IDEAS AT THE CONFLUENCE OF COMPUTING AND SOCIETY: EMERGING THEMES IN SOCIO-TECHNICAL SYSTEMS

AAAS 2016: Global Science Engagement

February 12, 2016

CCC

Computing Community Consortium

Catalyst

COMPUTING COMMUNITY CONSORTIUM

The **mission** of Computing Research Association's Computing Community Consortium (CCC) is to:

catalyze the computing research community and
enable the pursuit of innovative, high-impact research.

CCC conducts activities that

strengthen the research community,
articulate compelling **research visions**, and
align those visions with pressing **national and global challenges**.

CCC **communicates** the importance of those visions to **policymakers**, **government** and **industry stakeholders**, the **public**, and the **research community** itself.

- Established in 2006 as a standing committee of the Computing Research Association
- Funded by NSF through a Cooperative Agreement

CCC
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Catalyst

CATALYZING: VISIONING ACTIVITIES

- Over 30 Workshops to date
- More than 2,500 participants

Inclusive Access

BRAIN

Personalized Education

Sustainability & IT

Financial Cyberinfrastructure

Extreme Scale Design Automation

Online Education

Computing and Healthcare

Uncertainty

Privacy by Design

Cyber-physical systems

Spatial Computing

Big Data Computing

ROBOTICS

Aging in Place

Disaster Management

Human Computation

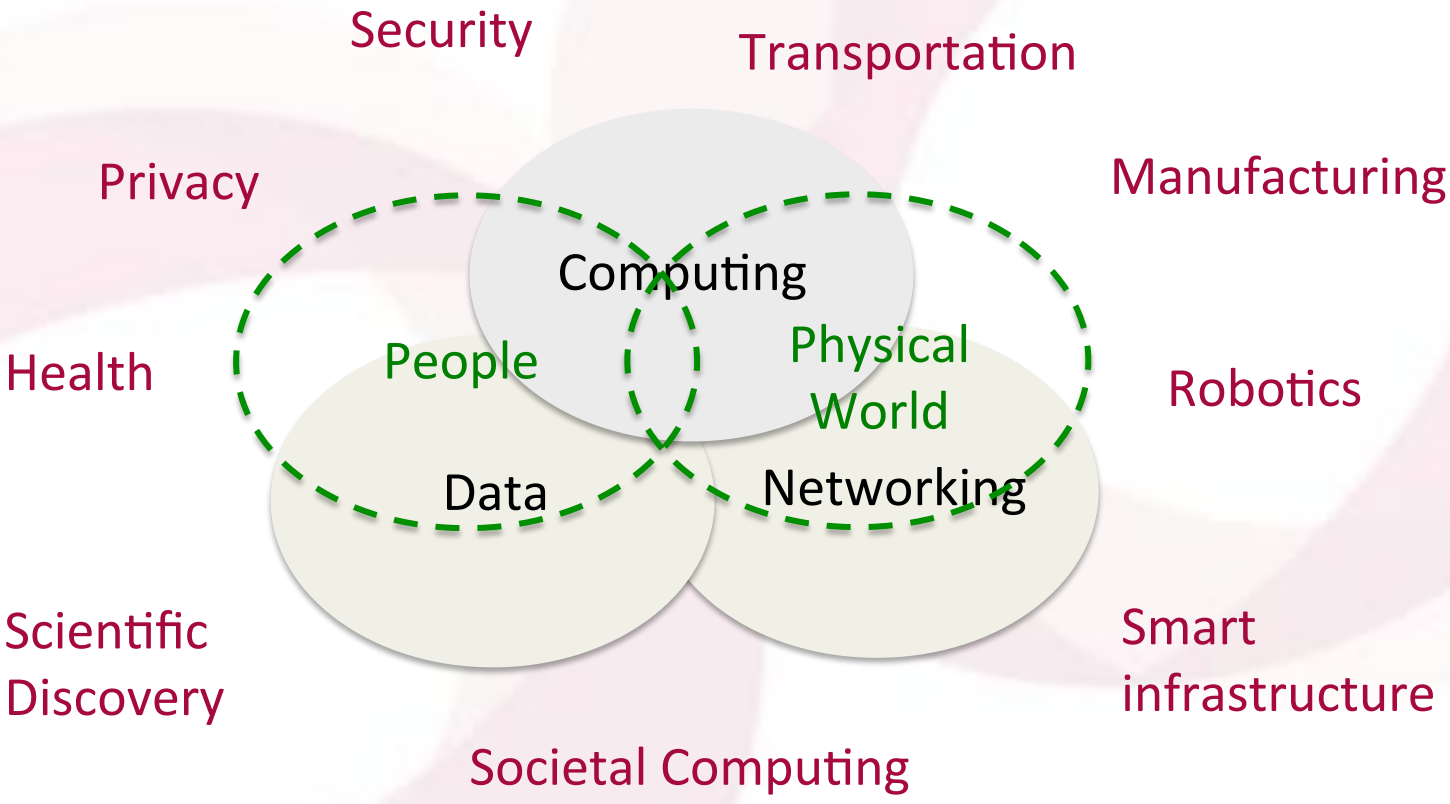
Theoretical Foundations for Social Computing

Learning Technologies

Global Development

Computing Community Consortium
Catalyst

EVOLUTION OF COMPUTING



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OVERVIEW

- Health and Healthcare in an Increasingly Connected World
  - Elizabeth Mynatt, Georgia Tech
- Technology's Law of Amplification in International Development
  - Kentaro Toyama, University of Michigan
- Computational Actors in a Physical World
  - Gregory D. Hager, Johns Hopkins University

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Health and Healthcare in an Increasingly Connected World

Elizabeth D. Mynatt

Professor, Interactive Computing

Executive Director

Institute for People and Technology

Georgia Tech

Vice-Chair

Computing Community Consortium (CCC)

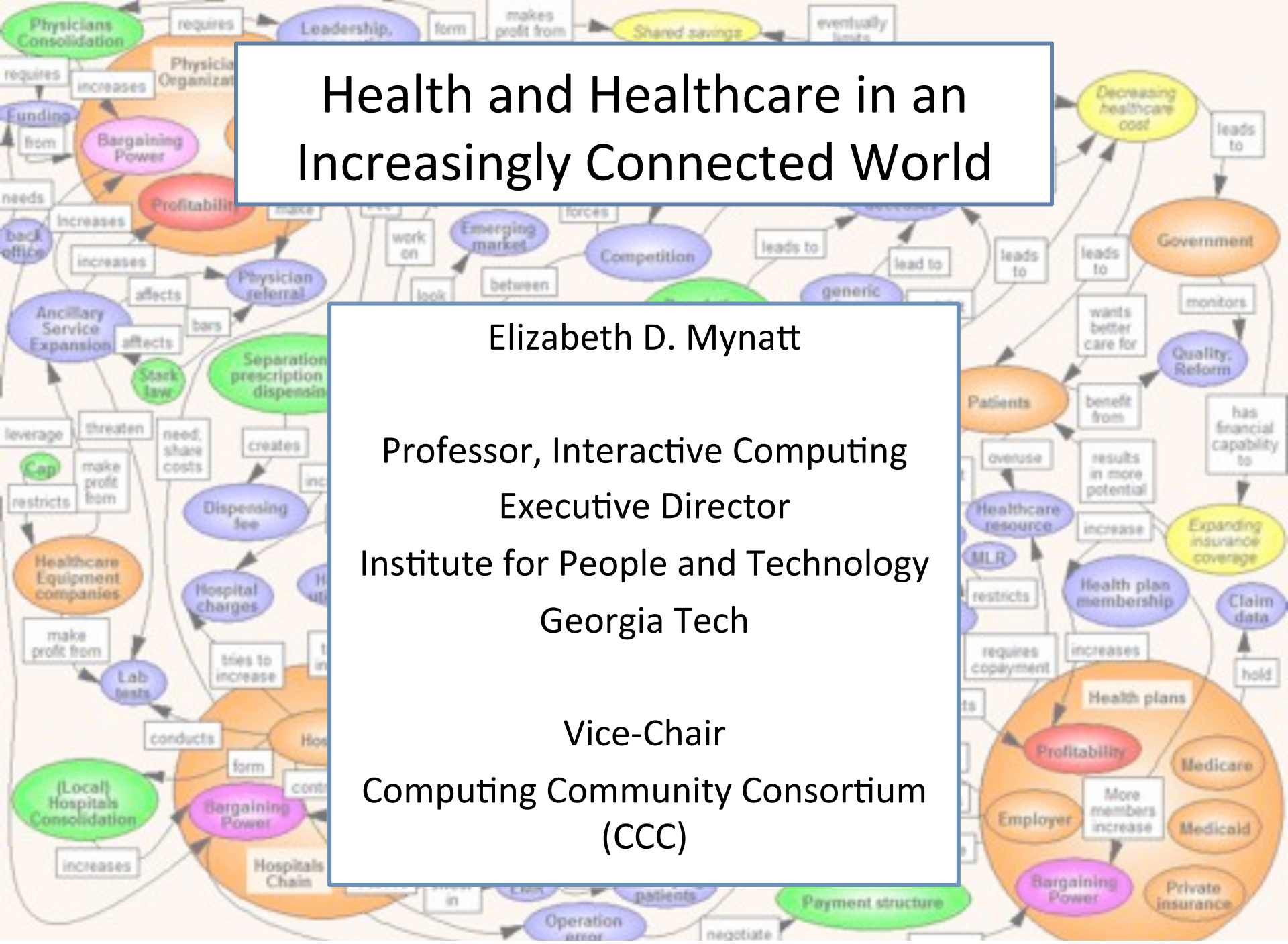
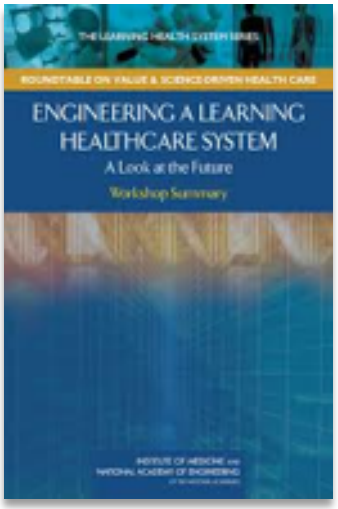


Figure by Zhongyuan Yu

Health Care: Costs, Complexity and Quality

NAE / IOM (2006)



IOM (2011)

Absolute expenditures	$3.0 trillion 17.5% GDP (2014)
Relative expenditures	50% increase in past 10 years
Potential efficiency gains	$750 billion (2009); more than 25% of the total
More conditions	e.g. 79 year old patient with 19 meds per day
More clinicians	e.g. 200 other doctors treating patients of single primary care doctor
More choices	e.g. hundreds of diagnostic factors; dozens of treatments
More activities	e.g. ICU clinicians with 180 activities per day
Patient harm	1/5 to 1/3 of hospital patients suffered preventable harm during stay
Recommended care	Only about half of recommended care actually delivered.
Healthcare Disparity	If all care quality matched highest statewide performance, there would have been 75,000 fewer deaths nationally.

