



# A Camp for Broadening Participation in Cybersecurity



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# Mo Tech, Mo Problems

And it's one of the great paradoxes of our time that the very technologies that empower us to do great good can also be used to undermine us and inflict great harm.

- Barack Obama, 2/13/2015  
Cybersecurity and Consumer Protection Summit

# How do we begin to solve these problems?

We learn and we teach



Camps to develop the next-generation of cybersecurity professionals

# **What does a cybersecurity professional look like?**

**A bit of an enigma...**

**One could play any number of roles, including...**

# Cryptographer



## Goldwasser and Micali win Turing Award

Team honored for 'revolutionizing the science of cryptography.'

**Abby Abazorius, CSAIL**  
**March 13, 2013**

# Politician



## Ron Wyden, the Internet's senator

Eric Geller — Mar 24, 2015 at 6:06AM | Last updated Dec 11 at 9:47AM

He has been one of Congress' leading voices on key Internet issues—[surveillance reform](#), [online privacy](#), and [cybersecurity](#), in particular—famously battling the entrenched U.S. intelligence community on issues ranging from unlawful domestic surveillance to the deliberate weakening of encryption standards.

# Research director



NEWS

## The NSA Research Director Wants Hackers to Know Who She Is

Deborah Frincke disarms NSA's doubters with transparency.

# Journalist

The screenshot shows the homepage of KrebsOnSecurity. At the top, the site's name "KrebsOnSecurity" is displayed in large white letters on a dark background, with the subtitle "In-depth security news and investigation" below it. To the right of the title is a portrait of the author, Brian Krebs. Below the header, there is a navigation bar with links for "BLOG ADVERTISING" and "ABOUT THE AUTHOR". On the left side of the main content area, there is a link to "All About Skimmers — 34 comments" and a post titled "26 Skimmer Innovation: 'Wiretapping' ATMs" dated NOV 14. The post discusses a new type of ATM skimmer. On the right side, there is an advertisement for "ARC TITAN" with the text "Email Archiving & Regulatory Compliance".

All About Skimmers — 34 comments

**26 Skimmer Innovation: 'Wiretapping' ATMs**

NOV 14

Banks in Europe are warning about the emergence of a rare, virtually invisible form of ATM skimmer involving a so-called "wiretapping" device that is inserted through a tiny hole cut in the cash machine's front. The hole is covered up by a fake decal, and the thieves then use custom-made equipment to attach the device to ATM's internal card reader.

BLOG ADVERTISING | ABOUT THE AUTHOR

Advertisement

ARC TITAN

Email Archiving & Regulatory Compliance

The screenshot shows a promotional page for Glenn Greenwald. At the top, his name "GLENN GREENWALD" is displayed in large red letters, with his email address "ggreenwald@salon.com" below it. Below this, there is a portrait of Glenn Greenwald. To the right of the portrait, there is a quote in bold black text: "I have been to the darkest corners of government, and what they fear is light". Below the quote, there is a brief description: "The untold story of how Edward Snowden risked everything to contact Glenn Greenwald — and changed the world forever".

GLENN GREENWALD

ggreenwald@salon.com

"I have been to the darkest corners of government, and what they fear is light"

The untold story of how Edward Snowden risked everything to contact Glenn Greenwald — and changed the world forever

# Bug hunter



## Google Project Zero researchers find 'crazy bad' Windows RCE flaw

The attack works against default Windows installations and is 'wormable'



 Natalie Silvanovich  
@natashenka

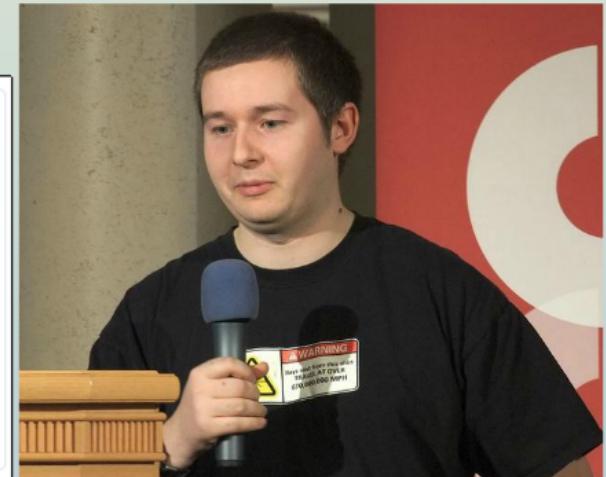
[Follow](#)

