This is Not a Game

Early Observations on Using Alternate Reality Games for Teaching Security Concepts to First-Year Undergraduates

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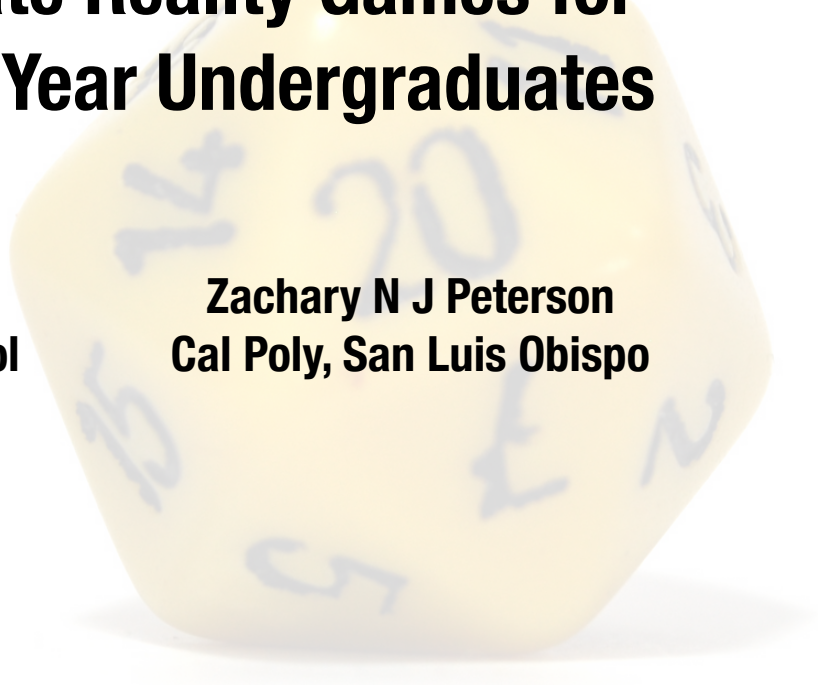
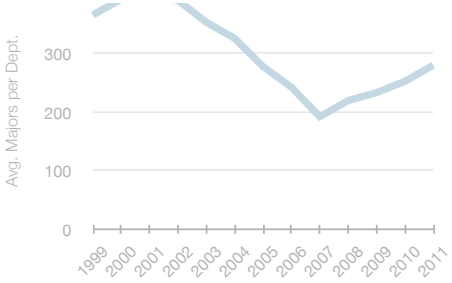
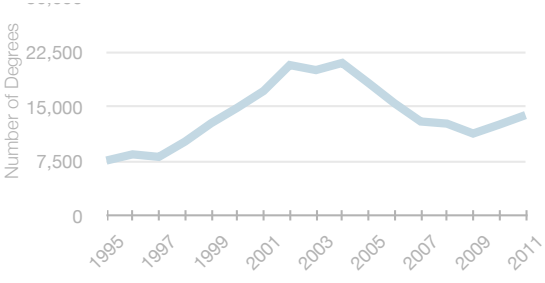


