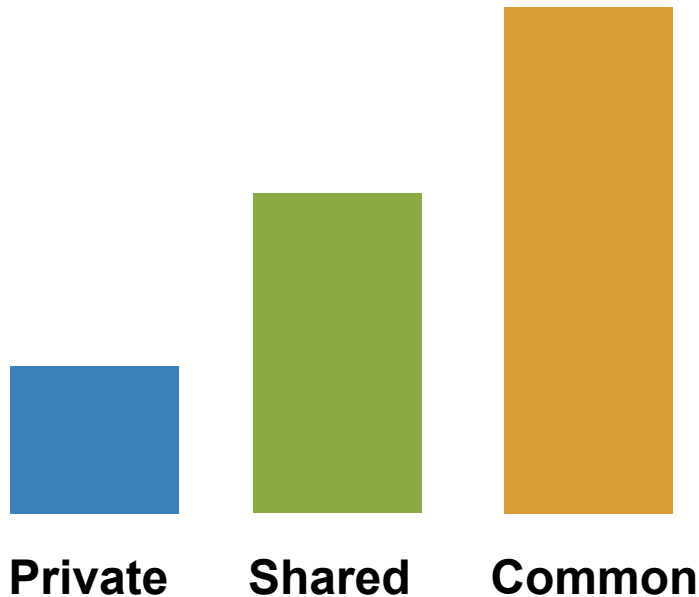
## Common Knowledge

Let's say that **A** and **B** need to coordinate about plan **X** to work together (For example, releasing a software version)

Is it more likely they will together with:

1. **Private knowledge:** **A** doesn't know if **B** knows plan **X**
2. **Shared knowledge:** **A** knows that **B** knows plan **X**
3. **Common knowledge:** **A** and **B** hear publicly about plan **X**

# of participants who want to work together



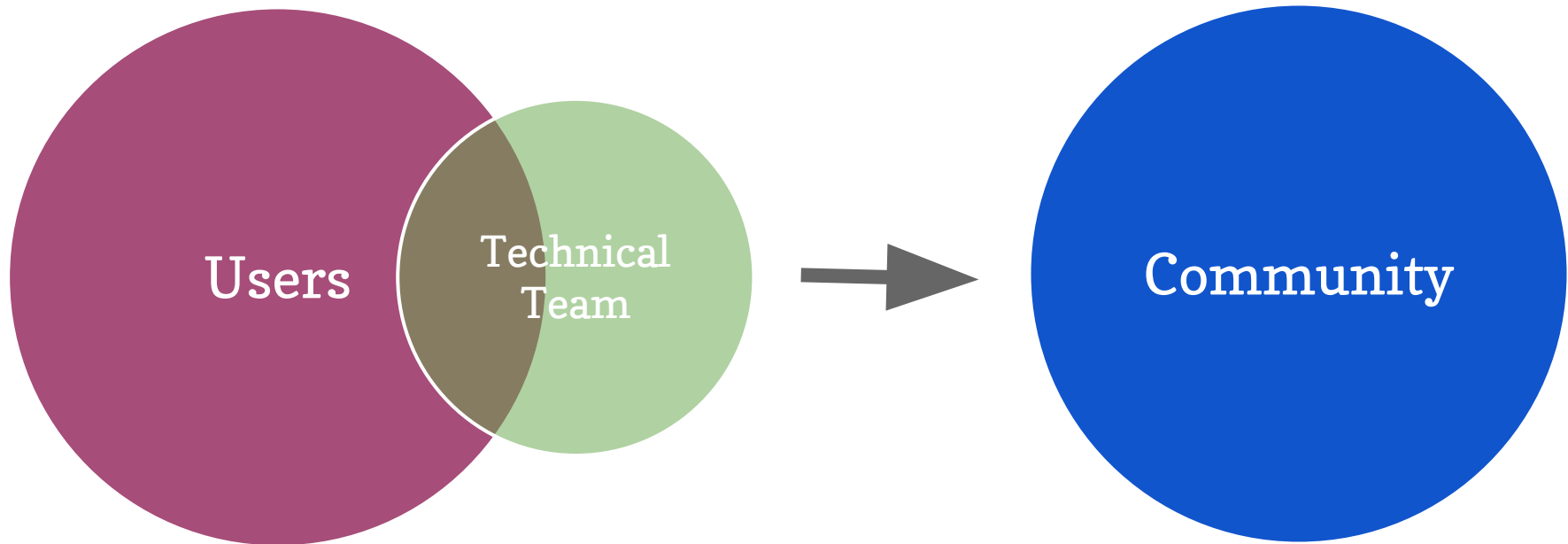
Study finds that:

- **A** and **B** are more likely to work together with **common knowledge**

It also shows that:

- Being more agreeable or open makes no difference to working together with private or common knowledge (but yes with shared)
- Common knowledge is a distinct cognitive category

## Creating Community



- Collaborative engagement creates community
- Collecting and analyzing data helps knowing how to grow it

# **How Collaboration Relates to Women**

---

## Sex Differences

- Facial, gesture expression recognition
- Emotionally expressive
- Egalitarian
- Extraversion
- Parallel processing



- Visuospatial, pattern recognition
- Emotional regulation
- Dominance hierarchy
- Competition
- Serial processing

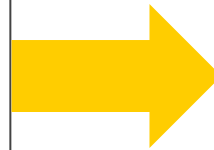


**Notwithstanding**, in the words of Susan Sontag, *“What is most beautiful in virile men is something feminine; what is most beautiful in feminine women is something masculine”*



## Well Suited to Collaborate

- Facial, gesture expression recognition
- Emotionally expressive
- Egalitarian
- Extraversion
- Multi-tasking, parallel processing



## Collaboration

- Shared discourse
- Social cognition
- Social connection
- Common knowledge
- Creating community

# **Why it is Important for World's Global Progress**

---

**Until now there have been individual stereotypes...**



**LEGO Series 7 Computer Programmer**



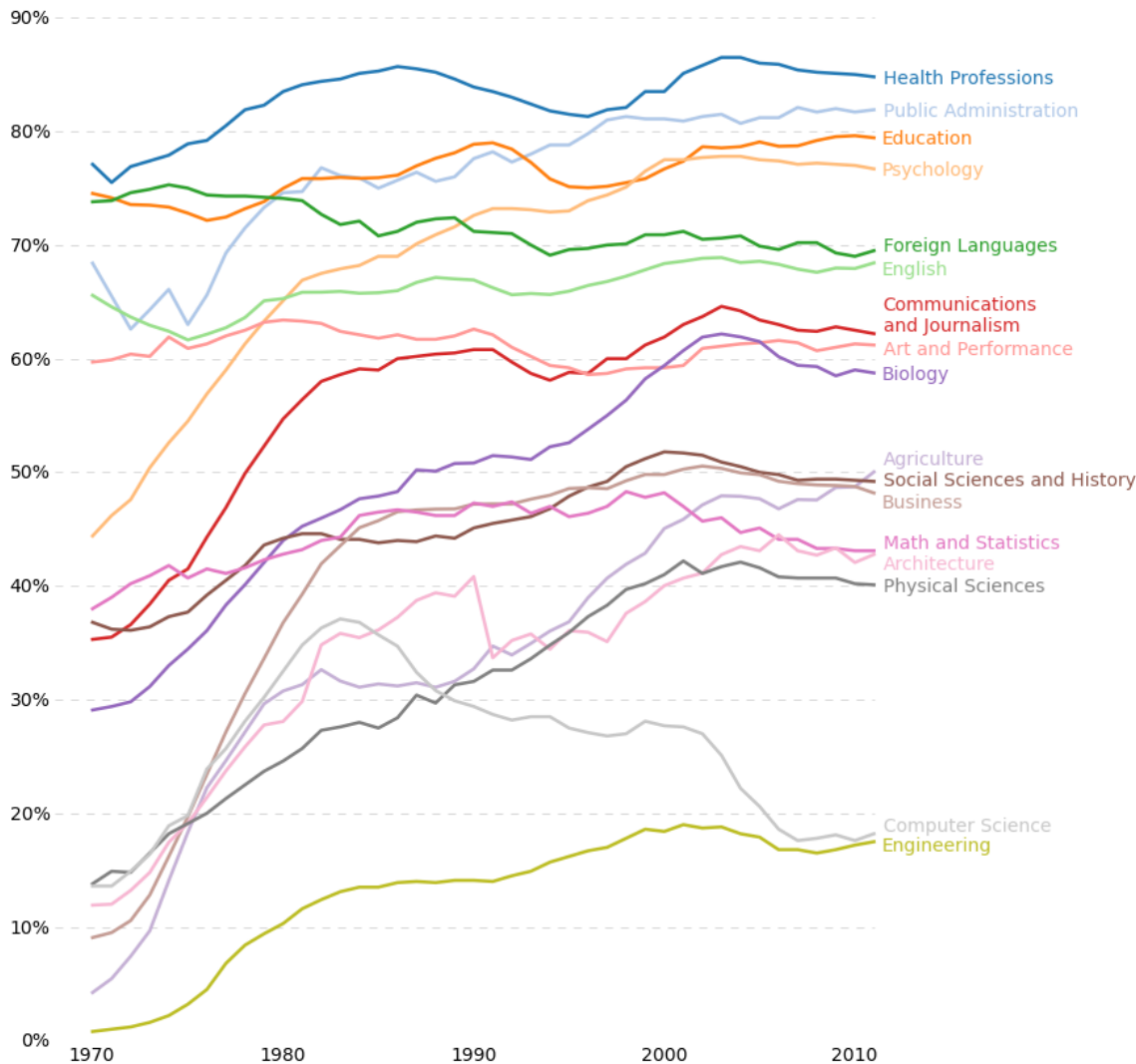
**LEGO Series Women Scientist**



© UNHCR/S.Baldwin

**...but there is a new reality: Teams**

Percentage of Bachelor's degrees conferred to women in the U.S.A., by major (1970-2012)



Data source: [nces.ed.gov/programs/digest/2013menu\\_tables.asp](http://nces.ed.gov/programs/digest/2013menu_tables.asp)  