Socio-Technical System Research Challenges in Healthcare

Designing for **Human Actors**

- Safety

Supporting **Coordinated Action**

- Coordinated care

Working with, around, and against **Incentives, Biases, Norms** and more

- Economic interoperability
- Behavior change for chronic disease

Managing **Scale** and **Scope**

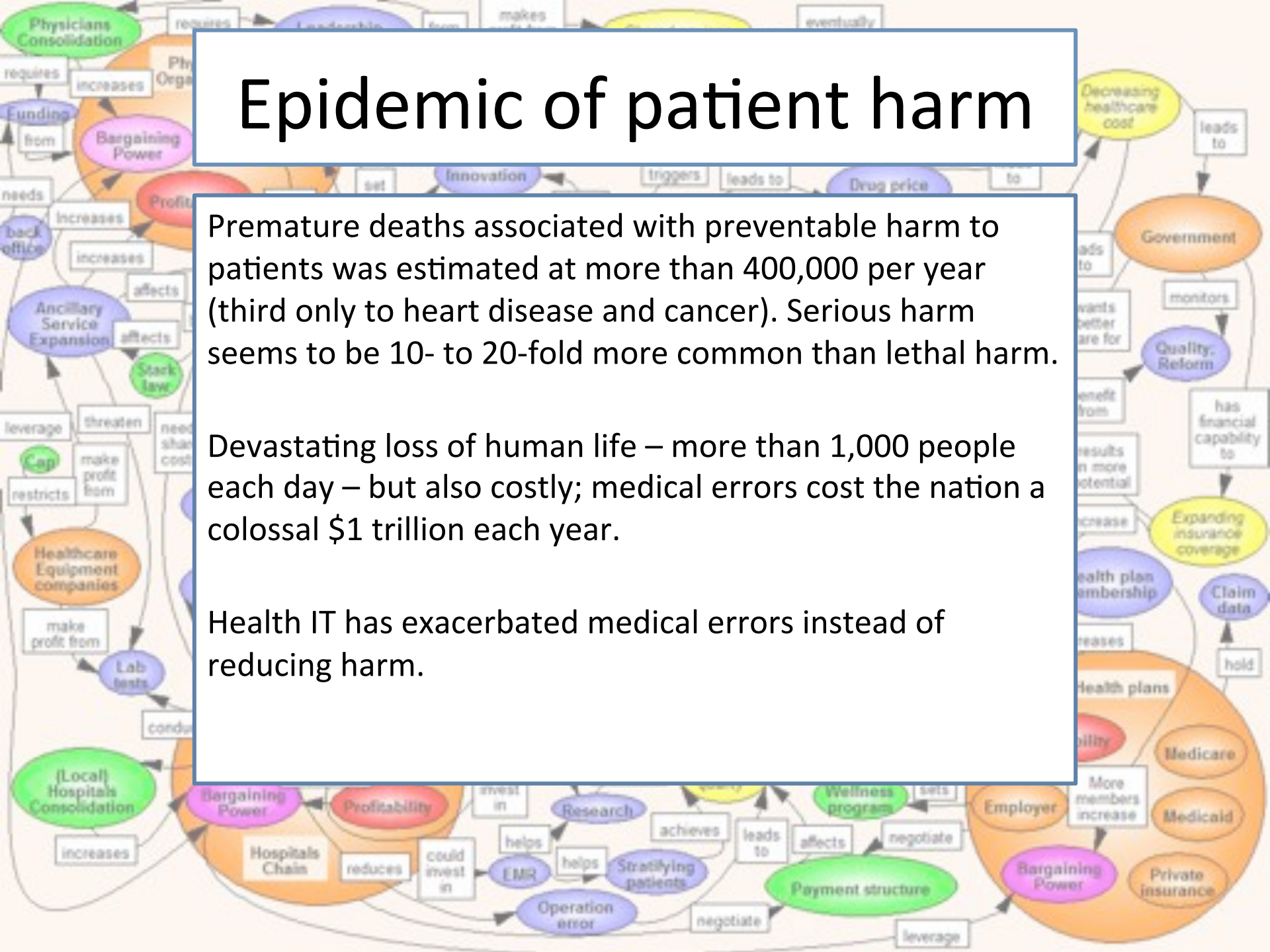
- *Patient*-centered care
- Simulating future systems

Epidemic of patient harm

Premature deaths associated with preventable harm to patients was estimated at more than 400,000 per year (third only to heart disease and cancer). Serious harm seems to be 10- to 20-fold more common than lethal harm.

Devastating loss of human life – more than 1,000 people each day – but also costly; medical errors cost the nation a colossal $1 trillion each year.

Health IT has exacerbated medical errors instead of reducing harm.



Frequent Safety Errors

- Medication Errors (Harm to over 1.5 million annually (IOM))
- Healthcare associated infections
- Infections from central lines
- Miscommunication in the care team
- Surgical errors
- Falls
- Surgical errors
- Pharmacy errors
- Lab errors
- Transitions of care; care following discharge

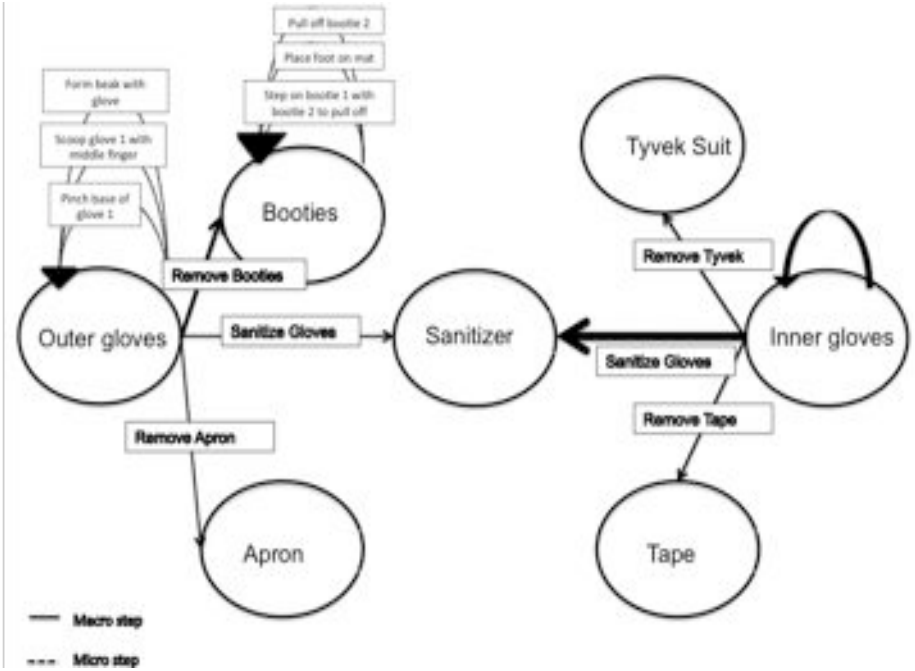
Health IT Patient Safety

- ✅ Clinical Decision Support
- ✅ System Interoperability
- ✅ Patient Identification
- ✅ **User-Centered Design and Use of Testing, Evaluation, and Simulation to Promote Safety across the HIT Lifecycle**
- ✅ System Downtime (Data Availability)
- ✅ Feedback and Information-Sharing
- ✅ Use of HIT to Facilitate Timely and High-Quality Documentation
- ✅ Patient Engagement
- ✅ HIT-Focused Risk-Management Infrastructure

National Quality Forum: November 2015

Prevention Epicenter of Emory and Atlanta Consortium Hospitals (PEACH)

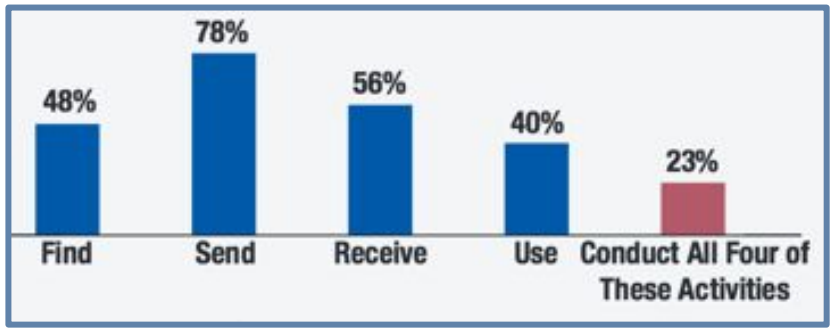
Translate microbiological, epidemiological, and technological discoveries into new strategies to reduce the spread of dangerous germs like Ebola. Their work will include rapid prototyping in simulation labs, quantifying and visualizing spatial metrics using special analytic tools, and utilizing novel technologic approaches enhancing hand hygiene adherence



Zimring, 2016

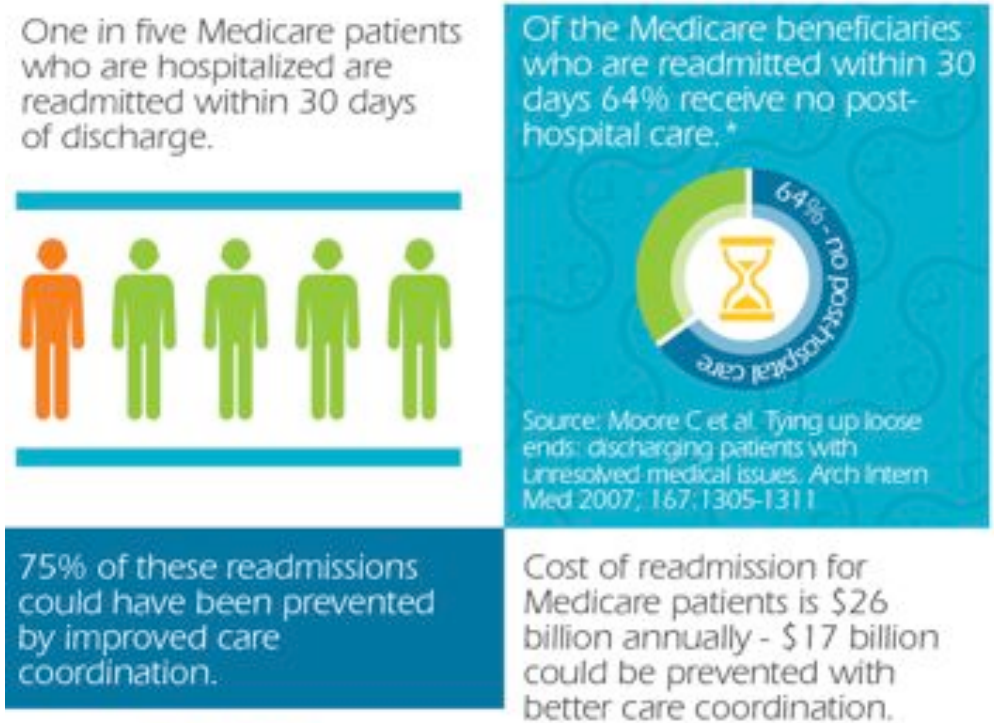
Coordinated Care

The average patient sees 14 specialists



Only 40 percent of hospitals can use the information they receive, i.e. the records are integrated into the hospital's EHR without the need for manual data entry.