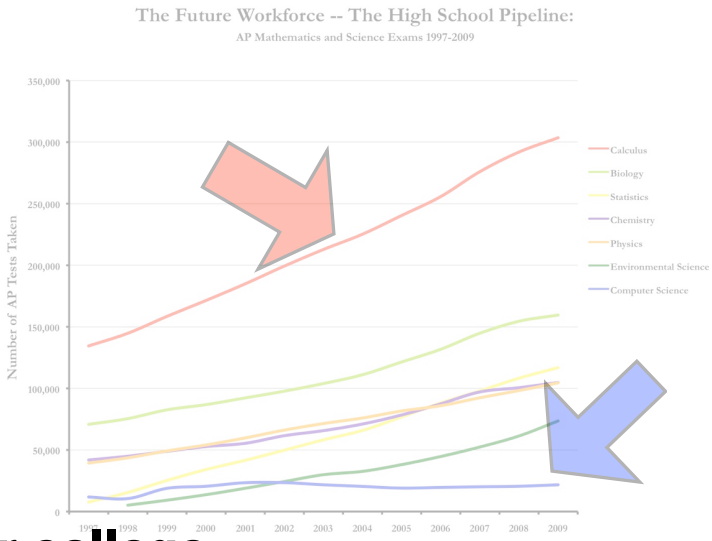
USENIX CSET 2015



Source: Table 6: Total Bachelor's Enrollment by Department Type



Source: Table 3: Bachelor's Degrees Awarded by Department Type



CS enrollment

CS graduates

security education

few students pursuing CS in high school or college

many leave the discipline after the first year

don't pursue security

and, aren't very diverse

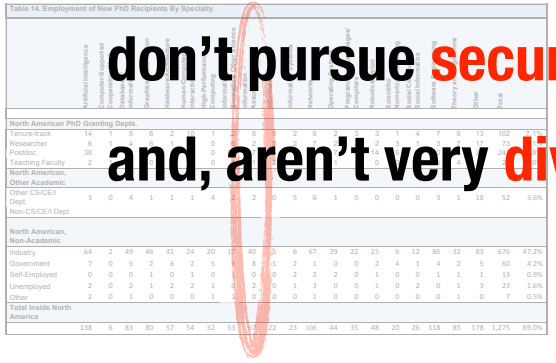
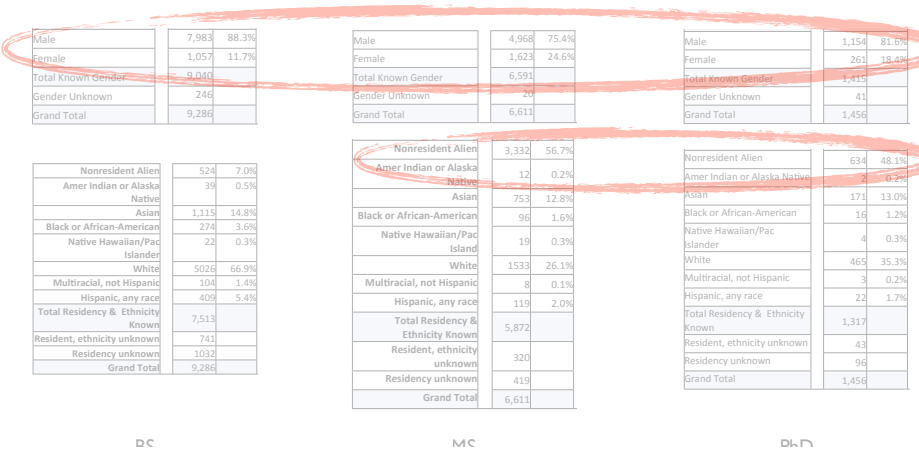


Table 14. Employment of New PhD Recipients By Specialty

	Artificial Intelligence	Computer Engineering	Computer Science	Cognitive Science	Database	Graphics	Hardware	Human Computer Interaction	High Performance Computing	Information Science	Mathematical Software	Modeling & Simulation	Networks	Operating Systems	Programming Languages	Robotics	Scientific Computing	Social Informatics	Software Engineering	Theory	Other	Total	
North American PhD Granting Depts.																							
Tenure-track	14	1	8	6	2	10	1	3	5	0	2	6	2	3	3	1	4	7	6	13	102	7.1%	
Researcher	6	1	2	2	0	0	0	0	0	0	0	1	0	2	2	0	0	1	0	1	17	1.2%	
Postdoc	38	1	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	3.2%	
Teaching Faculty	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.1%	
North American, Other Academic																							
Other CS/CE/I Dept.	3	0	4	1	1	1	4	2	2	0	5	6	1	0	0	0	0	3	1	18	52	3.6%	
Non-CS/CE/I Dept.																							
North American, Non-Academic																							
Industry	64	2	49	46	41	24	20	17	40	15	6	67	29	22	25	6	12	86	32	83	676	47.2%	
Government	7	0	5	2	6	2	5	5	8	1	1	2	1	0	0	2	4	1	4	2	5	60	4.2%
Self-Employed	0	0	0	1	0	1	0	1	0	0	2	2	2	0	1	0	0	1	1	1	13	0.9%	
Unemployed	2	0	2	1	2	2	1	0	2	0	1	3	0	0	1	0	2	0	1	3	23	1.6%	
Other	2	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	7	0.5%	
Total Inside North America																							
	138	6	83	80	57	54	32	53	77	22	23	106	44	35	48	20	26	118	85	178	1,275	89.0%	

