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Daphne Koller
Stanford University & Coursera

NIPS 2013

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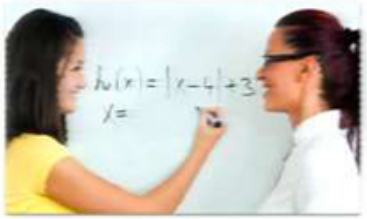
How it works »

Northwestern University »

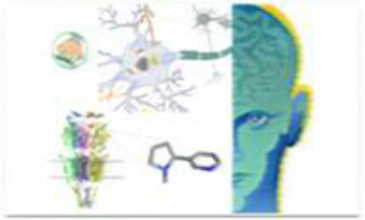
数据结构与算法 Data Structures and Algorithms
Peking University, Oct 20th



Common Core in Action: Math Formative Assessment
New Teacher Center, Oct 21st

Introduction to Programming for Musicians and Digital Artists
California Institute of the Arts, Oct 21st

Mathematical Biostatistics Boot Camp 1
Johns Hopkins University, Nov 18th



Drugs and the Brain
California Institute of Technology, Nov 2nd

The Power of Markets
University of Rochester, Nov 4th

NUMBER OF COURSES AVAILABLE

2 Oct. 2011 **532** Oct. 2013

NUMBER OF PARTNER UNIVERSITIES

1 Oct. 2011 **107** Oct. 2013

NUMBER OF STUDENTS

111,479 Oct. 2011 **5,266,200** Oct. 2013

TOTAL COURSE ENROLLMENTS

19.1 Million

TIME SPENT WATCHING VIDEOS

48,784,829 hours
that's 5,565 years...

NUMBER OF COURSE INSTRUCTORS

731

coursera

35 of the top 60 universities worldwide, including the #1 or #2 ranked university in 16 countries.

UNIVERSITY OF MARYLAND, COLLEGE PARK

E-learning and Digital Cultures

Jeremy Knox, Sian Bayne, Hamish Macleod, Jen Ross, Christine Sinclair

Jan 28th 2013
5 weeks long

UNIVERSITY OF EDINBURGH

Introduction to Philosophy

Dave Ward, Duncan Pritchard, Michela Massimi, Sulin Lavelle, Matthew Chrisman, Allan Hazlett, Alasdair Richmond

Jan 28th 2013
7 weeks long

UNIVERSITY OF EDINBURGH

The Social Context of Mental Health and Illness

Charmaine Williams

Jan 28th 2013
6 weeks long

UNIVERSITY OF TORONTO

Critical Thinking in Global Challenges

Celine Caquineau, Mayank Dutia

Jan 28th 2013
5 weeks long

UNIVERSITY OF EDINBURGH

Introduction to Computer Networks

Arvind Krishnamurthy, David Wetherall, John Zahorjan

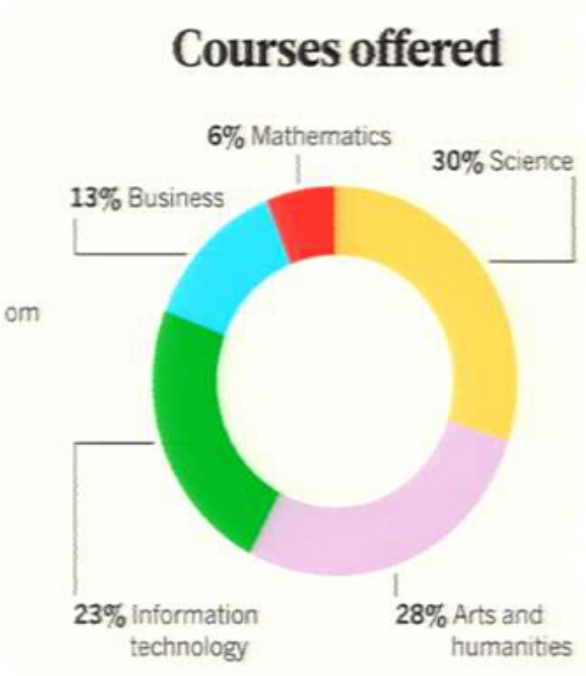
Jan 28th 2013
10 weeks long

UNIVERSITY OF WASHINGTON

Grow to Greatness: Smart Growth for Private Businesses, Part I

Edward D. Hess

Jan 28th 2013
5 weeks long



The Humanities, Sciences, Engineering, Business, ….

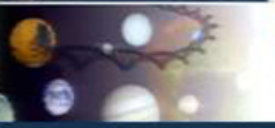
The Social Context of Mental Health and Illness
Charmaine Williams
UNIVERSITY OF TORONTO
Jan 28th 2013
6 weeks long

Critical Thinking in Global Challenges
Celine Caquineau, Mayank Dutia
UNIVERSITY OF EDINBURGH
Jan 28th 2013
5 weeks long

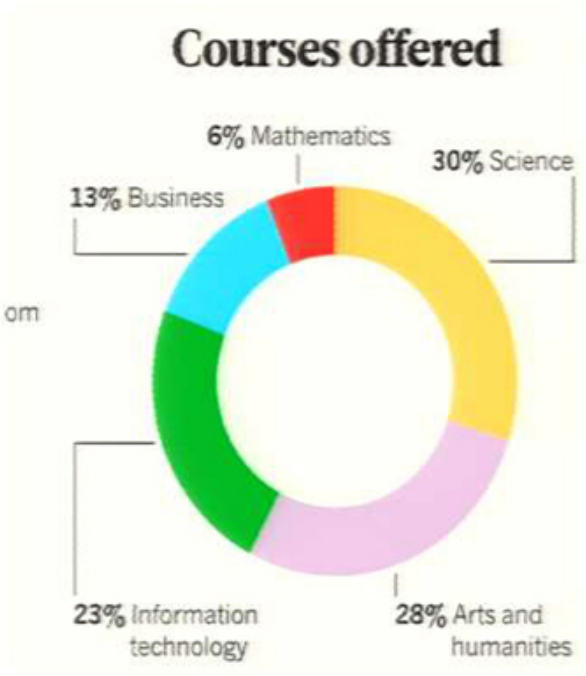
Introduction to Computer Networks
Arvind Krishnamurthy, David Wetherall, John Zahorjan
UNIVERSITY OF WASHINGTON
Jan 28th 2013
10 weeks long

Grow to Greatness: Smart Growth for Private Businesses, Part I
Edward D. Hess
UNIVERSITY OF VIRGINIA
Jan 28th 2013
5 weeks long

Computational Photography
Irfan Essa
GEORGIA INSTITUTE OF TECHNOLOGY
Jan 28th 2013
8 weeks long



Astrobiology and the Search for Extraterrestrial Life
Charles Cockell
Jan 28th 2013
5 weeks long



The Humanities, Sciences, Engineering, Business, ….

VANDERBILT UNIVERSITY

Digital Signal Processing
Paolo Prandoni and Martin Vetterli
February 2013
8 weeks long

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

MOS Transistors
Yannis Tsividis
February 2013

COLUMBIA UNIVERSITY

The Modern and the Postmodern
Michael S. Roth
Feb 1st 2013

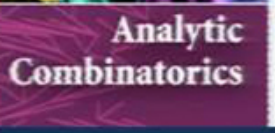
WESLEYAN UNIVERSITY

Introduction to Sociology
Mitchell Duneier
February 2013
7 weeks long

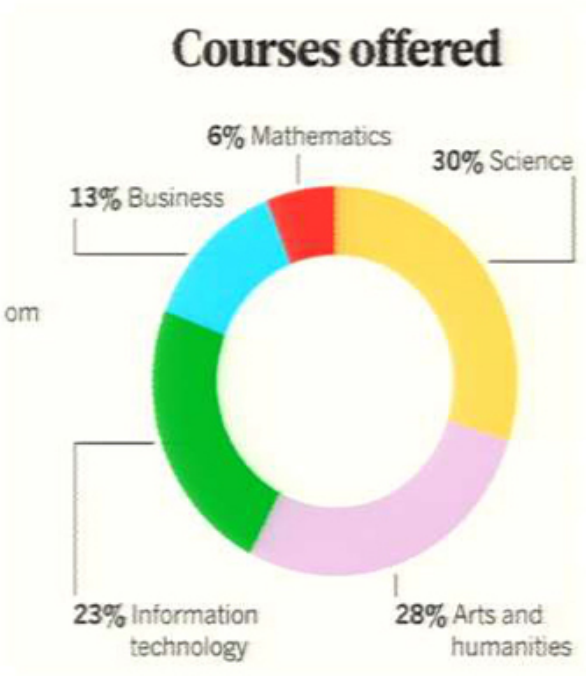
PRINCETON UNIVERSITY

The Language of Hollywood: Storytelling, Sound, and Color
Scott Higgins
Feb 1st 2013
5 weeks long

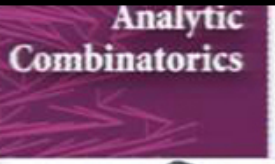
WESLEYAN UNIVERSITY



Analytic Combinatorics, Part I
Robert Sedgewick
February 2013
5 weeks long



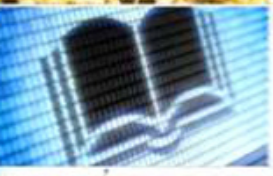
The Humanities, Sciences, Engineering, Business, ….



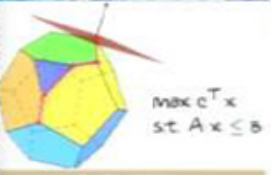
Analytic Combinatorics, Part I
Robert Sedgewick
PRINCETON UNIVERSITY
February 2013
5 weeks long

Software Defined Networking
Dr. Nick Feamster
UNIVERSITY OF MARYLAND, COLLEGE PARK
Feb 4th 2013
6 weeks long

Pattern-Oriented Software Architectures for Concurrent and Networked Software
Douglas C. Schmidt
VANDERBILT UNIVERSITY
Feb 4th 2013
6 weeks long



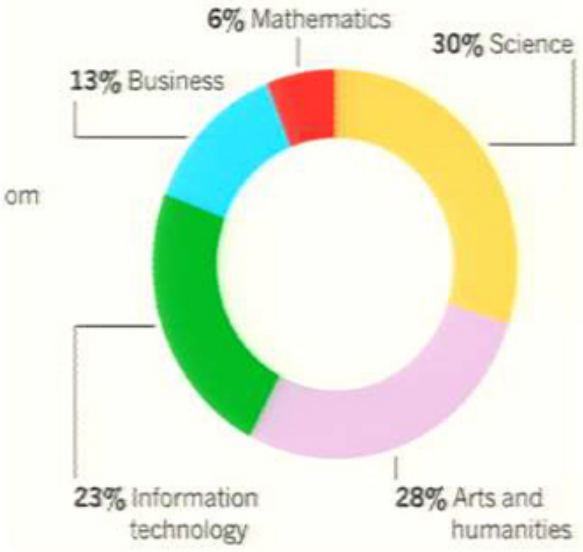
Natural Language Processing
Michael Collins
COLUMBIA UNIVERSITY
Feb 11th 2013
10 weeks long



Linear and Discrete Optimization
Friedrich Eisenbrand
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE
Feb 18th 2013
8 weeks long

Women and the Civil Rights Movement
Dr. Elsa Barkley Brown
UNIVERSITY OF MARYLAND, COLLEGE PARK
Feb 25th 2013
12 weeks long

Courses offered



The Humanities, Sciences, Engineering, Business, ….

PRINCETON UNIVERSITY

Software Defined Networking

Dr. Nick Feamster

Feb 4th 2013
6 weeks long

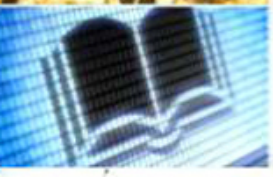
UNIVERSITY OF MARYLAND, COLLEGE PARK

Pattern-Oriented Software Architectures for Concurrent and Networked Software

Douglas C. Schmidt

Feb 4th 2013
6 weeks long

VANDERBILT UNIVERSITY

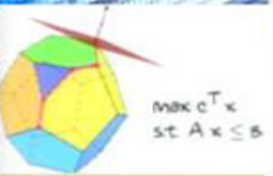


Natural Language Processing

Michael Collins

Feb 11th 2013
10 weeks long

COLUMBIA UNIVERSITY



Linear and Discrete Optimization

Friedrich Eisenbrand

Feb 18th 2013
8 weeks long

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Women and the Civil Rights Movement

Dr. Elsa Barkley Brown

Feb 25th 2013
12 weeks long

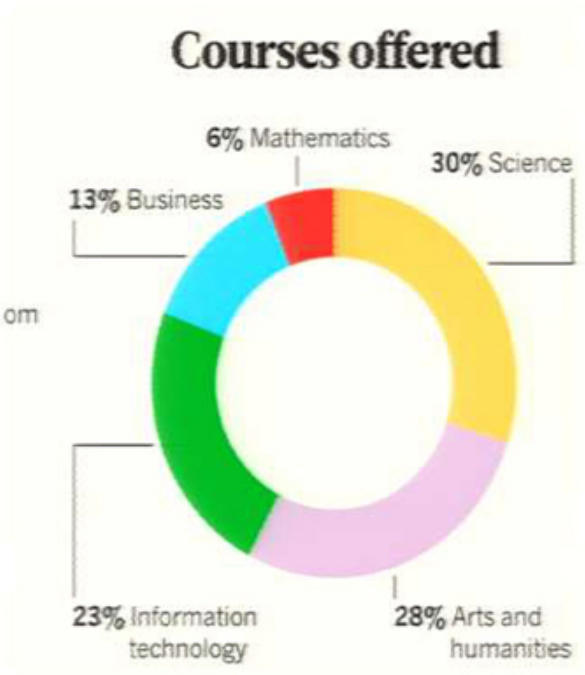
UNIVERSITY OF MARYLAND, COLLEGE PARK

Aboriginal Worldviews and Education

Jean-Paul Restoule

Feb 25th 2013
4 weeks long

om



The Humanities, Sciences, Engineering, Business, ….

Coursera makes studying easier for me. I could sit at home and learn ke I'm at school, no distractions just me, my head phones and my ooks. … I could earn certificates … without spending a dime to get to ny local school. It helps me a lot since my mom is in the hospital and inancially, I cannot afford to attend school. *(Amanda, Dominica)*

was devastated as I had left my job and was finding out new directions
life. I wanted to go back to academics and could not find a way to do
o. One of my friend recommended Coursera and it was like a new life
o me. I was thrilled to see so many courses and so many ways of
earning. Thanks to Coursera, I got admission into one of the premier
chools in my country and I could continue my academics. (Aarti, India)

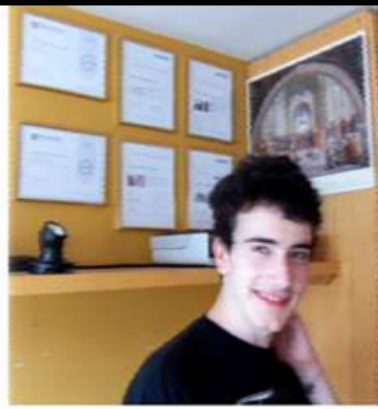
took the class on Experimental Genome Science... The course was
ery, very challenging, I had to do some of the coursework during lunch
t work ... There's a different kind of commitment needed in taking
nline courses. There is a stronger sense of personal integrity required
or it... I got into an interview for a job I really desire, and I mentioned
hat I was taking the Experimental Genome Science course. Now, I have
new job evaluating genomic research proposals. Funny how that
orks. *(Jose, Philippines)*

Two years ago I felt incredibly miserable. I am coming from a traditional family - so I married young and all my life I was either pregnant, breastfeeding or both.

I knew that I am talented, but all I had in life was cleaning, feeding, cleaning, feeding, working part time... I wanted very much to study like my classmates ... but it was very hard to find time. I started and left, started and left. I was deeply depressed. There was a moment ... when I tried to kill myself. But we - humans are very tenacious of life and I survived.

At that time I found Coursera. My first course called the "game theory" expelled the depression and the desire to die once and forever. I feel happy and I enjoy my life and my family much more. In the last two years I have taken about 40 courses (I am addicted) ... Coursera breathes life into me. It gave me hope. I know that when my kids will grow up (in 10-15 years) I will leave everything and go to Oxford. I dream about it...

As Charles Dickens once said: "Suffering has been stronger than all other teaching .... I have been bent and broken, but - I hope - into a better shape."
(Anonymous)



grew a lot from answering the longer quizzes and wrestling with
he complex essay grading rubrics... you are not only allowing
utistic people to learn, but actually diminishing the severity of the
llness itself. *(Daniel Bergmann, USA)*

The Student Experience

Real Course


users on site
Course Begins
100K
50K
SEP 26
OCT 3
OCT 10
OCT 17
OCT 24
OCT 31
NOV 7
Timeline

Real Course

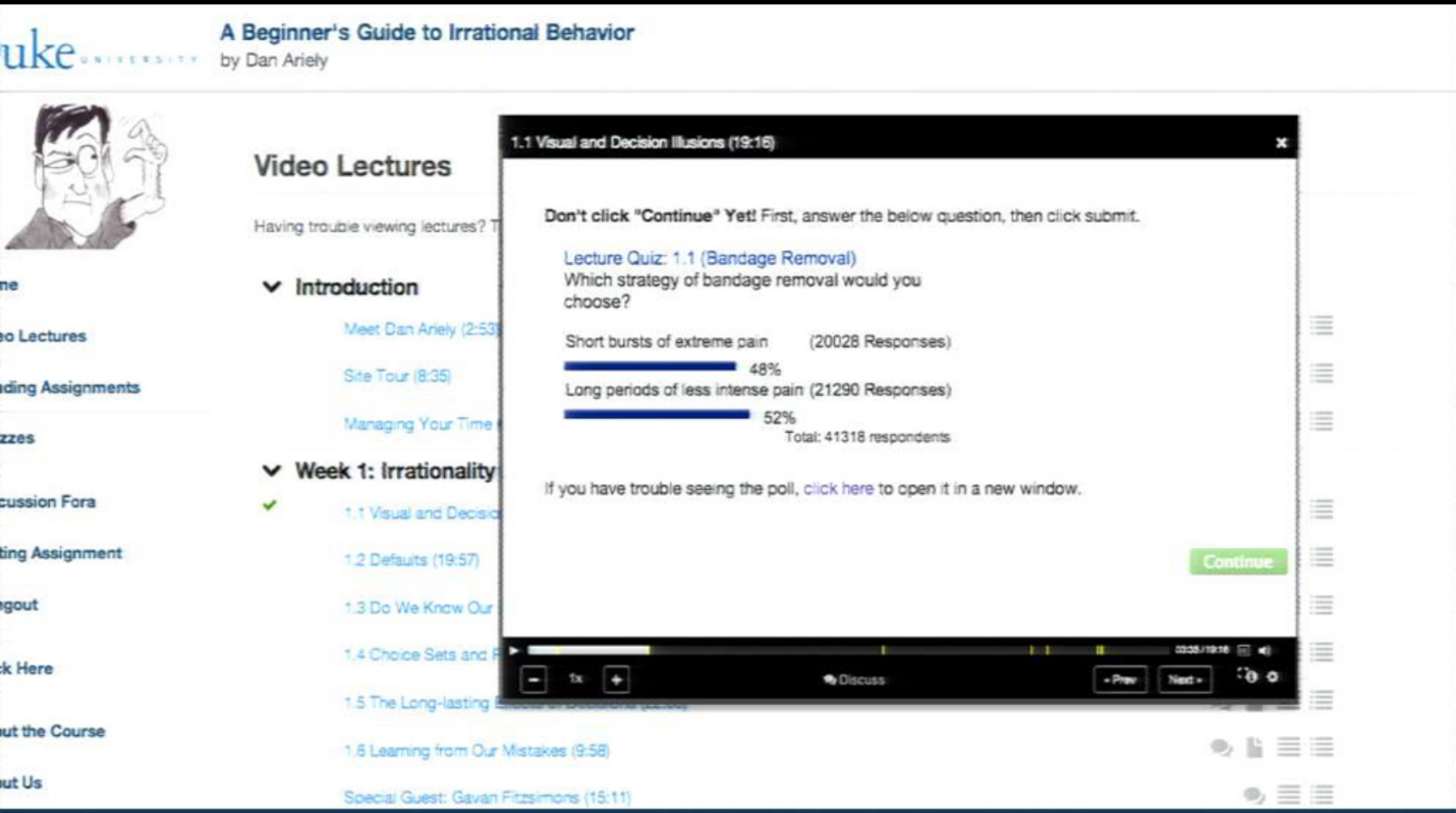

users on site
Course Begins
100K
50K
SEP 26
OCT 3
OCT 10
OCT 17
OCT 24
OCT 31
NOV 7
NOV 14
NOV 21
Timeline

Real Course


users on site
Course Begins
100K
50K
SEP 26
OCT 3
OCT 10
OCT 17
OCT 24
OCT 31
NOV 7
NOV 14
NOV 21
Timeline

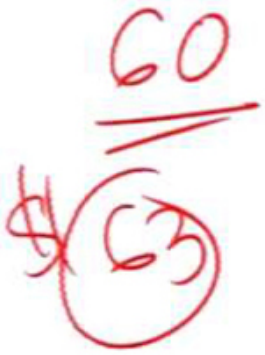
Real Course

In-Lecture Interaction



In-video quizzes

Base Rate Bias



Okay, so we've looked at these four things. Prospect theory, hyperbolic

09:30/12:49

John takes out a loan for his business at extremely high interest rates, even though there is no conceivable way that he'll make enough money from the loan to pay off the interest. Of the behavioral biases we've covered, which type could John be operating under?

The mode he's using is hyperbolic discounting.

Explanation

The loan has an immediate payoff. The cost of borrowing is too high, but since it can be deferred until much later, the cost appears acceptable. This is an example of hyperbolic discounting.

Ok

Continue

Explanation

Correct!

09:42 / 12:49

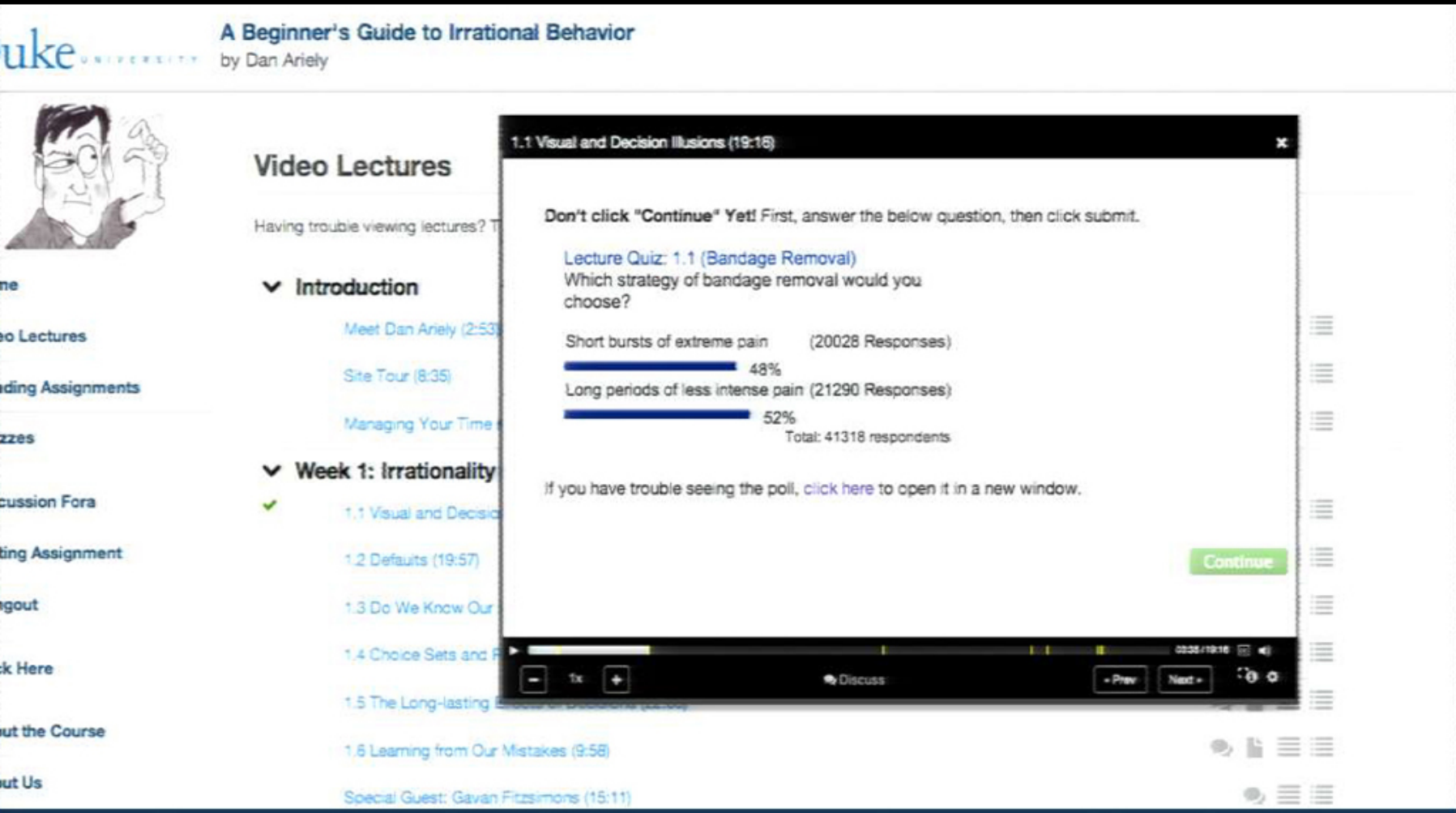
« Previous

Press H for keyboard shortcuts

Behavioral Models

- Speed: 1.50x +

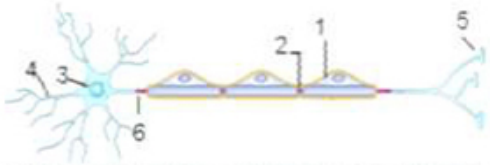
Next »



In-video quizzes

Multiple choice

Question 1



Match the name of the section with the number as plotted in the figure

AIS – Axon Initial Segment

Computer programs

```
image = new SimpleImage("puzzle-copper.png");

for (pixel: image) {
  // your code here
  pixel.setRed(0);
  pixel.setGreen(pixel.getGreen() * 10);

  pixel.setBlue(pixel.getBlue() * 10);

}

print(image);
```

Run

Short answer (regular expression)

Who discovered the theory of general relativity?

Albert Einstein

Submit

Math expressions

Question 1

What is the derivative of $\frac{sin(x)}{x}$ w.r.t. x ?

