

CONTROL-ALT HACK™

WHITE HAT HACKING FOR FUN AND PROFIT

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BACKGROUND CONTEXT



UNIVERSITY of WASHINGTON

SECURITY AND PRIVACY
RESEARCH LAB

- Implantable medical devices
- Consumer technologies in the home
- Augmented reality

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BACKGROUND CONTEXT



UNIVERSITY of WASHINGTON

SECURITY AND PRIVACY
RESEARCH LAB

- Implantable medical devices
- Consumer technologies in the home
- Augmented reality

- Cars
- Web tracking
- Powerline electromagnetic interference

THEMES

- Security affects all kinds of technologies
 - Embedded
 - Cyber-physical
 - Public infrastructure

THEMES


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 - Cyber-physical
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- Attacks can be creative and subtle

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THEMES

- Security affects all kinds of technologies
 - Embedded
 - Cyber-physical
 - Public infrastructure
- Attacks can be creative and subtle
- Risks to users are varied
- (Security is really neat)



How can we communicate these kinds of issues to users, managers, (current and future) developers, computer science students...?

APPROACH: A GAME

- Games
 - Can be fun → engagement
 - Casual → explore ideas
 - Entertainment → voluntary play

APPROACH: A GAME

- Games
 - Can be fun → engagement
 - Casual → explore ideas
 - Entertainment → voluntary play
- Physical games
 - Can be left around
 - Suitable for social gatherings
 - No resource dependencies

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- Physical games
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Prioritized Fun > Education

WHAT WE DID

1. Designed and produced a game



WHAT WE DID

1. Designed and produced a game

2. Evaluated its usage in educational contexts



Keen to Engage?	Engaged?

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Not appropriate content

Would Use Again	Would Suggest to Others

DEVELOPING MECHANICS

- We are not game designers
- *Ninja Burger* from Steve Jackson Games



DEVELOPMENT PROCESS

- Writing Card Text (16 Hacker cards, 56 Mission cards, 72 Entropy cards)

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 - Humor/Enjoyment

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 - Humor/Enjoyment
 - Mapping Game Mechanics

DEVELOPMENT PROCESS

- Writing Card Text (16 Hacker cards, 56 Mission cards, 72 Entropy cards)
 - (Accurate) technical content
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 - Brevity
 - Humor/Enjoyment
 - Mapping Game Mechanics
- Art and Graphic Design

DEVELOPMENT PROCESS

- Writing Card Text (16 Hacker cards, 56 Mission cards, 72 Entropy cards)
 - (Accurate) technical content
 - Comprehensibility
 - Brevity
 - Humor/Enjoyment
 - Mapping Game Mechanics
- Art and Graphic Design
- Playtesting, Production...



CONTROL-ALT HACK™
WHITE HAT HACKING FOR FUN AND PROFIT

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WHITE HAT HACKING FOR FUN AND PROFIT

FRANZI

ROXANI

KARL

ENTROPY

MISSION

ATTENDANCE

1
HACKER CRED

5
HACKER CRED

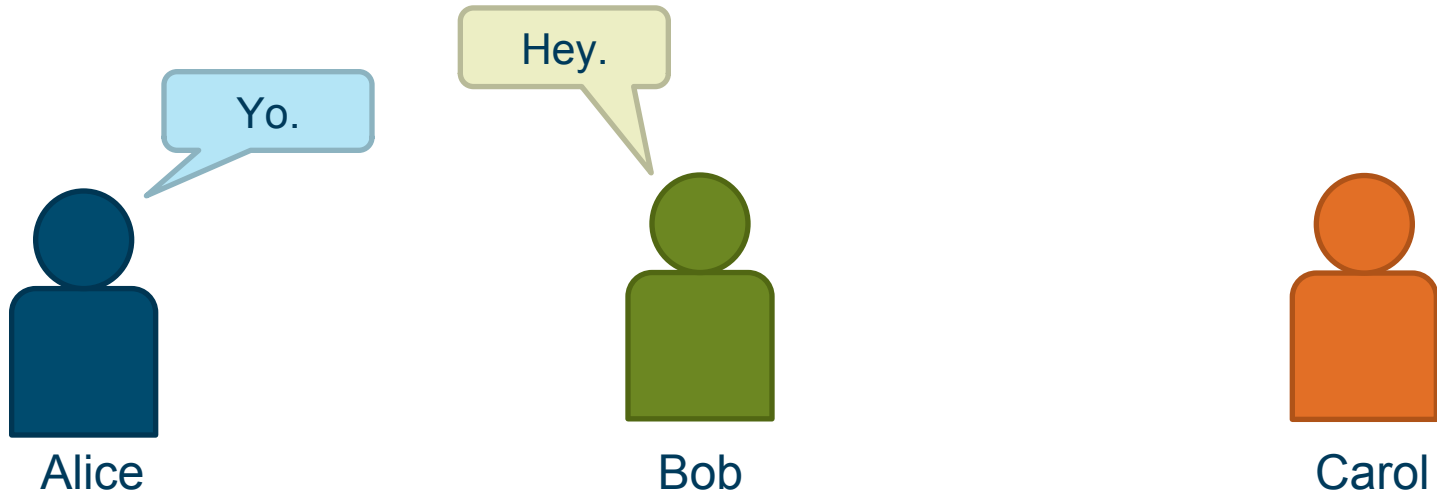
\$2K

\$1K

\$1K

\$50K

Alice, Bob, and Carol are playing.