67/1275 (5%) of CS PhDs pursued security



Male	7,983	88.3%
Female	1,057	11.7%
Total Known Gender	9,040	
Gender Unknown	246	
Grand Total	9,286	

Male	4,968	75.4%
Female	1,623	24.6%
Total Known Gender	6,591	
Gender Unknown	20	
Grand Total	6,611	

Male	1,154	81.6%
Female	261	18.4%
Total Known Gender	1,415	
Gender Unknown	41	
Grand Total	1,456	

Nonresident Alien	524	7.0%
Amer Indian or Alaska Native	39	0.5%
Asian	1,115	14.8%
Black or African-American	274	3.6%
Native Hawaiian/Pac Islander	22	0.3%
White	5026	66.9%
Multiracial, not Hispanic	104	1.4%
Hispanic, any race	409	5.4%
Total Residency & Ethnicity Known	7,513	
Resident, ethnicity unknown	741	
Residency unknown	1032	
Grand Total	9,286	

Nonresident Alien	3,332	56.7%
Amer Indian or Alaska Native	12	0.2%
Asian	753	12.8%
Black or African-American	96	1.6%
Native Hawaiian/Pac Island	19	0.3%
White	1533	26.1%
Multiracial, not Hispanic	8	0.1%
Hispanic, any race	119	2.0%
Total Residency & Ethnicity Known	5,872	
Resident, ethnicity unknown	320	
Residency unknown	419	
Grand Total	6,611	

Nonresident Alien	634	48.1%
Amer Indian or Alaska Native	2	0.2%
Asian	171	13.0%
Black or African-American	16	1.2%
Native Hawaiian/Pac Islander	4	0.3%
White	465	35.3%
Multiracial, not Hispanic	3	0.2%
Hispanic, any race	22	1.7%
Total Residency & Ethnicity Known	1,317	
Resident, ethnicity unknown	43	
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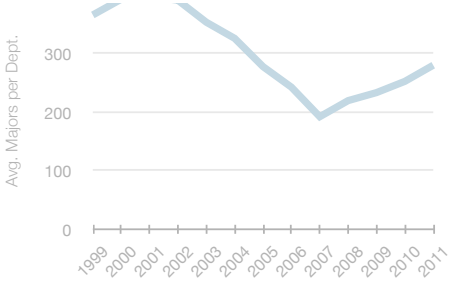
BS MS PhD



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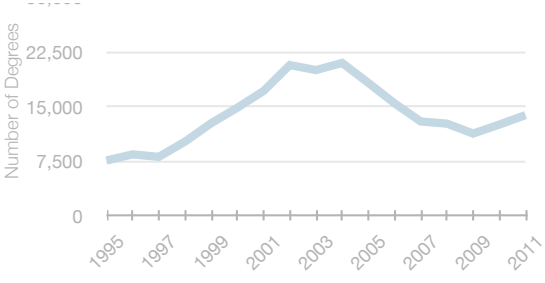