CVE-2017-0290 is tweetable :)

```
var e = new Error();e.toString.call({message : 7
});bugs.chromium.org/p/project-zero...
```

6:03 PM - 8 May 2017

  1,028  1,167



# Film maker



Alex Gibney on Stuxnet film Zero Days:  
'We need laws for cyberweapons'

His latest documentary lays bare the story of the Stuxnet worm, a groundbreaking virus jointly created by the US and Israel. Here the acclaimed film-maker discusses the pervasive threat posed by this new age of warfare

# Systems developer



**The Register®**  
*Biting the hand that feeds IT*

**Security**

**Trustworthy x86 laptops? There is a way, says system-level security ace**

ARM isn't the answer either, adds Joanna Rutkowska

Jessie Frazelle's Blog

Docker Containers on the Desktop

Saturday, February 21, 2015

# Television producer



[Home](#) > All > Is Mr. Robot the new WarGames?

IS MR. ROBOT THE NEW WARGAMES?

# Professor



## P@\$WORD PROTECTOR

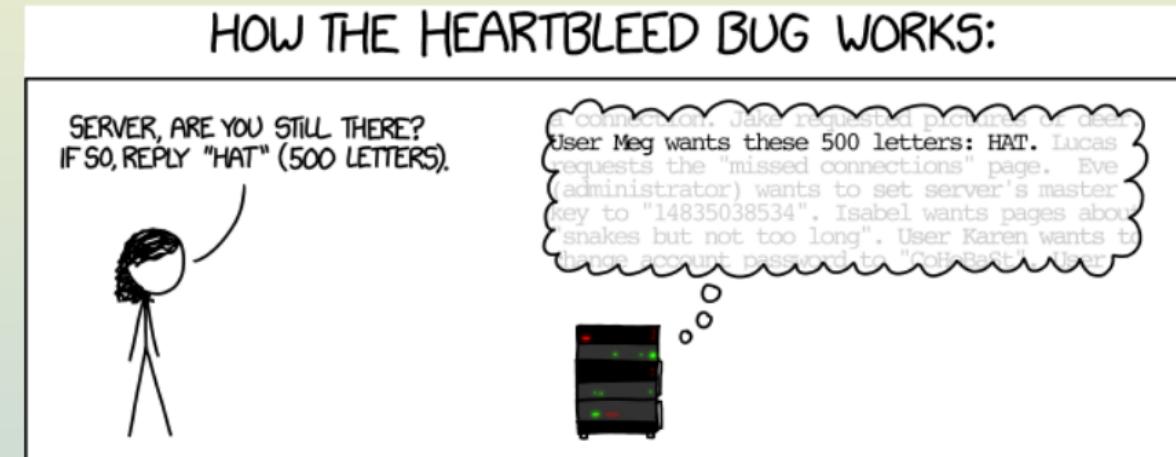
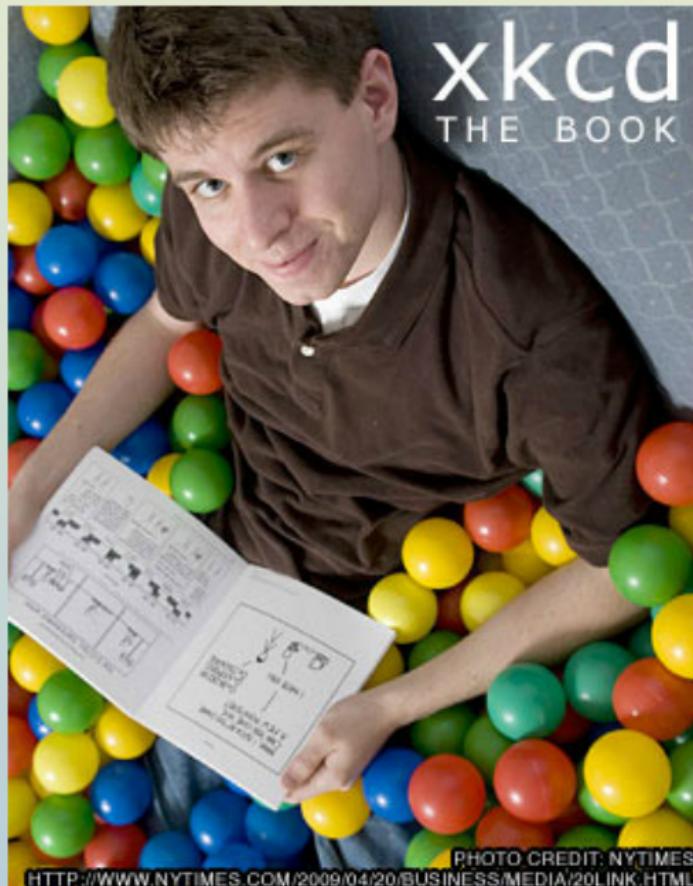
The Switch