(x*cos(x) - sin(x)) / x^2

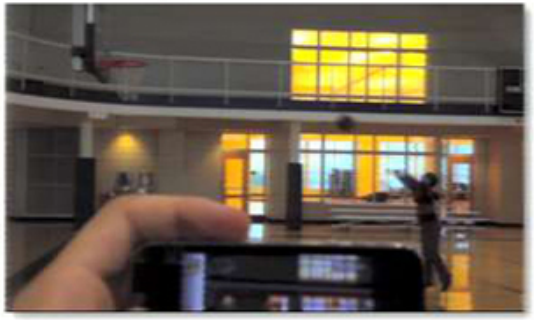
Preview

Your submission is equivalent to: $\frac{x\cos(x) - \sin(x)}{x^2}$

Autograded Homeworks and Exercises

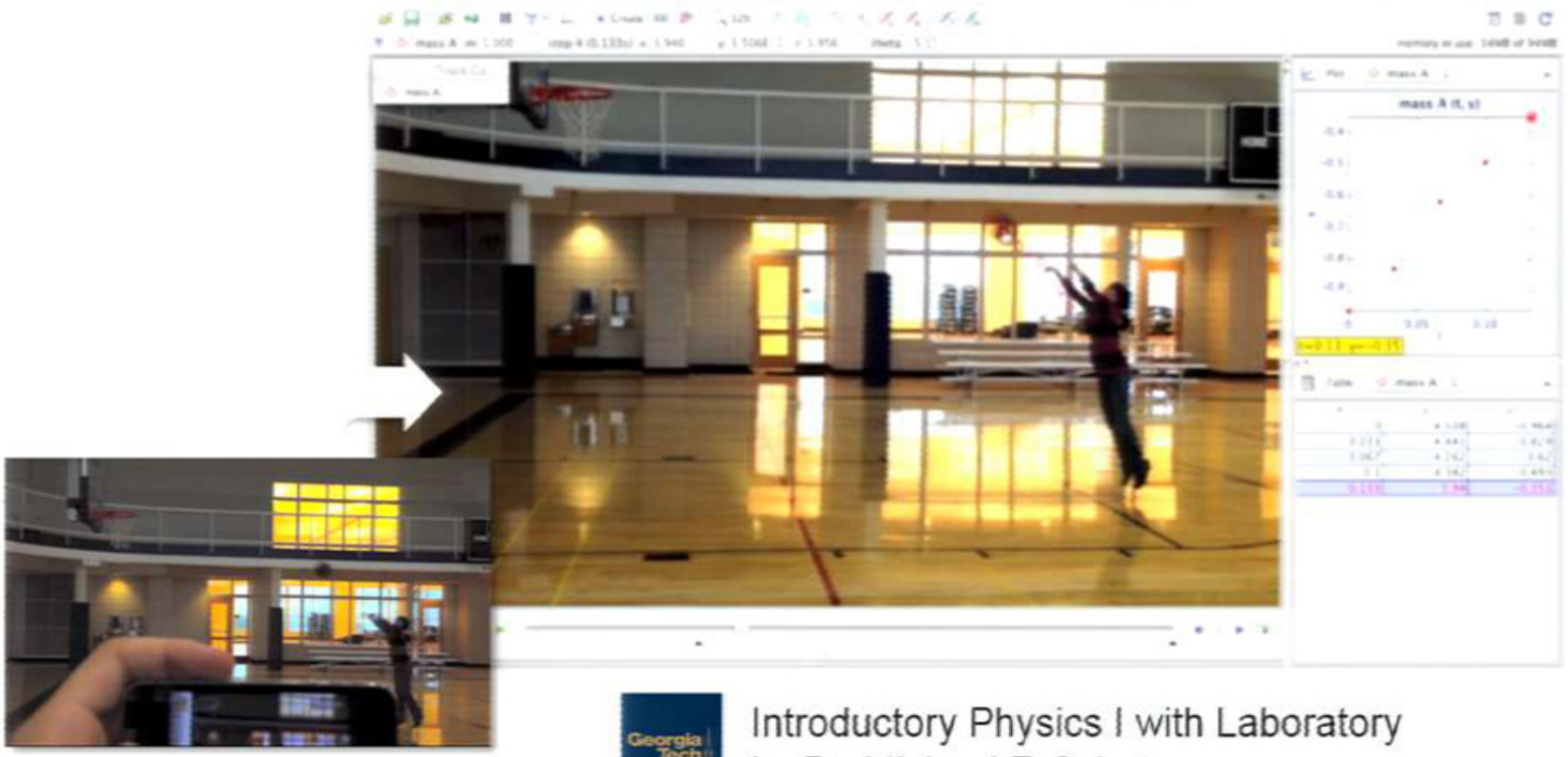
Introductory Physics I with Laboratory
by Dr. Michael F. Schatz

Online Labs



Introductory Physics I with Laboratory
by Dr. Michael F. Schatz

Online Labs



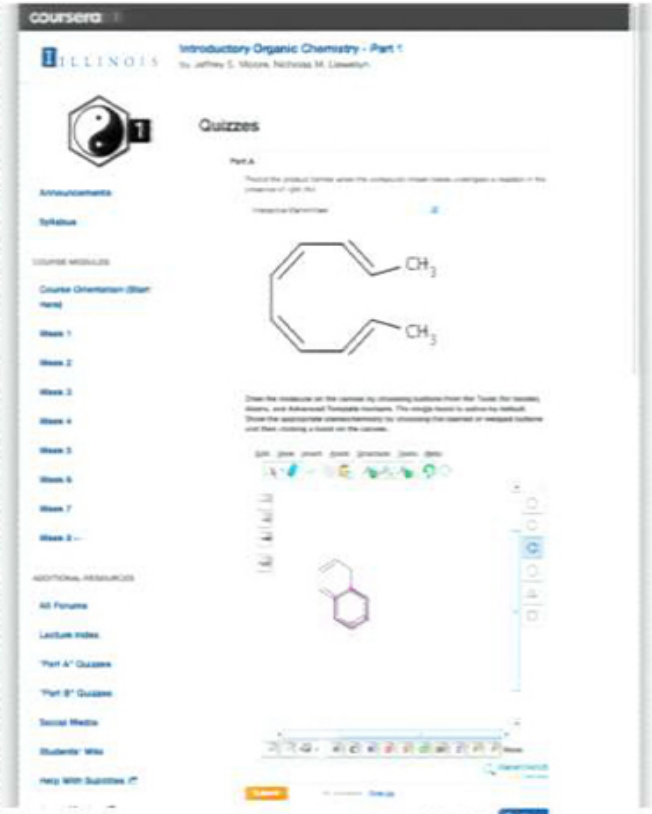
Introductory Physics I with Laboratory
by Dr. Michael F. Schatz

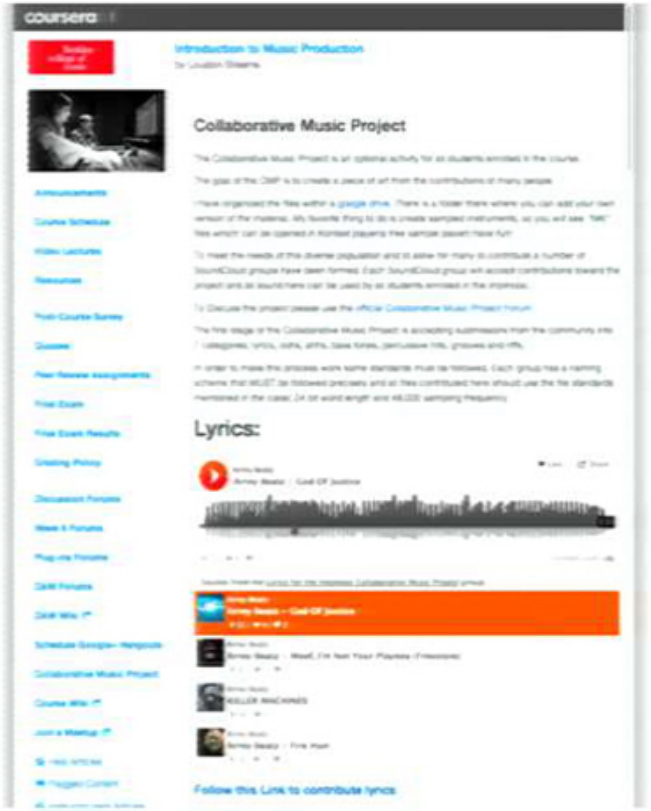
Online Labs

An Introduction to Interactive Programming in Python

by Joe Warren, John Greiner, Stephen Wong, Scott Rixner RICE

Share and run code in the browser



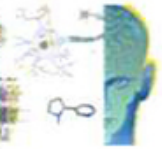


Coursera
App Platform

Third-party integration

Caltech

Drugs and the Brain
by Henry A. Lester, PhD



-course Data Dump

w the Syllabus

h Video miniLectures

Quizzes

t Assessments &
ments of Completion

e complete the Survey

ground &
lementary materials

iniLectures as Static
s

ussion Forums

se Staff

losures

Feedback — Quiz on miniLectures 1-10

You submitted this quiz on **Sun 3 Nov 2013 12:35 PM PST (UTC -0800)**. You got a score of **3.60** out of **23.00**. However, you will not get credit for it, since it was submitted past the deadline.

Quiz 1 treats material in Week 1, miniLectures 1 through 10.

Question 1

1. A newly synthesized drug called numb3rcaine contains an amine group, an aromatic group, a carbonyl group, and an ester linkage. Which of these moieties would be expected to form a charge-charge (or coulombic or ionic or cation-pi) interaction with the receptor?

Your Answer		Score	Explanation
• ester linkage	✗	0.00	Ester linkages typically do not participate in charge-charge or cation-pi interactions
carbonyl group			
aromatic group			
amine group			
Total		0.00 / 1.00	

Instant feedback

MoMA

Art and Inquiry: Museum Teaching Strategies For Your Classroom

by Lisa Mazzola

Your Final Project for this course is to take the concepts we have explored each week and create a resource that you can incorporate into your teaching. The project outline below has been structured to allow you to tailor the content to the context in which you teach so that it can be most useful. The goal of this final project assignment is to give you an opportunity to practice and be creative with the concepts from the class in a forum where you can share ideas and get feedback from your peers. The peer assessment process will also give you the opportunity to see the ideas that others come up with. Be creative! **This is your chance to apply the course concepts to real-world situations**

Your assignment is to select an artwork that you would like to use as the starting point for an inquiry based lesson in your classroom.

Format: Please provide the following information in the order that it is presented below:

1. Subject Area
2. Intended grade level range
3. Artwork Selection (please use the "Upload an Image" button or insert a link to the image)
4. Artwork Title
5. Artist
6. Date
7. Materials

Peer Grading

MoMA

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by Lisa Mazzola

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2. Intended grade level range
3. Artwork Selection (please use the "Upload an Image" button or insert a link to the image)
4. Artwork Title
5. Artist
6. Date
7. Materials

Evaluation/feedback on the above work

Does the activity relate to the artwork?
Are the instructions/prompts clear?
Is the activity developmentally appropriate?

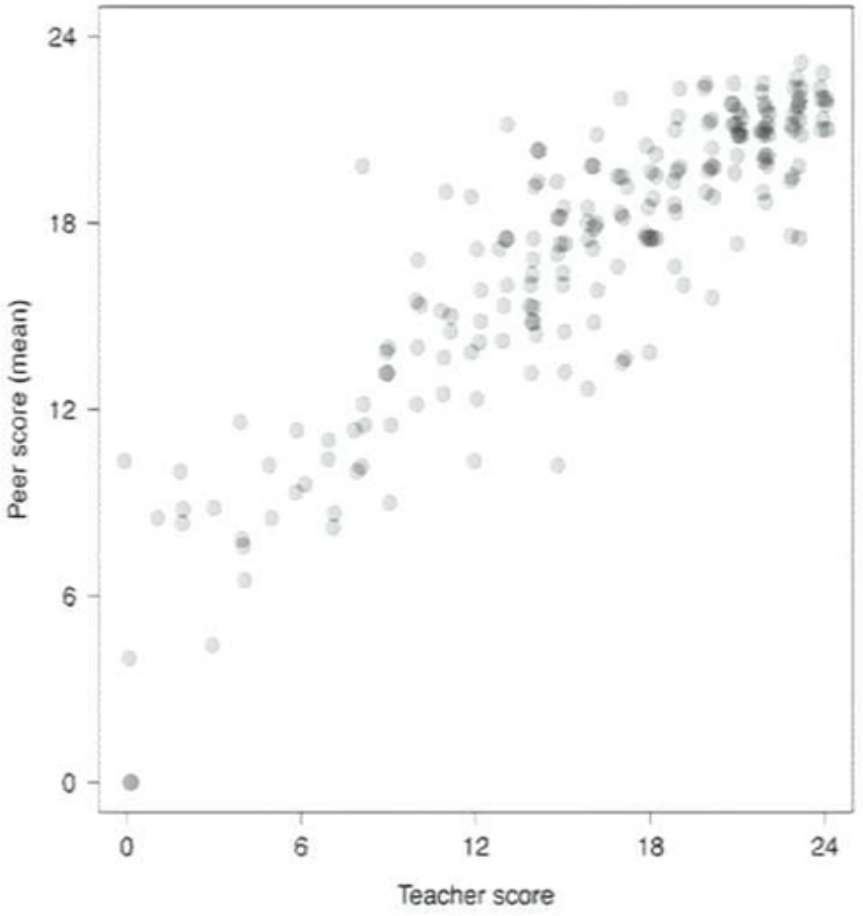
Peer Grading

Mitch Duneier
Princeton

Peer Grading

Mitch Duneier
Princeton

Analysis by:
Matthew Salganik & Mitch Duneier
Princeton University Sociology Dept.



Peer Grading

Karl Ulrich
Penn

LaPtabel
laptop table

Ramaswamy Venkatachalam
Gujarat, India

DuoSlim
portable device holder

Aranzazu Hurtado Ruiz
Madrid, Spain

Neo-WD
space-efficient workdesk

Paul Mendoza
Manila, Philippines

From Knowledge to Action

The Hebrew University of Jerusalem

Synapses, Neurons and Brains

by Idan Segev.

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Sort replies by: Oldest first | Newest first | Most popular

No tags yet. + Add Tag

Student 1 a day ago

The problem summary:
How is the information storaged in our brain? As in computers we use potentials, or magnetization for example to make an array of binary code (1 or 0), what is the analogous in the brain?

Steps to rea
-We have wa
real time, pa

-The questio
would be the
memories? I
and where in

Coments:
Thank you so much. S
this topic or is someth

Student 2 a day ago

Maybe in
really do
may cha
network
excited.

Actually
accurate
really jus

Student 3 a day ago

https://ca
said, but a
maybe I'm
activated,
female frie

Anonymous - 20 hours ago

Perha

Student 4 - 5 minutes ago

"Within the human
I'm also curious h
each one and test

I've already worked a lot on this before starting with this course (nonetheless I learned a lot of details in the course). One of the most interesting papers I found is that information is represented feature based http://www.cs.rochester.edu/users/faculty/dana/tanifuji.pdf . I've already tried around building some small information processing algorithms based on this. If you are interested we could probably talk a bit about it.

Community

coursera

The Hebrew University of Jerusalem

Synapses, Neurons and Brains
by Idan Segev

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Course Wiki

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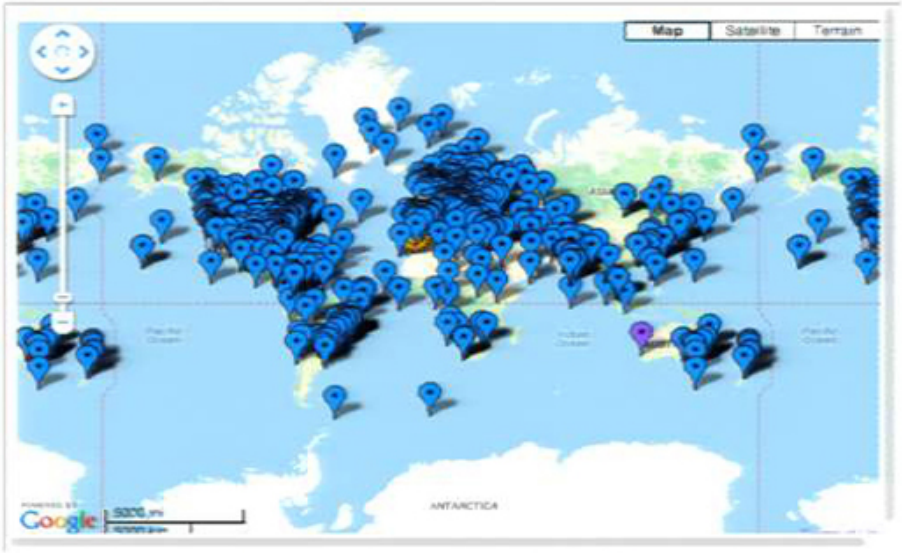
Instructor Help Articles

I18N Editor

Synapses, Neurons and Brains Students Map

Tag yourself in our map here: http://goo.gl/maps/XaCW0



Note that we update this map every week, so new tags won't appear immediately in this page

Edit Page

Global community

2982 Coursera communities

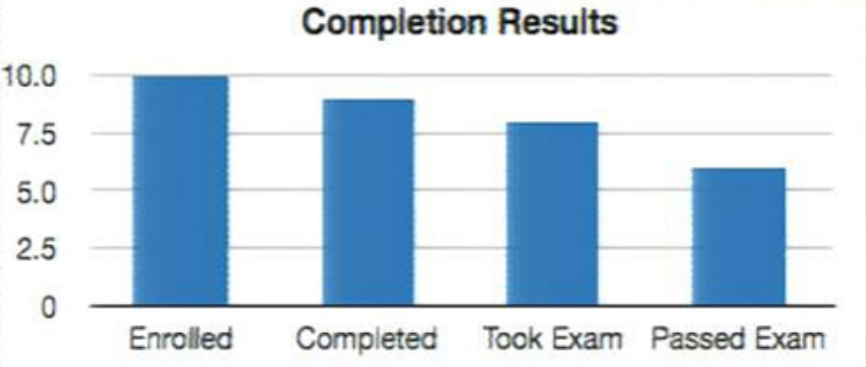
Global Network of Learning Communities

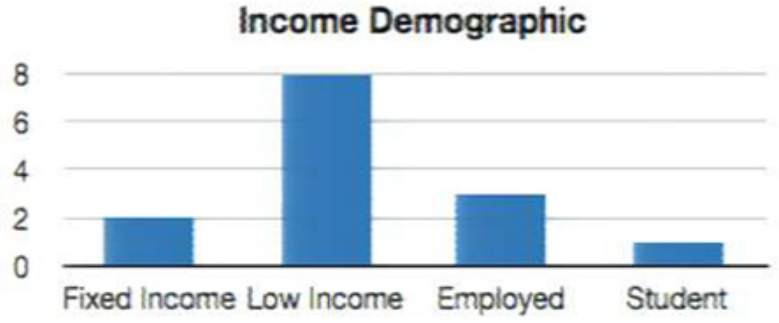
Grow to Greatness

UNIVERSITY of VIRGINIA
DARDEN SCHOOL OF BUSINESS

Grow to Greatness

University of Virginia
Darden School of Business





Internet access

Group learning

Learning Hubs

Global Learning Hubs, 24 Countries, 5 Continents

nature Track Course Record

Verified Certificate record successfully ma

ane Learner has successfully completed Genetics and Society: A Course for Educators, a nc
f Natural History. This student met or exceeded minimum passing requirements set by the co
ccomplishment, was issued a Verified Certificate on October 8th 2013.

out this Course

rse Title: Genetics and Society: A Course for Educators

uctors: Rob DeSalle, David Randle

tion of course: 4 weeks

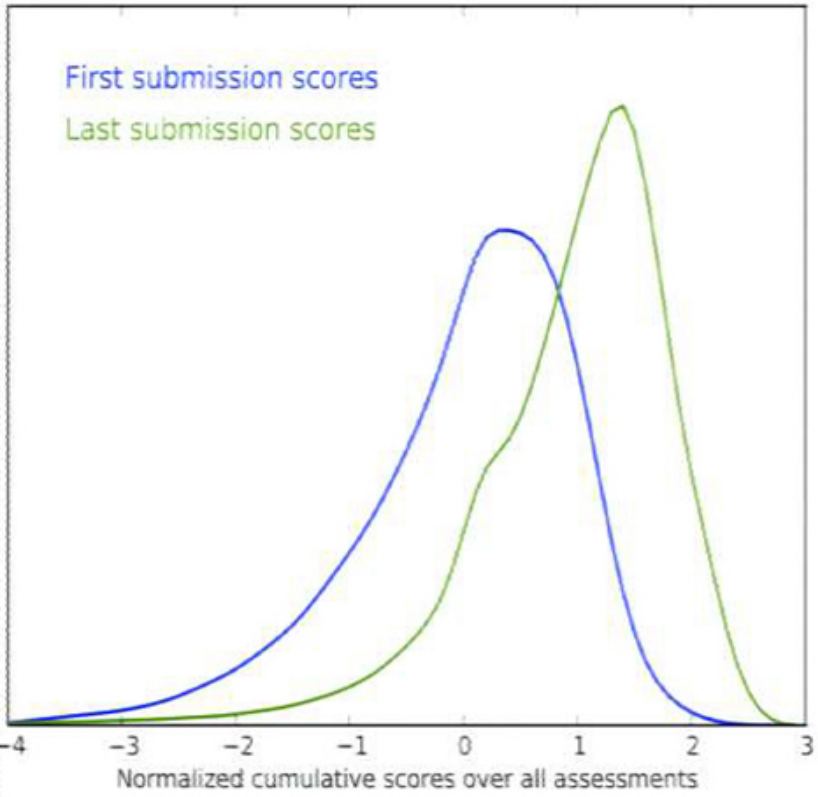
commitment: 5-8 hours/week

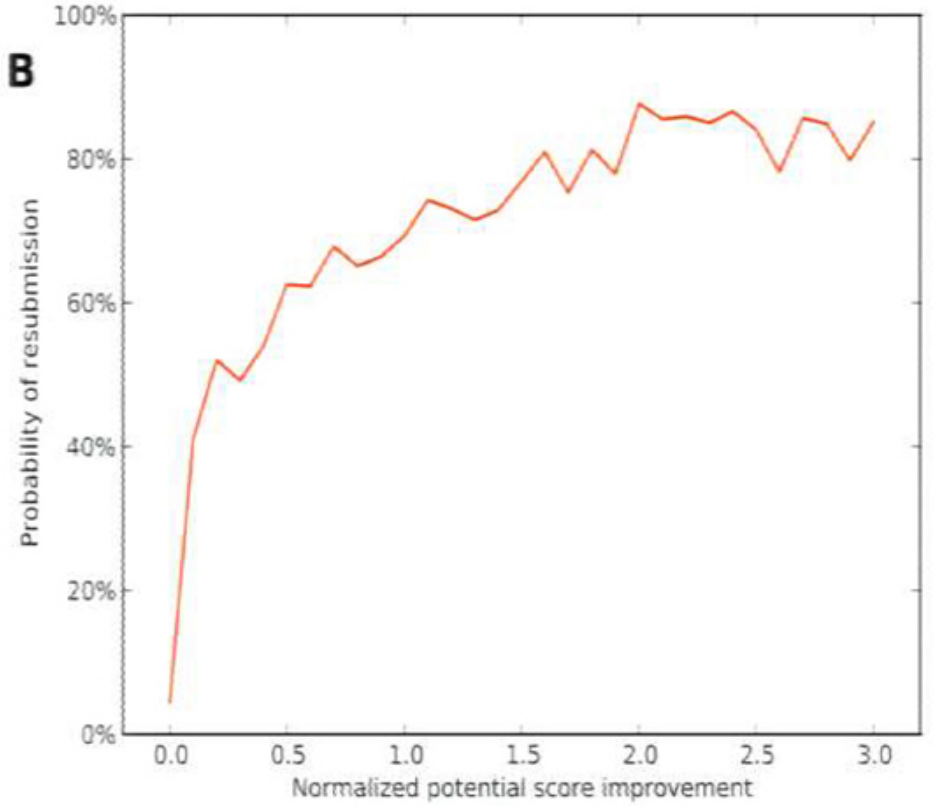
rse Description:

AMNH course *Genetics and Society: A Course for Educators* explores the social, legal and ethical issues of modern-day genetics. Informed by
ecently released *Next Generation Science Standards*, the course provides an overview of recent genetic discoveries and molecular lab
niques. Participants will acquire an understanding of the science and technology behind breakthroughs such as therapeutic cloning and the
uencing of the human genome. You will also have the opportunity to discuss and debate issues surrounding hot-button topics in genetics: *If it is*