Only 25% of all hospitals can find, send, receive and use electronic information due to substantial barriers.



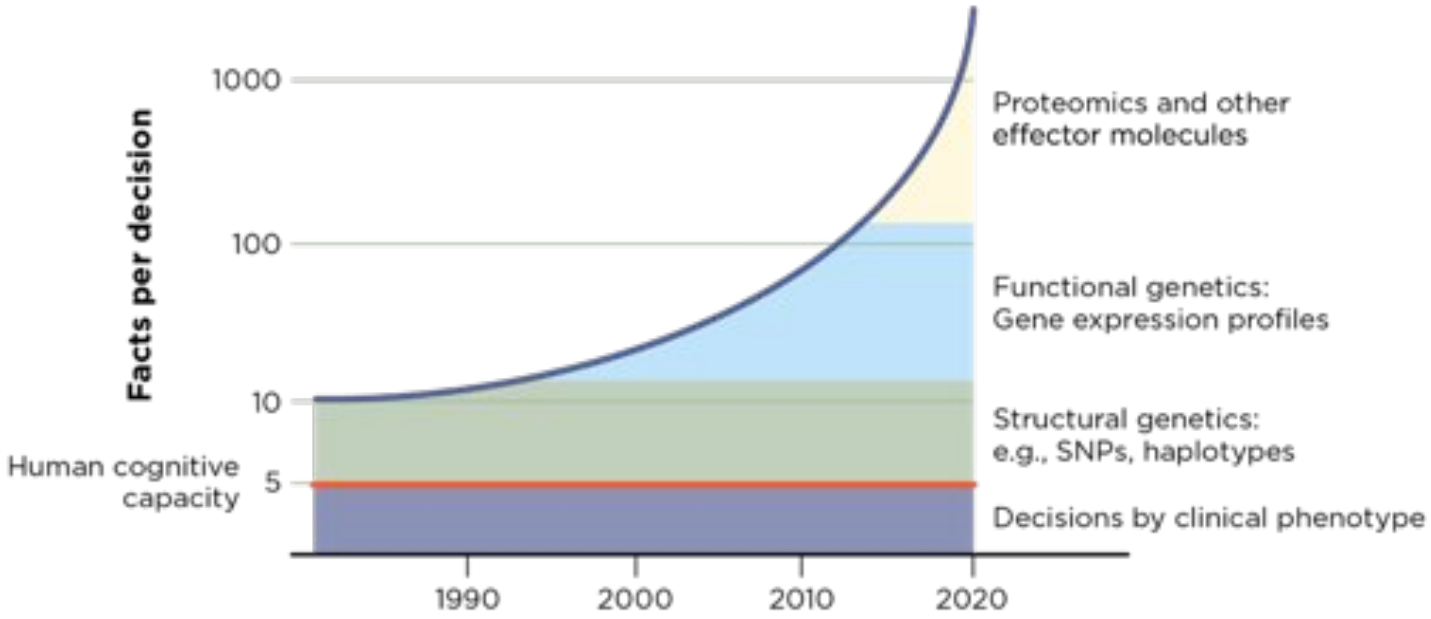
The Revolving Door by RWJF

Coordinated Care as Decision Support

Classic coordinated care. Models of timeliness and relevance.

Data Mining and Machine Learning (Learning Health System)

Bayesian Models of Surprise



From "Best Care At Lower Costs: The Path to Continuously Learning Health Care in America" Institute of Medicine, 2012

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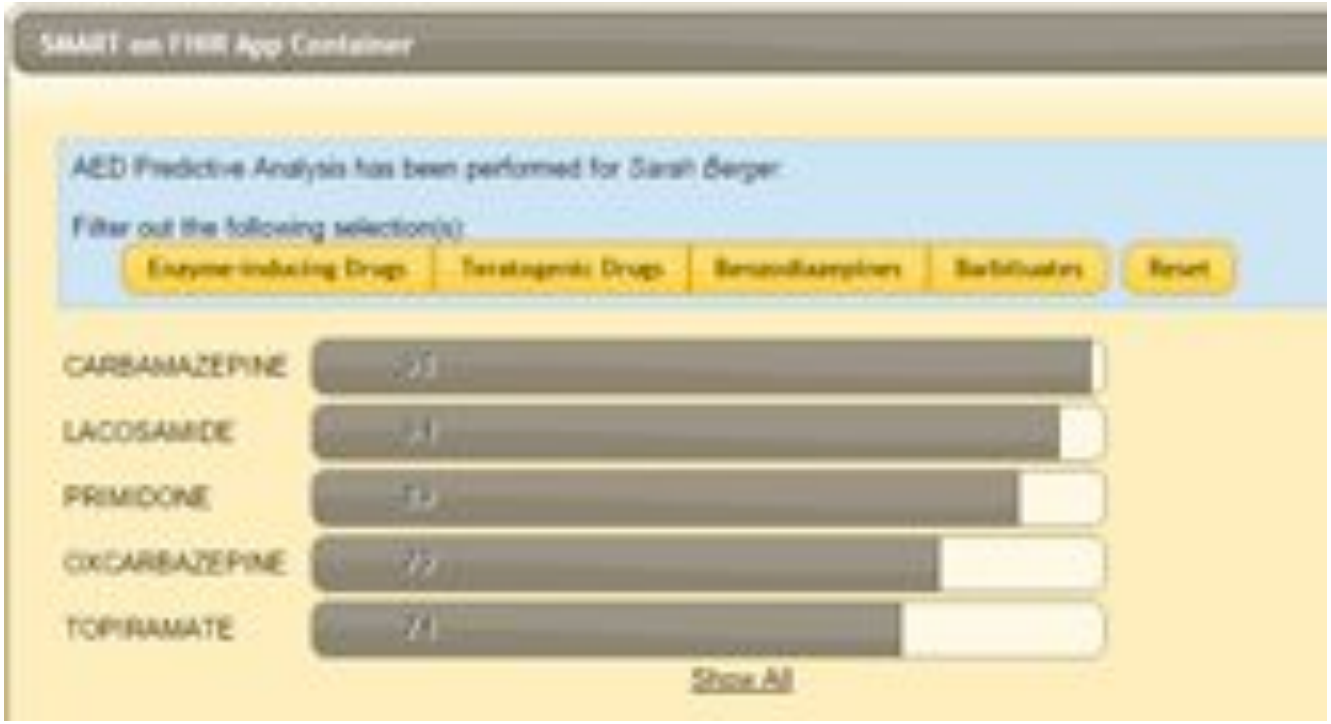

Epilepsy medication clinical guidance based on 30M patient claims records

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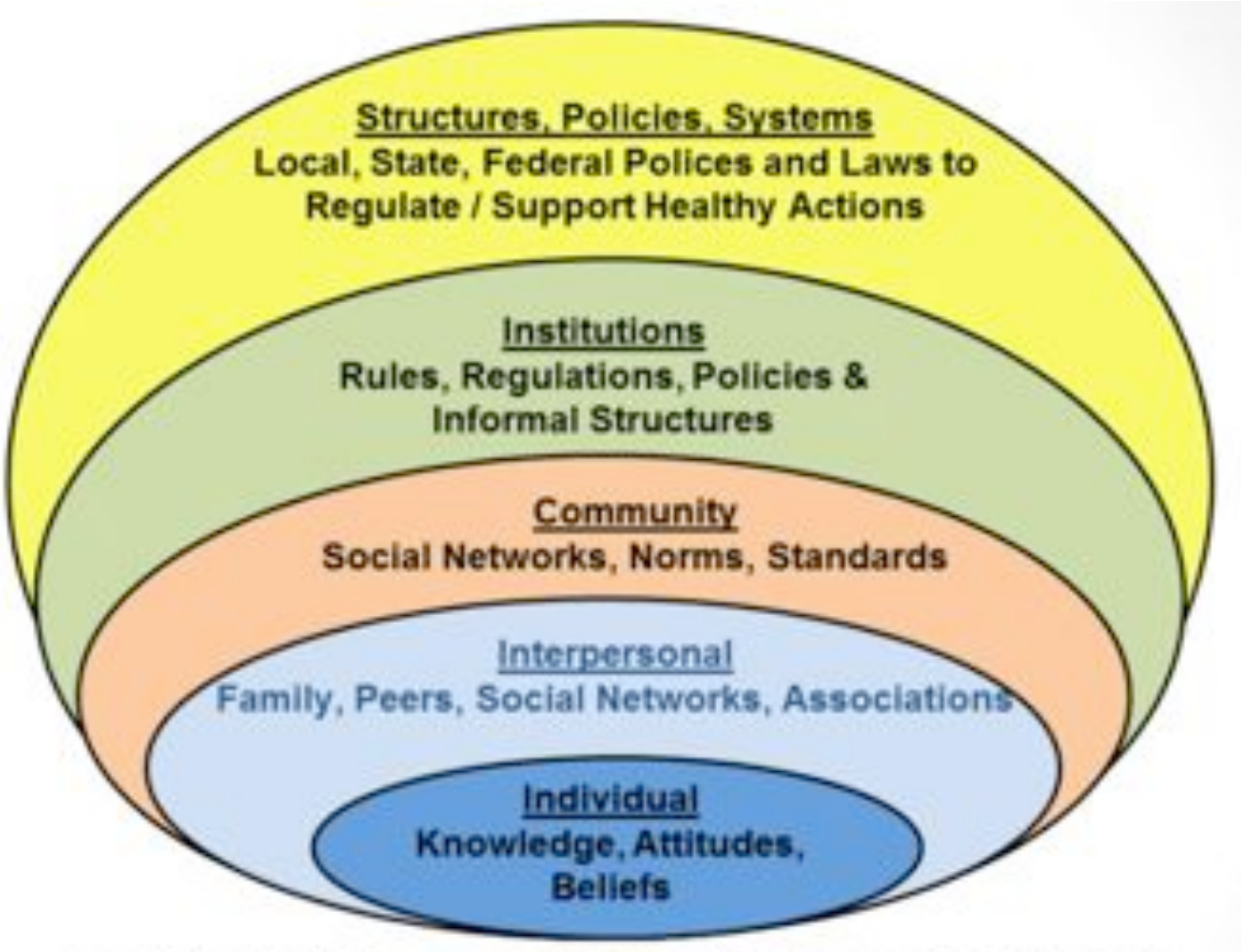
Incentives, Biases, Norms. Oh my.