**The FTC is getting a new chief technologist: Carnegie Mellon's Lorrie Cranor**

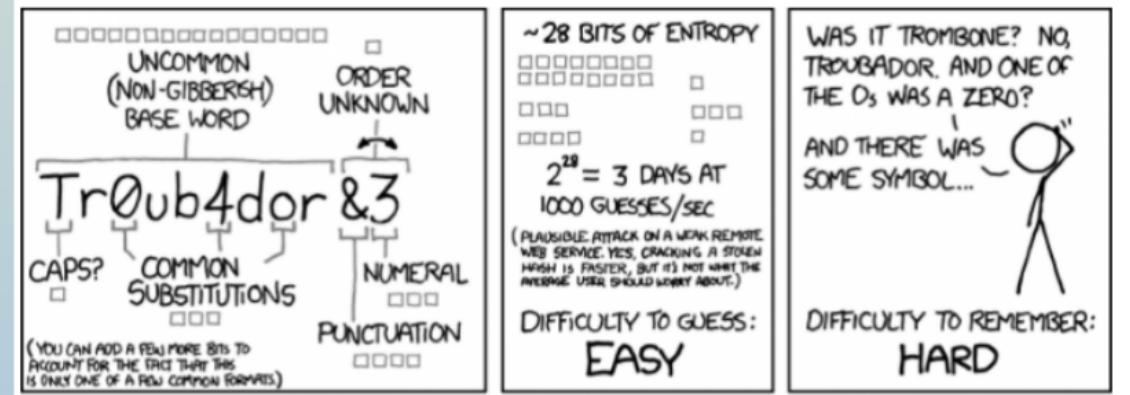
**Carnegie Mellon**



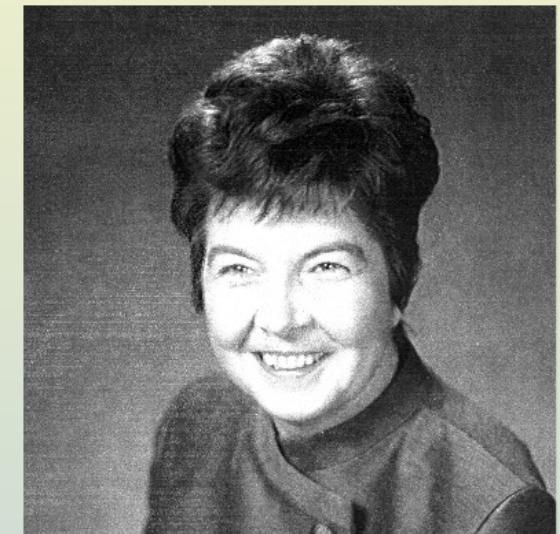
# Cartoonist



The inspiration for Ghazvininejad and Knight's study was actually a cartoon, created by Randall Munroe of Xkcd, which showed how a



# Cryptanalyst



[NSA.Gov](#) > [About Us](#) > [Cryptologic Heritage](#) > [Historical Figures & Publications](#) > [Hall Of Honor](#) > [2003](#)

## Cryptologic Hall of Honor

### Juanita Moody

Ms. Moody supervised NSA's day-to-day -- sometimes, minute-by-minute -- response to the Cuban Missile Crisis as head of the major element responsible for Signals Intelligence (SIGINT) on that region. She often worked around the clock, grabbing only a few hours sleep on a cot in her office.

In the years following the Cuban Missile Crisis, Ms. Moody was assigned to higher positions within the production organization at NSA. She revolutionized SIGINT reporting, and put NSA into the White House Situation Room.

# Comedian



## John Oliver Makes Edward Snowden Squirm on 'Last Week Tonight'

Strangely enough, the host of HBO's *Last Week Tonight* conducted arguably the toughest interview with Edward Snowden, taking him to task on the leaked NSA documents.