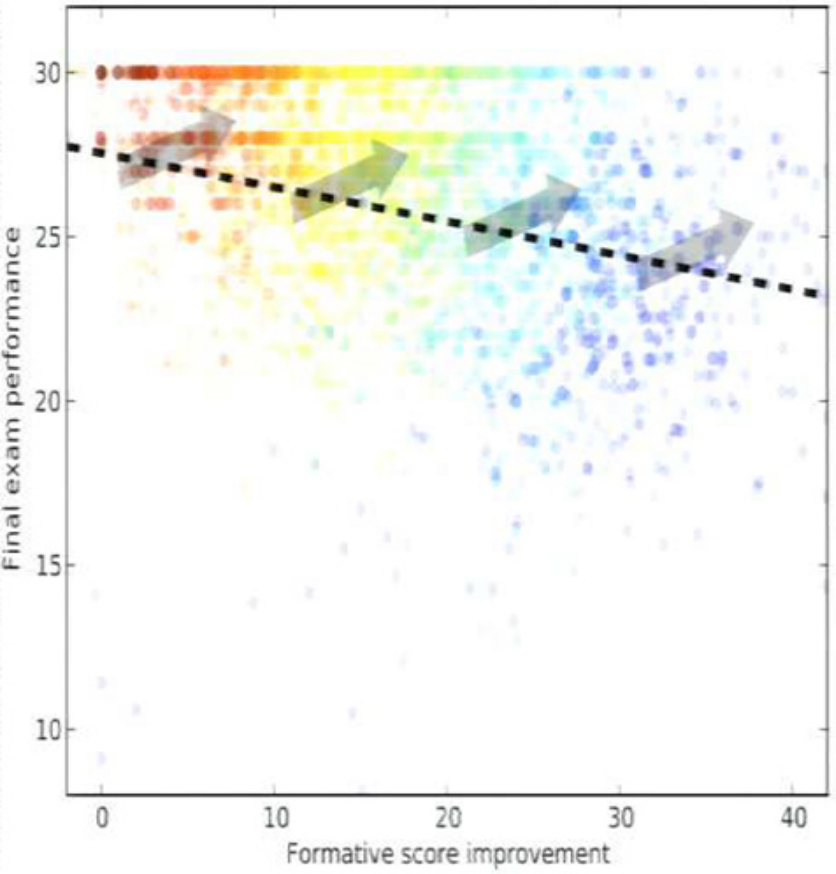
Signature Track

Data & Learning



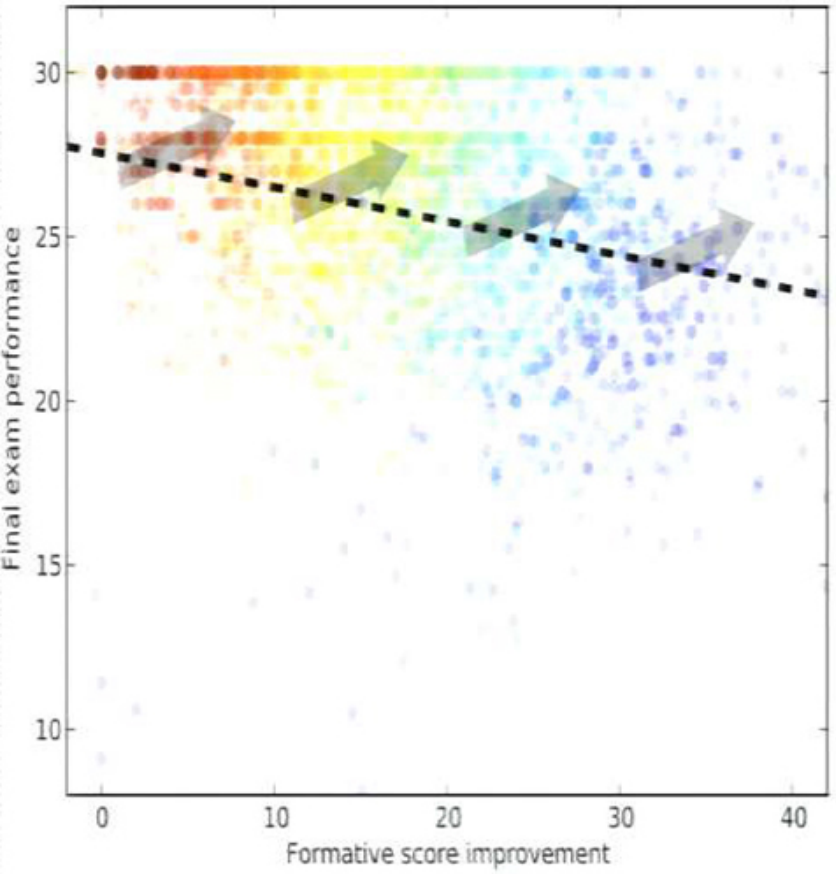


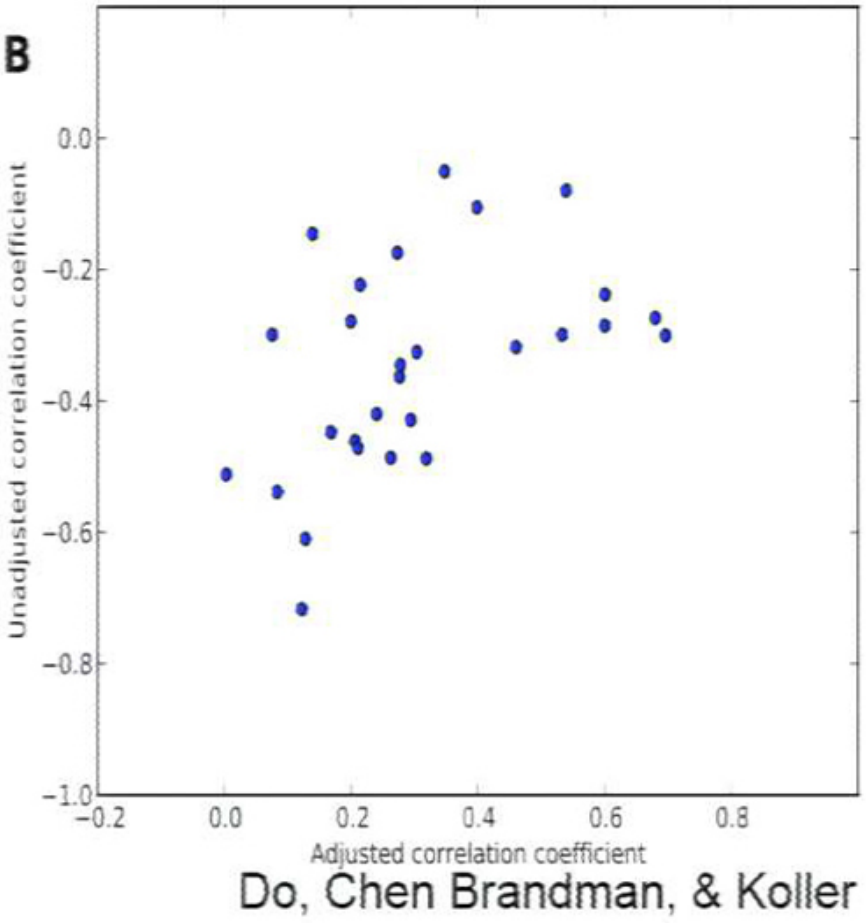
Self-Induced Mastery



Do, Chen Brandman, & Koller

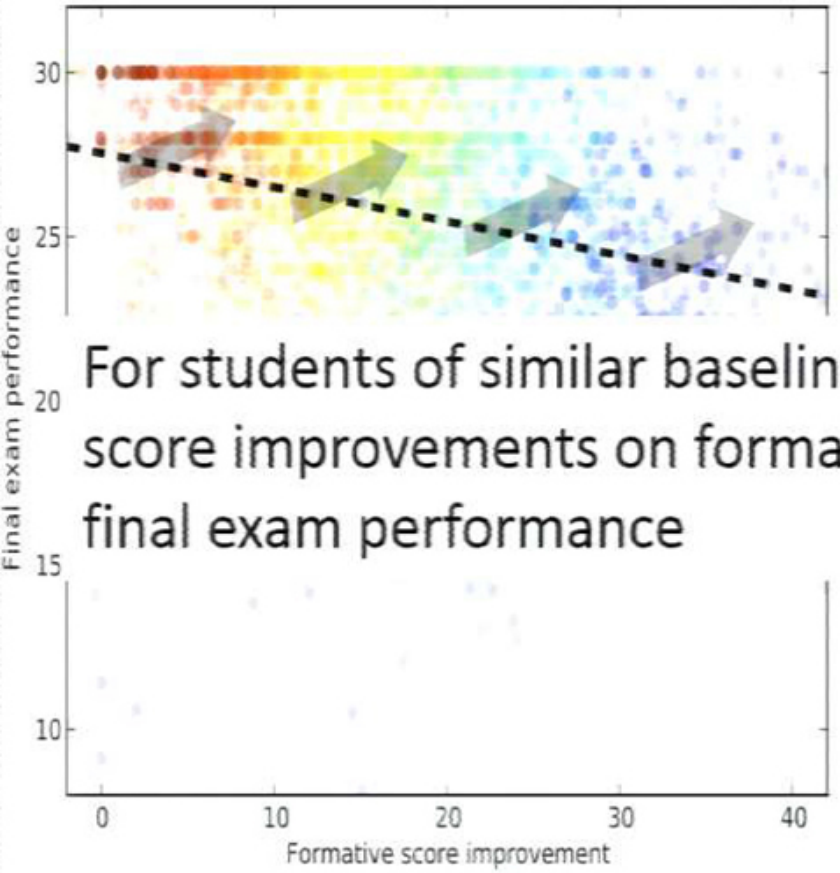
Mastery Improves Outcomes

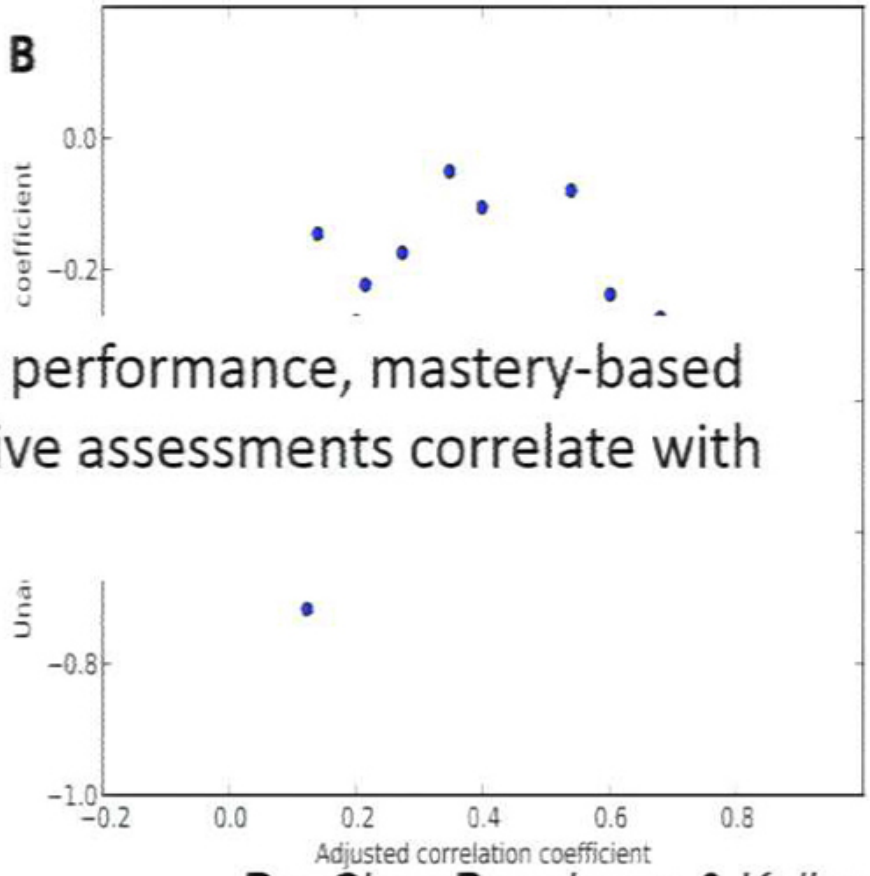




Do, Chen Brandman, & Koller

Mastery Improves Outcomes

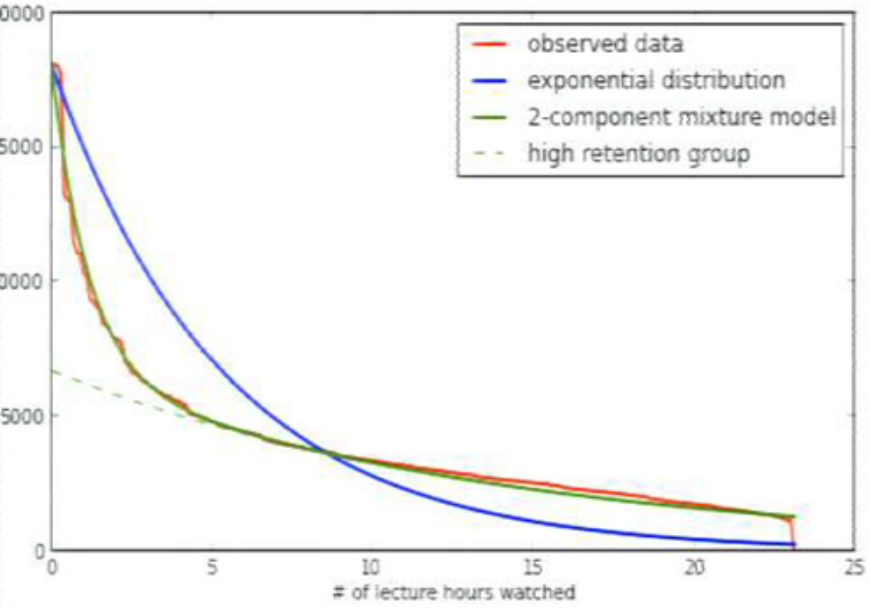




For students of similar baseline performance, mastery-based score improvements on formative assessments correlate with final exam performance

Do, Chen Brandman, & Koller

Mastery Improves Outcomes



Hourly retention
High group

Hourly retention
Low group

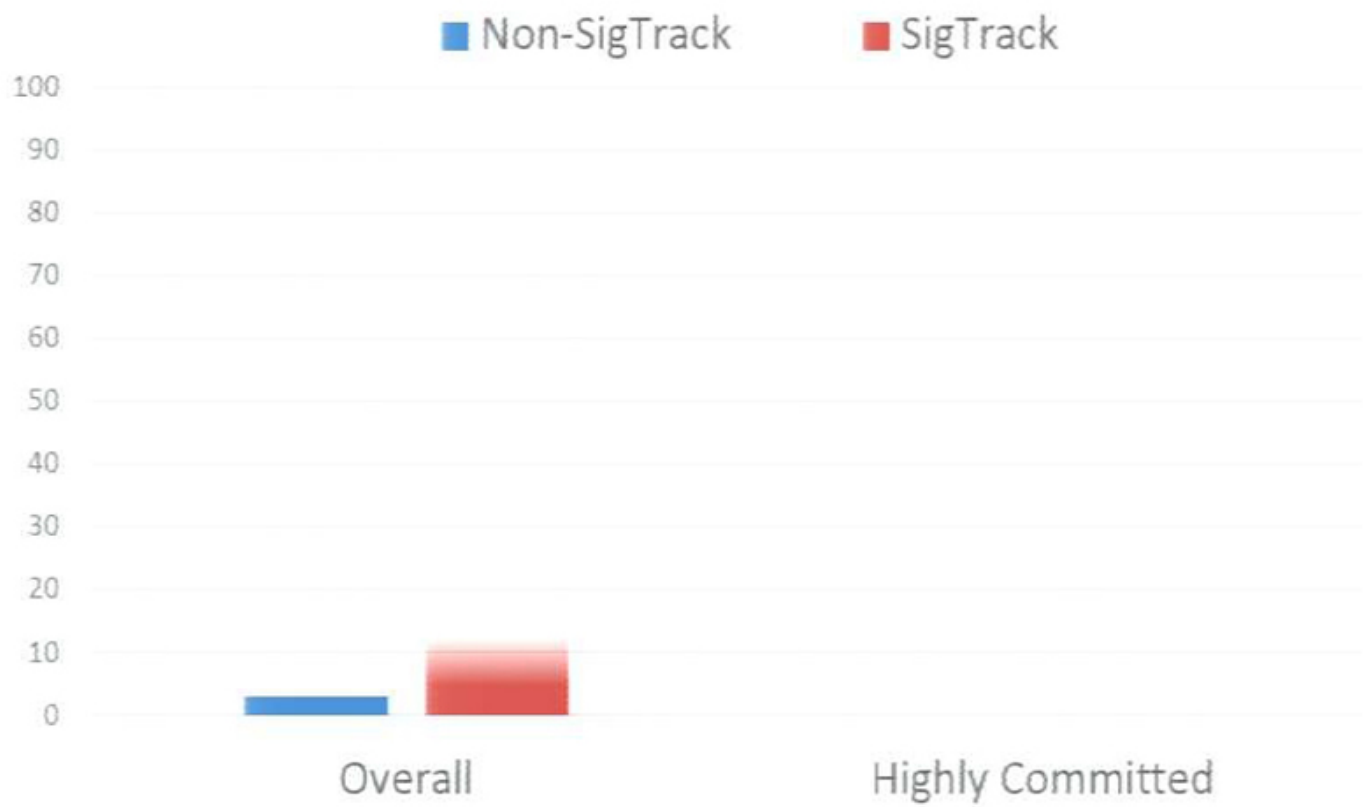
Koller, Ng, Do & Chen

Intent & Retention

Maas, Heather, Do, Brandman, Koller, Ng

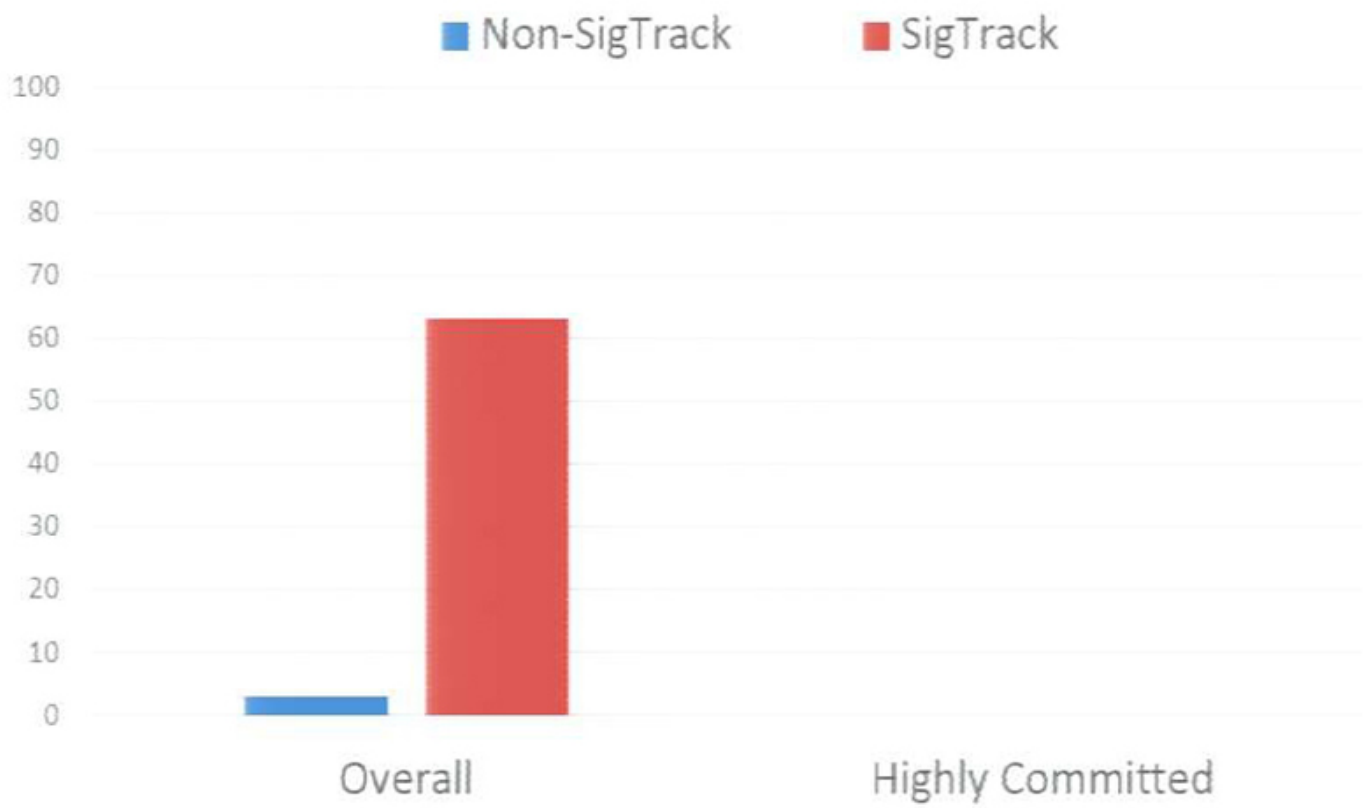
Intent & Retention

Maas, Heather, Do, Brandman, Koller, Ng



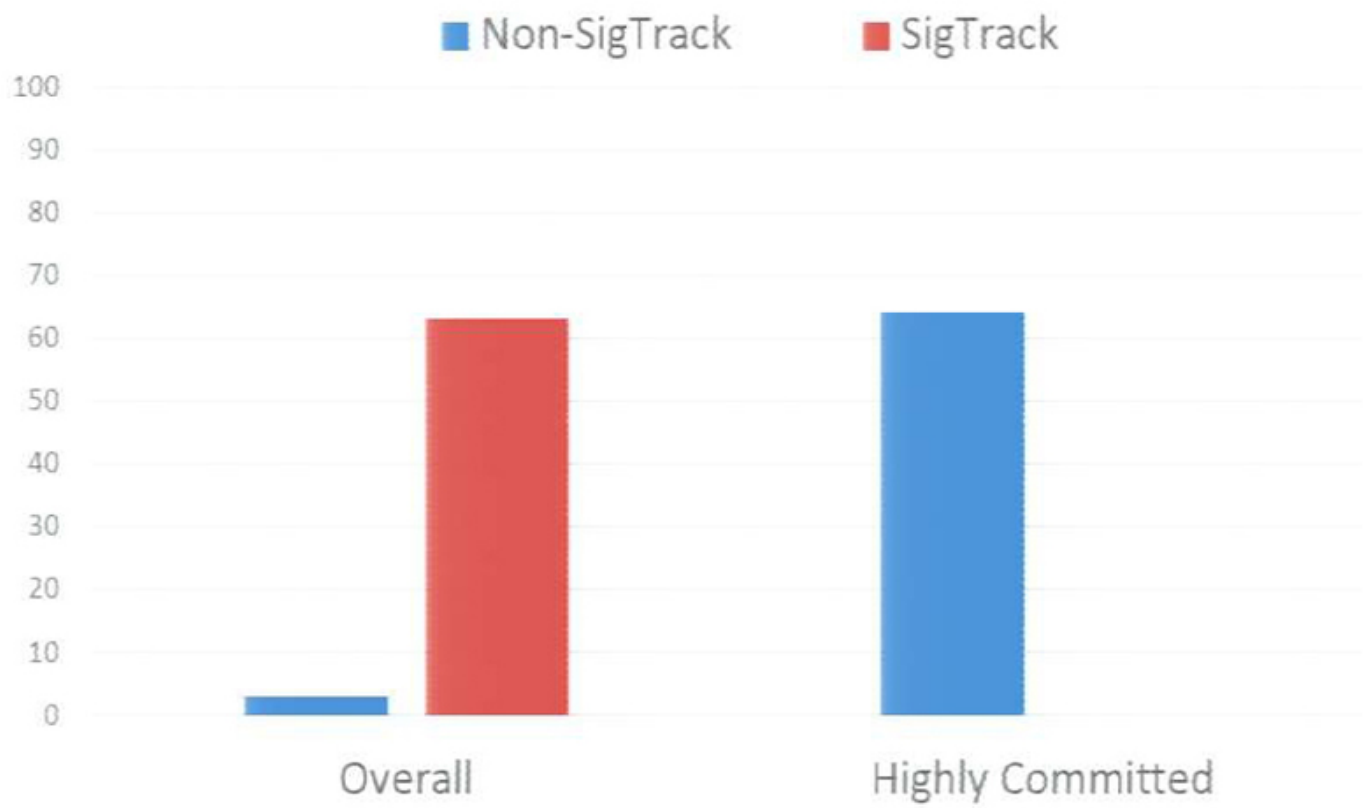
Intent & Retention

Maas, Heather, Do, Brandman, Koller, Ng



Intent & Retention

Maas, Heather, Do, Brandman, Koller, Ng



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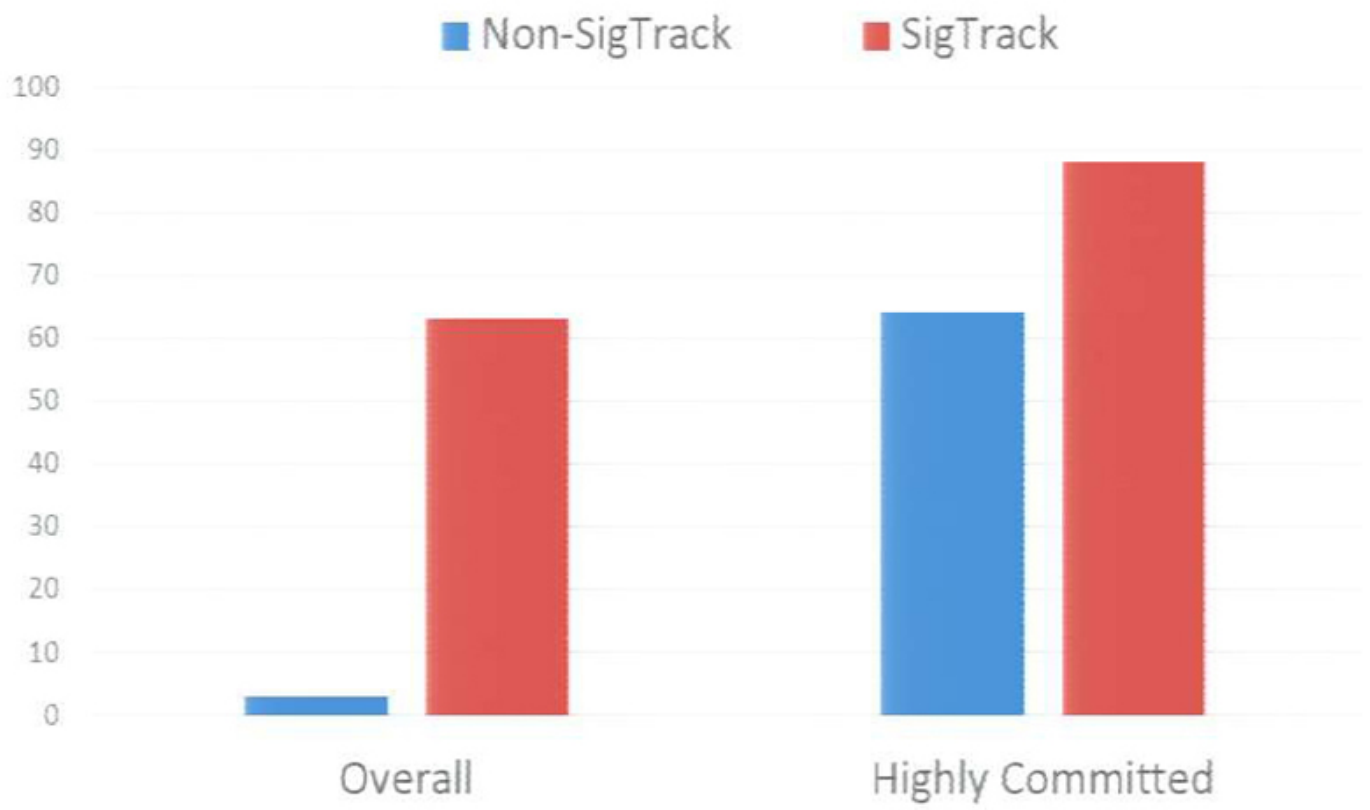
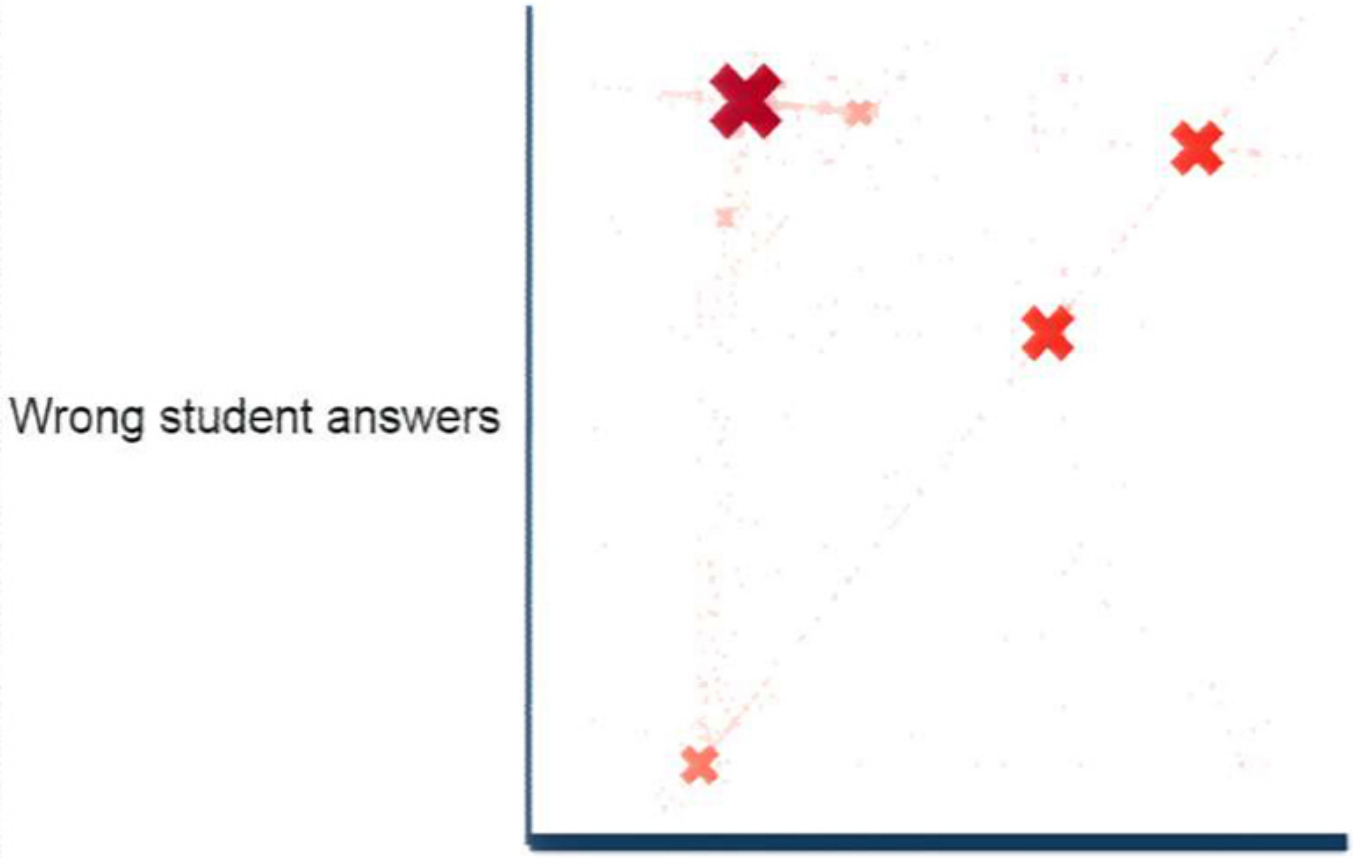


Intent & Retention

New Window into Human Learning



New Window into Human Learning

"The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring." *B. Bloom, Educational Researcher* (1984).