DEBORAH



TOPE

HARDWARE HACKING

10

CRYPTANALYSIS

11

SEARCH FU

11

NETWORK NINJA

11

SOCIAL ENGINEERING

11

SOFTWARE WIZARDRY

10

CRYPTANALYSIS

11

SEARCH FU

9

KITCHEN SINK

11

SOCIAL ENGINEERING

11

SOFTWARE WIZARDRY

11

HARDWARE HACKING

11

NETWORK NINJA

11

SOCIAL ENGINEERING

11

SOFTWARE WIZARDRY

9

CRYPTANALYSIS

12

BARISTA

10

KITCHEN SINK

Once per turn, she may substitute any one skill for any other skill. This substitution only applies to one task.



Alice



Bob



Carol

He normally gets \$3K at the beginning of each round (instead of \$2K).

As a connoisseur of relaxation (there's nothing better than a Saturday afternoon!), Deb knows how to challenge head-on when there's work to be done.

Gabriel is a professional chef and always brings an awful lot of...

Tope is as passionate about elegant code as he is about elegant music. He has regular gigs playing acoustic guitar at local lounges.

DEBORAH

10

CRYPTANALYSIS

11

SEARCH FU

11

NETWORK NINJA

11

SOCIAL ENGINEERING

11

SOFTWARE WIZARDRY

Once per turn, she may substitute any one skill for any other skill. This substitution only applies to one task.

GABRIEL

10

CRYPTANALYSIS

11

SEARCH FU

11

NETWORK NINJA

11

SOCIAL ENGINEERING

11

SOFTWARE WIZARDRY

He normally draws two Mission cards and chooses which one he wants to use. If he comes to the Staff Mission Conference, he may look at the other players' assigned Missions before he decides. The other chosen Mission is discarded.

TOPE

11

HARDWARE HACKING

11

NETWORK NINJA

11

SOCIAL ENGINEERING

11

SOFTWARE WIZARDRY

He normally gets \$3K at the beginning of each round (instead of \$2K).

Everyone gets: 3 Entropy Cards, 1 Not Attending Card, and 6 Hacker Cred.



Alice



Bob



Carol



Ready to start playing...



Alice

5 HACKER CRED
1 HACKER CRED



Bob

5 HACKER CRED
1 HACKER CRED



Carol

5 HACKER CRED
1 HACKER CRED



DEBORAH

12	12	12
10	11	11
11	9	9
10	9	9

Once per turn, after my substitute any one skill for any other skill. This substitution only applies to one task.

As a consequence of Deborah's shifting loyalties, when a task may be a liability afterward, she knows better than to take a challenge based on other people's workarounds.

[ENTROPY-0] [CRED]



ENTROPY

ATTI

ATTENDANCE



GABRIEL

13	12	8
10	14	14
8	9	9
10	9	9

He normally drives two Mission cards and chooses which one he wants to use. If he comes to the Staff Mission Conference, he may look at the other players' assigned Missions before he decides. The other chosen Mission is discarded.

Being, often, breaking, getting...Gabriel craves about food. He's always bringing his latest creation to the office, and gets as excited as if he's a child.

[ENTROPY-0] [CRED]



ENTROPY

ATTI

ATTENDANCE



TOPE

11	12	9
11	12	12
11	10	10
11	9	9

He normally gets 50% of the beginning of each round (payment of 50%).

Tope is an passionate about music so he is about always make the fun regular play playing the acoustic guitar at local hangouts.

[ENTROPY-0] [CRED]



ENTROPY

ATTI

ATTENDANCE

Round 1

Phase 1: Distribute Money and Draw Entropy Cards.

Alice: 5 HACKER CRED, 1 HACKER CRED

Bob: 5 HACKER CRED, 1 HACKER CRED

Carol: 5 HACKER CRED, 1 HACKER CRED

Resources: \$1k, \$200, \$100, \$50, \$20, \$10, \$5, \$2, \$1; ENTROPY cards

Carol's speech bubble: w00t.

DEBORAH

12	12
10	11
11	9
15	

Skills: NETWORKING, CONFIDENTIALITY, NETWORK SKILL, SEARCH FU, SOCIAL ENGINEERING, NETWORK GUY, SOFTWARE REVISION

Blaze per hour, after they substitute any one skill for any other skill. This substitution only applies to one task.

As a consequence of Deborah's not being better than a boy, say on a Saturday afternoon, she knows better than to take a challenge head-on when there's a workweek.

[ENTROPY-0] [CRED]

ENTROPY

ATTI

ATTENDANCE

GABRIEL

13	8
10	14
8	9
15	

Skills: NETWORKING, CONFIDENTIALITY, NETWORK SKILL, LOCKPOCKING, SOCIAL ENGINEERING, NETWORK GUY, SOFTWARE REVISION

He normally draws two Mission cards and chooses which one he wants to use. If he comes to the Staff Writer Conference, he may look at the other player's assigned Mission before he decides. The other player's Mission is discarded.