# Podcaster



[Risky Business #453 -- The Intel bugs: How freaked out should you be?](#)

PLUS Claudio Guarnieri and Alex Rice talk Flexispy and bug bounties...

May 04, 2017

# Lawyer



philly.com

The Inquirer  
DAILY NEWS

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Susan Hennessey, the managing editor of Lawfare and a Brookings Fellow, dropped a truth bomb. A Harvard Law graduate, she was previously an attorney in the general counsel's office at the National Security Agency:



**Susan Hennessey**   
@Susan\_Hennessey

 Follow

I cannot say this strongly or sincerely enough. If you work in the White House, you need to have a plan in place for retaining a lawyer.

7:10 PM - 10 Jul 2017



4,242



14,328



# Author



# With this in mind..

How do we offer a camp that speaks to these diverse roles?

What do we teach and how do we teach it?



A one-week residential camp for introducing  
cybersecurity to high-school students and teachers

# CyberPDX approach

A curriculum that integrates technology and the liberal arts to highlight the breadth of the field



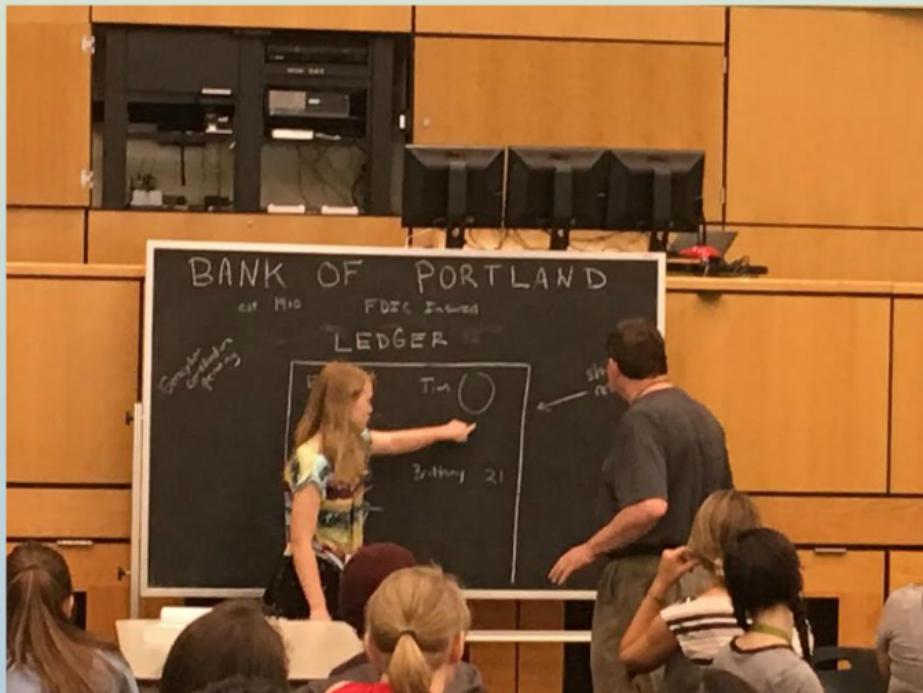
# CyberPDX approach

Focus on collaborative, cooperative, peer learning, not competition



# CyberPDX approach

Role playing exercises to allow each student to practice different aspects of cybersecurity