The 2 Sigma Problem

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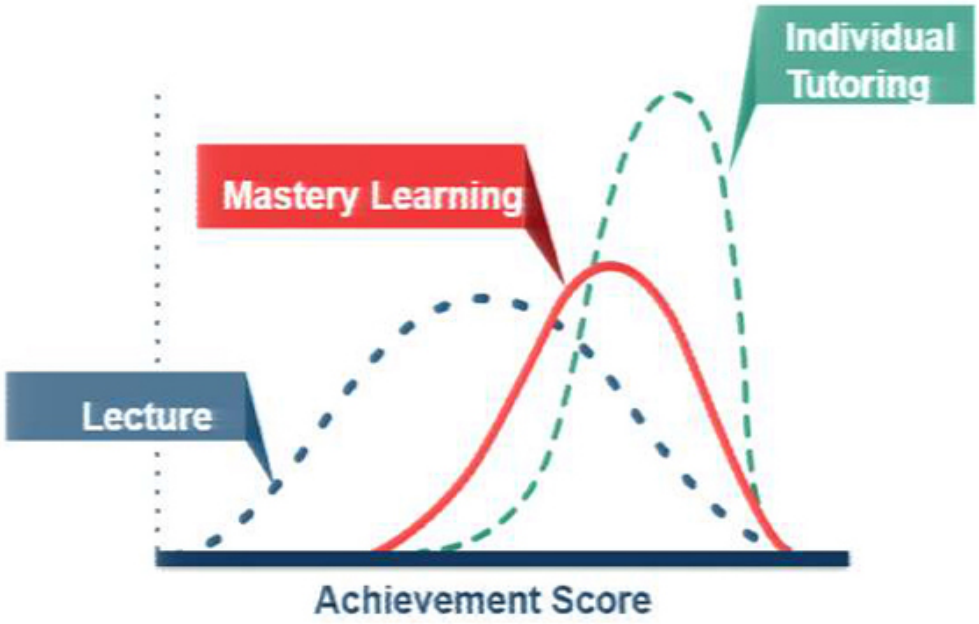

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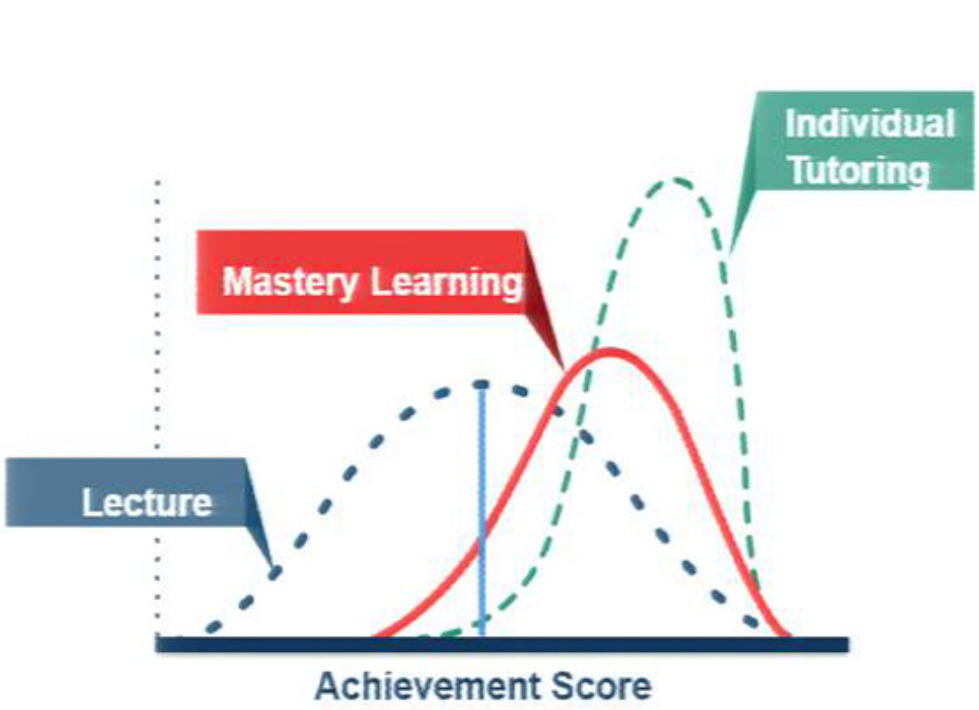

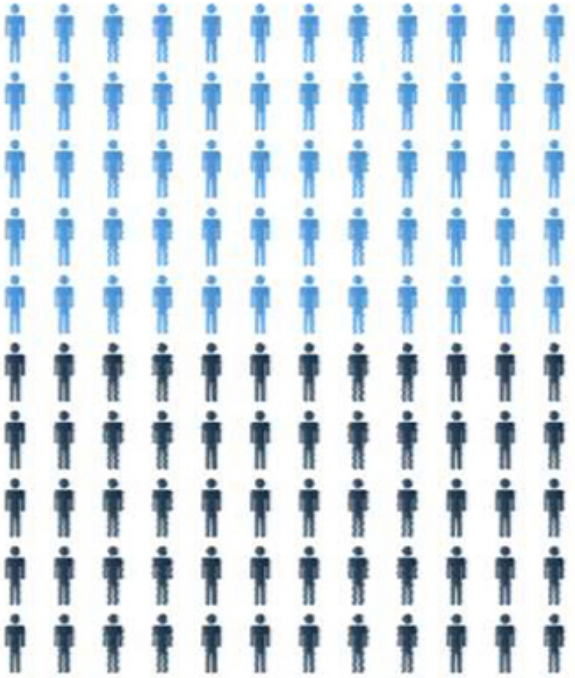

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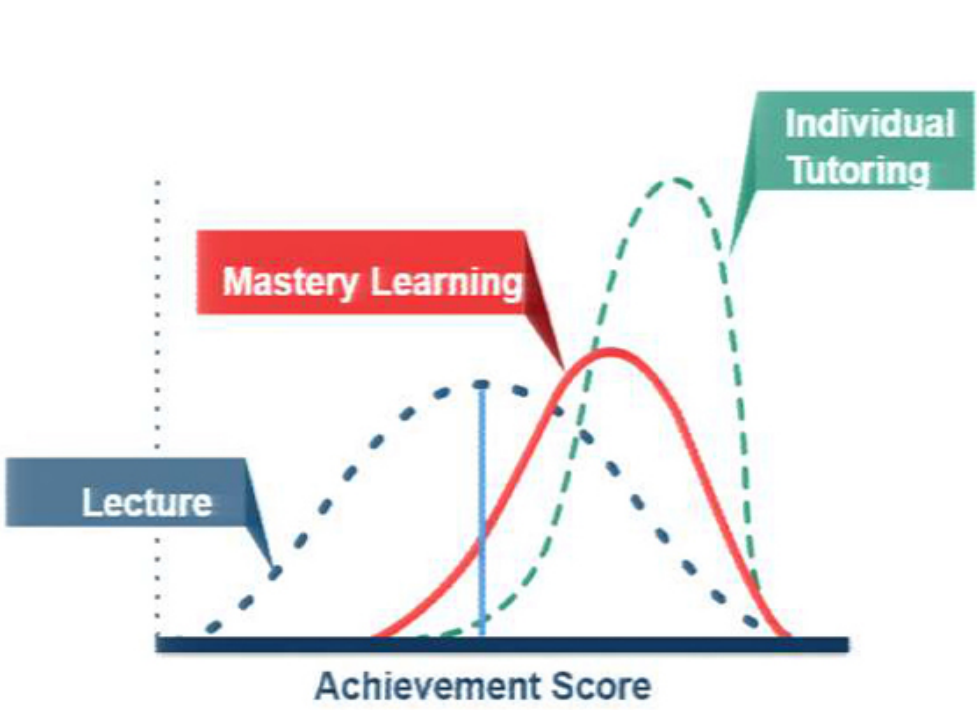

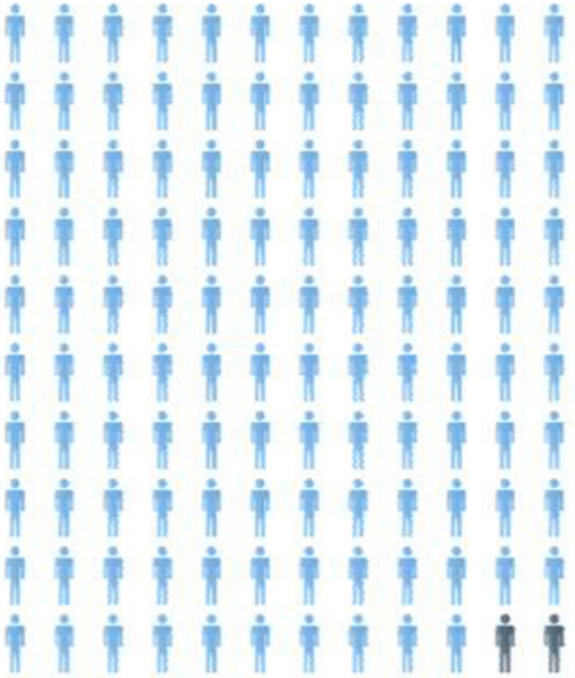

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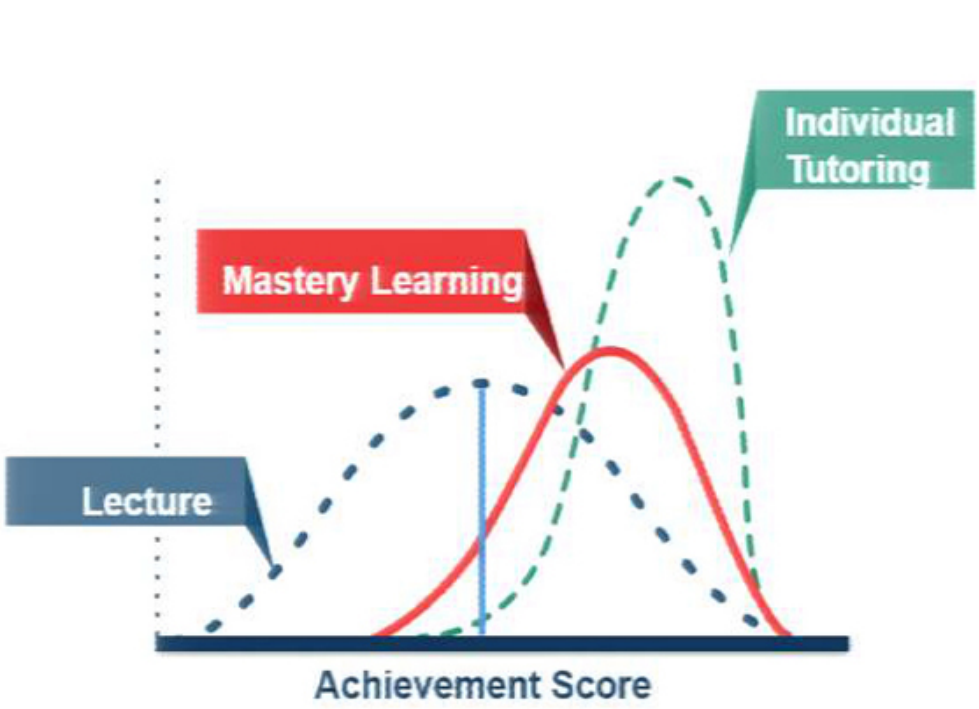
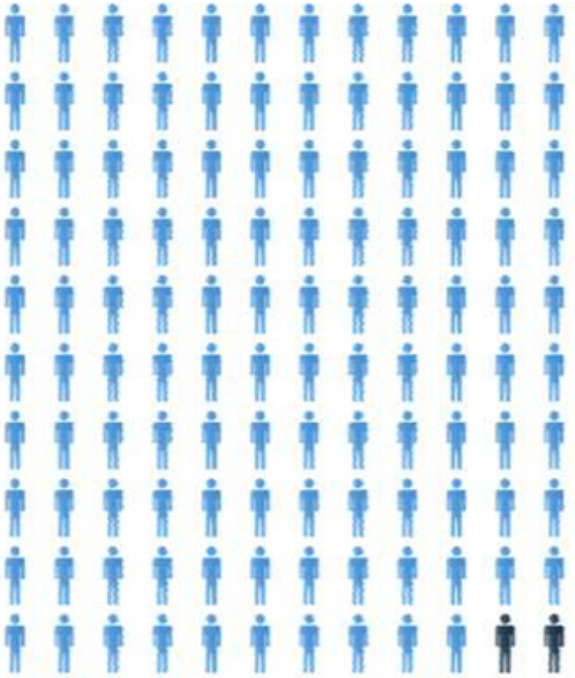




The 2 Sigma Problem

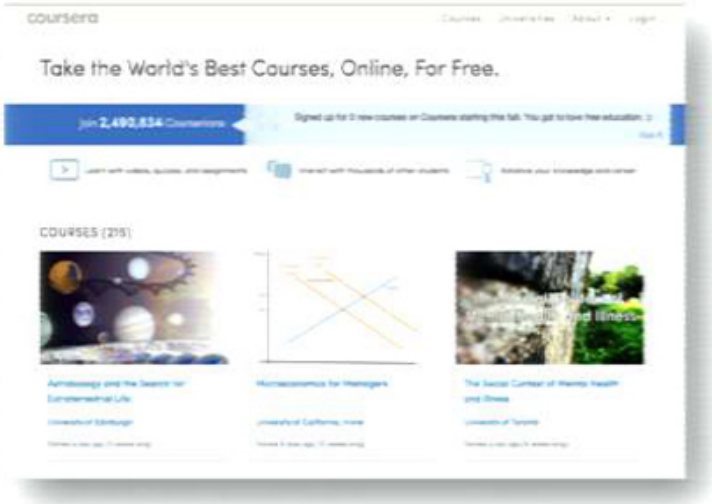
College is a place where a professor's lecture notes go straight to the students' lecture notes,

—Edwin Emery Slosson

College is a place where a professor's lecture notes go straight to the students' lecture notes, without passing through the brains of either.

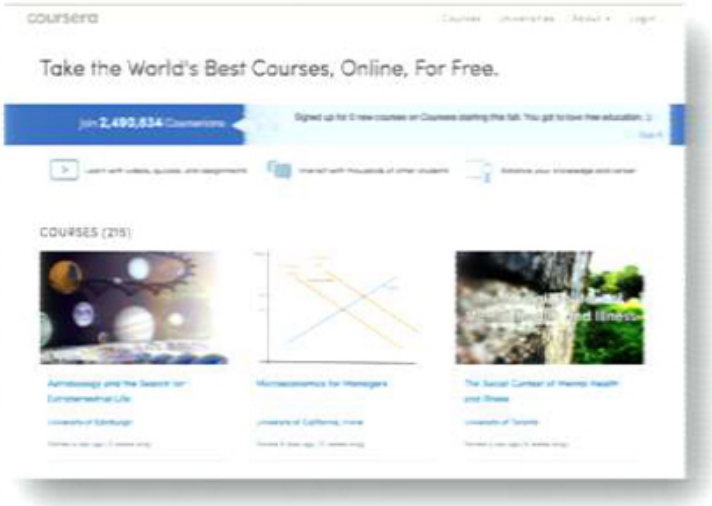
—Edwin Emery Slosson

The Best of Both Worlds



High-qua

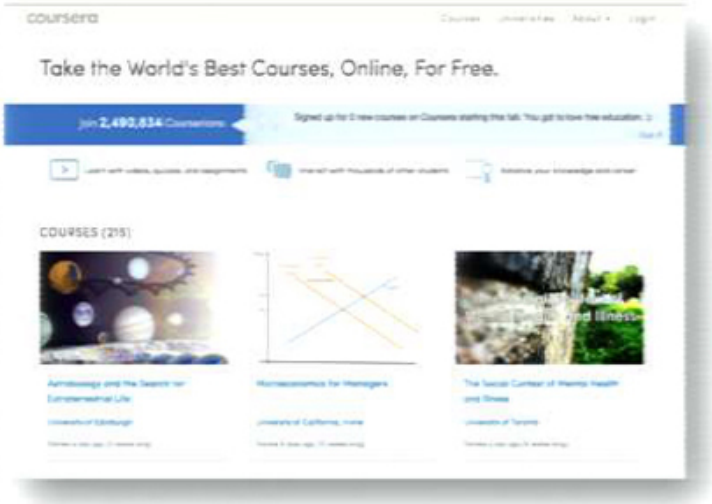
The Best of Both Worlds



High-quality online content

Produced locally or adopted

The Best of Both Worlds

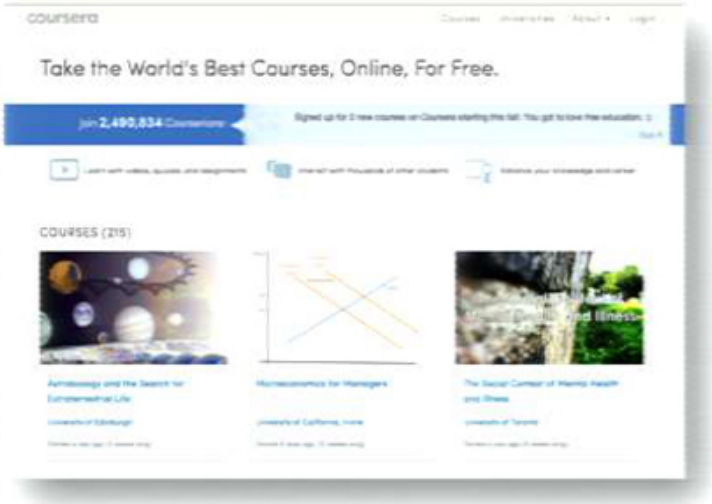


High-quality online content

Produced locally or adopted

- Active learning, problem solving

The Best of Both Worlds



High-quality online content

Produced locally or adopted

- Active learning, problem solving
- Personal attention to students

The Best of Both Worlds

Scott Rixner and Joe Warren, Rice:
I will never, ever, ever, teach a class any other way as far as I can ell…This is so much better- I had so much more fun teaching and the students learned so much more, I will never get up here and lecture. I ust don't see the point anymore. I can do better this way."

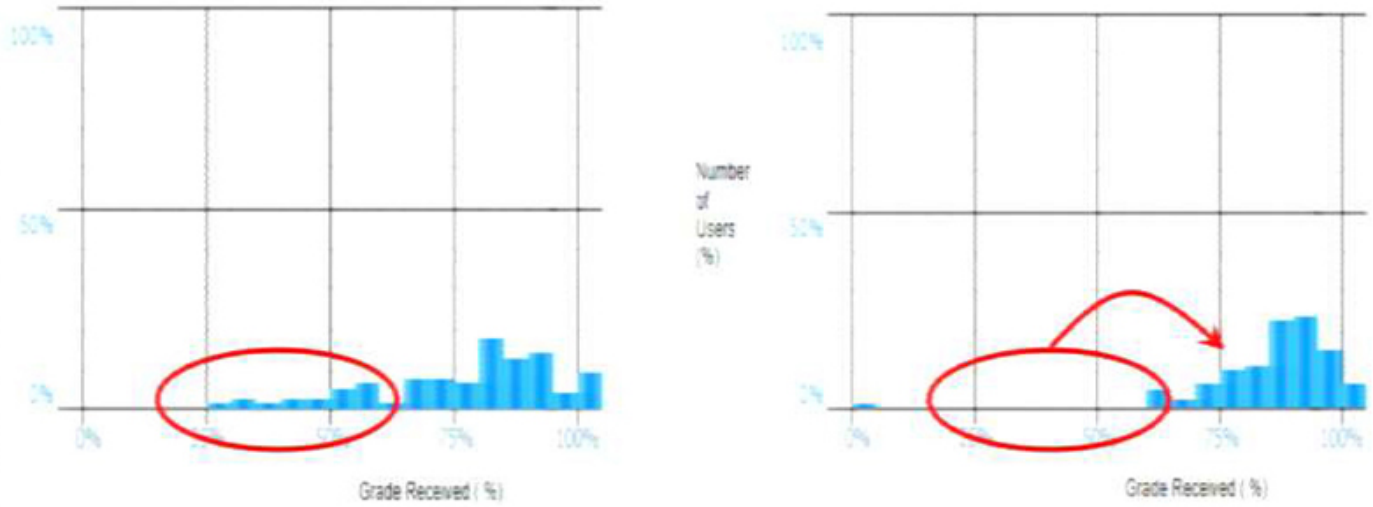
Adrienne Williams, UCI:
"This was more fun to teach than a traditional course…students were awake, asking questions, and much more engaged."

Kristin Sainani, Stanford:
"As the instructor, I definitely preferred engaging in interactive discussions and exercises with the students rather than lecturing at them…my lectures used to take up nearly all the class time and I'd be rushing just to get through them."

On-campus instruction with Coursera

Fall 2011: Traditional

Spring 2012: Blended



Comparison of ECE course,
University of Wisconsin Madison

Flipped Classroom Results (not Coursera)

Where Next?