Bronfenbrenner's ecological framework for for social influence

Economic Interoperability

Information blocking occurs when persons or entities knowingly and unreasonably interfere with the exchange or use of electronic health information.

Vendors

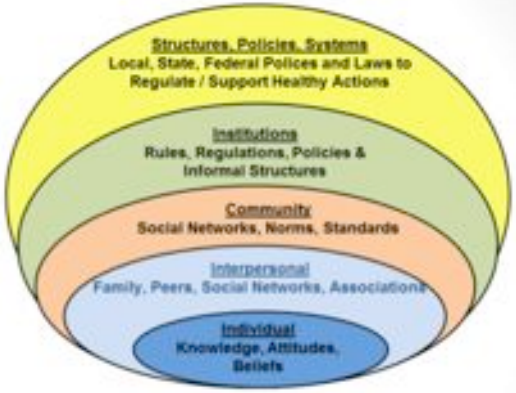
- Substantial per transaction fee, required training
- Impossible or prohibitively expensive to connect with 3rd party HIT modules
- Kill switch

Healthcare Providers

- Requiring exchange via fax instead of electronic exchange
- Mis-citing HIPAA to deny exchange exchange
- Prepopulated recipient lists
- Walled gardens

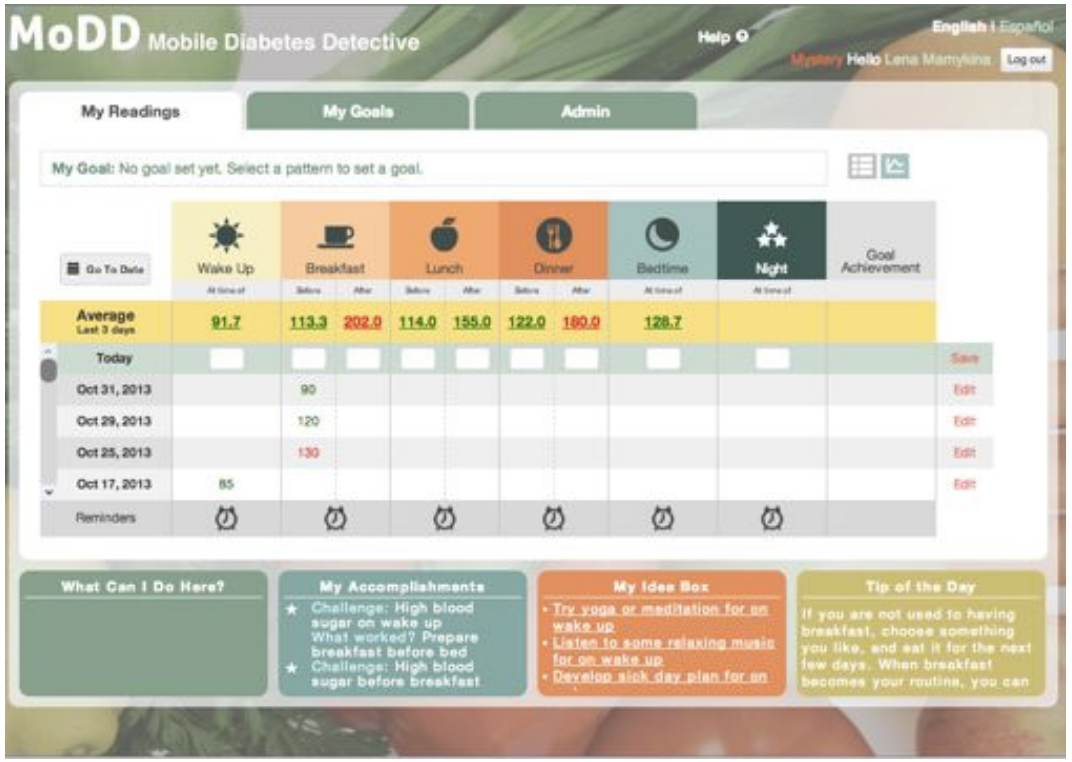
ONC REPORT TO CONGRESS April 2015 Report on Information Blocking

Behavior Change



Individuals with one or more of 19 chronic medical conditions typically comprise 20% of the population and account for 80% of the total claims cost (American Health Data Institute)

- Carrots and Sticks
- Ecological models, e.g. nutrition
  - Education
  - Healthy food availability
  - Trusted voices in the community
  - School lunch programs
- Engagement and problem solving



Mamykina et al. Diabetes Detective

Scale and Scope

What is the scale and scope of the healthcare system?

How to simulate and model future healthcare systems?