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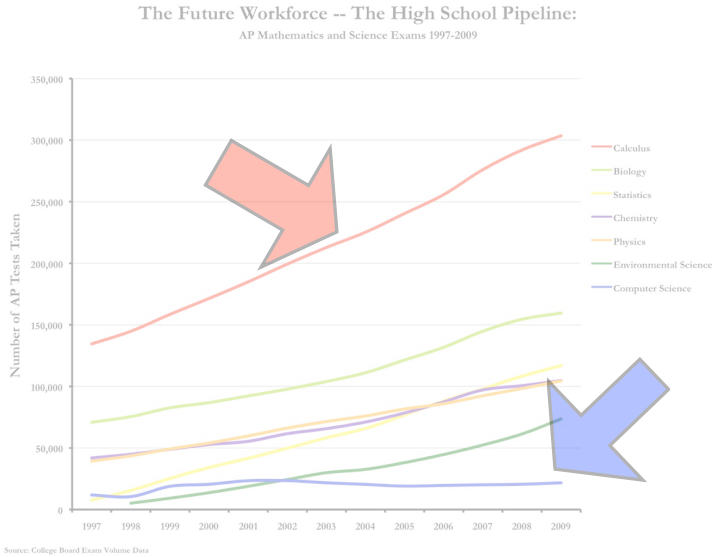
CS enrollment

but, why?

CS graduates



Source: College Board Exam Volume Data

causes are generally unknown

shortcomings in first-year experience:

lacks real world context

reenforced perceptions

limitations on creativity

67/1275 (5%) of CS PhDs pursued security

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BS MS PhD

rethinking CS1

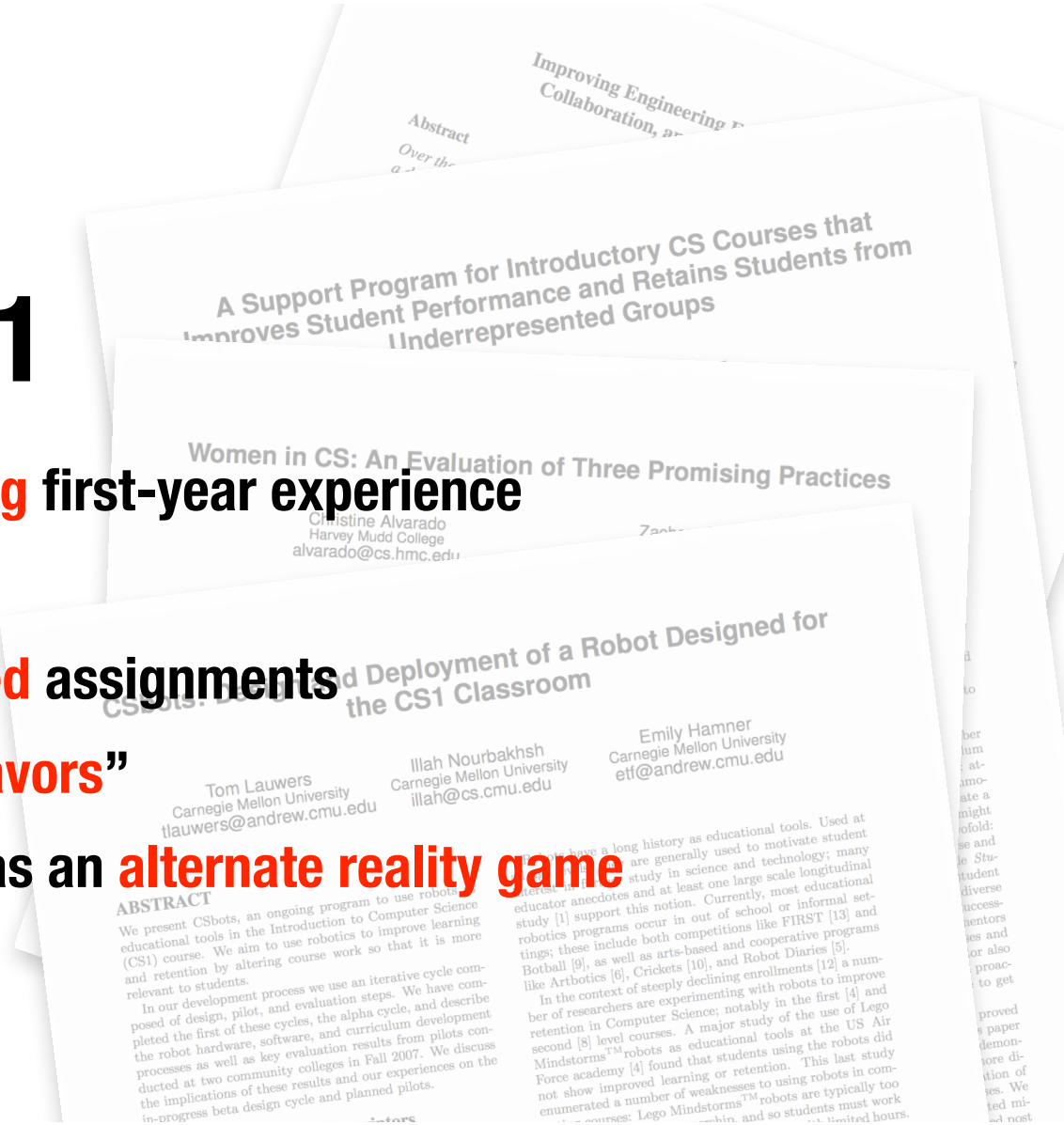
many universities reinventing first-year experience