Being, communicating, knowing, getting—Gabriel craves about food. He's always bringing his salad (made by the office, and gets as good as a good salad).

[ENTROPY-0] [CRED]

ENTROPY

ATTI

ATTENDANCE

TOPE

11	9
11	12
11	10
11	

Skills: NETWORKING, CONFIDENTIALITY, NETWORK SKILL, BURSTING, SOCIAL ENGINEERING, NETWORK GUY, SOFTWARE REVISION

He normally gets \$20 at the beginning of each round (instead of \$25).

Tope is an passionate about music so he is about always make the his regular play during the annual guide at local venues.

[ENTROPY-0] [CRED]

ENTROPY

ATTI

ATTENDANCE

Phase 2: Draw Mission Cards.



\$2K

Alice

5 HACKER CRED

1 HACKER CRED

\$2K

Bob

5 HACKER CRED

1 HACKER CRED

\$2K

\$1K

Carol

5 HACKER CRED

1 HACKER CRED

DEBORAH

12	12	12	12
10	10	10	10
11	11	11	11
10	10	10	10

She's per form, she may substitute any one skill for any other skill. This substitution only applies to one task.

As a consequence of Deborah's skill level, she may not be able to complete a task on a Saturday afternoon. She knows better than to take a challenge head-on when there's a workweek.

[ATTENDANCE] [ENTROPY]



GABRIEL

13	13	13	13
10	10	10	10
11	11	11	11
10	10	10	10

He normally draws two Mission cards and chooses which one he wants to use. If he comes to the Staff Skills Conference, he may look at the other players' assigned Missions before he decides. The other chosen Mission is discarded.

Being, often, breaking, breaking, getting—Gabriel craves about food. He's always bringing his latest creation to the office, and gets as excited as if it's a great creation.

[ATTENDANCE] [ENTROPY]



TOPE

11	11	11	11
11	11	11	11
11	11	11	11
11	11	11	11

He normally gets \$2K at the beginning of each round (instead of \$1K).

Tope is an passionate about music so he is about always make the best regular play playing the acoustic guitar at his hangout.

[ATTENDANCE] [ENTROPY]





ATTENDING

If you choose to attend the Staff Video Conference, play this card face down during Phase 2.

If you attend the Staff Video Conference, you:

- > draw an additional Entropy card.
- > may trade or bargain with other players to exchange Missions.
- > may be stuck with a Newb Job, if you have a low Hacker Cred score (see rules).
- > may push your Newb Job onto a player with a low Hacker Cred score (see rules).

If you are the only player who attends the Staff Video Conference, you also get one free re-roll during your Mission.

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NOT ATTENDING

If you choose to NOT attend the Staff Video Conference (and instead have “connectivity issues”), play this card face down during Phase 2.

If you do not attend the Staff Video Conference, you get one free re-roll during your Mission.

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\$2K



Alice



5 HACKER CRED

1 HACKER CRED



\$2K



Bob



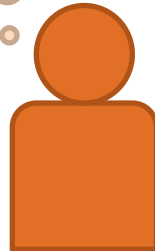
5 HACKER CRED

1 HACKER CRED



\$1K

\$2K



Carol



5 HACKER CRED

1 HACKER CRED

DEBORAH

12	12	12	12
12	12	12	12
11	11	11	11
10	10	10	10

She's a combination of Deborah's stuffy father and a boy who's a bit of a rebel. She's more than just a challenge to her father's authority.

[ENTROPY] [ATTI] [CRED]



GABRIEL

12	12	12	12
12	12	12	12
11	11	11	11
10	10	10	10

He normally drives two Mission cards and always uses the cards to work if he comes to the Staff Mission Conference, he may look at the other player's assigned Mission before he decides. The other player's Mission is discarded.

[ENTROPY] [ATTI] [CRED]



TOPE

11	11	11	11
11	11	11	11
11	11	11	11
11	11	11	11

He normally gets \$2K at the beginning of each round (instead of \$1K).

[ENTROPY] [ATTI] [CRED]



Phase 3: Staffing Conference.



Trade Me!

No.

Alice

\$2K

5 HACKER CRED
1 HACKER CRED

ATTENDANCE MISSION

Bob

\$2K

5 HACKER CRED
1 HACKER CRED

NOT ATTENDING MISSION

Carol

\$2K

\$1K

5 HACKER CRED
1 HACKER CRED

ATTENDANCE MISSION

DEBORAH

12	HARDWARE HACKING	12	0	0	0
10	NETWORKING	11	1	1	0
11	SOCIAL ENGINEERING	10	0	0	0
05	SOFTWARE SECURITY	0	0	0	0

She's perky, but she may substitute any one skill for any other skill. This substitution only applies to one task.

As a consequence of Deborah's snafu, nothing better than a 100% hit on a Saturday afternoon. She knows better than to take a challenge head-on when there's a workweek.