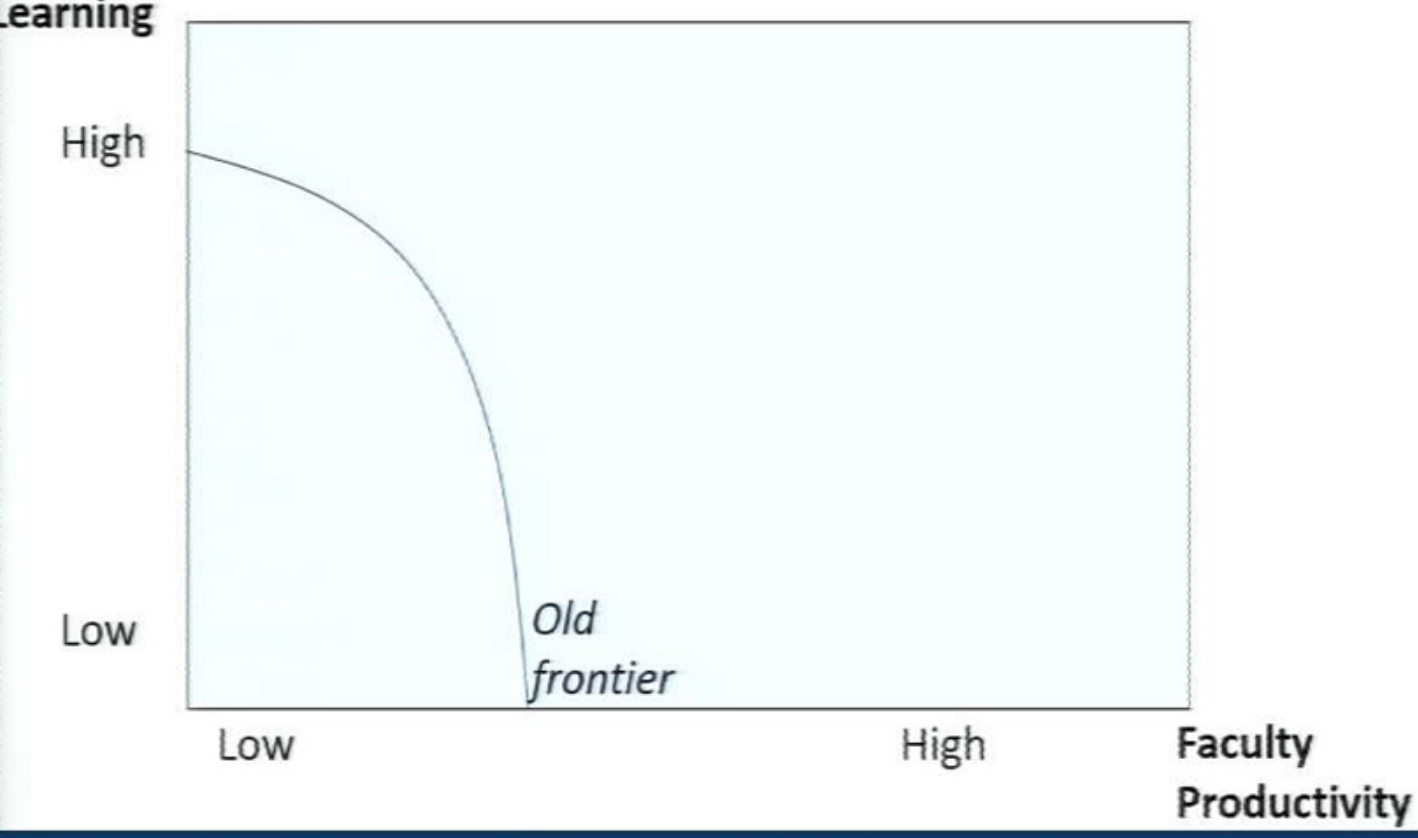
Christian Terwiesch

Wharton Operations

A New Frontier for Education

Christian Terwiesch

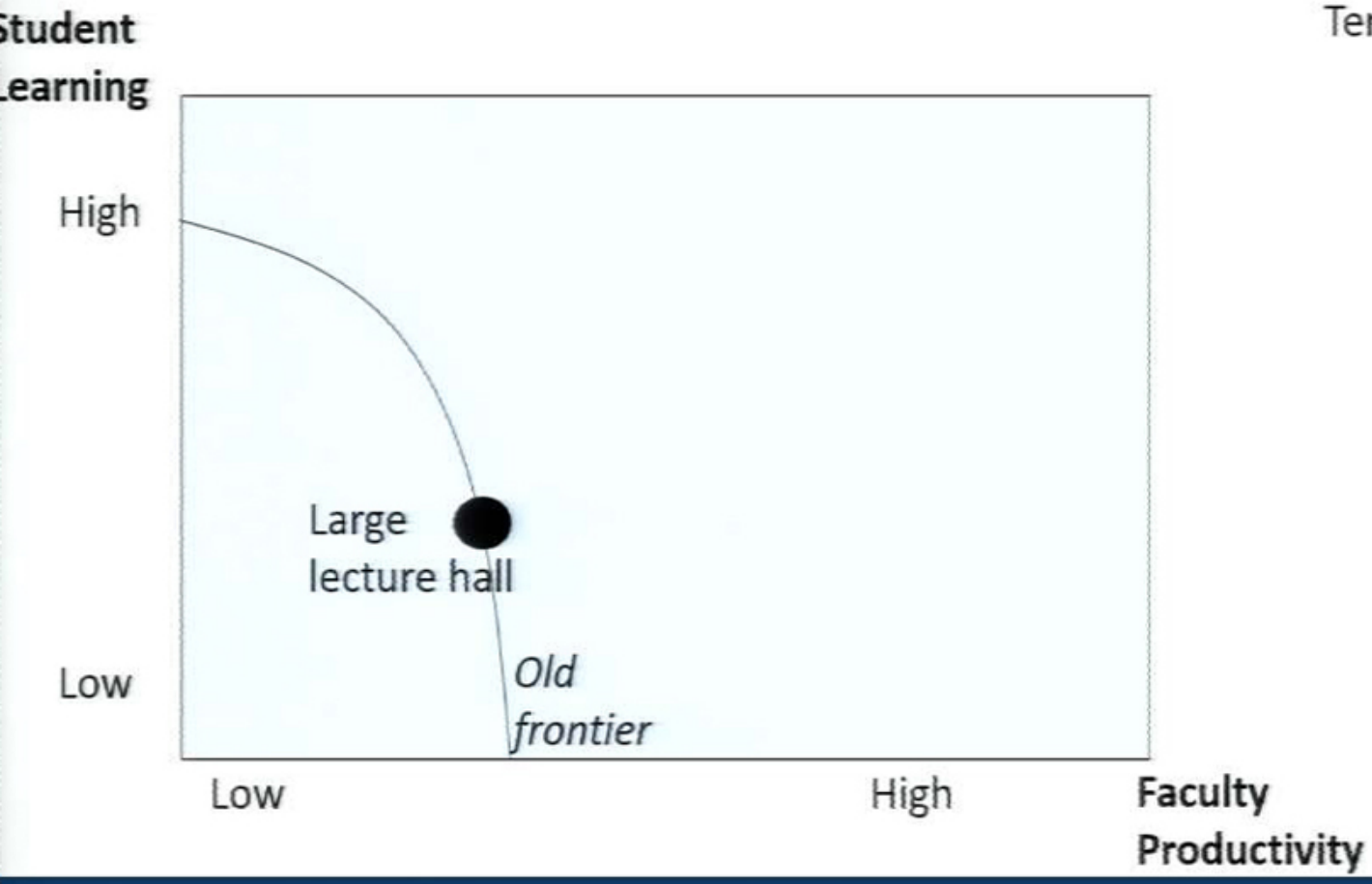
Wharton Operations



A New Frontier for Education

Christian Terwiesch

Wharton Operations



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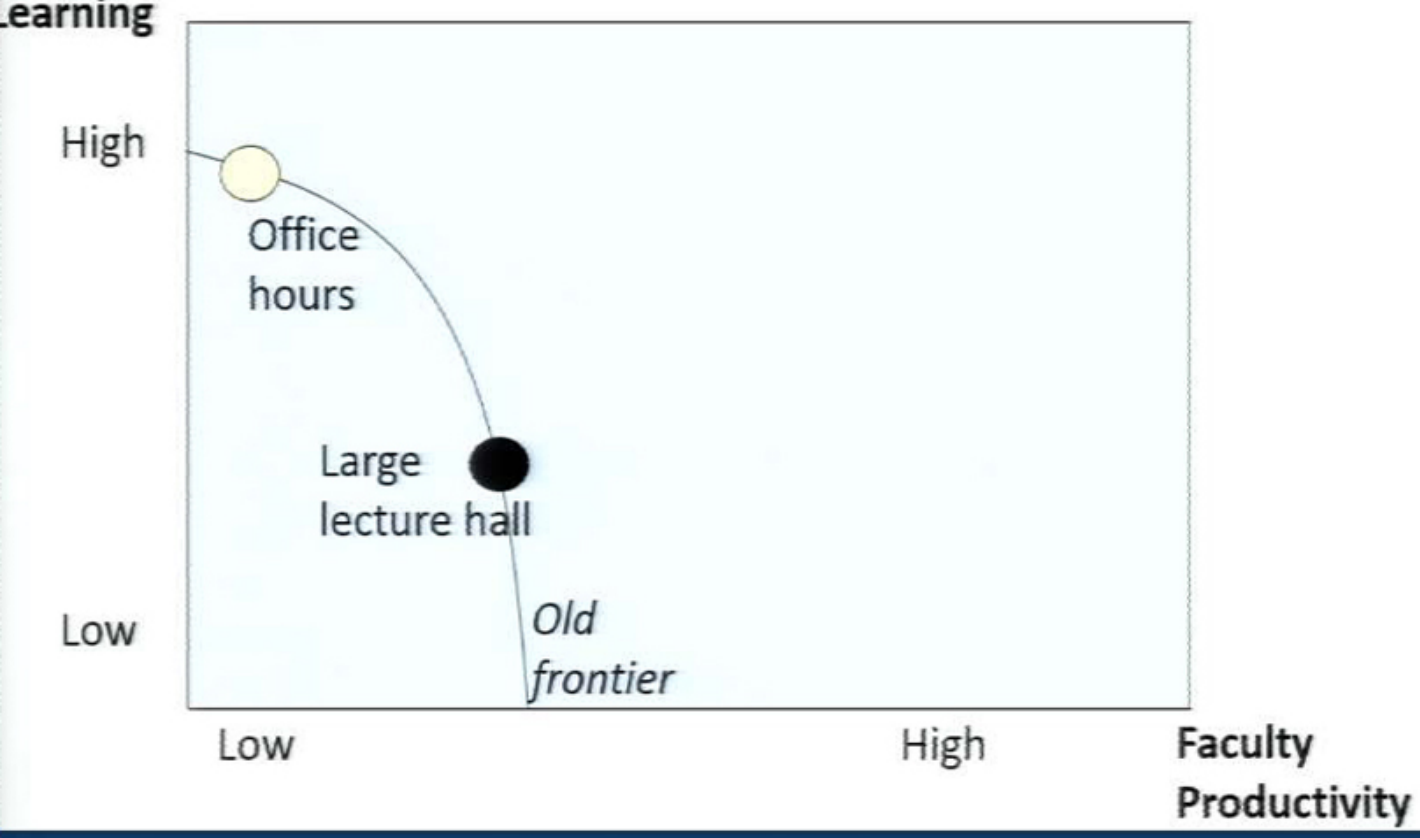

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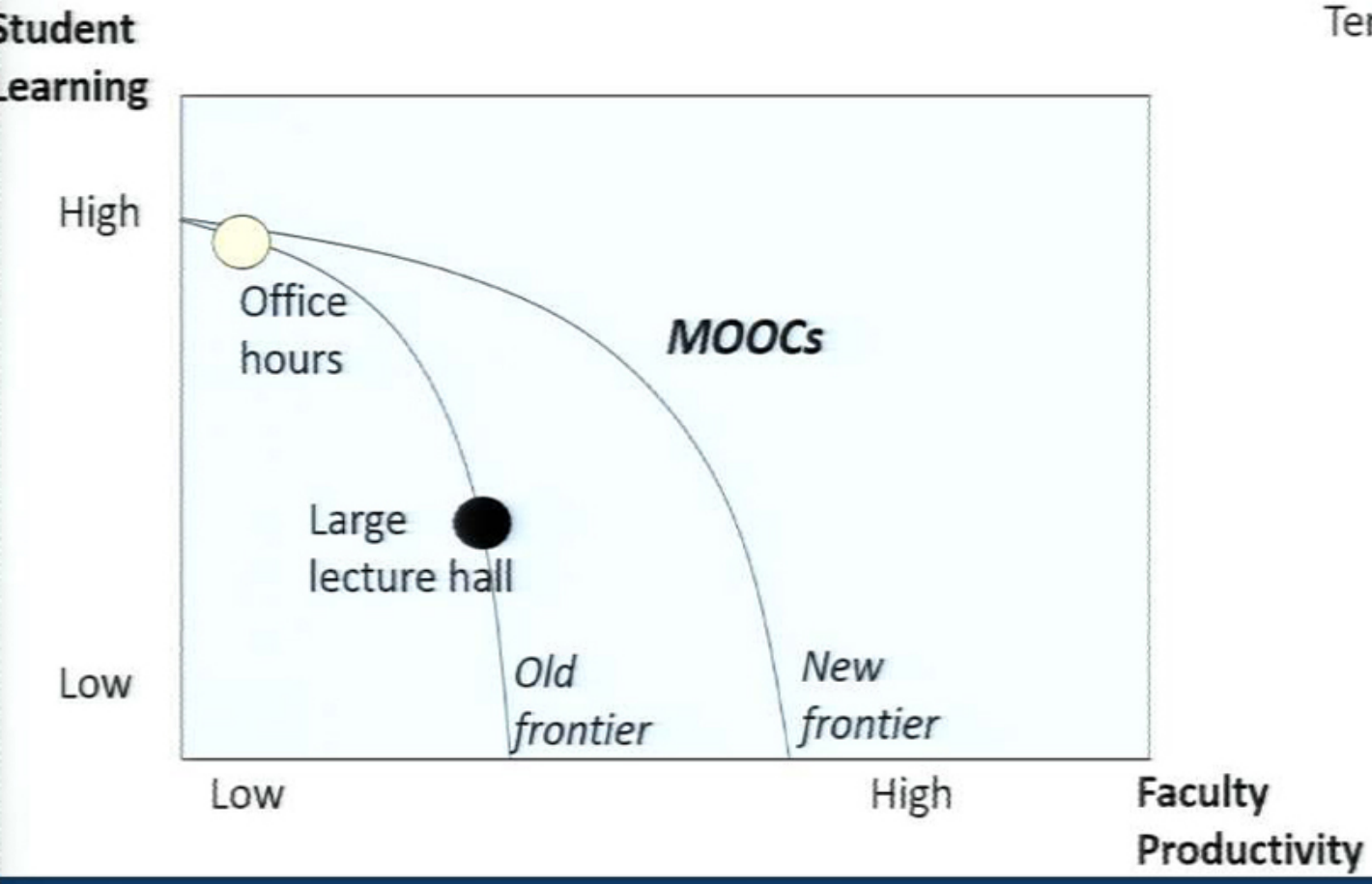

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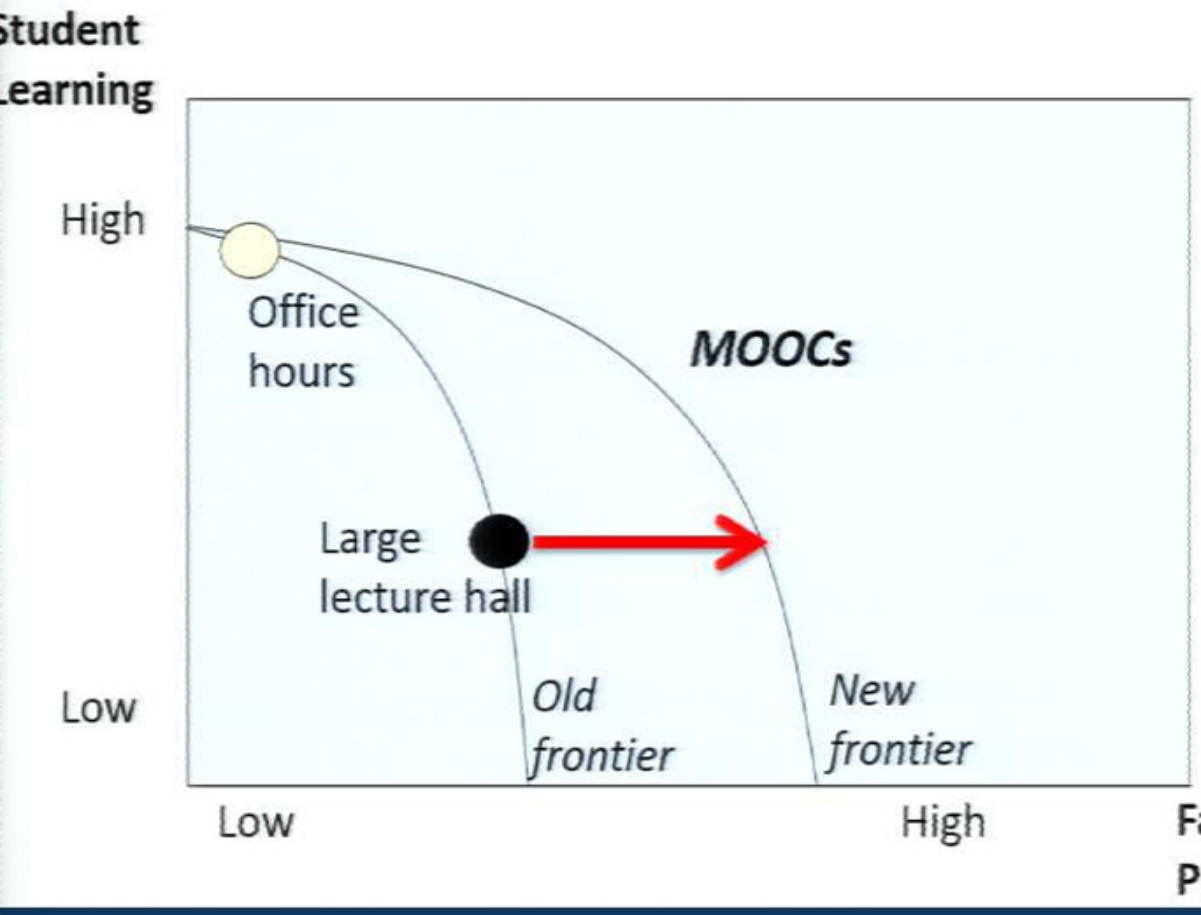


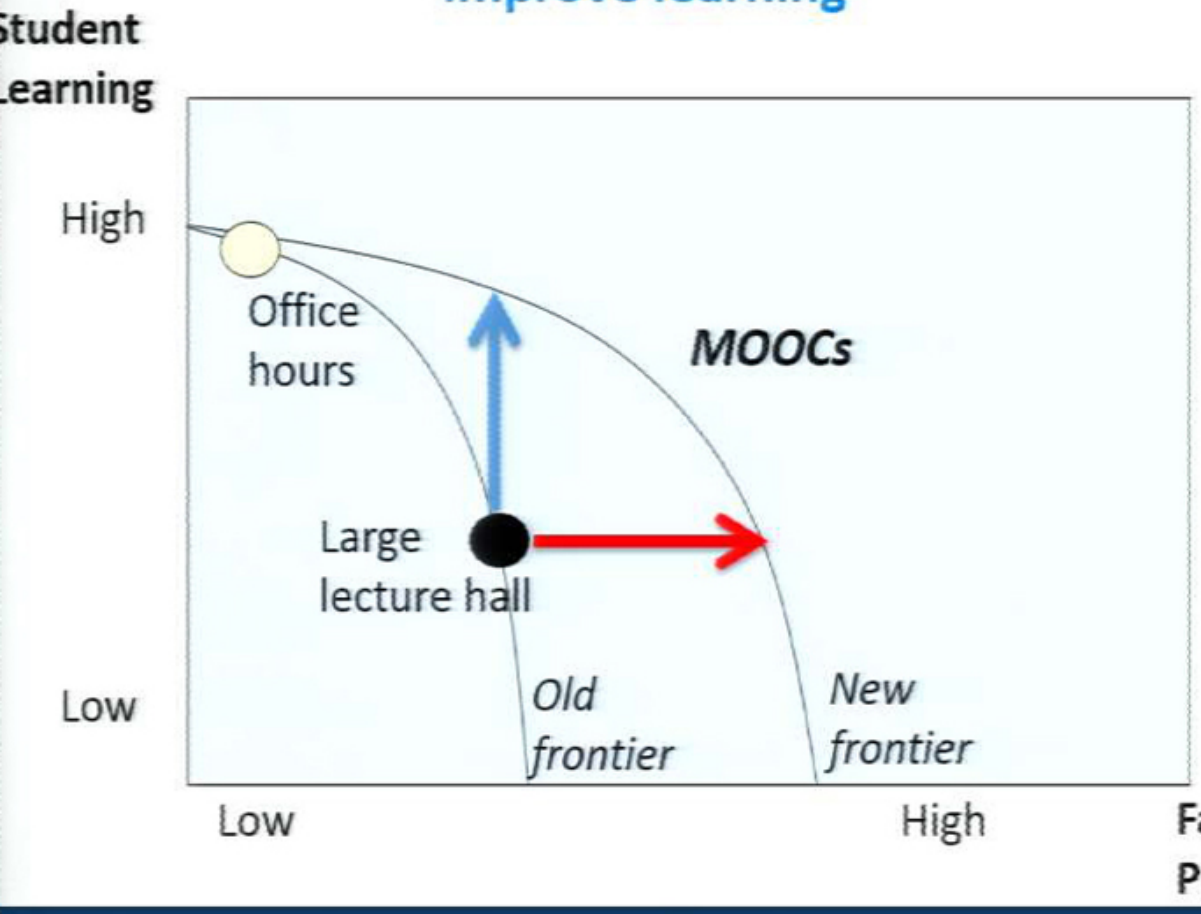
Increase productivity

A New Frontier for Education

Christian Terwiesch

Wharton Operations

improve learning



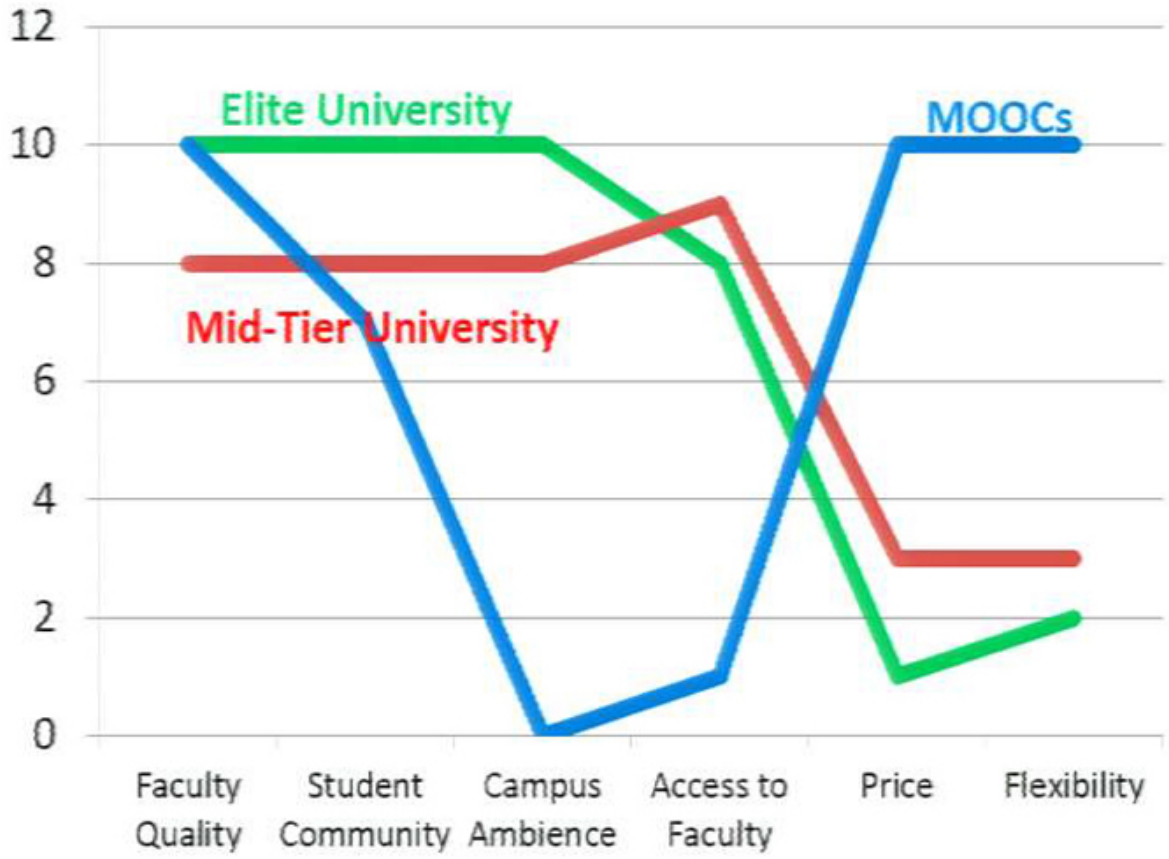
Increase productivity

A New Frontier for Education

m and Maurbogne, 2005

Christian Terwiesch

Wharton Operations



MOOCs: The Blue Ocean Strategy*

—Thomas Friedman

May 15, 2012 · New York Times

Big breakthroughs happen when what is suddenly possible meets what is desperately necessary.

—Thomas Friedman

May 15, 2012 · New York Times

Wanted: 1,500 universities; apply here

FT

NANCIAL
MES

Over the next six years, India needs to create another 1,500 universities… "the low penetration of high-quality education and the growing demand for educated workers in a fast developing service-led economy" offers huge potential to develop the education market. (James Lamont, 1/30/2009)

Desperately Necessary

Wanted: 1,500 universities; apply here

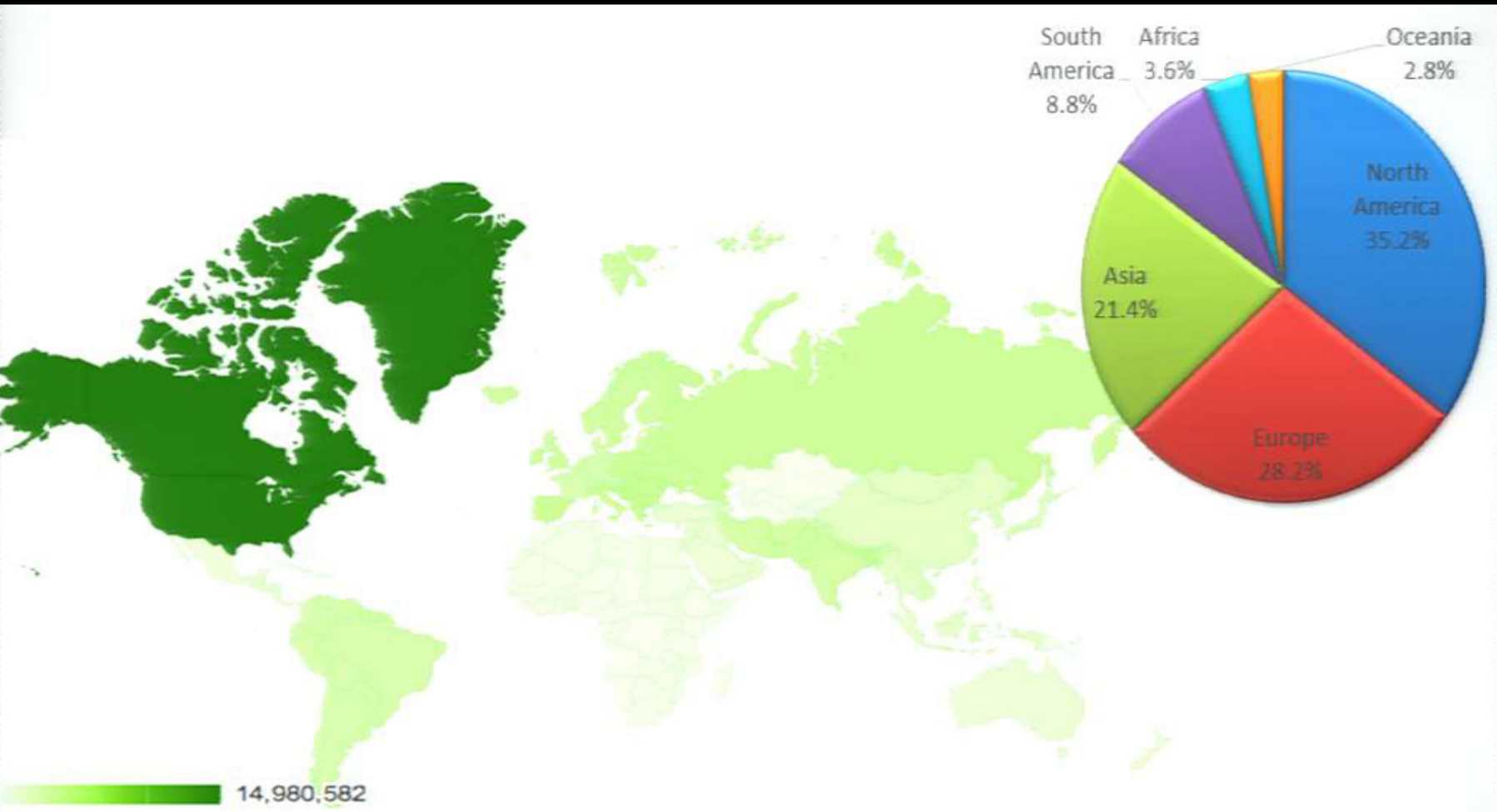
FT
NANCIAL
MES

Over the next six years, India needs to create another 1,500 universities… "the low penetration of high-quality education and the growing demand for educated workers in a fast developing service-led economy" offers huge potential to develop the education market. (James Lamont, 1/30/2009)

BBC NEWS
USINESS

… even the most prestigious public institutions, including the IITs, are struggling to fill top faculty positions and teacher student ratios are deteriorating. (Yojana Sharma, 3/2/2011)

Desperately Necessary



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Optimizing Instructional Policies

Robert Lindsey, Michael Mozer, William Huggins
Department of Computer Science,
Institute of Cognitive Science

University of Colorado
Boulder

Harold Pashler
Department of Psychology

UCSD

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Harold Pashler
Department of Psychology
University of California, San Diego