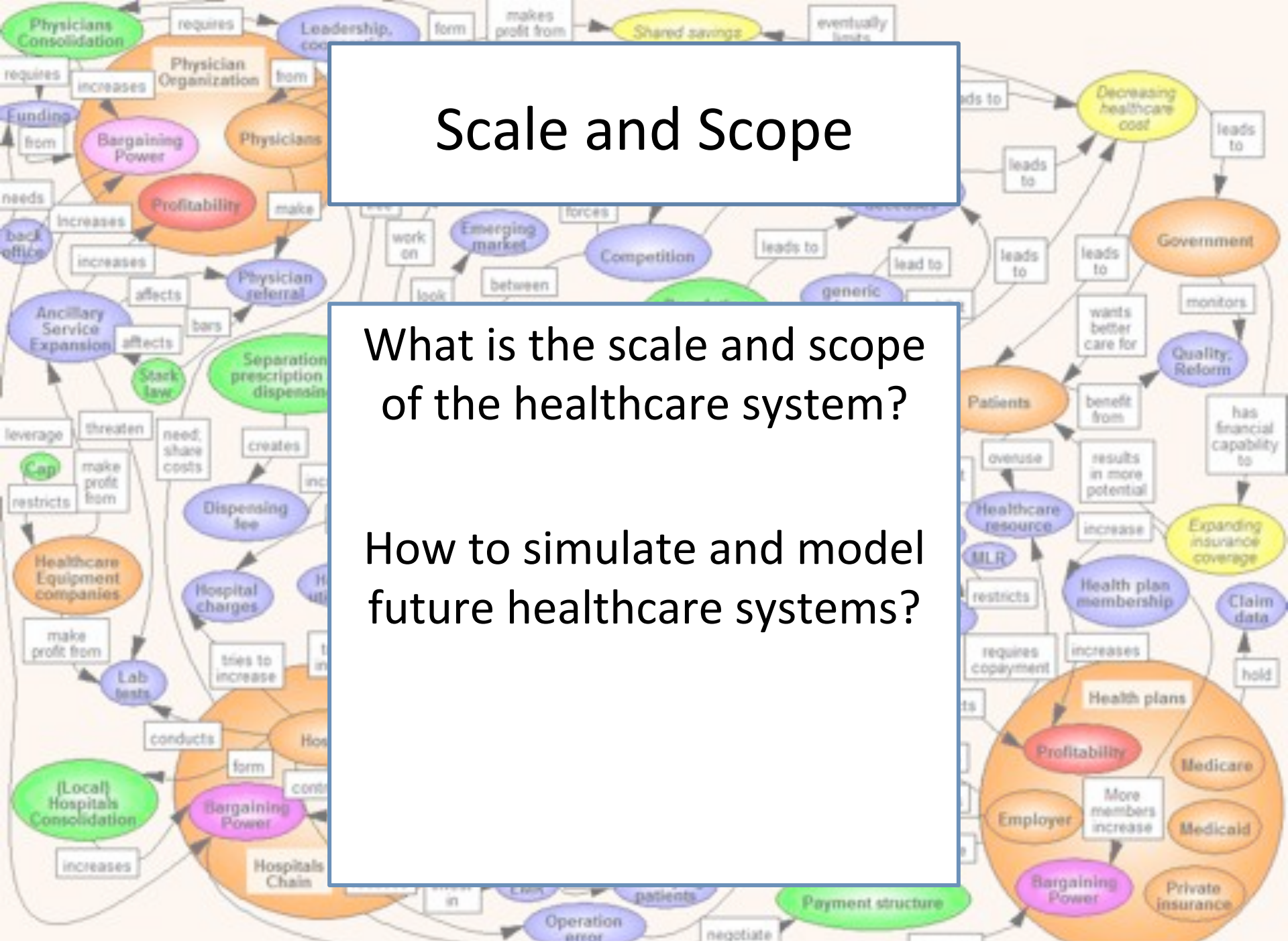


Figure by Zhongyuan Yu

Patient-Centered Care

Patient-Centered Care

MyPath: Supporting the Cancer Journey

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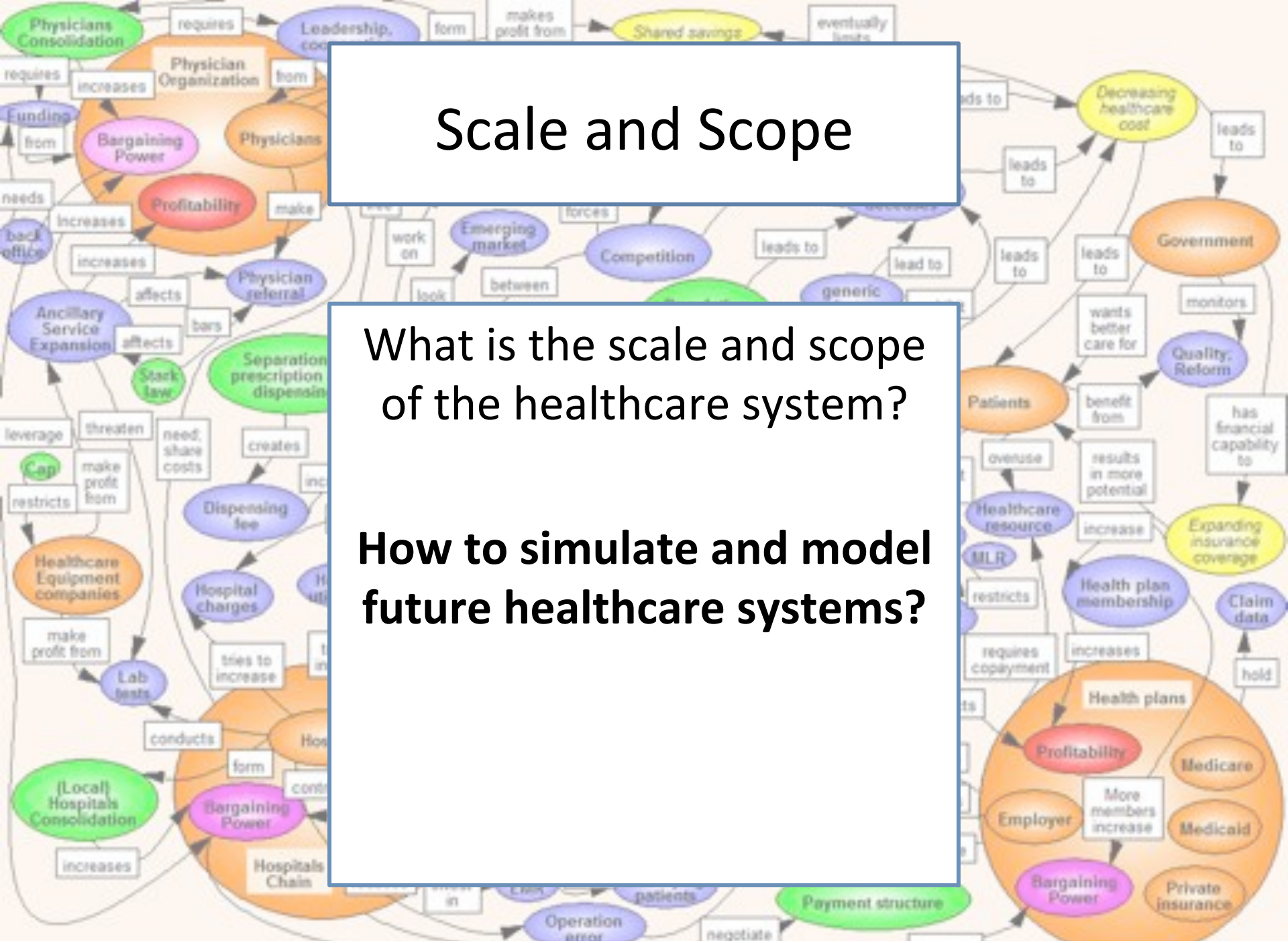
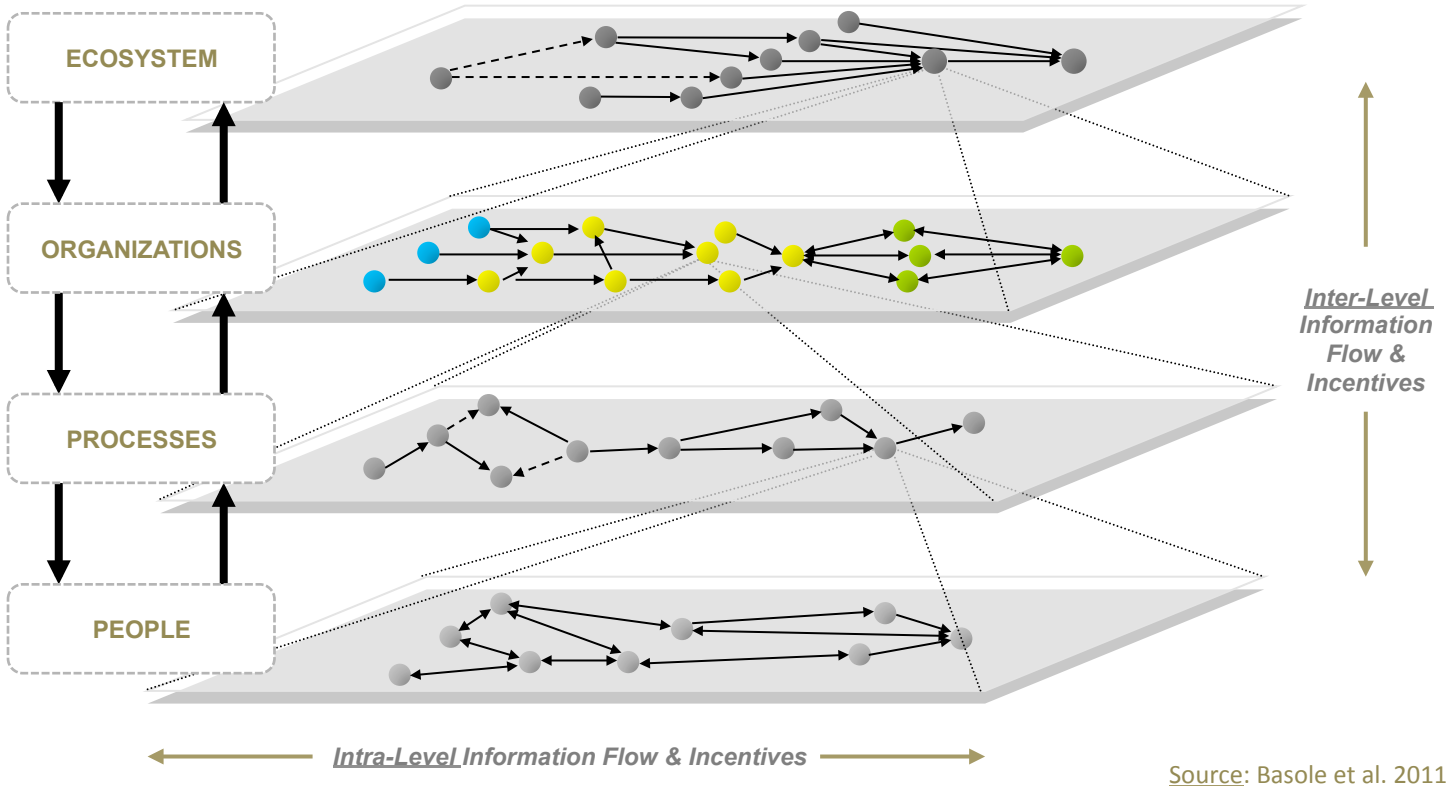


Figure by Zhongyuan Yu

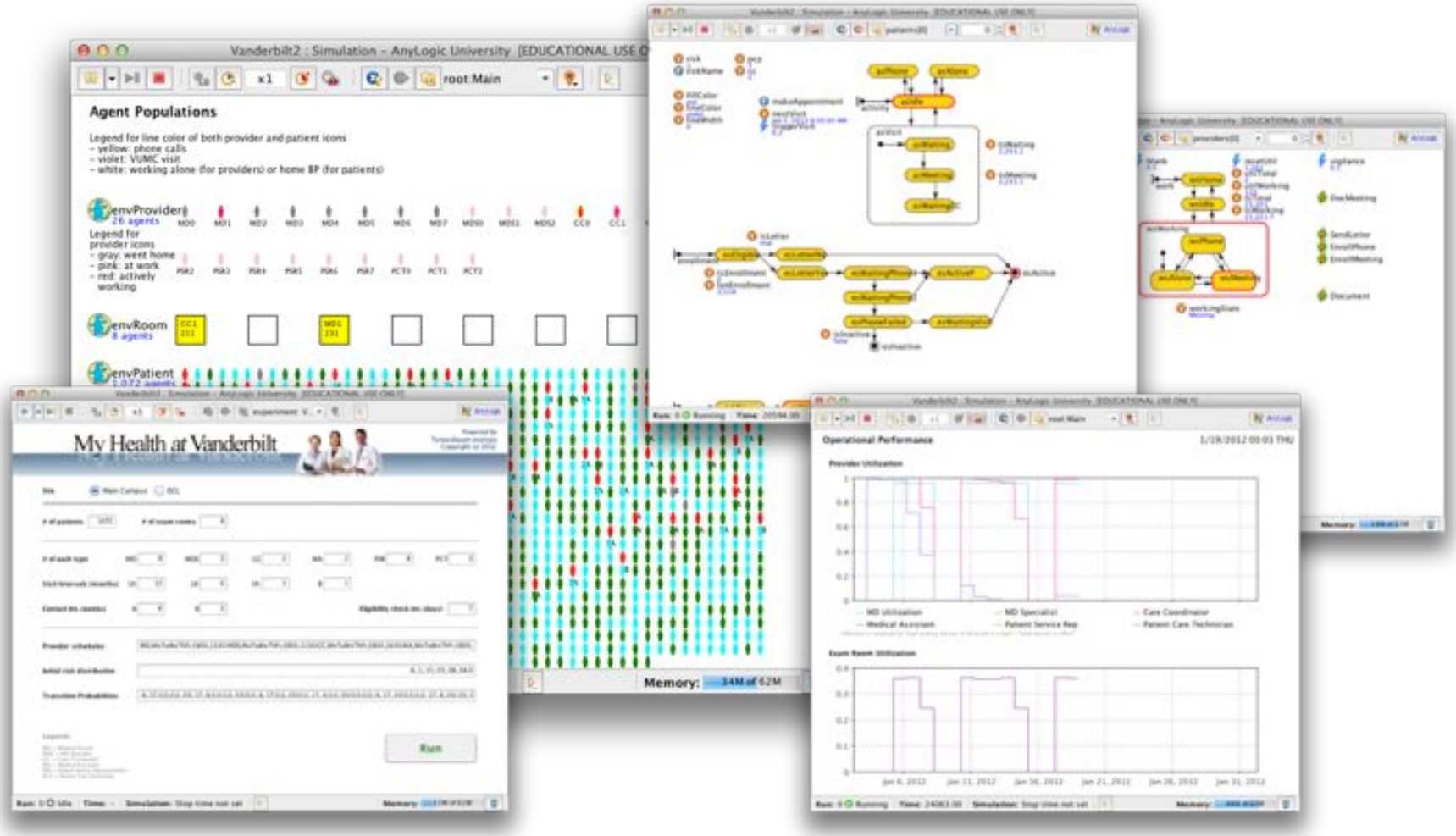
Modeling and Simulating Complex Adaptive Systems

"A goal-directed organization of resources – human, information, financial, and physical – and activities, usually of significant operational scope, complication, risk, and duration."