[ENTROPY-01] [CRED]



GABRIEL

13	HARDWARE HACKING	12	0	0	0
10	NETWORKING	11	1	1	0
0	SOCIAL ENGINEERING	0	0	0	0
05	SOFTWARE SECURITY	0	0	0	0

He normally drives two Mission cards and chooses which one he wants to use. If he comes to the Staffing Conference, he may look at the other players' assigned Missions before he decides. The other chosen Mission is discarded.

Being, unfortunately, looking, getting...Gabriel craves about food. He's always bringing his latest creation to the office, and gets as excited as if it's a good creation.

[ENTROPY-01] [CRED]



TOPE

11	HARDWARE HACKING	12	0	0	0
11	NETWORKING	11	1	1	0
11	SOCIAL ENGINEERING	10	0	0	0
05	SOFTWARE SECURITY	0	0	0	0

He normally gets \$2K at the beginning of each round (instead of \$1K).

Tope is a passionate about music so he is about always make the best regular play during the annual guide at local venues.

[ENTROPY-01] [CRED]





rand()

Phase 4: The Missions (Player Turns).

7

Alice

\$2K

14

Bob

\$2K

12

Carol

\$2K

\$1K

DEBORAH

12	12
10	11
11	9
10	10

ENTROPY

GABRIEL

13	8
10	14
8	10
10	10

ENTROPY

TOPE

11	9
11	12
11	10
11	10

ENTROPY

MISSION

Blind Trust

Sometimes you think people will install any phone app, no matter where it comes from.
Time for an experiment.

SOFTWARE WIZARDRY

Write a game that secretly takes a photo every 30 minutes. (As a white hat, you play nice, so don't upload them!)

SOCIAL ENGINEERING

What would make your game popular? Pigs? Birds? Kittens? Chainsaws?

Success: They may have trusted you, but your app isn't so blind. Some of those photos could be really, um, interesting.

+1 Hacker Cred

Failure: You released a Trojan app—what were you thinking? **-1 Hacker Cred**



Alice

5
HACKER
CRED

1
HACKER
CRED

\$2K



Carol

5
HACKER
CRED

1
HACKER
CRED

\$2K

\$1K



LIGHTNING STRIKES

P

Play this card on a rival starting a Mission, before *any* die rolls are made. This card cannot be played on a player with a Newb Job.

Got a Date

You met someone charming! Get a last-minute reservation for tonight's date at that amazing Thai place.

Roll vs. 🐱 Social Engineering.

Success: Continue with your Mission.

Failure: **-1 Hacker Cred** immediately. Continue with your Mission.

Discard this card after use.

:(



5
HACKER
CRED

1
HACKER
CRED

\$2K

Alice

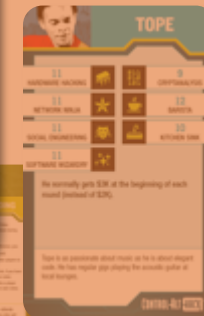


5
HACKER
CRED

1
HACKER
CRED

\$2K

Carol



CONTROL-ALT HACK™



rand()

LIGHTNING STRIKES

DEBORAH



5
HACKER
CRED

1
HACKER
CRED

\$2K

Alice

Play this card on a rival starting a Mission, before *any* die rolls are made. This card cannot be played on a player with a Newb Job.

Got a Date

You met someone charming! Get a last-minute reservation for tonight's date at that amazing Thai place.

Roll vs. 🤖 Social Engineering.

Success: Continue with your Mission.

Failure: -1 Hacker Cred immediately. Continue with your Mission.

Discard this card after use.

12 HARDWARE HACKING	👓	011 010 101	10 CRYPTANALYSIS
10 NETWORK NINJA	★	🔍	11 SEARCH FU
11 SOCIAL ENGINEERING	🤖	🔒	9 KITCHEN SINK
10 SOFTWARE WIZARDRY	🌟		

Once per turn, she may substitute any one skill for any other skill. This substitution only applies to one task.

As a connoisseur of relaxation (there's nothing better than a lazy nap on a Saturday afternoon!), Deb knows better than to face a challenge head-on when there's a workaround.



CONTROL-ALT HACK

CONTROL-ALT HACK

Phase 4: The Missions (Player Turns).

The diagram illustrates the state of three players during Phase 4: The Missions (Player Turns). Each player has a specific amount of money, Hacker Cred, and Entropy, and is associated with a mission card and a set of Entropy cards.

Alice: Represented by a blue figure. She has a blue speech bubble with ":P". She has \$2K, 5 Hacker Cred, and 1 Hacker Cred. Her mission card is crossed out with a large orange 'X'. She has a stack of 5 Entropy cards.

Bob: Represented by a green figure. He has a green speech bubble with ":(" (though the bubble is orange). He has \$2K, 5 Hacker Cred, and 1 Hacker Cred. He has a blue mission card. He has a stack of 5 Entropy cards.

Carol: Represented by an orange figure. She has an orange speech bubble with ":(" (though the bubble is orange). She has \$2K, 5 Hacker Cred, and 1 Hacker Cred. She has a blue mission card. She has a stack of 5 Entropy cards.