An Illustrative Learning Problem

Zoubin
Ghahramani

Is it better to study

Each face once
2 seconds per face

Each face twice
1 second per face

Geoffrey
Hinton

Is it better to study

Each face once
2 seconds per face

Each face twice
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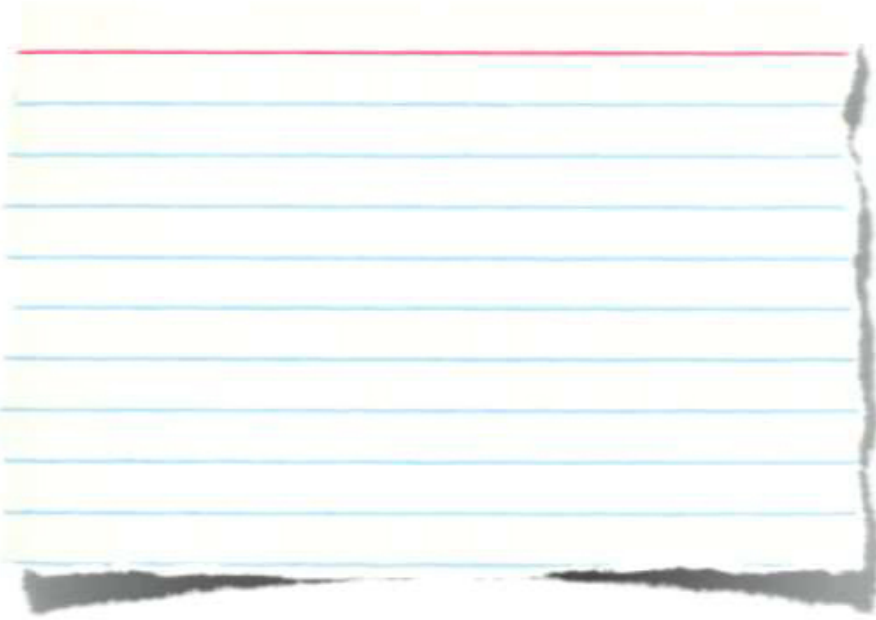

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Finding The Better Training Policy

Conduct an experiment where

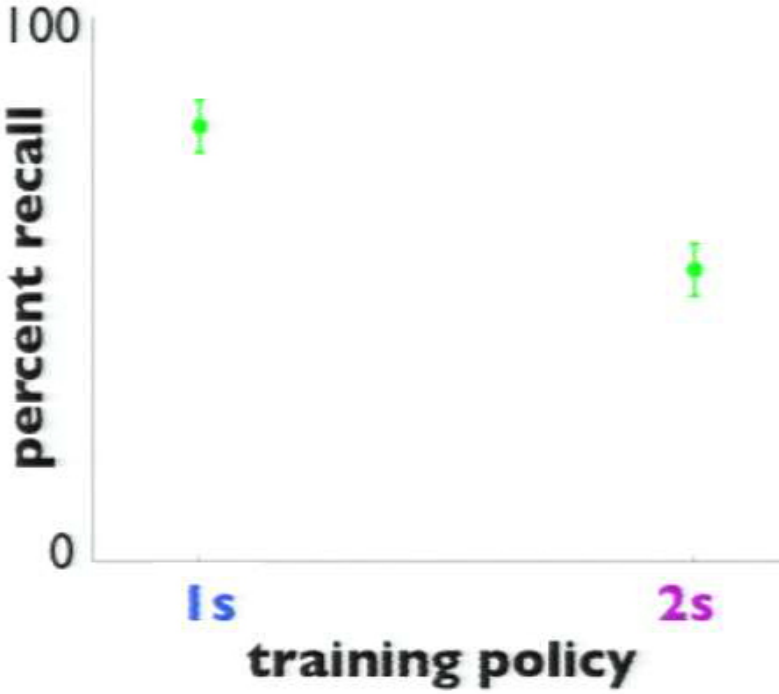
- half the audience studies at 1s / face
- half at 2s / face

Finding The Better Training Policy

Conduct an experiment where

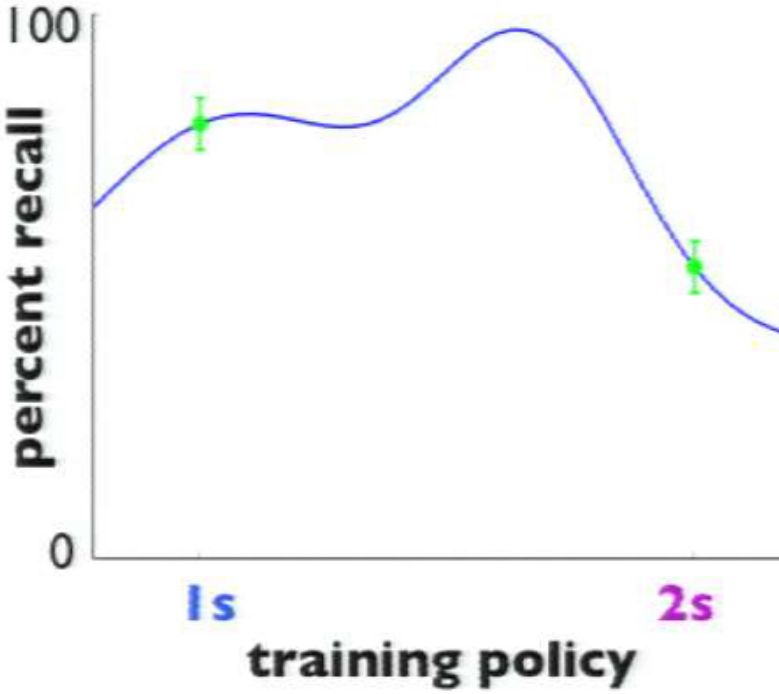
- half the audience studies at 1s / face
- half at 2s / face

Test everyone's memory and look for a statistically reliable advantage



Finding The Best Training Policy

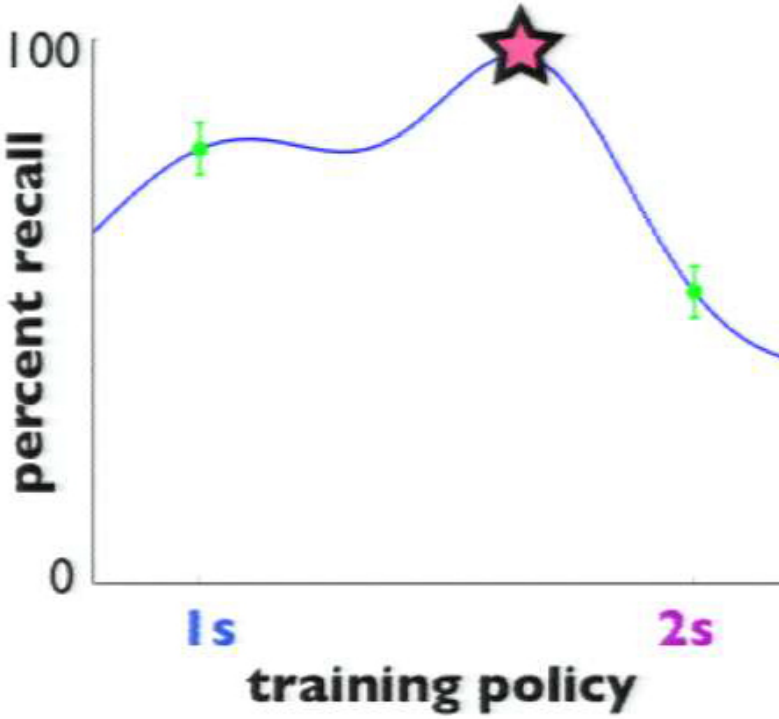
Continuum of potential training policies



Finding The Best Training Policy

Continuum of potential training policies

Want to identify the optimum

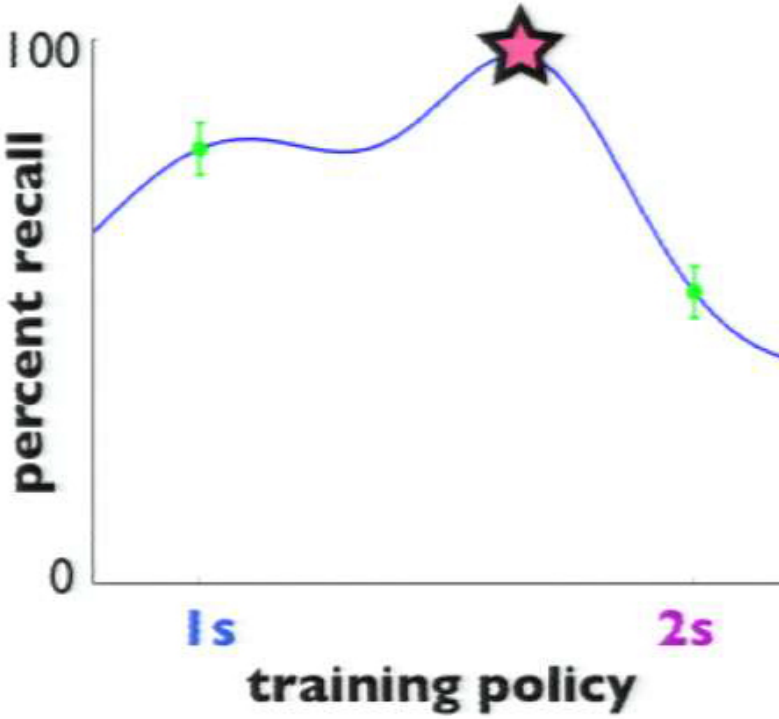


Finding The Best Training Policy

Continuum of potential training policies

Want to identify the optimum

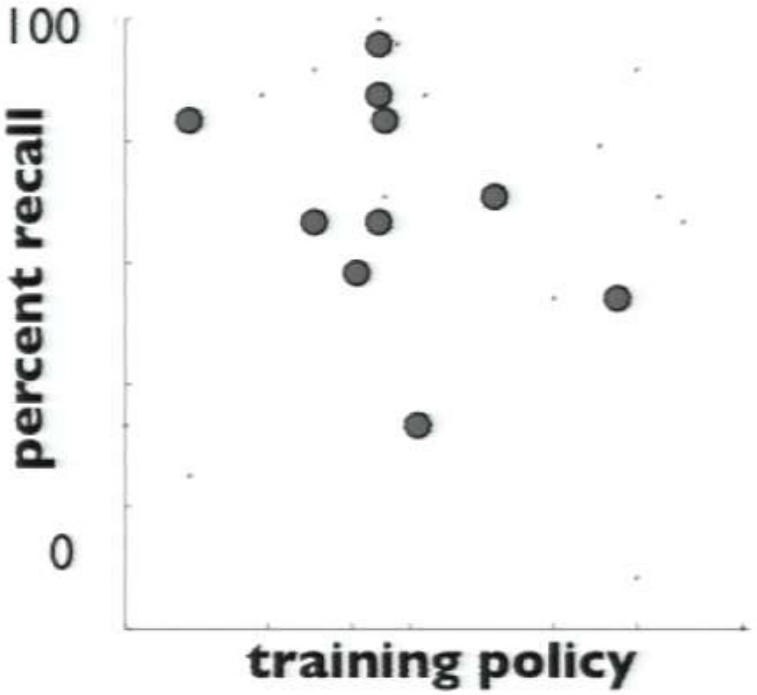
Treat the search as function optimization



A Bayesian Active Learning Approach

A Bayesian Active Learning Approach

Given data from individuals trained at various points in policy space



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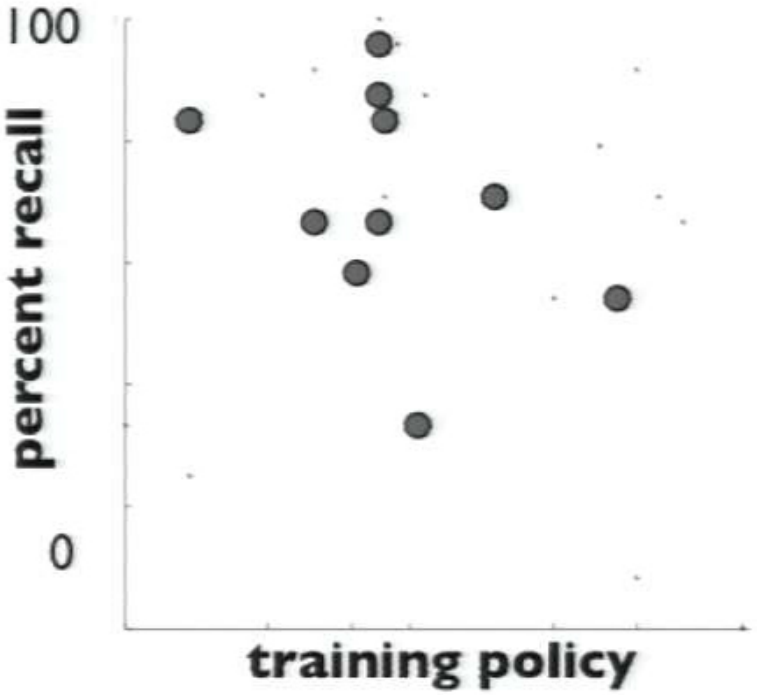
Approximate the performance function with Gaussian process regression



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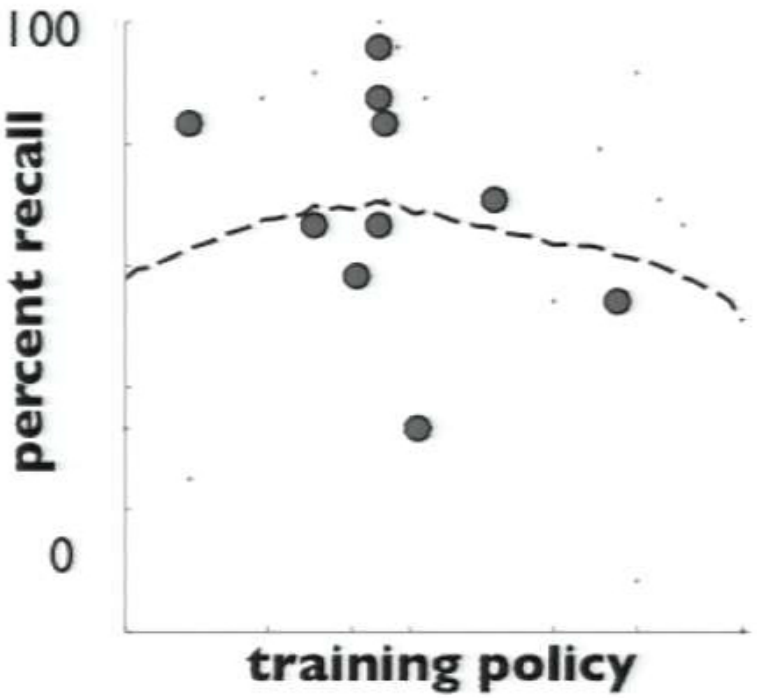

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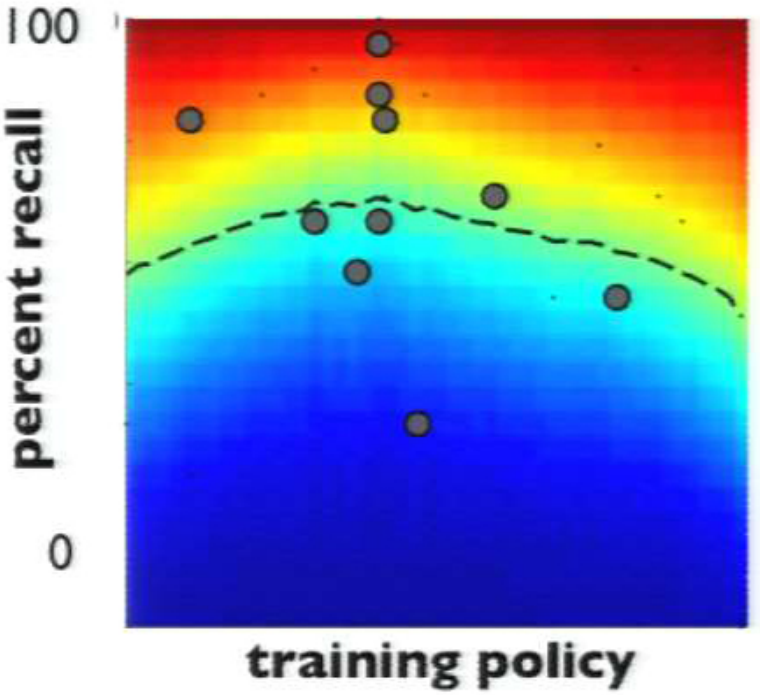

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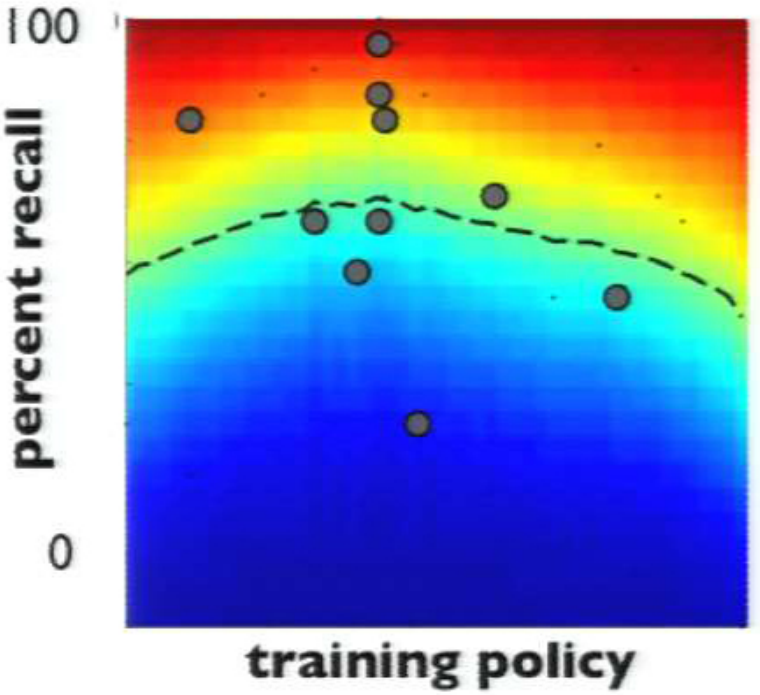

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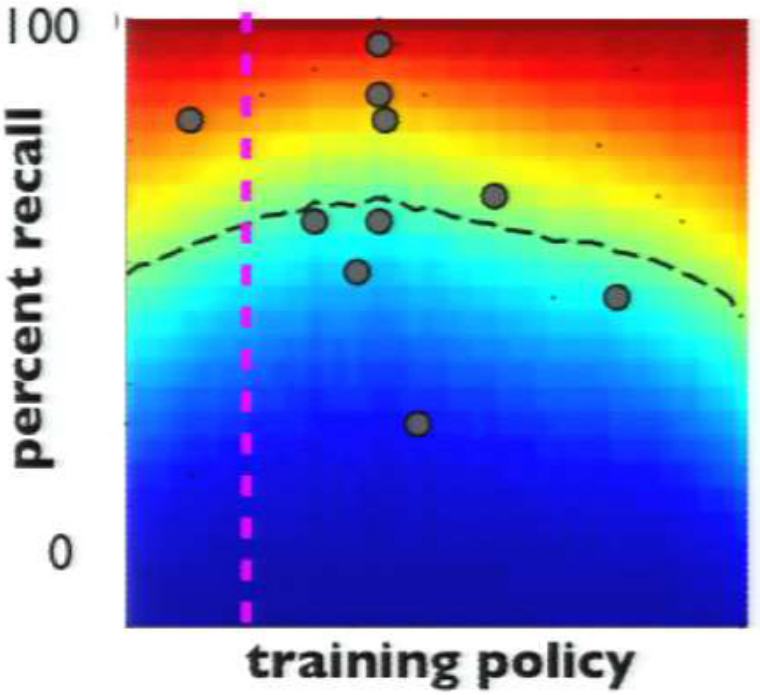

Embellishments To Off-The-Shelf GP Regression

Draw from GP represents latent population-wide effectiveness of training policies

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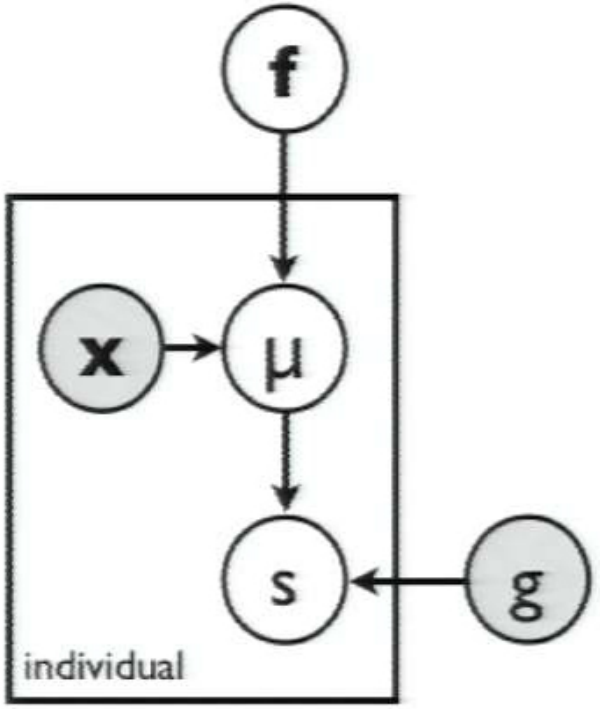
Chance-corrected beta-binomial observation model

Population effectiveness

$$f(\mathbf{x}) \sim \mathcal{GP}(m(\mathbf{x}), k(\mathbf{x}, \mathbf{x}'))$$

Population probability correct

$$c(\mathbf{x}) \triangleq [1 + \exp(-f(\mathbf{x}))]^{-1}$$



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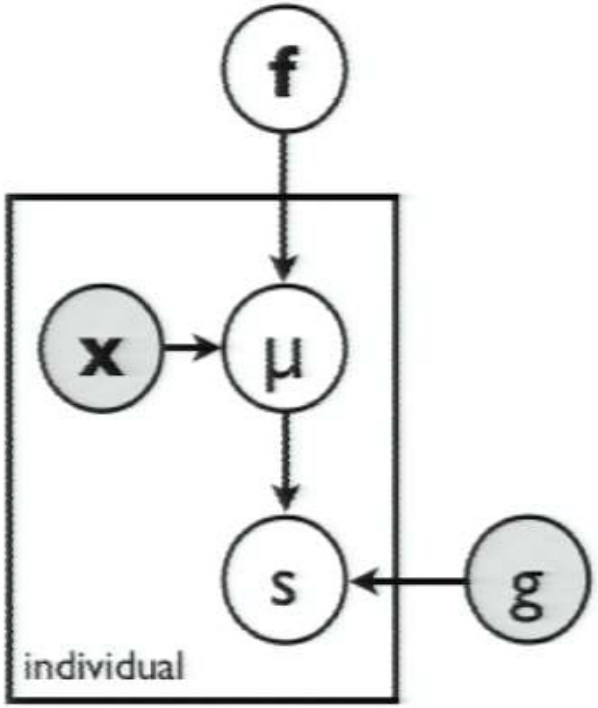

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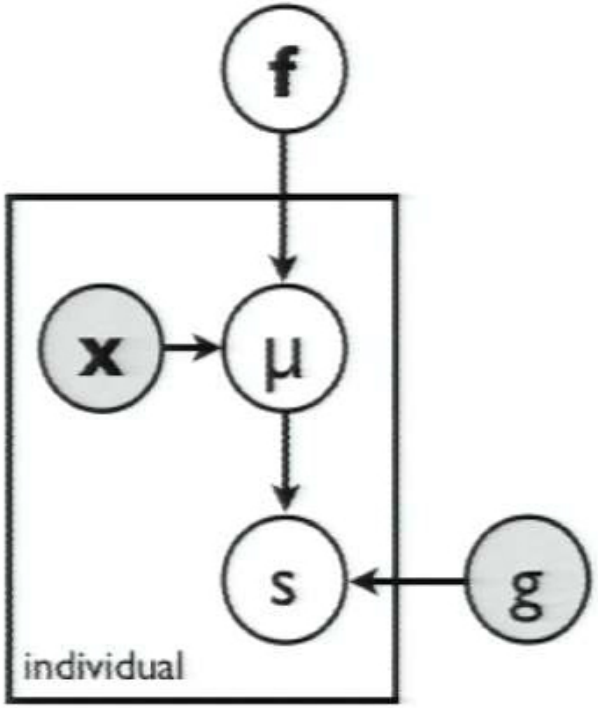
$$\mu_i \mid c(\mathbf{x}) \sim \text{Beta}(\alpha, \alpha(1 - c(\mathbf{x}))/c(\mathbf{x}))$$

Individual's exam score

$$s_i \mid \mu_i \sim \text{Binomial}(g + (1 - g)\mu_i; n)$$



Experiment 1

Associate faces with the name of their favorite sports team

Jets or ***Sharks***

Six training faces, 30 seconds of training

Each face shown for duration d ms
(each face shown 5000/d times)

Sharks Fan

Experiment 1

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Jets or ***Sharks***

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Each face shown for duration d ms
(each face shown 5000/d times)

Immediate test following training

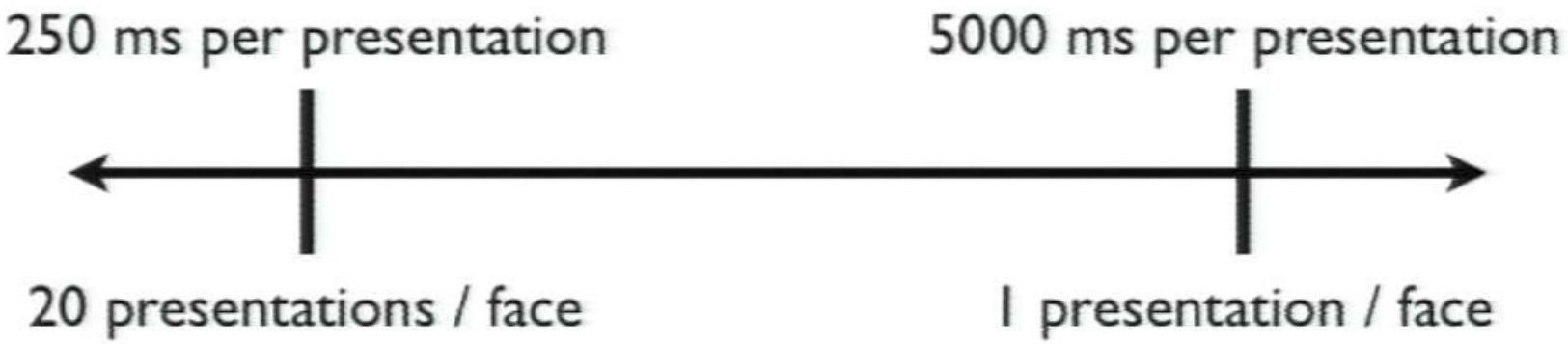
Sharks Fan or Jets Fan?

Experiment 1

What is the optimal presentation duration?

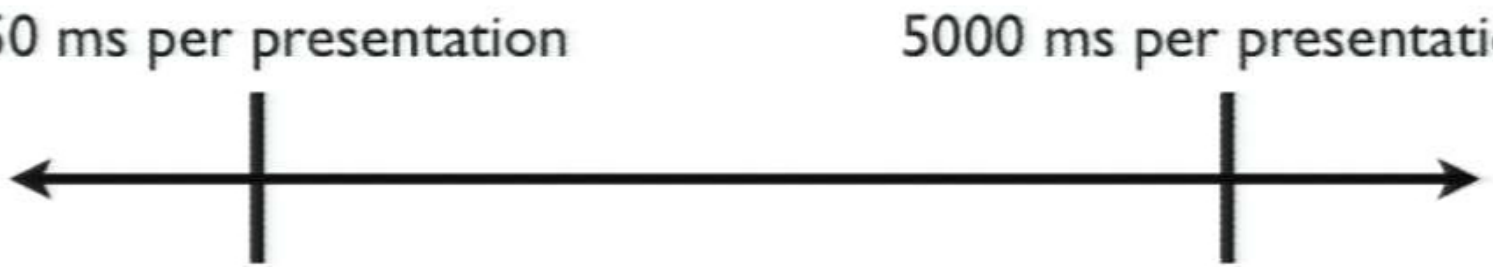
Experiment 1

What is the optimal presentation duration?