Source: Basole et al. 2011

Healthcare Enterprise Simulator



Source: Basole et al. 2014

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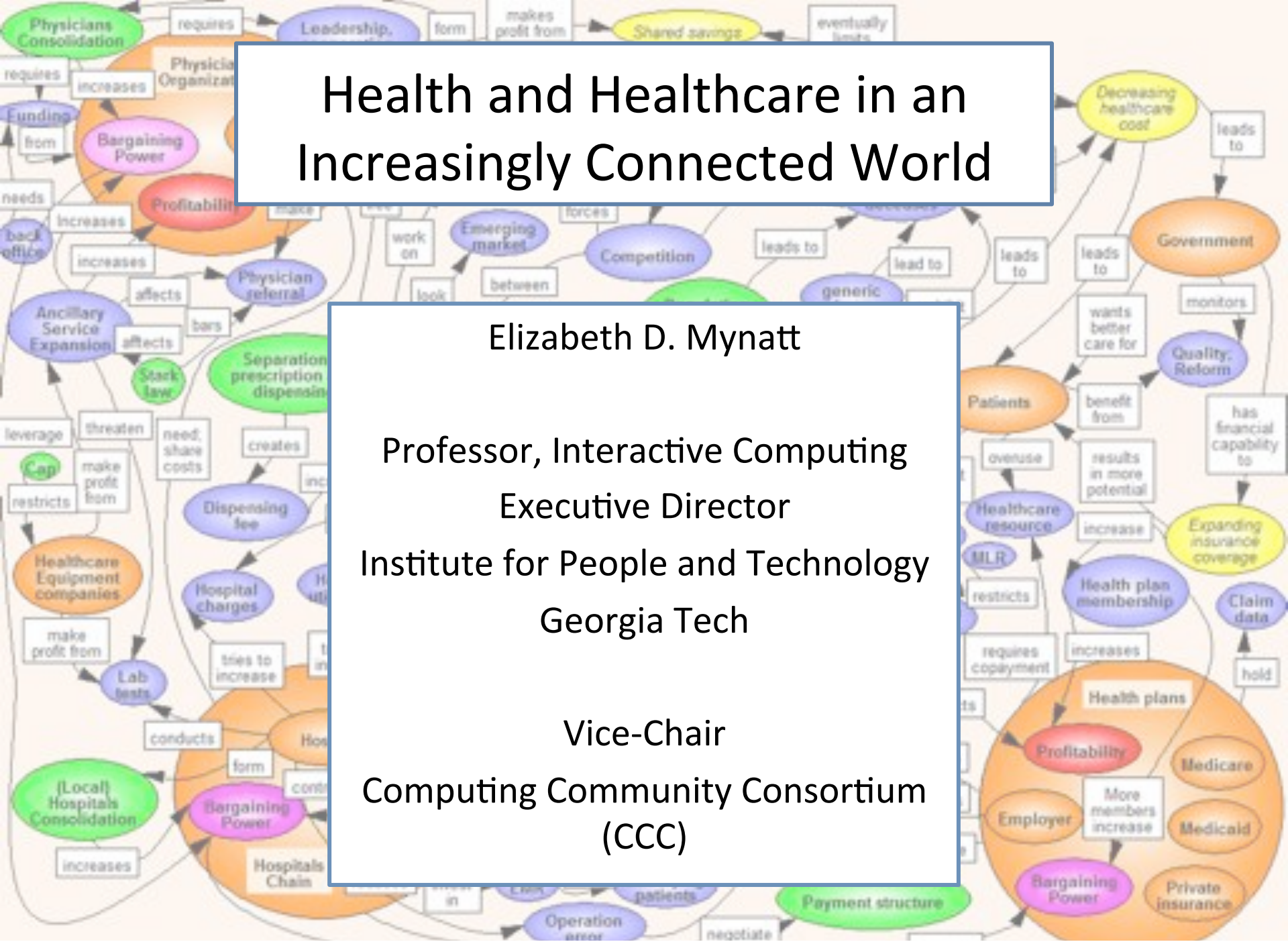


Figure by Zhongyuan Yu

Technological Amplification in International Development

Kentaro Toyama
W. K. Kellogg Associate Professor
University of Michigan

AAAS Annual Meeting
Global Science Engagement
February 12, 2016


Photo: Indrani Medhi

スポーツ観戦の日程情報！ レポート掲載中

Yahoo!検索 検索

リクナビ ログイン
※1秒でもっと便利に【 新規取得 】

Yahoo! JAPAN - ヘルプ

Yahoo!リクナビ

・求職お役立ち情報

職業とキャリアに関するQ&Aや雇用関連のニュースなど、求職お役立ち情報

求人・仕事情報:おすすめトピックス

貯金はどれぐらい？ 一人暮らしフリーターの貯金事情

条件で探す: 正社員を目指す、時給1000円以上、未経験歓迎、日払い・週払い、留学生(関東)

短期で探す: 1日、1週間、1カ月 職種で探す: 事務、販売、サービス、フード、イベント・芸能、配送 →職種一覧

地域で探す: 北海道・東北 | 関東(23区、その他関東) | 甲信越・北陸 | 東海 | 関西 | 中国・四国 | 九州・沖縄 | リゾート

フロム・エー ナビでバイトを探す: 地域: 関東 検索

転 職

社会人のための総合転職サイト リクナビNEXT

- リクナビNEXT
- 今週の新着求人
- スカウトを待つ
- 職種から探す
- 検索ランキング
- 勤務地から探す
- 初めての転職ガイド
- 第二新卒(若手社会人)専用の求人

特集 仕事とプライベートを両立できる仕事
共感できる上司と働ける、営業の仕事

アルバイト

アルバイト探しの総合サイト FromAnavi

- フロム・エー ナビ
- 北海道・東北版
- 関東版
- 甲信越・北陸版
- 東海版
- 関西版
- 中国・四国版
- 九州・沖縄版
- リゾート版
- 留学生版(関東)
- 社員を目指す(関東)

特集 通勤楽ちん！駅チカの社員/契約社員(関東)

メニュー

- リクナビNEXT
- とらばーゆ
- フロム・エー ナビ
- ショットワークス
- リクナビ派遣
- リクルートエージェント
- リクナビ/新卒
  - リクナビ2009
  - リクナビ2008
- アントレnet/独立開業
- 求職お役立ち情報

表示のカスタマイズについて

キーワードで検索する

リクナビNEXT

関東

検索


1500


150


150


500


200


100


100


50


250


Photo: Indrani Medhi


Photo: Udai Singh Pawar


Photo: Udai Singh Pawar


Photo: Rikin Gandhi


Photo: Rikin Gandhi

“The richest 500 million [people] have way more money than the next six billion combined. You solve that by getting everyone online.”

– Mark Zuckerberg (2015)

Photo: http://www.ibtimes.com/zuckerberg-tells-mobile-carriers-internetorg-will-get-people-paying-data-once-they-1833250
Source: http://www.wired.com/2013/08/mark-zuckerberg-internet-org/

"Technology is a game-changer in the field of education—
a game-changer we desperately need to both improve
achievement for all and increase equity..."

– US Secretary of Education Arne Duncan (2012)

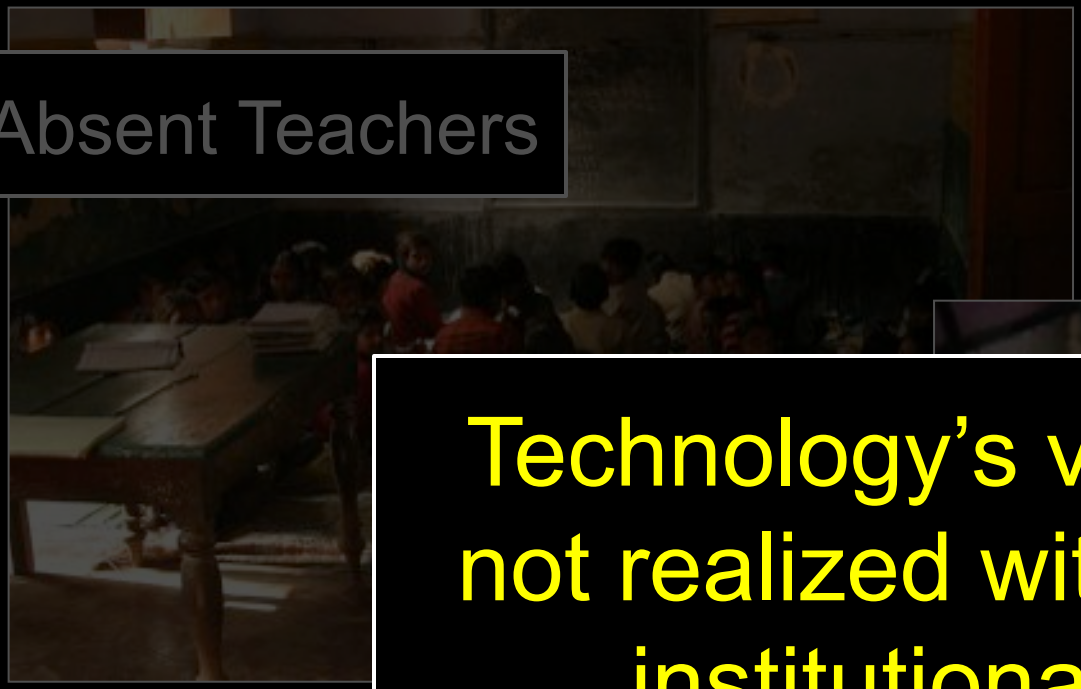
“Access to information helps citizens hold their own governments accountable.”

– Hillary Clinton (2011)

Source: Clinton, Hillary. (2010). Remarks on Internet Freedom. http://www.state.gov/secretary/rm/2010/01/135519.htm


Marketing
Bookkeeping
Recruiting
Technology's value not realized without institutional foundation.
Contracts
Training
Follow-up
Are you still looking for a maid who can come to work at your convenience and do cooking, cleaning and other household chores?
Do you need references before you hir
her? Do you want to know her previous and cu
employment records?
We can help you find one!!
Please call Shakuntala at 9845581930 for further

Absent Teachers



Limited Budgets

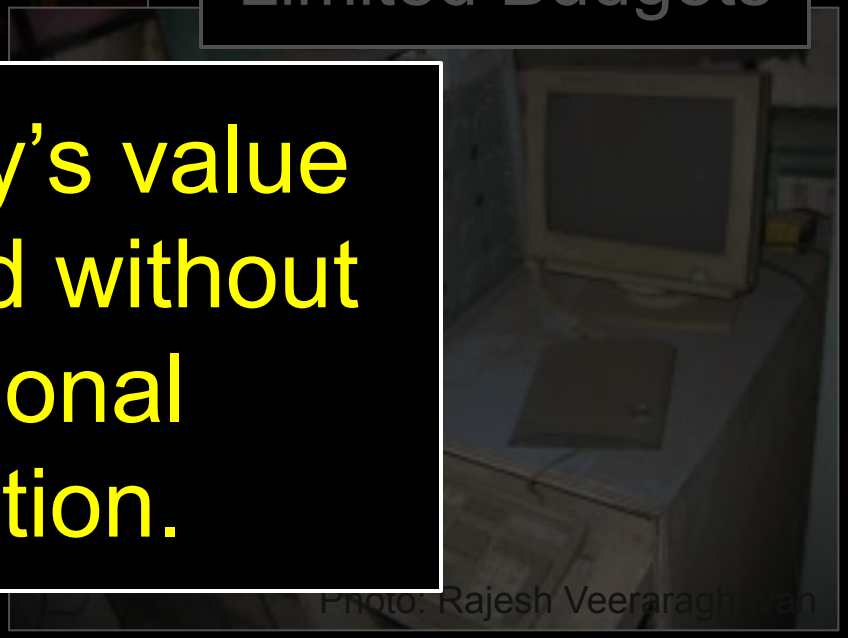


Photo: Rajesh Veeraraghavan

Technology's value not realized without institutional foundation.