Player Cards: Three player cards are shown at the bottom: DEBORAH, GABRIEL, and TOPE. Each card displays various stats and abilities.

Player	Hardware Hacking	Operational	Network Skills	Search FU	Social Engineering	Network Ops	Software Hacking
DEBORAH	12	12	10	11	11	10	10
GABRIEL	13	8	10	14	8	10	10
TOPE	11	9	11	12	11	10	11



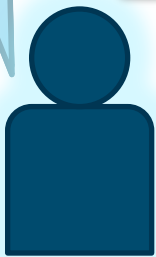
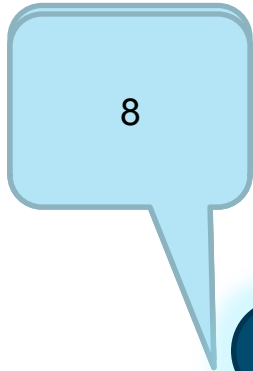
rand()

Phas

MISSION

turn

DEBORAH

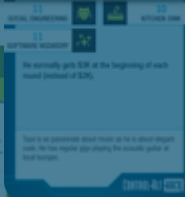


5
HACKER
CRED

1
HACKER
CRED

\$2K

Alice



Blind Trust

Sometimes you think people will install any phone app, no matter where it comes from.
Time for an experiment.

SOFTWARE WIZARDRY

Write a game that secretly takes a photo every 30 minutes. (As a white hat, you play nice, so don't upload them!)

SOCIAL ENGINEERING

What would make your game popular? Pigs? Birds? Kittens? Chainsaws?

Success: They may have trusted you, but your app isn't so blind. Some of those photos could be really, um, interesting.

+1 Hacker Cred

Failure: You released a Trojan app—what were you thinking? **-1 Hacker Cred**

CONTROL-ALT-HACK



12
HARDWARE HACKING



011
010
101

10
CRYPTANALYSIS

10
NETWORK NINJA



11
SEARCH FU

11
SOCIAL ENGINEERING



9
KITCHEN SINK

10
SOFTWARE WIZARDRY



Once per turn, she may substitute any one skill for any other skill. This substitution only applies to one task.

As a connoisseur of relaxation (there's nothing better than a lazy nap on a Saturday afternoon!), Deb knows better than to face a challenge head-on when there's a workaround.

CONTROL-ALT-HACK



rand()

Phas

MISSION

Turn

DEBORAH

10



Alice

5
HACKER
CRED

1
HACKER
CRED

\$2K



Blind Trust

Sometimes you think people will install any phone app, no matter where it comes from.
Time for an experiment.

SOFTWARE WIZARDRY

Write a game that secretly takes a photo every 30 minutes. (As a white hat, you play nice, so don't *upload them!*)

SOCIAL ENGINEERING

What would make your game popular? Pigs? Birds? Kittens? Chainsaws?

Success: They may have trusted you, but your app isn't so blind. Some of those photos could be really, um, interesting.

1 Hacker Cred

Failure: You released a Trojan app—what were you thinking? **-1 Hacker Cred**

CONTROL-ALT-HACK



12
HARDWARE HACKING



011
010
101

10
CRYPTANALYSIS

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NETWORK NINJA



11
SEARCH FU

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SOCIAL ENGINEERING



9
KITCHEN SINK

10
SOFTWARE WIZARDRY



Once per turn, she may substitute any one skill for any other skill. This substitution only applies to one task.

As a connoisseur of relaxation (there's nothing better than a lazy nap on a Saturday afternoon!), Deb knows better than to face a challenge head-on when there's a workaround.

CONTROL-ALT-HACK



Phase 4: The Missions (Player Turns).

ü

5 HACKER CRED
1 HACKER CRED
1 HACKER CRED

\$2K

Alice

☹

5 HACKER CRED
1 HACKER CRED

\$2K

Bob

☹

5 HACKER CRED
1 HACKER CRED

\$2K
\$1K

Carol

DEBORAH

12	12	12
10	11	11
11	9	10
10	10	10

Skills per turn, after they substitute any one skill for any other skill. This substitution only applies to one task.

As a consequence of Deborah's working better than a key tap on a Saturday afternoon, she knows better than to lose a challenge based on other people's workarounds.

[CONTINGENCY CARD]

ENTROPY

MISSION

GABRIEL

13	12	8
10	14	14
8	10	10
10	10	10

He normally drives two Mission cards and chooses which one he wants to use. If he comes to the Staff Water Conference, he may look at the other players' engaged Missions before he decides. The other chosen Mission is discarded.

Being, often, making, knowing, getting—Gabriel craves about food. He's always bringing his latest creation to the office, and gets as excited as if it's a good creation.

[CONTINGENCY CARD]

ENTROPY

MISSION

TOPE

11	12	9
11	12	12
11	10	10
11	10	10

He normally gets \$2K at the beginning of each round (instead of \$1K).

Tope is an passionate about music so he is about always make the his regular play playing the acoustic guitar at his hangout.