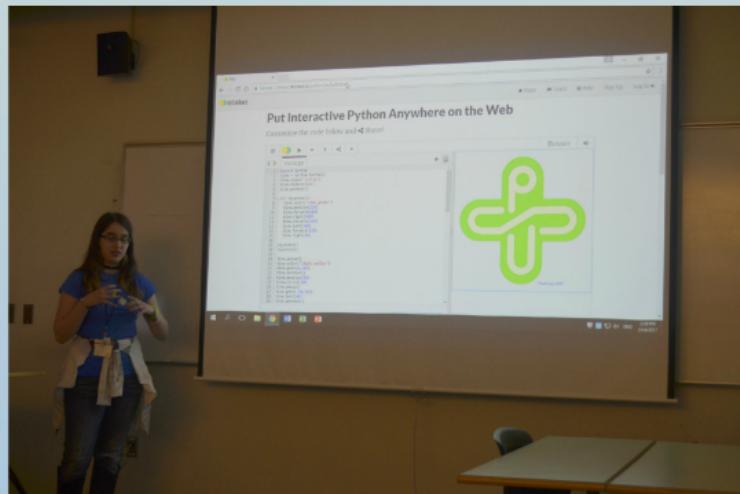
# CyberPDX approach

Problem-based learning involving creative, intrinsically motivating activities



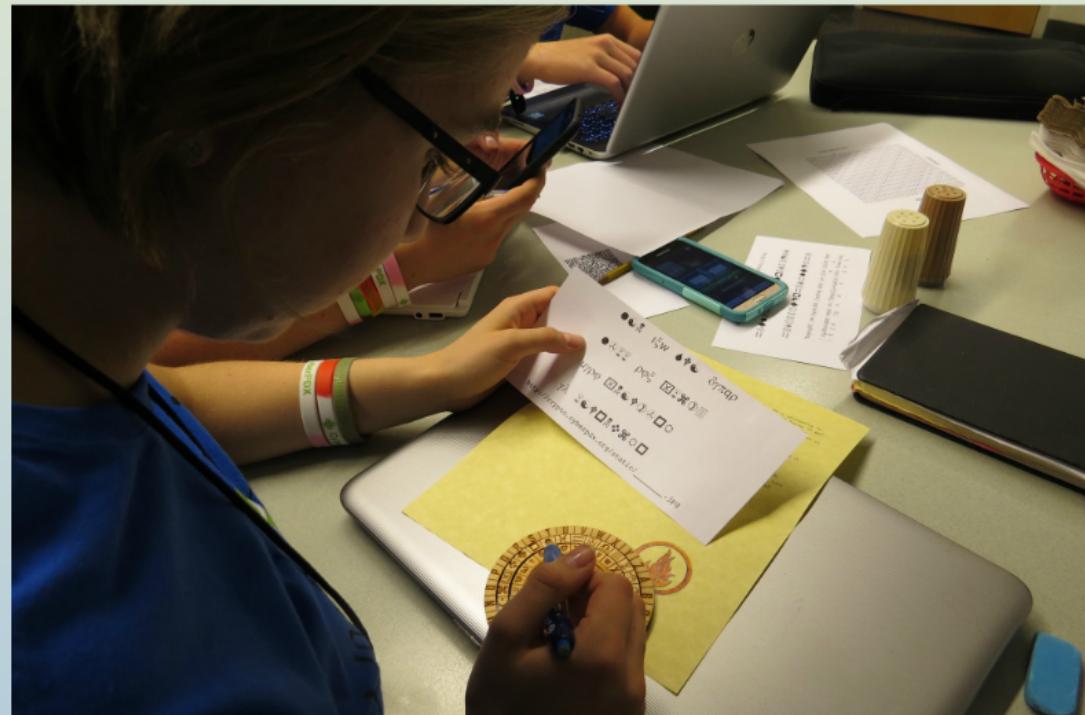
# CyberPDX approach

Multi-modal instruction to engage diverse learning styles



# CyberPDX approach

Scaffolded exercises to cultivate competence and confidence



# CyberPDX approach

Inclusive targeting of students underrepresented in both college and in the cybersecurity field



# CyberPDX approach

Teacher camp with curriculum projects available in a public repository for use in high-schools



## CyberPDX Repository

Home

[Curriculum Map – An Interdisciplinary Approach to Cyber Security](#)

Motivation

admin - 11/11/2016 - 10:38

[2016 Capital High School Sound wave and encryption project.](#)

Original Source: <http://capitalcomtech.info/2016/07/13/sound-phase-code-and-encryption/>

Article note taking guide: <http://capitalcomtech.info/2016/07/12/8596/>

admin - 11/11/2016 - 10:40

[Cyber Security Strand: Socratic Seminar](#)

[Cyber Security Strand: Socratic Seminar](#)

I teach Pre-AP English to all of the incoming freshmen in our SMT magnet. It is a mandatory course. This generally means between 80 to 120 students (25-35 students per class) on any given year. I often employ the Socratic Seminar format in class. I was inspired by the cybersecurity summit exercise last year and decided to try a kind of hybrid of summit/debate/Socratic seminar. The following is a synopsis of how I organized the exercise and changes I plan to make to the lesson plan this year.

admin - 11/11/2016 - 10:41

[Cryptology in an Algebra 2 Classroom](#)

Nicole Barker

CyberPDX 2016

[Lesson Plan](#)