 Author: Randy Olson ([randalolson.com](http://randalolson.com) / [@randal\\_olson](https://twitter.com/randal_olson))  
 Note: Some majors are missing because the historical data is not available for them

## Now (2013):

- women are 26% of computing force
- 57% women of total graduates
- < 20% women in computer science

## By 2020:

- 1.4M computer science jobs available

**SundayReview**

# Academic Science Isn't Sexist

OCT. 31, 2014



Most extensive study to-date shows:

- Academic science is a rewarding career for many, women and men alike

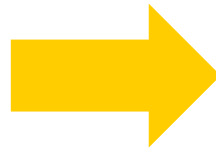
*Source: Ceci, Ginther, Khan, Williams, 2015 Women in Academic Science: A Changing Landscape, APS*

## A Changing Landscape to Improve Science and Technology

---

The **future of technology** includes teams with a mix of skills, combining scientific and technological talents.

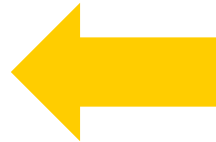
Teams achieve highest impact



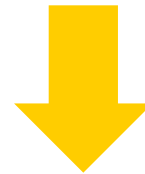
Being collaborative is essential



Teams with **women** perform better



Collaborative environments are well suited to female mind



SCIENCE & HEALTH > ENGINEERING & TECHNOLOGY

## A quantum leap for women

Step by step, student group helps to sculpt computer science 2.0

March 26, 2015 | ✓ 📱



Harvard Women in Computer Science (WICS) addresses:  
The “yearning for a sense of community”

*From Amna Hashmi '16, a computer science concentrator and one of the co-chairs of this year's WECODE, and Harvard Women in Computer Science (WICS)*

---

## Impact to Global Progress

---

“Money is the most egalitarian force in society. It confers power on whoever holds it.” (Roger Starr, NYT, CBS commentator)