[CONTINGENCY CARD]

ENTROPY

MISSION

MISSION

I Hack You a Latte

You're switching it up for this company audit. Tell the front desk that you're opening a new café and want to set up a promotional coffee cart in their lobby.

CONNECTIONS OR WEB PROCUREMENT


Of course, you need actual coffee cart equipment to pull this off.

BARISTA

12oz, non-fat, split-shot, extra-hot, 3-pump mocha with whip. Can you keep all the orders straight?

NETWORK NINJA -1

Plug into their internal wired network when nobody's looking and pwn them.

Success:  **+1 Hacker Cred.** Choose one Bag of Tricks card from your hand or the discards; you can play the item free of charge.

Failure:  **-1 Hacker Cred**

CONTROL-ALT HACK™

Ph



Alice

\$2K

5
HACKER
CRED

1
HACKER
CRED

1
HACKER
CRED

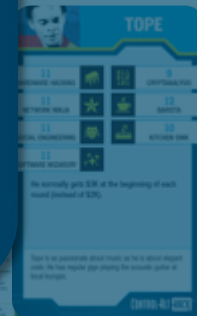


Carol

2K

5
HACKER
CRED

1
HACKER
CRED





rand()

Phase 4: The Missions (Player Turns).

Alice (\$2K, 5 HACKER CRED, 1 HACKER CRED)

Bob (\$2K, 5 HACKER CRED, 1 HACKER CRED, 10)

Carol (\$2K, \$1K, 5 HACKER CRED, 1 HACKER CRED)

DEBORAH (Skills: 12, 10, 11, 10; Entropy: 1)

GABRIEL (Skills: 13, 10, 8, 14; Entropy: 1)

TOPE (Skills: 11, 11, 11, 10; Entropy: 1)



NOT ATTENDING

If you choose to NOT attend the Staff Video Conference (and instead have “connectivity issues”), play this card face down during Phase 2.

If you do not attend the Staff Video Conference, you get one free re-roll during your Mission.

CONTROL-ALT HACK™

Phase



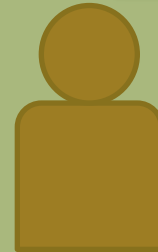
Alice

\$2K

5
HACKER
CRED

1
HACKER
CRED

1
HACKER
CRED



Carol

5
HACKER
CRED

1
HACKER
CRED



MISSION

Shock Value

Is the Pacific Northwest's power grid secure?

SOCIAL ENGINEERING -2

Call the IT desk (“I’m a new employee!”) and con them into giving you the IP (Internet) address of one of their servers.

NETWORK NINJA

Their computers can't be taken down for the standard software update procedures—and that means that you can exploit code that everyone else patched in 1999.

Success: +2 Hacker Cred. The managers are shocked; you aren't.

Failure: -1 Hacker Cred



Alice

\$2K

5
HACKER
CRED

1
HACKER
CRED

1
HACKER
CRED



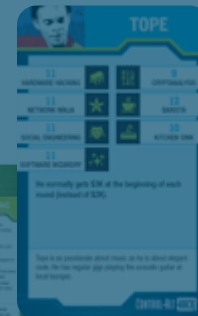
Carol

\$1K

\$2K

5
HACKER
CRED

1
HACKER
CRED



CONTROL-ALT HACK™



BAG OF TRICKS

Magic Lessons

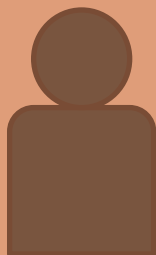
Sleight of hand, distractions, bluffs, fakes—magic has a lot to teach about using misdirection to con people.

Once per turn, you may re-roll a failed Social Engineering roll.

Keep this card in play.

Cost: **\$2K**

CONTROL-ALT HACK™



Alice

\$2K

5
HACKER
CRED

1
HACKER
CRED

1
HACKER
CRED

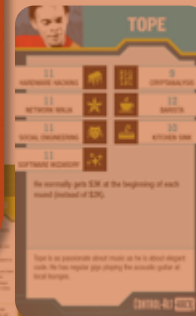


Carol

\$2K

5
HACKER
CRED

1
HACKER
CRED





rand()

Phase 4: The Missions (Player Turns).

\$2K




Alice

5 HACKER CRED

1 HACKER CRED

1 HACKER CRED

\$2K



Bob

5 HACKER CRED

13



Carol

5 HACKER CRED

1 HACKER CRED

\$2K

\$1K



DEBORAH

12	12	12
10	11	11
11	11	10
10	11	10

As a combination of Deborah's own skills and those of her team, she is a formidable force to be reckoned with.



ENTROPY



GABRIEL

13	12	10
10	14	14
10	11	10
10	11	10

He normally drives two Mission cards and chooses which one he wants to use if he comes to the Staff Mission Conference, he may look at the other players' assigned Missions before he decides. The other player's Mission is discarded.



ENTROPY



TOPE

11	11	10
11	12	12
11	11	10
11	11	10

Tope is an opportunist about money as he is about insight into the top regular player the security guide at most targets.



ENTROPY



Phase 4: The Missions (Player Turns).