at Cal Poly:

constructivist, open-ended assignments

offered in a variety of "flavors"

now, in a security flavor as an alternate reality game



why ARGs?

alternate reality games in the classroom, can:

- be social and inclusive
- stimulate counterfactual thinking
- maintain engagement
- provide an authentic context for material

our goals

(i) increase engagement

(ii) boost confidence

(iii) improve awareness

Team	Completed
Byte Me!	5/20
Poly Programmers	4/16
Securi-team	4/16
The League	3/16
Pretty Programmers	1/16
D-Dos	4/16
Peterson's Peppers	4/16

CPE123 Home Scoreboard Challenges Signed in as znjp. Logout

Team	Completed
Byte Me!	25/25
Hackstreet Boys	20/20
Securi-team	20/20
The League	19/20
Pretty Programmers	20/20
D-Dos	20/20
Peterson's Peppers	20/20

ZNJP's PASSWORD VAULT

This is my super secure password storage center.

I was tired of insecure systems that had only ONE password protecting ALL the passwords.

In my system, you must get through all the base authentications to even GET to the per-password security. Each password is secured by a different password, but you can make it less secure than normal because it's so hard to get in.

Enter Access Code Below:

1 2 3

4 5 6

7 8 9

0

ZNJP's PASSWORD VAULT

Enter Access Code Below:

1 2 3

Access Level One Confirmed

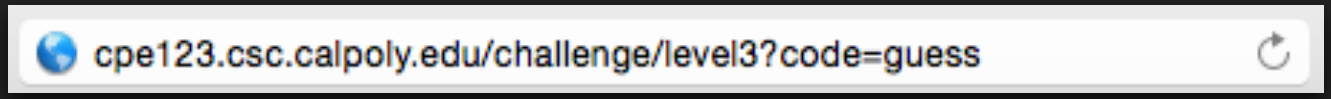
Confirmation Key =
one_digit_is_super_secure

0

LEVEL THREE AUTHORIZATION

PassWORD: .....

Submit



LEVEL FIVE AUTHORIZATION

Access Denied, Please Try Again Maintenance mode over, password bug fixed.

SHA-1 HASHES DO NOT MATCH
'943f264d7534aad8d4f5fdda2ed7e16d088f56de' != '77361fca965b3e53ff81a5d48525ca8adb8a9b87'

Password: ....