Experiment 1

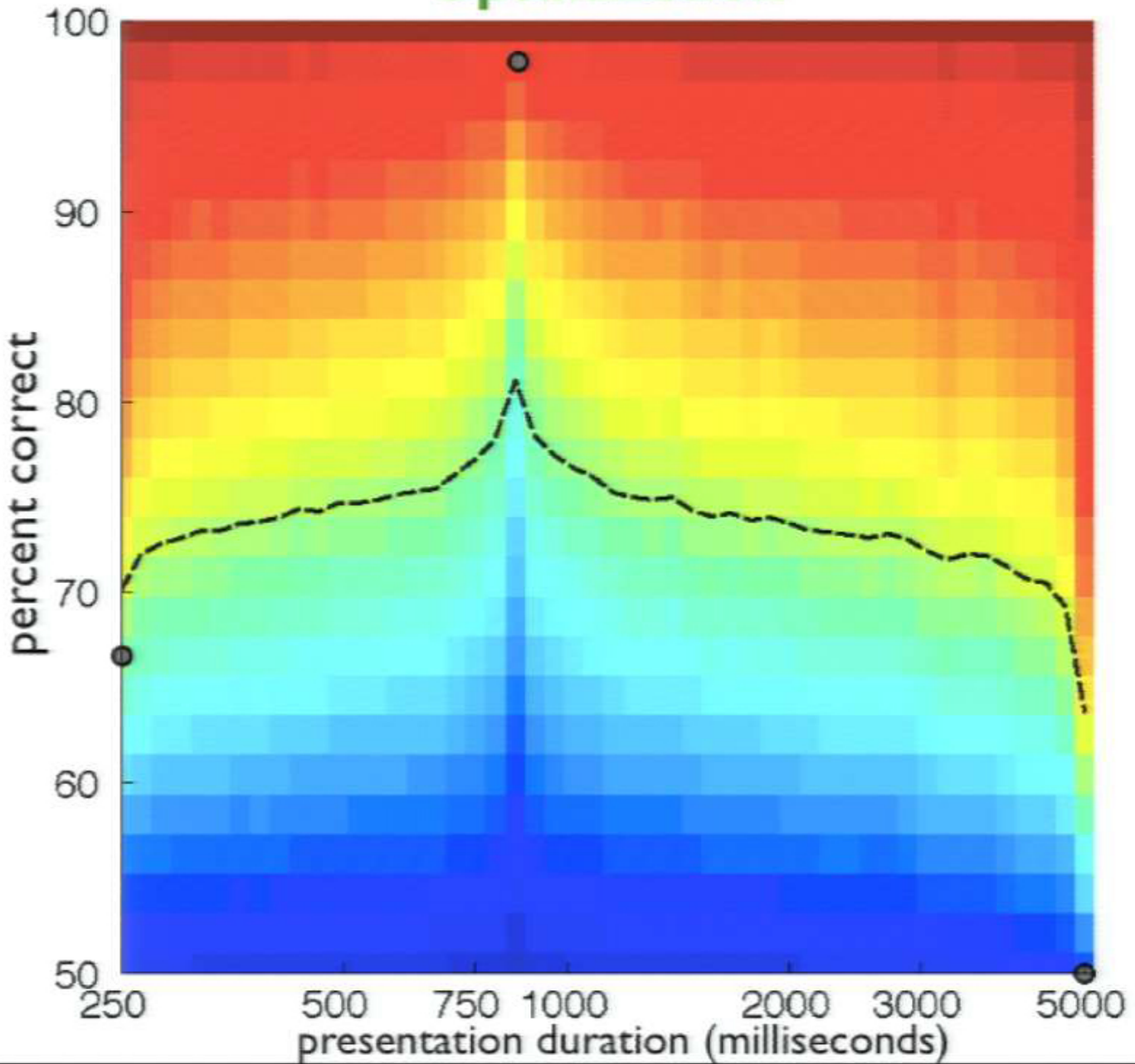
What is the optimal presentation duration?



More presentations are better (with diminishing returns)

More time to process is better (with diminishing returns)

Optimization



Experiment 2

Participants are told they are learning the Martian word "GLOPNOR"

The Martians can only teach through examples

Amazon Mechanical Turk

Amazon Mechanical Turk

Is this GLOPNOR?

No | Perhaps no | Don't know | Perhaps yes | Yes

Amazon Mechanical Turk

Amazon Mechanical Turk

Is this GLOPNOR?

No | Perhaps no | Don't know | Perhaps yes | Yes

Wrong! This is GLOPNOR.

Amazon Mechanical Turk

Amazon Mechanical Turk

(GLOPNOR)

Is this GLOPNOR?

No | Perhaps no | Don't know | Perhaps yes | Yes

Amazon Mechanical Turk

Amazon Mechanical Turk

(GLOPNOR)

Is this GLOPNOR?

No | Perhaps no | Don't know | Perhaps yes | Yes

Correct! This is not GLOPNOR.

Amazon Mechanical Turk

Amazon Mechanical Turk

(NOT GLOPNOR)

Is this GLOPNOR?

No | Perhaps no | Don't know | Perhaps yes | Yes

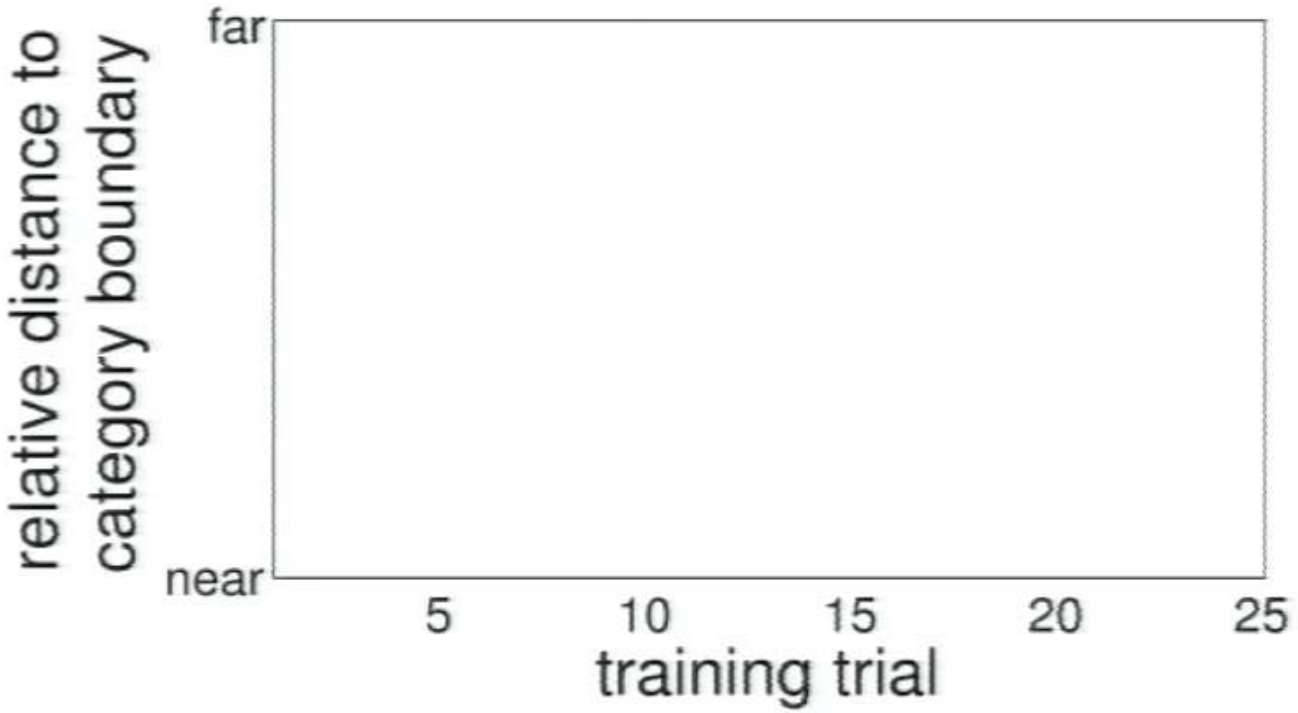
"GLOPNOR" = graspability

Ease of picking up & manipulating object with one hand

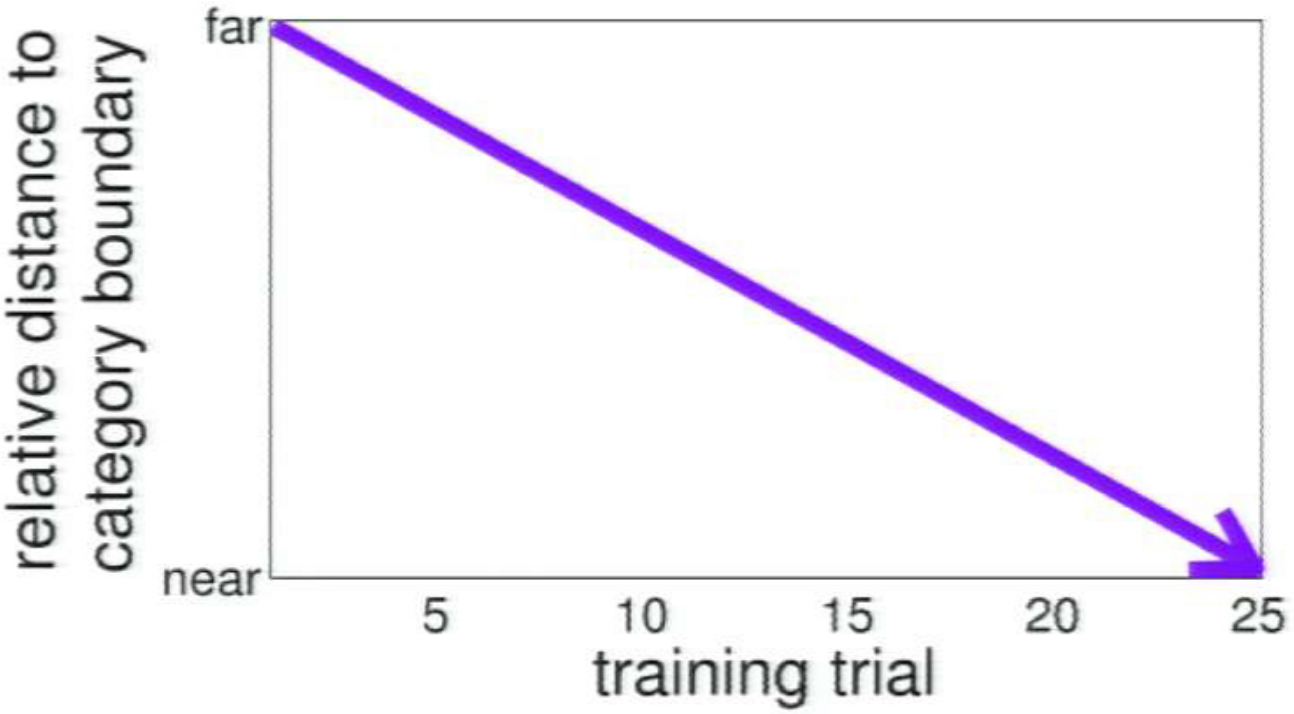
(Salmon, McMullen, & Filliter, 2010)

Participants must learn the **category boundary** from exemplars

Fading


relative distance to category boundary
far
near
5
10
15
20
25
training trial

Fading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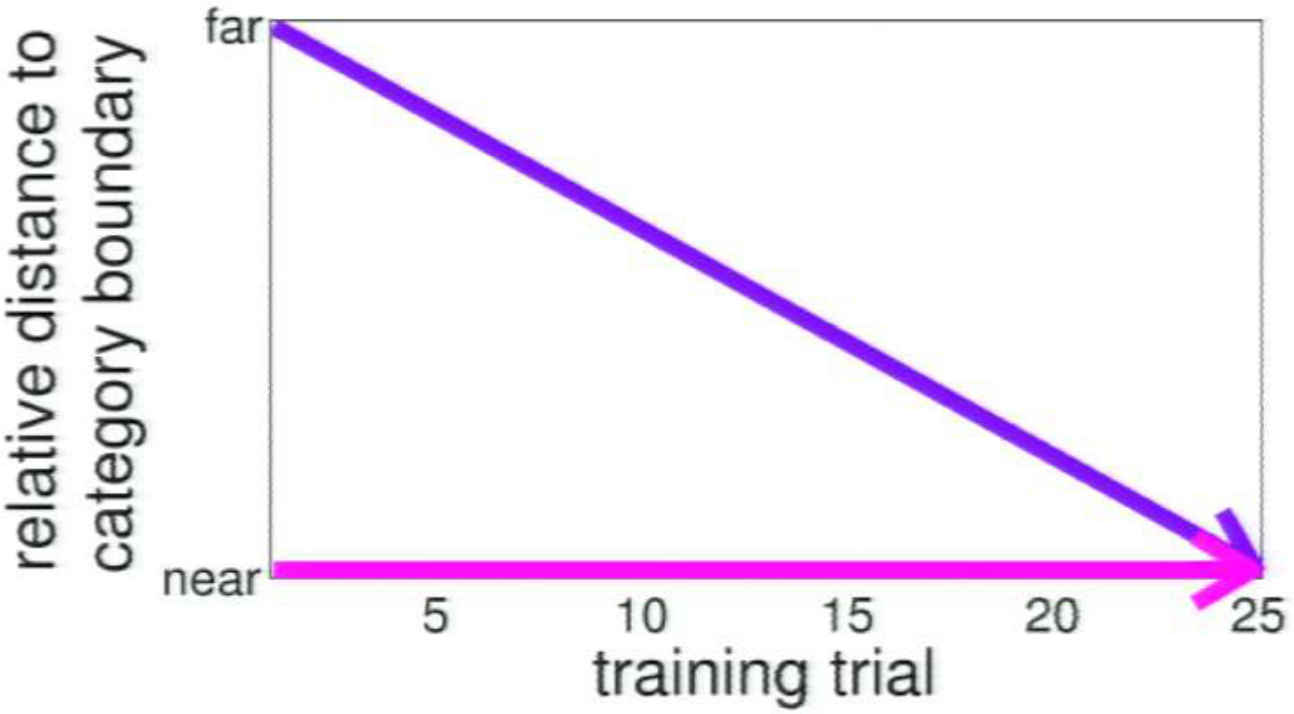
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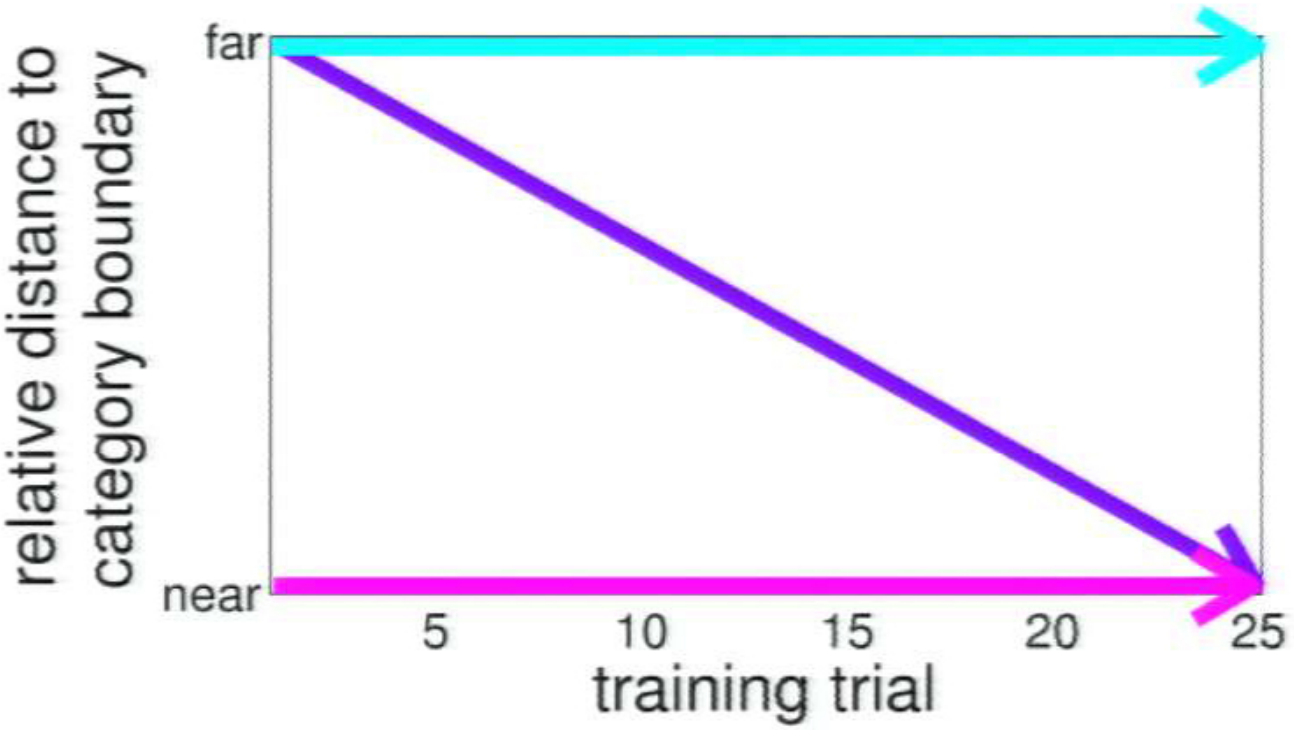
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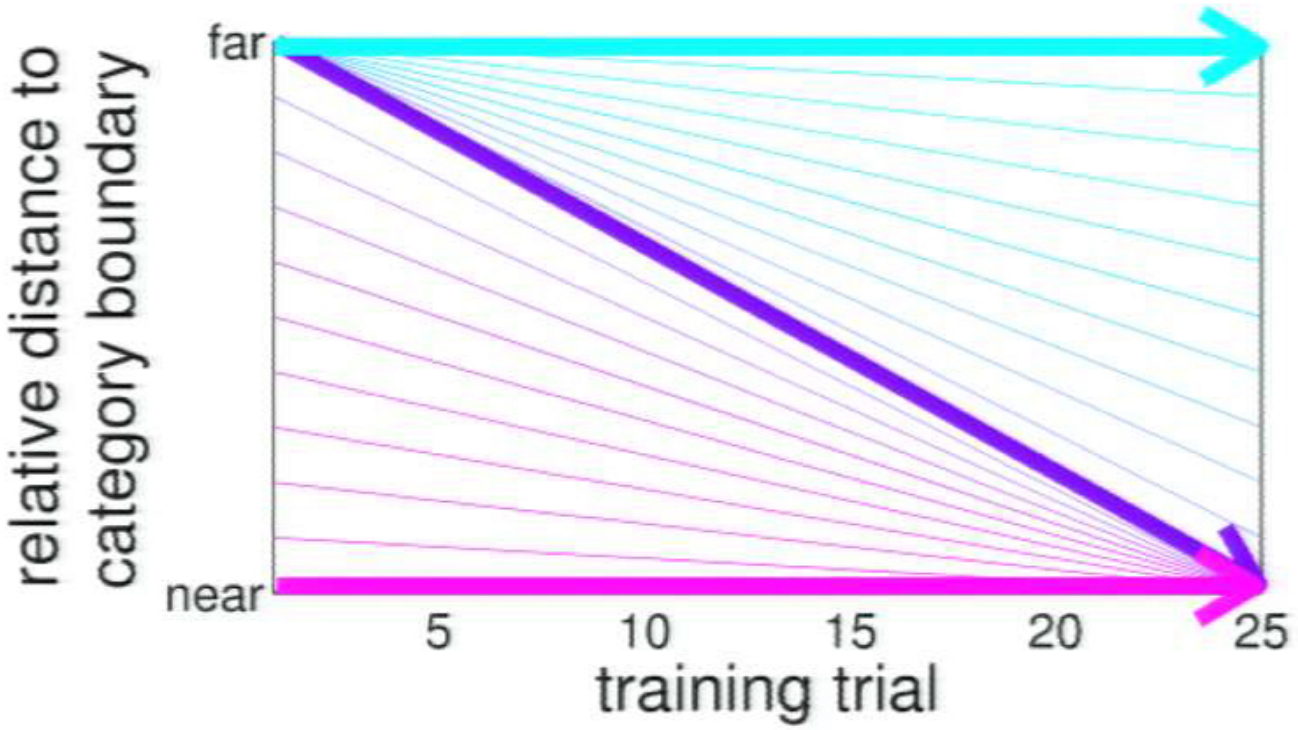