\$2K




Alice

5 HACKER CRED

1 HACKER CRED

1 HACKER CRED

\$2K



Bob

5 HACKER CRED

\$1K



Carol

5 HACKER CRED

1 HACKER CRED



DEBORAH

12	HACKER CRED	12	CONFIDENTIAL
10	NETWORK SKILL	11	SEARCH FU
11	SOCIAL ENGINEERING	9	NETWORK BORG
20	SOFTWARE RESILIENCE		

Once per turn, after my substitute any one skill for any other skill. This substitution only applies to one task.

As a consequence of Deborah's shifting loyalties, there is a 50% chance of a 50% reduction in her skills. This means that she is less of a challenge to deal with than other players.

[ENTROPY-0] [CRED]



EV 1 ENTROPY

ENTROPY

MISSION



GABRIEL

13	HACKER CRED	12	CONFIDENTIAL
10	NETWORK SKILL	14	LOCKDOWN
9	SOCIAL ENGINEERING	10	NETWORK BORG
20	SOFTWARE RESILIENCE		

He normally drives two Mission cards and chooses which one he wants to use. If he comes to the Staff Water Conference, he may look at the other players' assigned Missions before he decides. The other chosen Mission is discarded.

Being, unfortunately, breaking, getting—Gabriel may about find. He's always bringing the latest updates to the office, and gets on well with all kinds of people.

[ENTROPY-0] [CRED]



EV ENTROPY

ENTROPY

MISSION



TOPE

11	HACKER CRED	12	CONFIDENTIAL
11	NETWORK SKILL	12	BURST
11	SOCIAL ENGINEERING	10	NETWORK BORG
21	SOFTWARE RESILIENCE		

He normally gets 50% of the beginning of each round (instead of 25%).

Tope is an passionate about music so he is about always make the his regular job playing the acoustic guitar at local hangouts.

[ENTROPY-0] [CRED]



ENTROPY

MISSION

CARD TOPICS

- De-anonymization
- Cars
- Medical Devices
- Contactless Payment Systems
- Password Recovery Questions
- Voting Machines
- Anti-censorship
- Botnets
- ...



SYSTEM EVALUATION



SYSTEM EVALUATION

(in educational contexts)

EVALUATION METHODS

1. Educator Feedback Survey Evaluation
2. Direct User Study

EDUCATOR EVALUATION

- Distribution
 - Available for sale online for the general public
 - ~3000 educator copies distributed

EDUCATOR EVALUATION

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 - Available for sale online for the general public
 - ~3000 educator copies distributed

Tamara Denning and Tadayoshi Kohno are founders and equity owners of RGB Hats, LLC, a private, for-profit company which has licensed the subject technology from the University of Washington. This research is subject to the conditions of a financial conflict of interest management plan established by the University of Washington.

EDUCATOR EVALUATION

- Distribution

- Available for sale online for the general public
- ~3000 educator copies distributed



- Recruitment

- Shipped ~800 copies to 150 educators November 2012-March 2013
- 50 copies at SIGCSE (computer education) poster session

EDUCATOR EVALUATION

- 22 educators responded (~15%)
 - >450 students at high school, undergrad, grad levels
 - Computer/information science, computer/information security, game design courses

DATA ANALYSIS

- Survey consisted of:
 - Open-ended questions (primarily)
 - Multiple choice questions

DATA ANALYSIS

- Survey consisted of:
 - Open-ended questions (primarily)
 - Multiple choice questions
- Qualitative Analysis using primary & reliability coder

DATA ANALYSIS

1. Researchers independently review survey responses for themes & propose codes


DATA ANALYSIS

1. Researchers independently review survey responses for themes & propose codes
2. Researchers come to consensus on codes


DATA ANALYSIS

1. Researchers independently review survey responses for themes & propose codes
2. Researchers come to consensus on codes
3. Researchers review interviews in context of codes to judge fit


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DATA ANALYSIS

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1. Researchers independently review survey responses for themes & propose codes
 2. Researchers come to consensus on codes
 3. Researchers review interviews in context of codes to judge fit
 4. Researchers independently code interviews for presence or absence of each code

DATA ANALYSIS

- 
1. Researchers independently review survey responses for themes & propose codes
 2. Researchers come to consensus on codes
 3. Researchers review interviews in context of codes to judge fit
 4. Researchers independently code interviews for presence or absence of each code

“It worked as a way to break the ice and get students from diverse majors get to know [sic] each other and get thinking about the topics of the course.”