Submit

assessment

evaluated using:

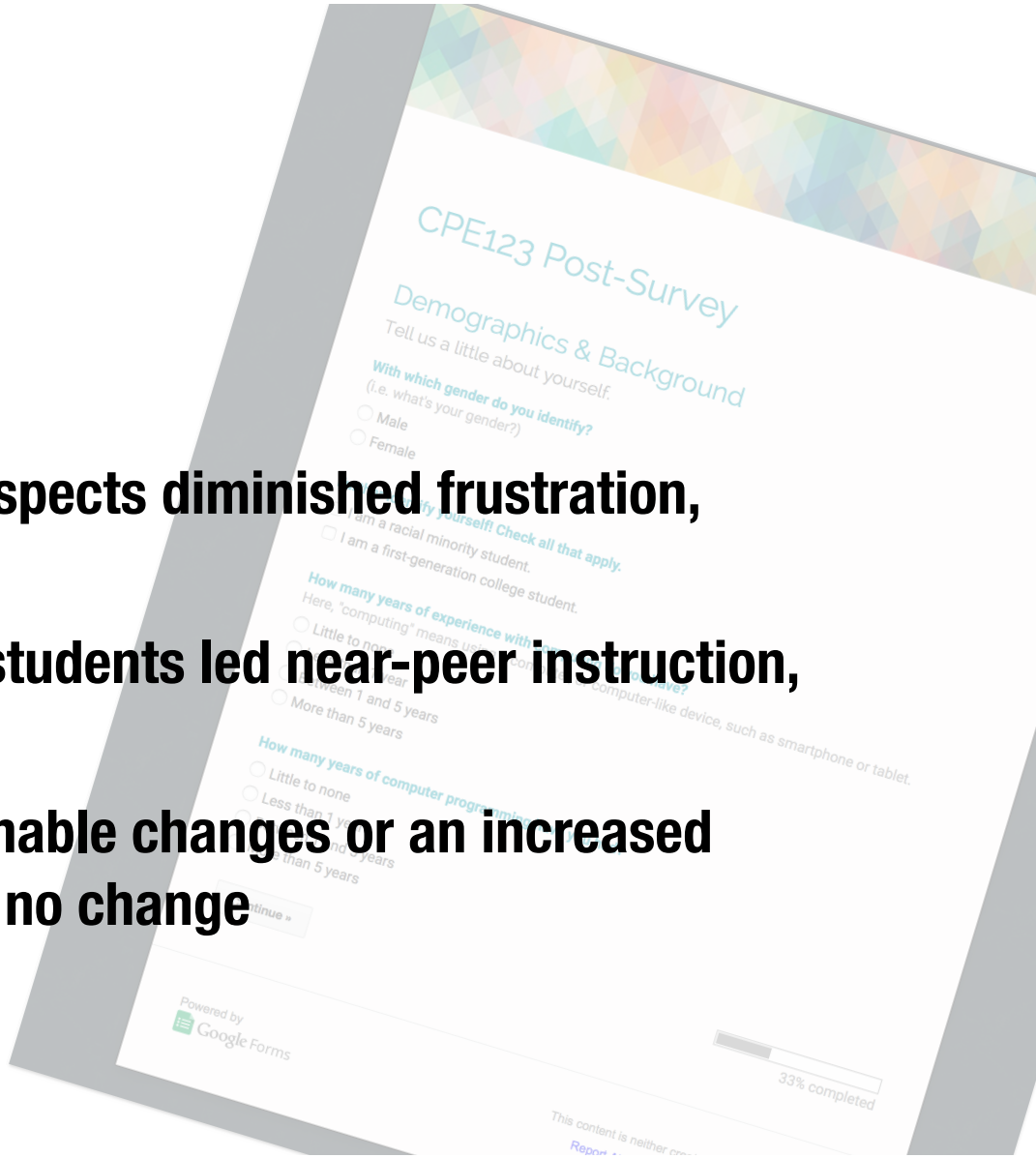
- **reflective journals**
- **modified computer attitude scale survey**
- **student interviews**

early results

game play: “cloak & dagger” aspects diminished frustration, increased engagement

group dynamics: experienced students led near-peer instruction, adoption of roles

behaviors & perceptions: actionable changes or an increased cognition and reasoning about no change



project status

open source: scoreboard framework & story modules

continuing to refine our assessment instruments

similar project aimed at middle & high school students

3GSE: Games, Gaming, and Gamification in Security Education

thanks

work funded by:

National Science Foundation

Google CS Engagement Award

Intel-NSF-GTISC Security Education Micro-grant Program