# CyberPDX content threads

Cryptography and security

Programming

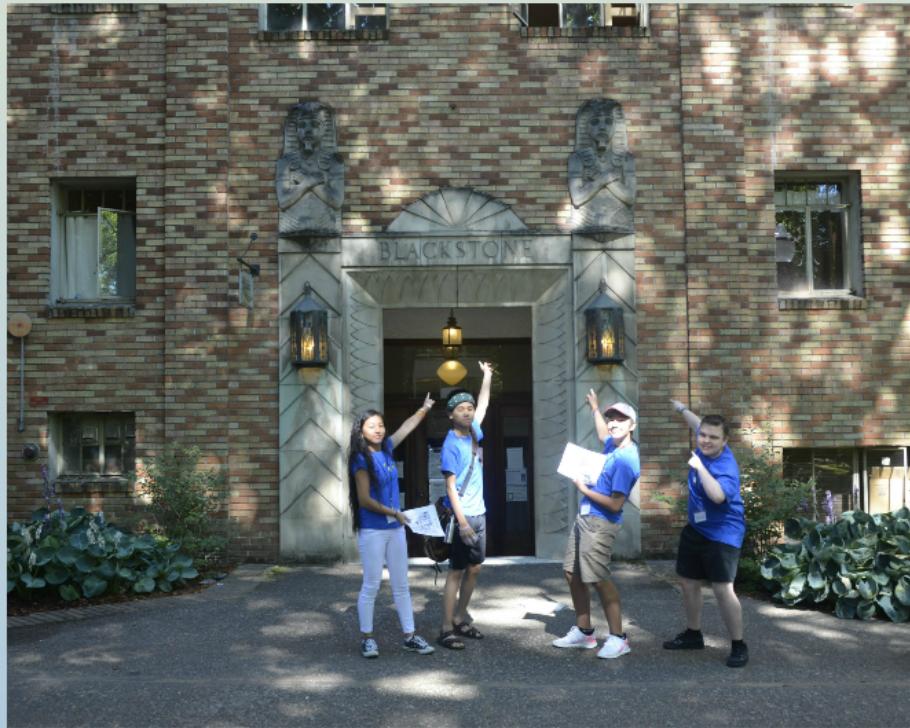
Film-making

Cyber policy

# Cryptography and security

How ciphers work, how they can eventually be broken

Modern security tools and techniques



# Cryptography and security

"A Divergent-themed Capture-the-Flag and Urban Race for Introducing Cryptography and Security", USENIX ASE 2016.

## Content modules and film

- Historical impact of cryptography and security
- Encoding (binary, hexadecimal, ASCII, barcodes, QR codes, steganography)
- Simple ciphers (Columnar transposition, Scytale, Caesar, simple substitution, Vigenere, Enigma)
  - Movie: The Imitation Game
- Modern ciphers (Public-private key cryptography via dominating set problem and prime factoring)
- Protocols and the Man-in-the-Middle attack



# Cryptography and security

Scaffolded CTF activity that leads to an Urban Race

Woven into the plot of the Divergent short story "The Traitor" by Veronica Roth

- Follows Four as a penetration tester attempting to compromise Erudite systems
- Campers practice decrypting messages while learning about modern security issues and tools by retracing Four's exploits

Content available at: <https://crypto.cyberpdx.org/>

CyberFour (@CDFour)

Hey. Thanks for the help. To get into the control room, I need the keys in the challenges I had Tris give you. Only Erudite are meant...

to solve them since it requires knowledge of the campus. The system only allows 10 incorrect guesses so be careful. What is key one?

8:34 AM

Start a new message

The | | | On >

1 2 3 4 5 6 7 8 9 0



# Programming

Practice different ways for developing software

Understand the difficulty in writing correct software



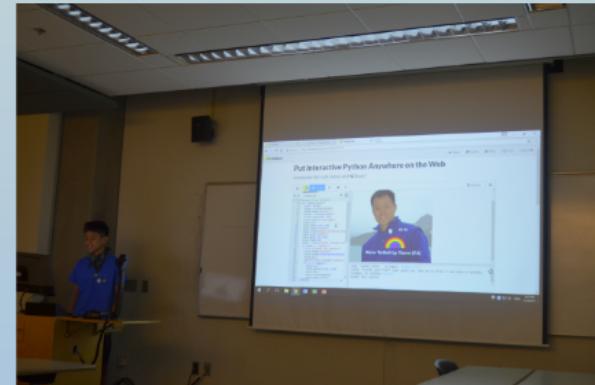
# Programming

## Content modules

- Basic programming constructs in Blockly
  - Commands, loops, conditionals, functions
- Text-based, graphical programming
  - Python with Turtle Graphics on Trinket.io
  - Variables, arithmetic, data types and structures
- Conditionals, loops, and functions
  - Programs for encryption and decryption used in cryptography thread