relative distance to category boundary
far
near
5
10
15
20
25
training trial

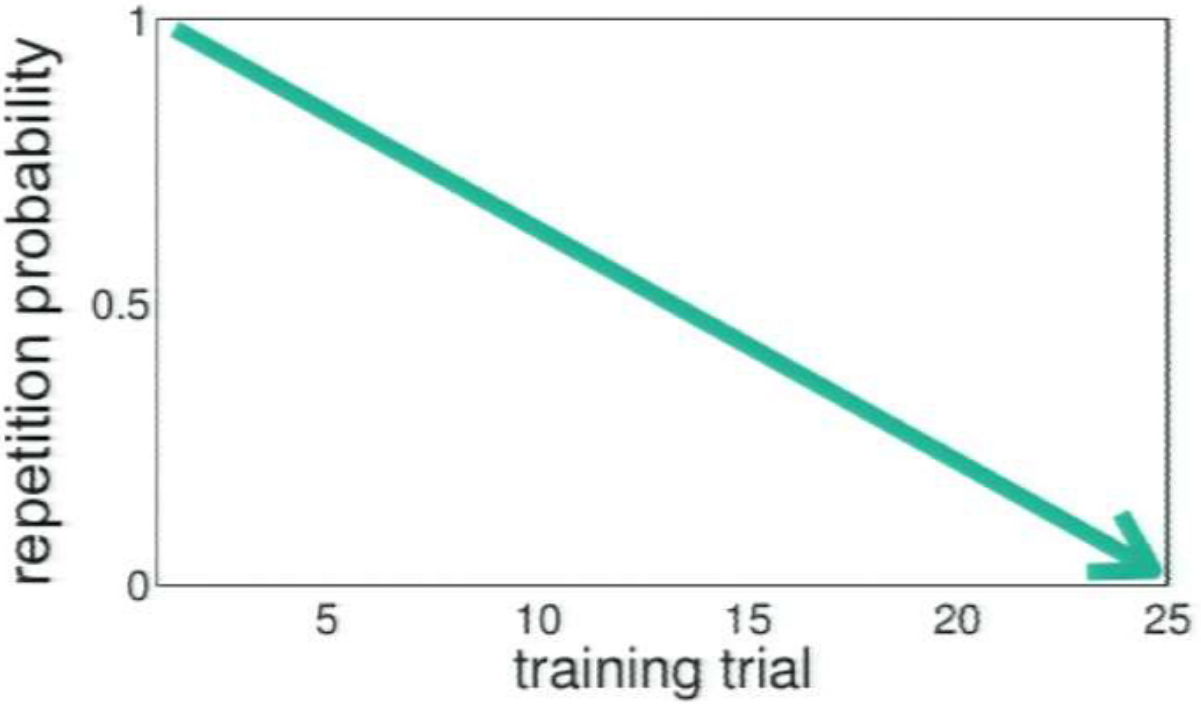

start far, end far
start far, end near
start near, end near

Blocking

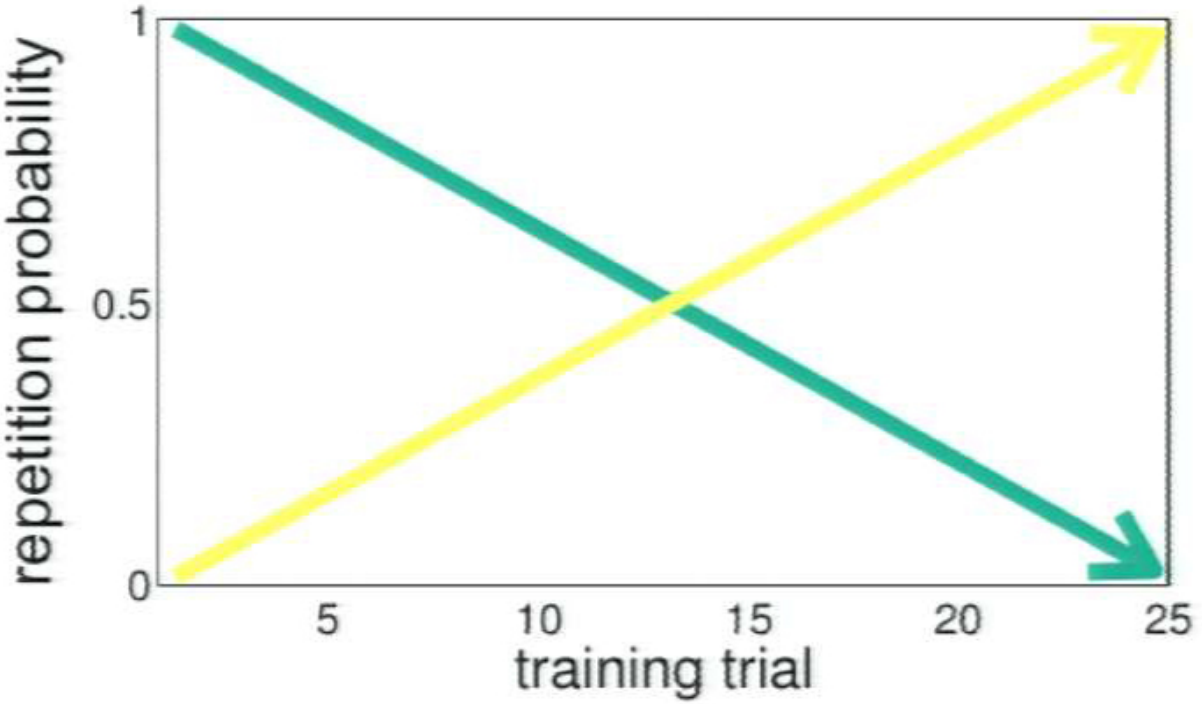
Blocking: + + + − − −

Interleaving: + − + − + −

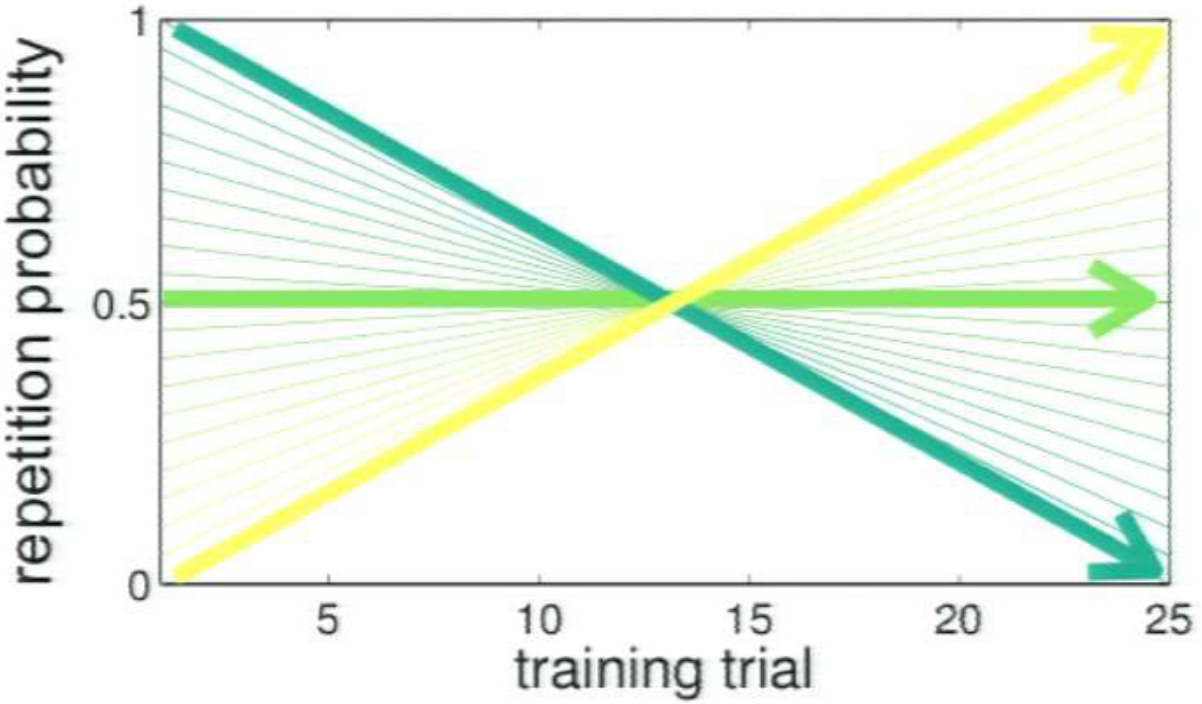
Blocking

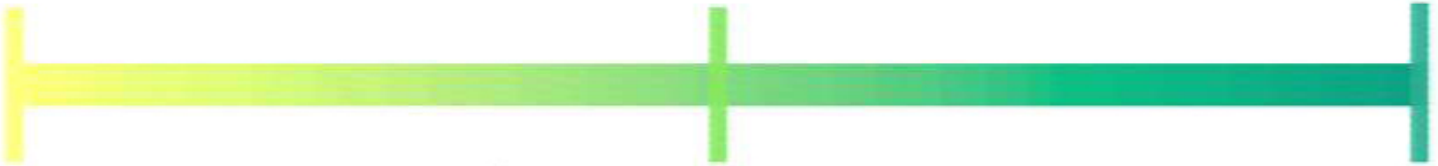


Blocking



Blocking





alternate early, repeat late

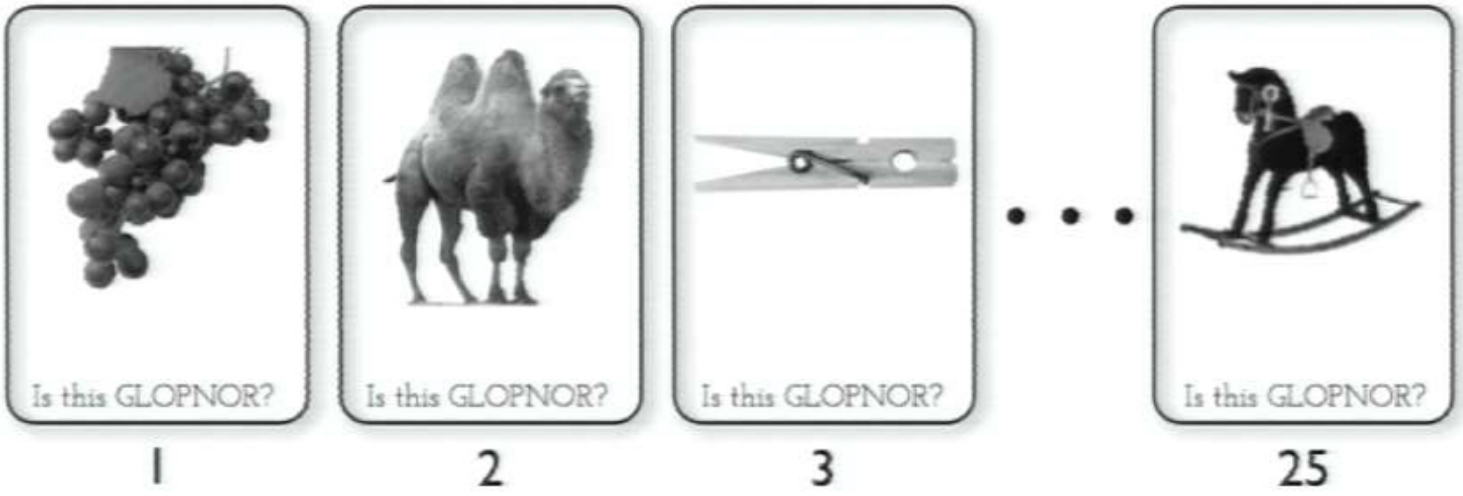
alternate or repeat with equal probability

repeat early, alternate late

Experiment 2

Training

- 25 trial sequence generated by chosen policy



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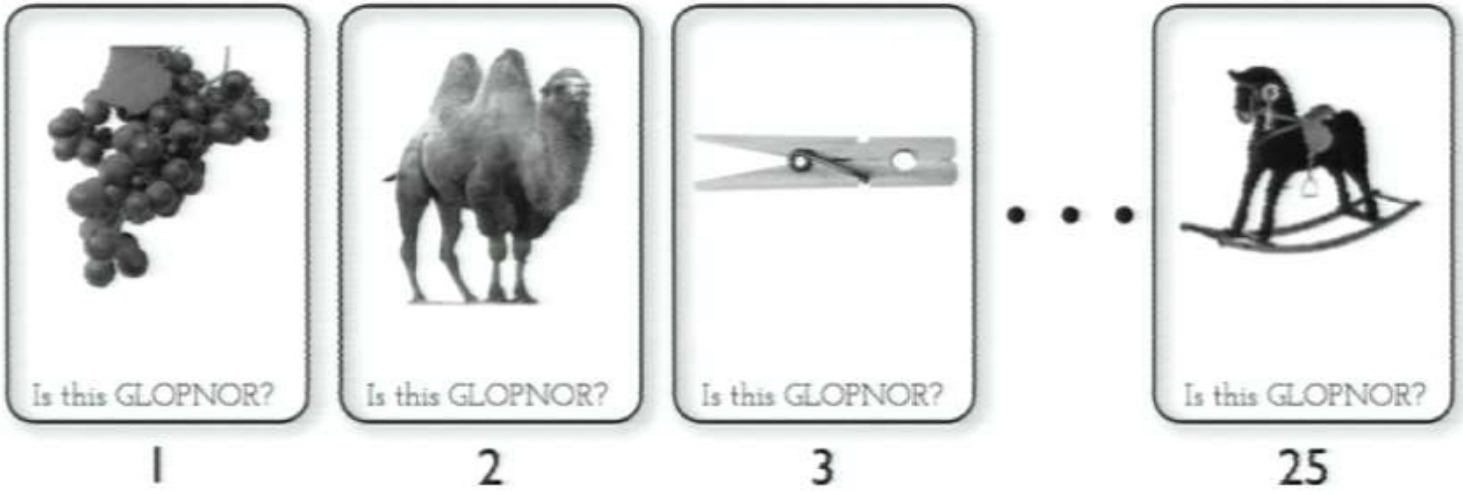
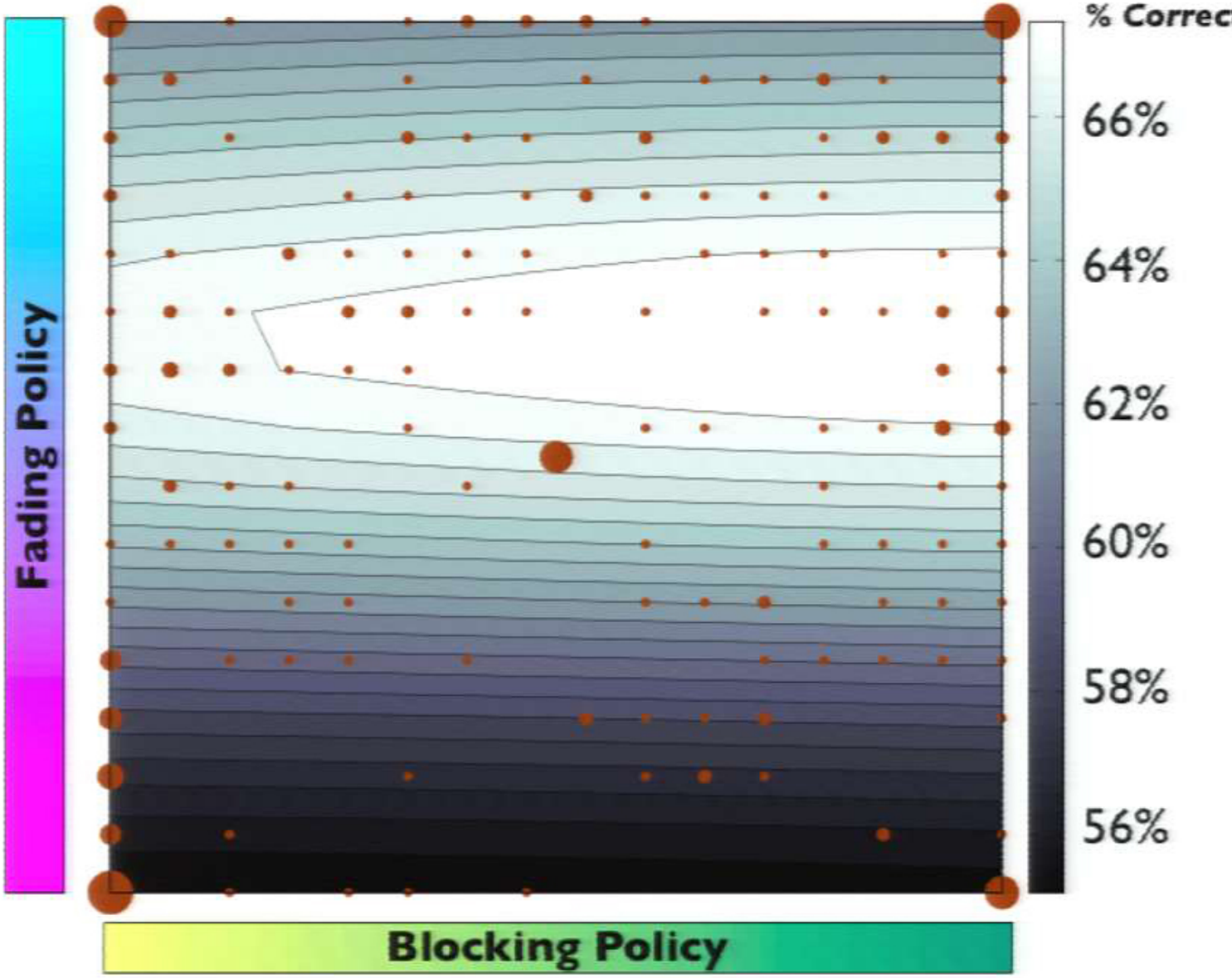
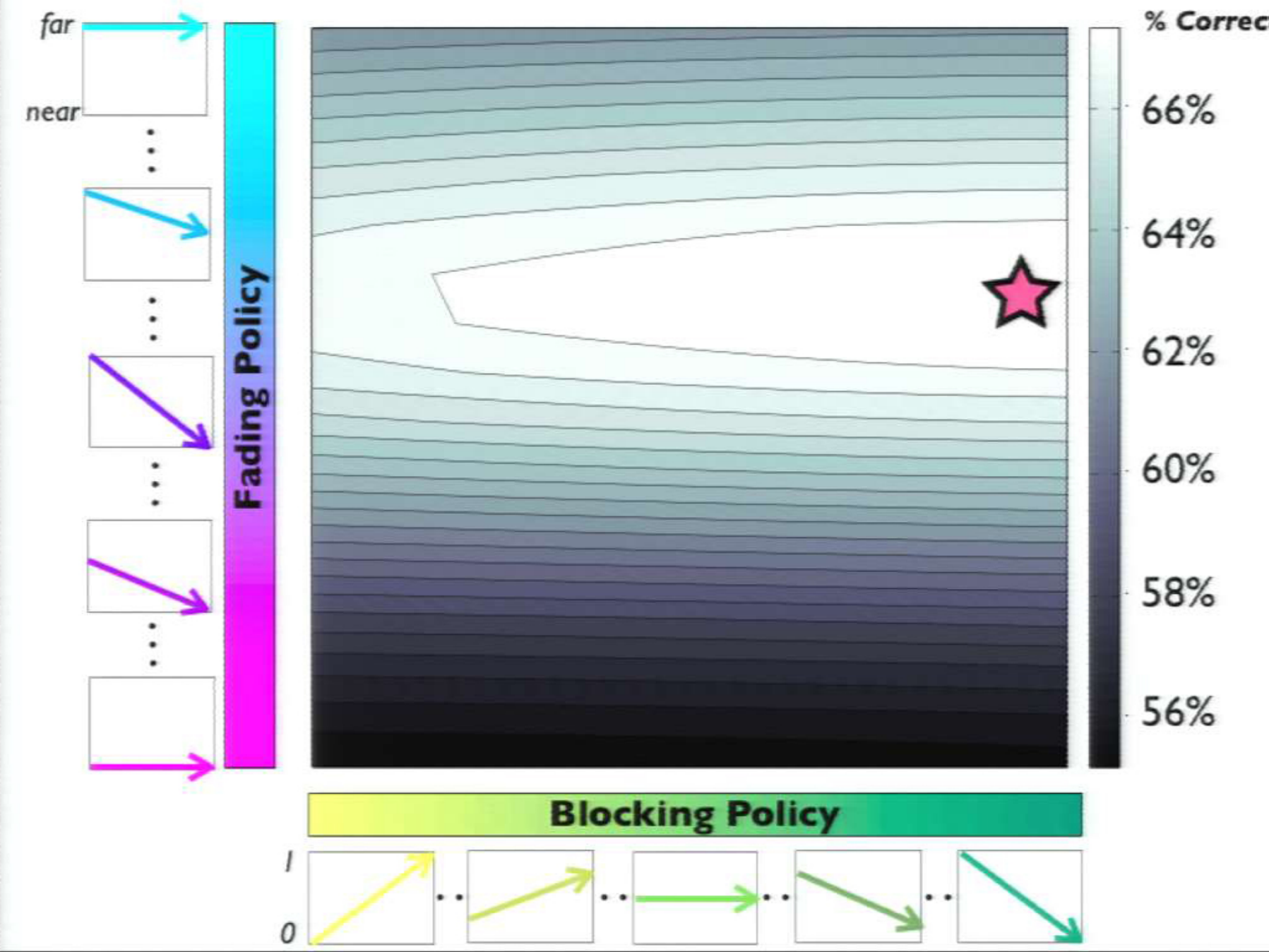
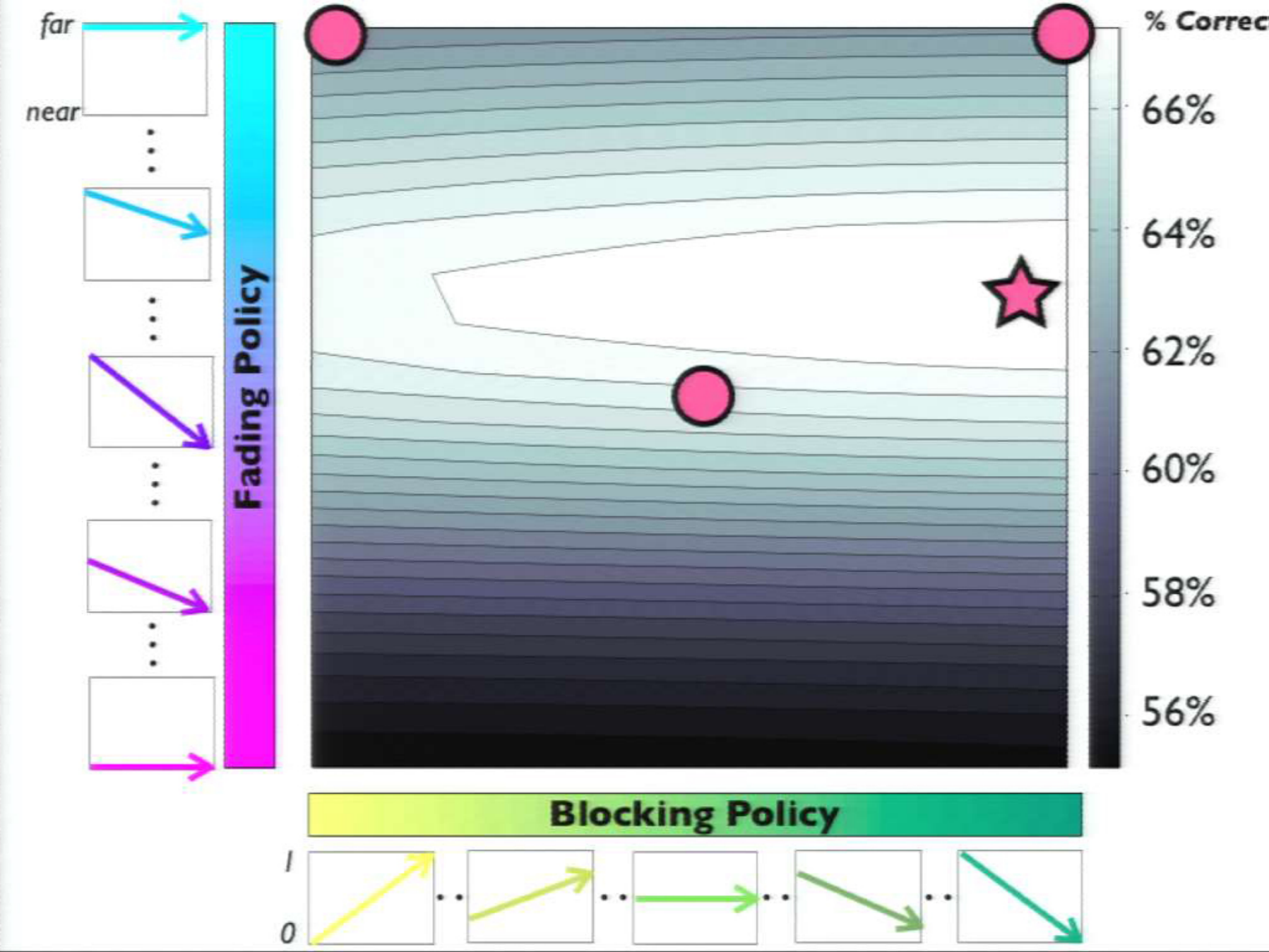


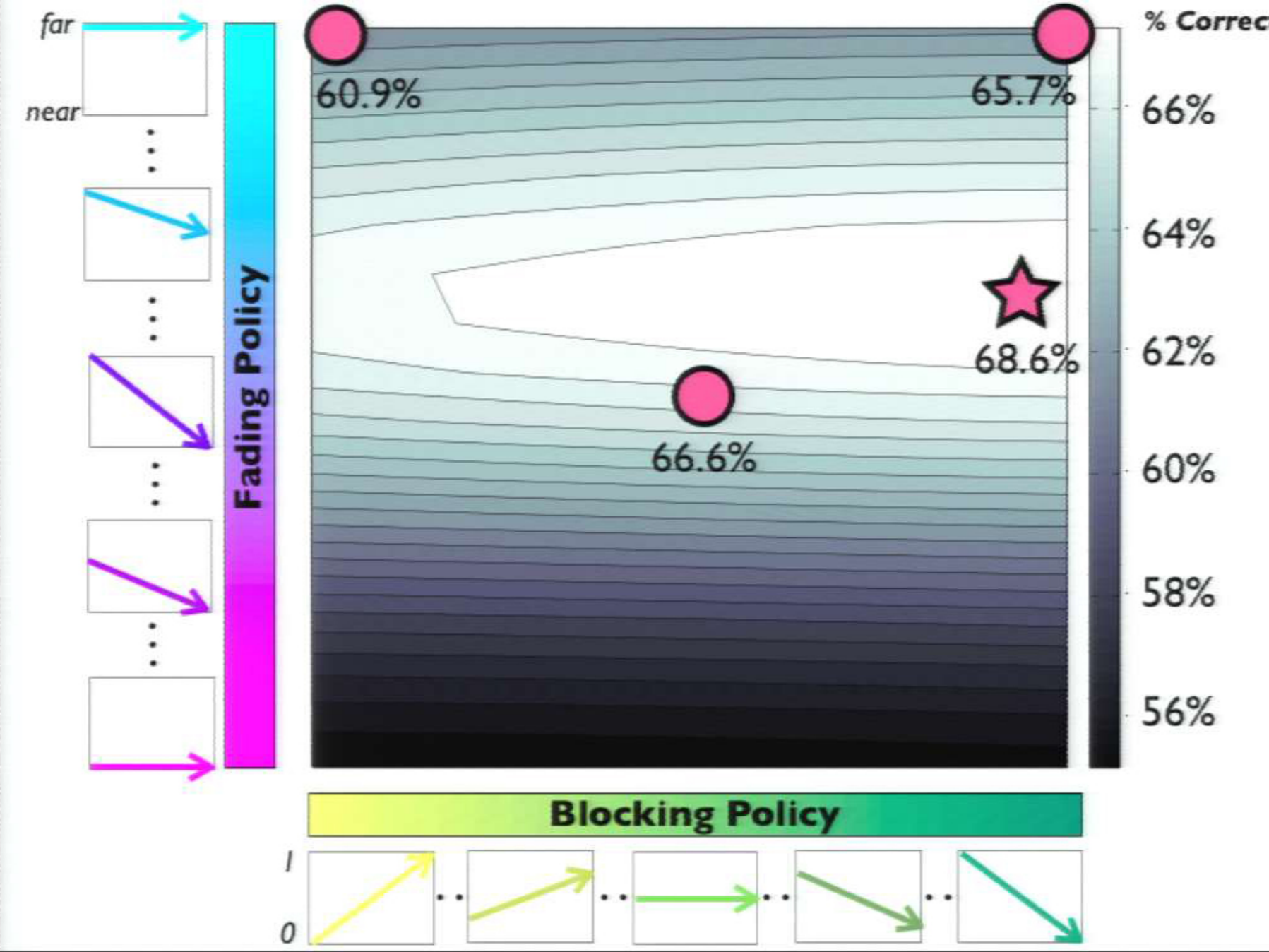
Testing

- 24 test trials, independent of policy
- No feedback


Fading Policy
Blocking Policy
% Correc
66%
64%
62%
60%
58%
56%


far
near
Fading Policy
% Correc
66%
64%
62%
60%
58%
56%
Blocking Policy
1
0

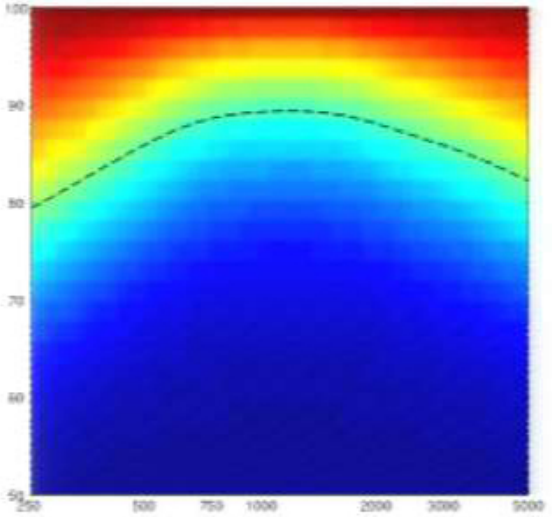

far
near
Fading Policy
% Correc
66%
64%
62%
60%
58%
56%
Blocking Policy
1
0


far
near
Fading Policy
60.9%
65.7%
68.6%
66.6%
% Correc
66%
64%
62%
60%
58%
56%
Blocking Policy
1
0

Our Contribution

Alternative to traditional A-B testing

Allows us to efficiently search over a continuum of alternatives to discover an optimum.



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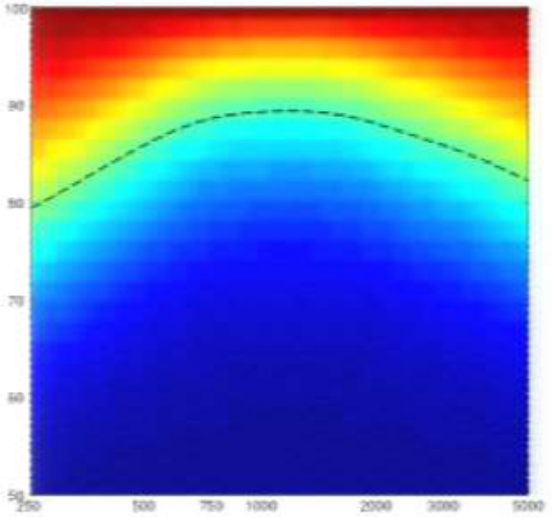
Used to optimize instructional policies

- presentation duration
- fading
- blocking



Extensions

- Individualized policies

Extensions

- Individualized policies
- Discrete policy spaces

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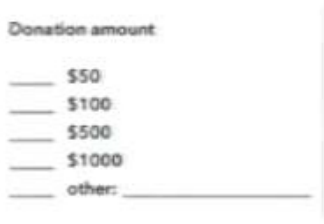
- Individualized policies
- Discrete policy spaces
- Higher-dimensional policy spaces

Other Human Optimization Problems

Other Human Optimization Problems

- Maximizing charitable donations via anchoring manipulation



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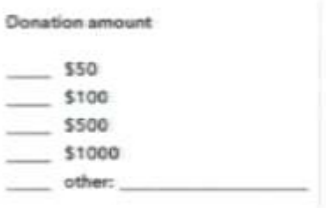

- Improving discriminability for the visually impaired via image transformations

Satgunam et al. (2012

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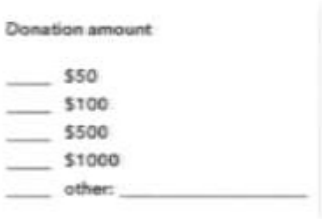

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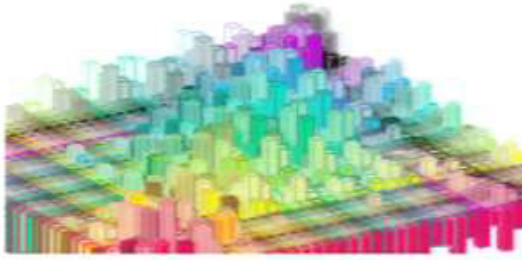
Satgunam et al. (2012

- Optimizing web page design
  - e.g., color combinations



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