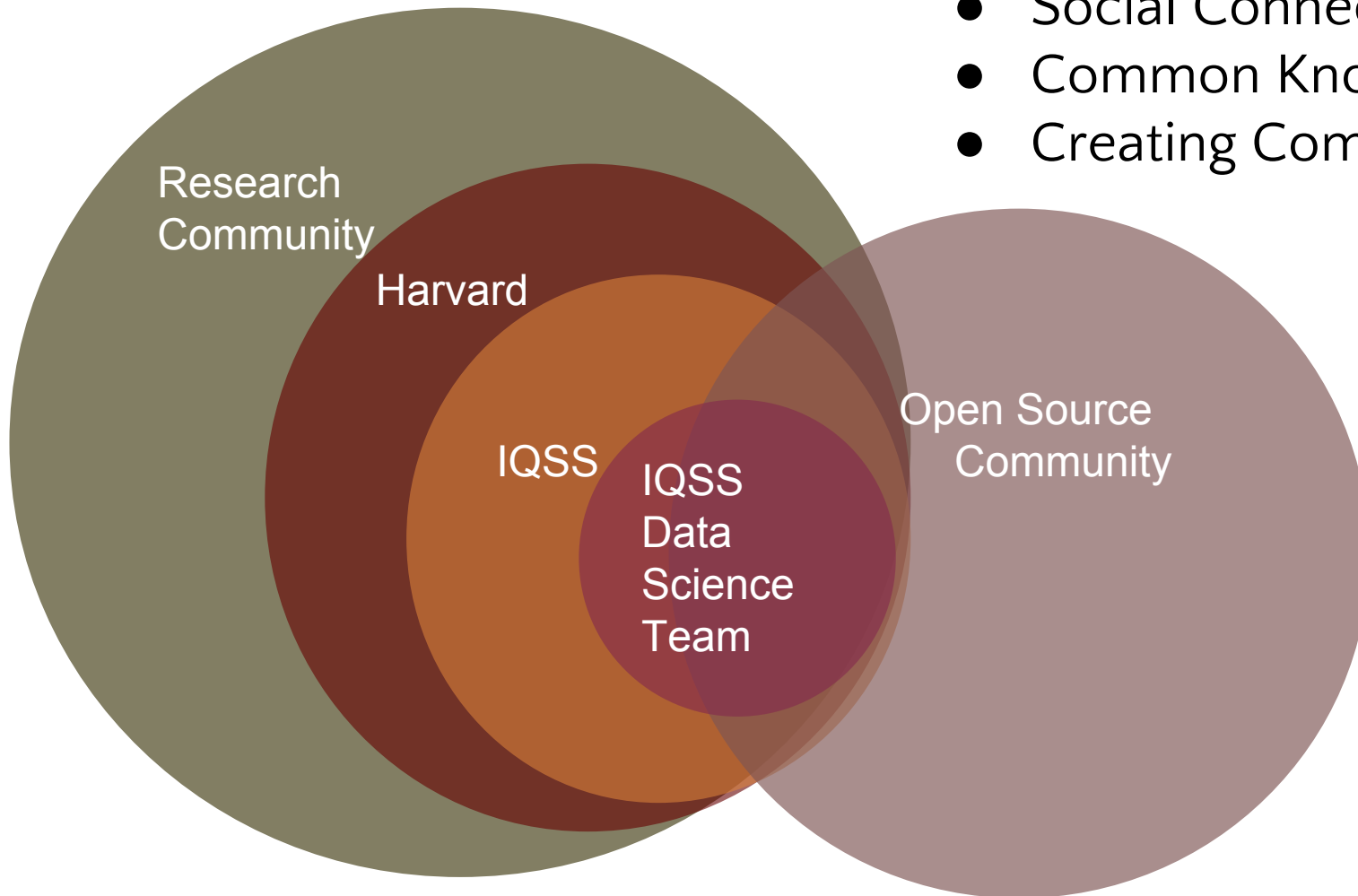
“The full realization of women’s equality would have the biggest impact on economic, political and social progress.”

(Melanne Verveer, director of the Georgetown institute for Women, Peace & Security and former U.S. ambassador-at-large for global women’s issues)



# Bringing it Back Home: Open Source and Open Governance

- Shared Discourse
- Social Cognition
- Social Connection
- Common Knowledge
- Creating Community



## REFERENCES

- Wuchty, Jones & Uzzi, 2007. *The Increasing Dominance of Teams in Production of Knowledge*, *Science*
- Wooley, Chabris, Pentland, Hashmi, Malone, 2010. *Evidence for Collective Intelligence Factor in the Performance of Human Groups*. *Science*
- Engel, Wooley, Jing, Chabris, Malone, 2014. *Reading the Mind in the Eyes or Reading between the Lines? Theory of Mind Predicts Collective Intelligence Equally Well Online and Face-To-Face*. *PLOS One*
- Thomas, deScioli, Haque, Pinker, 2015. *The Psychology of Coordination and Common Knowledge*. *Journal of Personality and Social Psychology*
- Harvard Business Review, Dec 2014: <https://hbr.org/2014/12/what-bosses-gain-by-being-vulnerable>
- Helen Fisher, 1999. *THE FIRST SEX: The Natural Talents of Women and How They are Changing the World*  
<http://news.harvard.edu/gazette/story/2015/03/a-quantum-leap-for-women>  
[http://www.politico.com/magazine/story/2015/01/15-big-breakthroughs-in-2015-114486.html#.VSNN6BPF\\_7c](http://www.politico.com/magazine/story/2015/01/15-big-breakthroughs-in-2015-114486.html#.VSNN6BPF_7c)
- Deborah Tannen, 1990. *You Just Don't Understand: Women and Men in Conversation*
- Judy Rosener, 1995. *America's Competitive Secret: Utilizing WOMen as a Management Strategy*
- Sally Helgesen, 1995. *The Female Advantage: Women's Ways of Leadership*  
[http://www.nytimes.com/2014/11/02/opinion/sunday/academic-science-isnt-sexist.html?\\_r=1](http://www.nytimes.com/2014/11/02/opinion/sunday/academic-science-isnt-sexist.html?_r=1)  
<http://www.nytimes.com/2015/01/18/opinion/sunday/why-some-teams-are-smarter-than-others.html>
- Ceci, Ginther, Khan, Williams, 2015 *Women in Academic Science: A Changing Landscape*, APS  
<http://video.mit.edu/watch/social-cognition-and-collective-intelligence-7792>

THANKS