Final project demonstrated with a code-walkthrough at a final Program Showcase event

<https://trinket.io/python/5280772377>



# Film

Influence of movies on cybersecurity awareness and policy

Techniques for creating impactful films



# Film

## Content modules

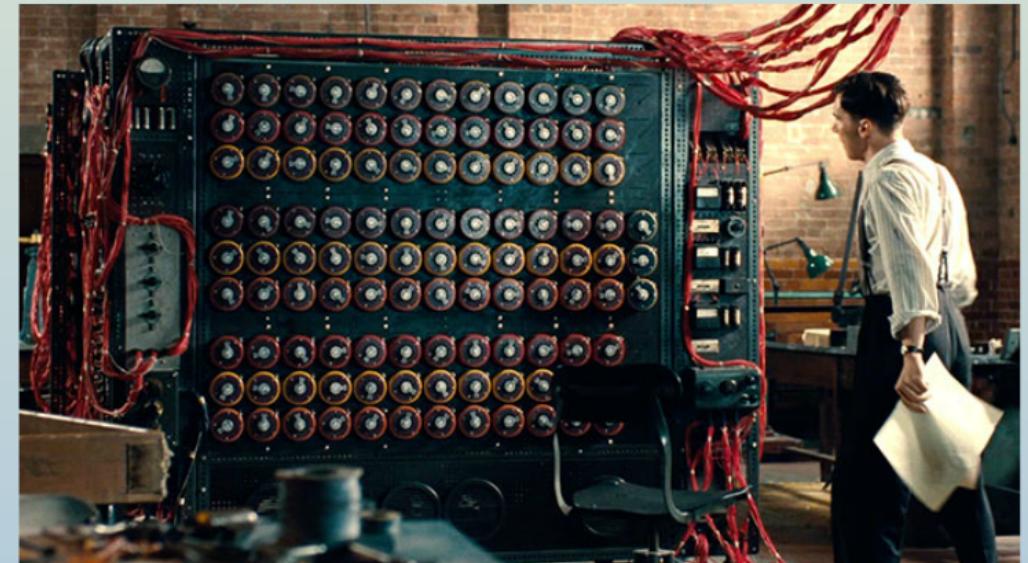
- Camera angle and its effects (bird's eye, eye-level, low, dutch)
- Camera movement and its effects (handheld, quick pan surprise, quick push in, tilt, slow dolly in/out)
- Camera shot size and its effects (long shot, close-up, insert, cut away, point-of-view, over-the-shoulder)



# Film

## Films and their impact

- War Games
- The Imitation Game



# Film

## Daily film assignment

- Incorporate themes of camp in short films
- Edited and uploaded via YouTube
- Final film tied to cyber policy thread shown at camp showcase



# Cyber policy

Social and legal problems brought about by technology

Importance of having policy makers that understand technology  
(and vice versa)

Collaborative problem solving to address policy issues



# Cyber policy

## Content modules

- Constitutional law, surveillance programs, security vs. privacy, spear phishing, fake news

## Role dossiers

- Learn position of a stakeholder in cyberpolicy debates
- Head of NSA, ACLU lawyer, Telecom CEO, Social media CEO, Journalist, Director of National Intelligence, White House



# Cyber policy

## Student mixer

- Meet with students playing other roles to learn the positions of all stakeholders