Minimal Teacher Training

Photo: Joyojeet Pal

To first approximation,
technology ***amplifies***
underlying human forces.

coursera

UDACITY
Learn. Think. Do.

edX

canvas
NETWORK

NovoED

iversity

OPEN
2 STUDY

Future
Learn

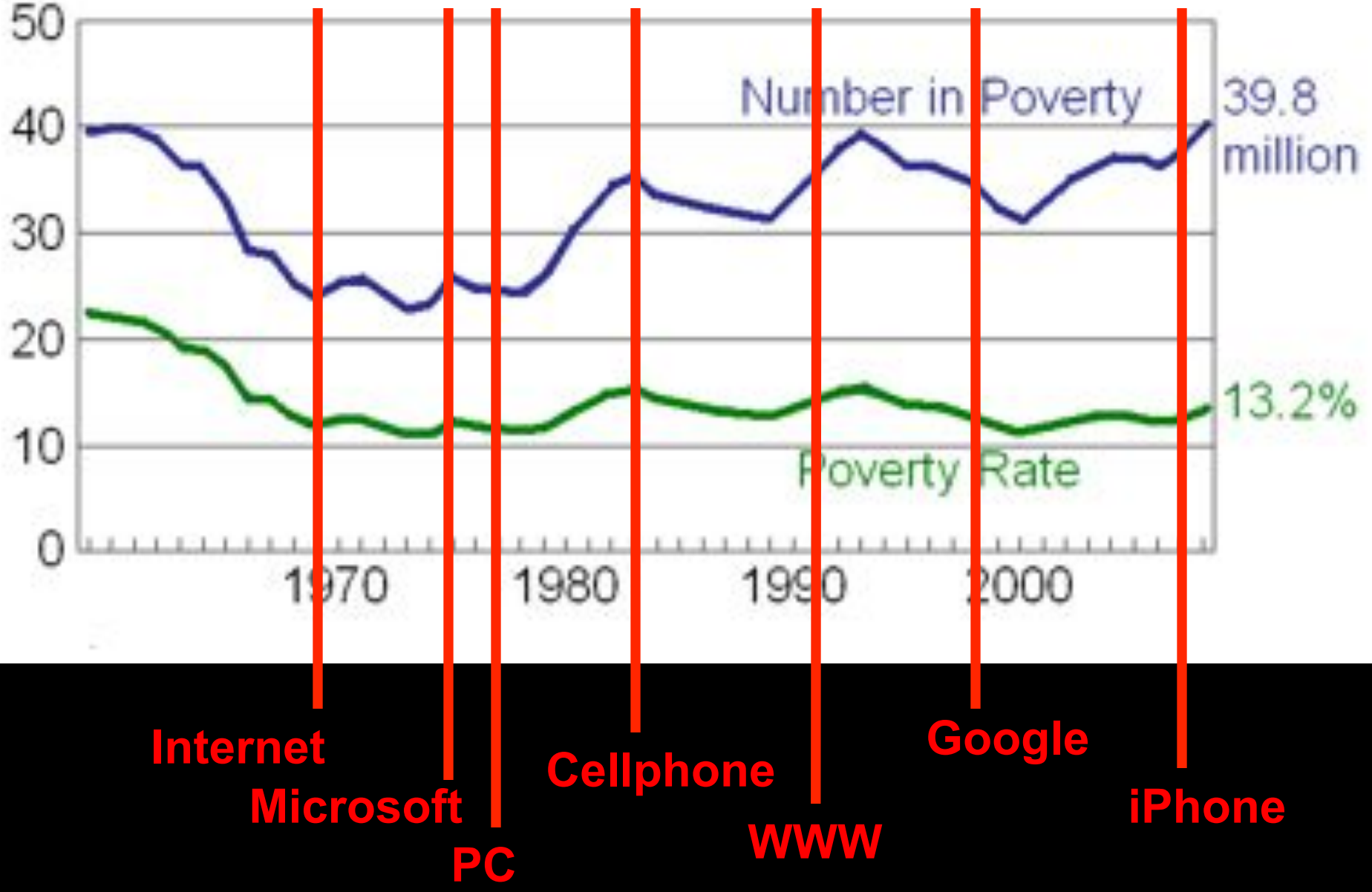
In and of itself, technology…

Does *not* fix dysfunctional institutions;

Does *not* make things more democratic;

Does *not* shrink inequalities.

Poverty in the United States (1959-2008)



Sources: U.S. Census Bureau, Wikipedia

Technology amplifies
underlying human forces.

For technology to have positive impact,
the right human forces
have to be there first.

Use technology to amplify positive human forces.

Rikin Gandhi
Founder of Digital Green

Teach how to be productive in a high-tech economy.

Patrick Awuah
Founder of
Ashesi University

"The acquisition of wealth is no longer the driving force in our lives... We work to better ourselves and the rest of humanity."

Jean-Luc Picard
First Contact

The Matrix	Facebook
Advanced technology	Advanced technology
harvests human energy	harvests human attention
to feed machine masters	to feed shareholders
while offering illusion of pleasant life.	while offering illusion of pleasant relationships.

Attend to science and technology policy.

Google's **Deep Dream**

Image: http://www.telegraph.co.uk/technology/google/11730050/deep-dream-best-images.html?frame=3370412

Summary

Technology **amplifies** underlying human forces.

It doesn't in and of itself

- Fix broken institutions,
- Cause democratization, or
- Alleviate inequality

Technology can have positive outcomes, but only if human forces are positively aligned.

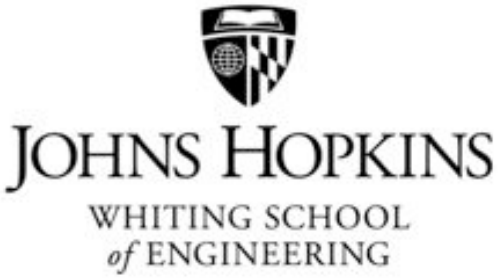
In a world of incredible machines, we need attention on the right human forces more than ever.

Thank you!

Computational Actors in a Physical World

Gregory D. Hager
Mandell Bellmore Professor of Computer Science
Laboratory for Computational Sensing and Robotics
The Johns Hopkins University

Hans Fischer Senior Fellow
Institute for Advanced Study
Technical University of Munich



The “Romance” of the Past

Efficiency and Productivity

Convenience and Quality of Life

Safety, Wellbeing, and Security

What is Over the Horizon?

1. How will we work with smart machines?

2. How will we live and interact with smart machines?

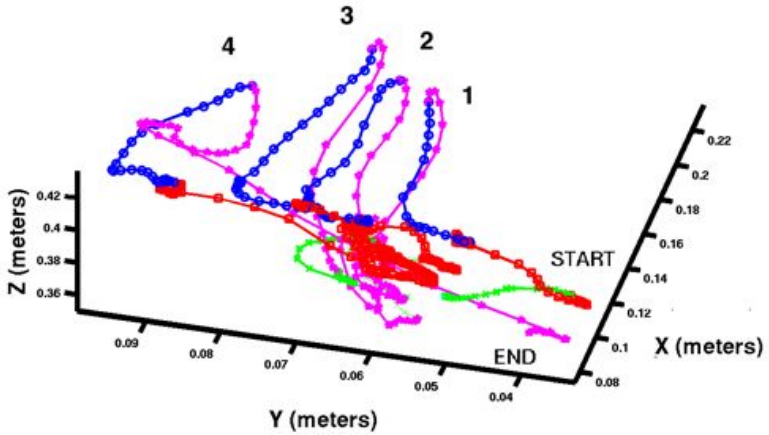
3. How will we create support and policy frameworks in a smart world?

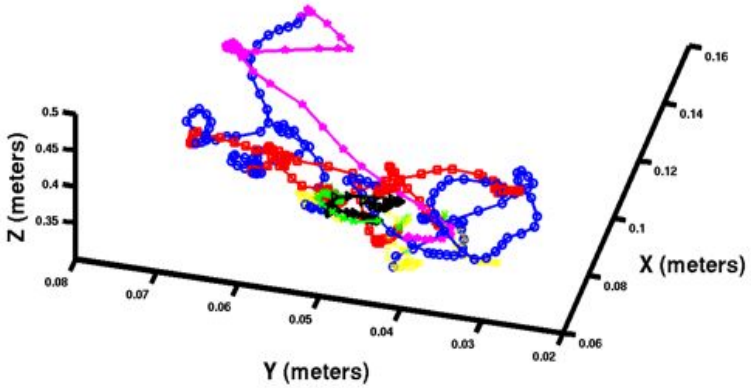
Working With Machines

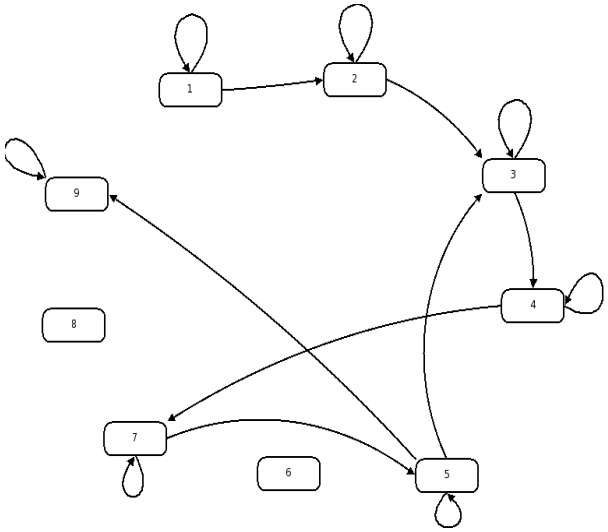
Please see the YouTube link below to view the video:

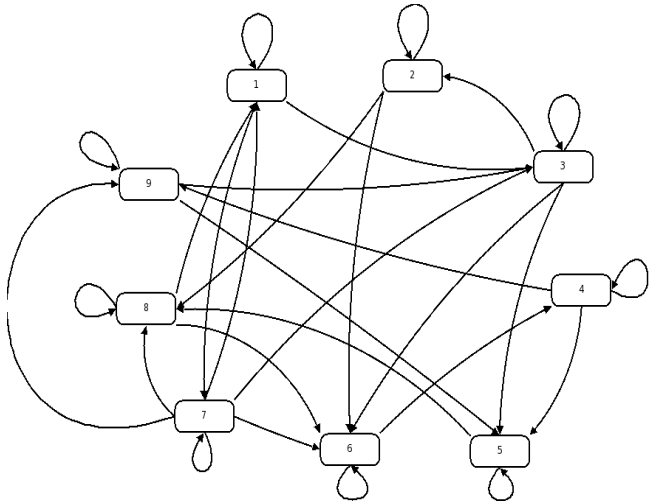
https://www.youtube.com/watch?v=09Ei-k5suZc&feature=youtu.be