# Cyber policy

## Cyber-summit

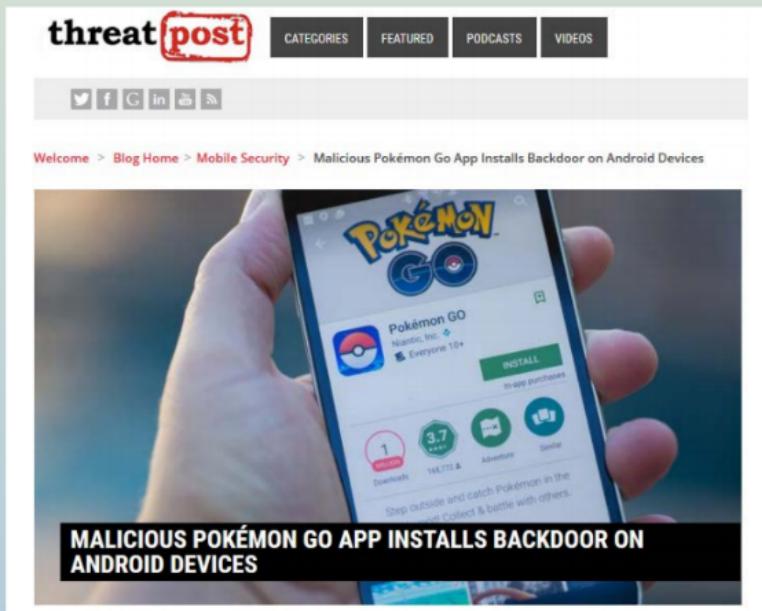
- 9 rounds of alternating discussions
  - Caucusing with fellow students sharing the same role
  - Negotiating in stakeholder groups to craft acceptable policy
- Analyzing similarities and differences in policies developed



# Cyber policy

## Pivot

- Crisis situation modeled after Cyber 9/12 competitions
- Students synthesize what they've learned into a 5-minute film that addresses the crisis
  - Pokemon Go 0-day exploit being used by NSA to track terrorist and criminal activity



In response to several known cases of ISIS using the Pokemon Go app to recruit new recruits, and 3 known cases where criminals used the app to lure game players into **compromising locations to effect blackmail, assault, and kidnapping**, it has been alleged that the NSA has used a undisclosed zero-day exploit to insert a backdoor into millions of apps in order to get an inside handle on how the app is being exploited by terrorists and criminals. Whoever created the backdoor, it is believed that the overwhelming majority of downloads in the last 2 months are now affected.

- Nation-state attack on 2018 election

# Evaluation

**Offered in 2016 and 2017 as a GenCyber camp to rising 10th grade students**

## **GenCyber student survey results**

- Metrics common in both surveys

2016: 58 students (60% female, 37% minority), 20 teachers

2017: 59 students (64% female, 45% minority), 20 teachers

Ratings (1=strongly disagree, 5=strongly agree)

	2016	2017
I learned a lot about cybersecurity	4.53	4.34
I enjoyed learning about cybersecurity	4.30	4.43
I enjoyed the projects and activities at this camp.	4.40	4.45
I am glad I attended this camp.	4.65	4.53

# Evaluation

## Comparison to GenCyber camp averages

Metric	GenCyber 2016	CyberPDX 2016	CyberPDX 2017
Pre-camp Intent to Pursue Cyber	2.78	2.41	2.64
Post-camp Intent to Pursue Cyber	3.45	3.33	3.66
Pre-Post delta	+0.65	+0.92	+1.02

# Resources

Camp site (including repository)

<https://cyberpdx.org>



# A Camp for Broadening Participation in Cybersecurity

The grid contains various sections and snippets of text:

- What does the profession look like?**
  - What do people do in the field?
  - What do people think about the field?
  - What do people say about the field?
- What do I need to know?**
  - What do I need to know to succeed in this field?
  - What do I need to know to succeed in this field?
  - What do I need to know to succeed in this field?
- Cybersecurity needs**
  - Industry needs
  - Education needs
  - Research needs
- Cybersecurity and society**
  - How does cybersecurity affect society?
  - How does cybersecurity affect society?
  - How does cybersecurity affect society?
- Cybersecurity and economy**
  - How does cybersecurity affect the economy?
  - How does cybersecurity affect the economy?
  - How does cybersecurity affect the economy?
- Cybersecurity and housing**
  - How does cybersecurity affect housing?
  - How does cybersecurity affect housing?
  - How does cybersecurity affect housing?
- Education**
  - What are the requirements for education?
  - What are the requirements for education?
  - What are the requirements for education?
- Research**
  - What are the requirements for research?
  - What are the requirements for research?
  - What are the requirements for research?
- Evaluation**
  - What are the requirements for evaluation?
  - What are the requirements for evaluation?
  - What are the requirements for evaluation?
- Feedback**
  - What are the requirements for feedback?
  - What are the requirements for feedback?
  - What are the requirements for feedback?



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