Machines Measuring People



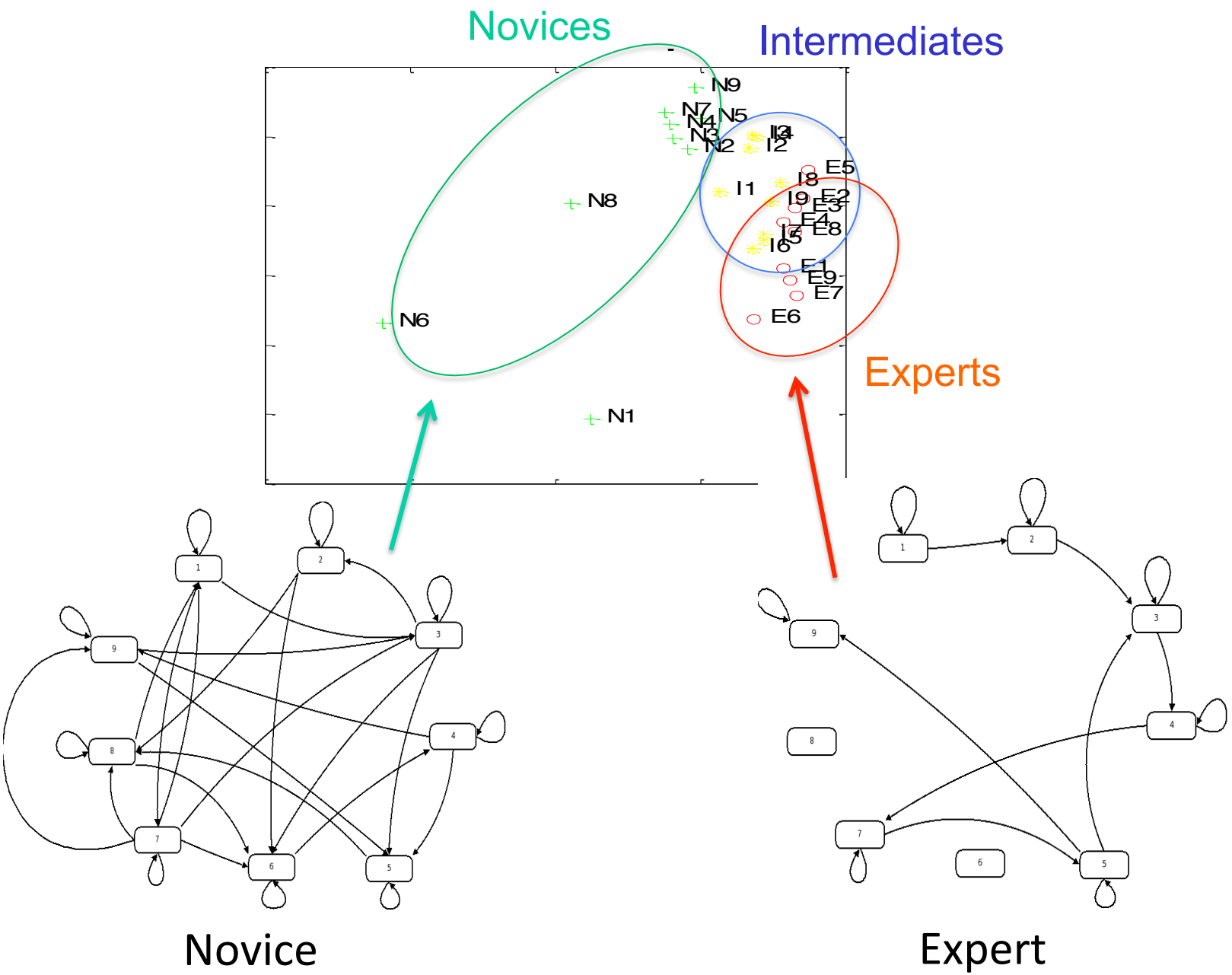






Expert

Novice



Machines Working With People

Please see the YouTube link below to view the video:

https://www.youtube.com/watch?v=FIfCWfB7ZEk&feature=youtu.be

Padoy and Hager. "Human-machine collaborative surgery using learned models." *ICRA 2011*

When Will My Surgeon Be a Robot?

The 20% Rule

The 20% Rule

People are still the most flexible form of “value added”

LIFE WITH ROBOTS: A REAL-WORLD CASE STUDY

Mutlu & Forlizzi, 2008, HRI

PLEASE SEE THE YOUTUBE LINK BELOW TO VIEW THE VIDEO:

https://www.youtube.com/watch?v=ammNHfP4JgE

"…[the robot] doesn't have the manners that we teach our children and it takes precedence over people most of the time… I sort of find it insulting that I stand out of the way for patients or a gurney or a wheelchair coming through, but [the robot]—just barrels right on… You need get out of the way [for the robot]."

"I called them nasty names and told them, 'Would you shut the hell up? Can't you see I'm on the phone? I'll get to you. If you say, '[robot] has arrived,' one more time, I'm about to kick you in your camera.'"

Mutlu & Forlizzi, 2008, HRI

Norms, Learning, and Dialog

- "Manners:"
  understanding social norms
- "You need get out of the way":
  communicating safety, trust
- Pets can be trained:
  what about robots?
- Can automation keep secrets?

Google Car Exposes Regulatory Divide on Computers as Drivers

By JOHN MARKOFF LAST UPDATED: FEBRUARY 10, 2016

Google's self-driving car on the road in California. GORDON DE LOS SANTOS/GOOGLE

The Importance of Societal Choices

How many lives would be saved by driving augmentation or automation?

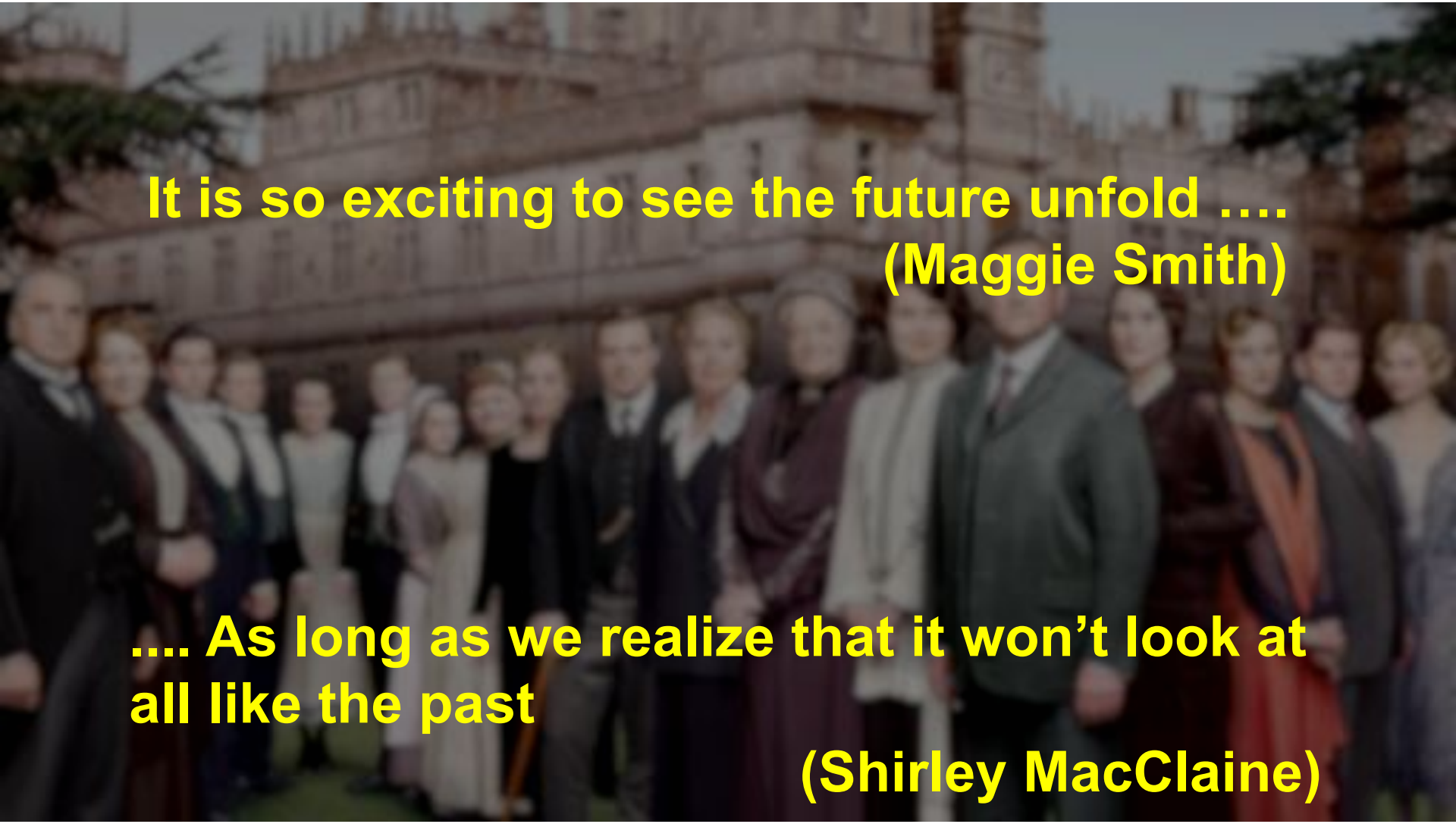
The Importance of Societal Choices

Do we segregate (and accelerate) technology to a limited few, or let it grow in the wild?

Some (Global) Implications

- "Smart" physical work will create new economies transcending scale distance, upending convention
  - What are the implications of investments in research and infrastructure?
  - How do we anticipate barriers and dangers, and create policies?
- The future lies in establishing partnerships to address these a challenges
  - Academia – Industry
  - Technical – Social
  - Government -- Academia

What Will Today Look Like to the Future?



Other Resources

Internet of Things

- System Computing Challenges in the Internet of Things
- Smart Communities Internet of Things

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Autonomy for Physical Systems

- Toward a Science of Autonomy for Physical Systems
- Aerial Earth Science
- Construction
- Defense
- Disaster
- Healthcare
- Service
- Transportation

http://cra.org/ccc/task-forces/computing-in-the-physical-world/

WHAT'S NEXT

Ideas at the Confluence of Computing and Society: Emerging Themes in Socio-Technical Systems

AAAS 2016

Computing Innovation, Societal Needs: The Impact of Computing Research Symposium, May 9-10, 2016

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IDEAS AT THE CONFLUENCE OF COMPUTING AND SOCIETY: EMERGING THEMES IN SOCIO-TECHNICAL SYSTEMS

Elizabeth Mynatt
Georgia Tech
mynatt@cc.gatech.edu

Kentaro Toyama
University of Michigan
toyama@umich.edu

Greg Hager
Johns Hopkins University
hager@cs.jhu.edu

Ann Drobnis
CCC Director
adrobnis@cra.org

CCC Website- www.cra.org/ccc

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