Social / Engagement

EVALUATION OVERVIEW

Social / Engagement	Awareness
Blue	Blue
Blue	Blue
Blue	White
Blue	Blue
Blue	Blue
Blue	Blue
Blue	Blue
White	Blue
Blue	White
Blue	Blue
White	White
Blue	Blue
Blue	Blue

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content
Orange	Orange			
Orange				
			Orange	
Orange				
	Orange		Orange	
Orange			Orange	
Orange	Orange			
Orange				
			Orange	
Orange				

Would Use Again	Would Suggest to Others
Green	Green
Green	Green
White	Green
Green	Green
Green	Green
White	Green
Green	Green
Green	Green
White	Green
Green	Green
Green	Green
White	White
Green	Green
Green	Green

Blue	Blue
White	White
White	White
White	White
Blue	White
White	White
White	White
White	White

			Orange	
		Orange	Orange	
Orange				
White			Orange	
Orange			Orange	
White				Orange
Orange				
White		Orange	Orange	

Green	Green
White	White
White	White
Green	Green
White	White
White	White
Green	Green
White	White

EVALUATION OVERVIEW

Social / Engagement	Awareness

Takes a long time to learn	Not enough	Has	Would Use	Would recommend to others

Positive functions served by usage of the game:

- Social/Engagement
- Awareness

EVALUATION OVERVIEW

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

Would Use Again	Would Suggest to Others

Critiques of the game:

- Takes a long time to learn
- Takes a long time to play
- Not enough fun
- Not enough educational value
- Has inappropriate content

EVALUATION OVERVIEW

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

Would Use Again	Would Suggest to Others

Used in classroom

Used out-of classroom (e.g., ACM lounge, staff lunch, vetting for classroom use)

EVALUATION OVERVIEW

Social / Engagement	Awareness
Blue	Blue
Blue	Blue
Blue	White
Blue	Blue
Blue	Blue
Blue	Blue
Blue	Blue
White	Blue
Blue	White
Blue	Blue
White	White
Blue	Blue
Blue	Blue

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content
Orange	Orange	White	White	White
White	White	White	White	White
Orange	White	White	White	White
White	White	White	White	White
White	White	White	Orange	White
Orange	White	White	White	White
White	Orange	White	Orange	White
Orange	White	White	Orange	White
Orange	Orange	White	White	White
White	White	White	White	White
White	White	White	Orange	White
Orange	White	White	White	White
White	White	White	White	White

Would Use Again	Would Suggest to Others
Green	Green
Green	Green
White	Green
Green	Green
White	Green
Green	Green
Green	Green
White	Green
Green	Green
Green	Green
Green	Green
White	Green
Green	Green
Green	Green

Blue	Blue
White	White
White	White
White	White
Blue	White
White	White
White	White
White	White

White	White	White	Orange	White
White	White	Orange	Orange	White
Orange	White	White	White	White
White	White	White	Orange	White
Orange	White	White	Orange	White
White	White	White	White	White
Orange	White	White	White	Orange
White	White	White	White	White
White	White	Orange	Orange	White

Green	Green
White	White
White	White
Green	Green
White	White
White	White
Green	Green
White	White
Green	Green

IN-CLASSROOM

Course	Class Size	Student Level
Information Software Technology	30	HS
Unknown	12	UG
Computer Science	75	HS
Cyber-Security and Information Assurance	56	UG
Computer and Network Security	10	UG, G
Computers and Information Technology	60	HS
Game Design	65	HS
Computer Security	22	UG
IT Security	8	UG
Information Security	15	UG
Intro CS Web Design	35	HS
Cyber Security	2	HS
Fundamentals of Information Security	30	UG
Computer and Network Security	27	UG

IN-CLASSROOM

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

IN-CLASSROOM

Social / Engagement	Awareness
Blue	Blue
Blue	Blue
Blue	White
Blue	Blue
Blue	Blue
Blue	Blue
Blue	Blue
Blue	Blue
White	Blue
Blue	White
Blue	Blue
White	Blue
White	White
Blue	Blue
Blue	Blue

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content
Orange	Orange	White	White	White
White	White	White	White	White
Orange	White	White	White	White
White	White	White	White	White
White	White	White	Orange	White
Orange	White	White	White	White
White	White	White	White	White
White	Orange	White	Orange	White
Orange	White	White	Orange	White
Orange	Orange	White	White	White
Orange	White	White	White	White
White	White	White	White	White
White	White	White	Orange	White
Orange	White	White	White	White
White	White	White	White	White

IN-CLASSROOM

Social / Engagement	Awareness

Social/Engagement

- 11/14 gave responses interpreted as providing evidence of “social/engagement” function
- 27 undergraduates, Computer and Network Security:
“I just wanted to reiterate how great my students thought the game was! The students begged me to leave the game in the student lounge so they could continue to play, and from what I hear it’s made a trip or two out to our weekly majors night at the pub.”

IN-CLASSROOM

Social / Engagement	Awareness

Awareness

- 11/14 gave responses interpreted as providing evidence of “awareness” function

- 60 high school students, Computers and Information Technology:

“The game did not necessarily teach security methods, but it did a great job of teaching vocabulary and literacy.” ...“It increased awareness of my program, and it got more students interested in computer science.”

IN-CLASSROOM

Social / Engagement	Awareness	Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

IN-CLASSROOM

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

EVALUATION OVERVIEW

Social / Engagement	Awareness
Blue	Blue
Blue	Blue
Blue	White
Blue	Blue
Blue	Blue
Blue	Blue
Blue	Blue
White	Blue
Blue	White
Blue	Blue
White	White
White	White
Blue	Blue
Blue	Blue

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content
Orange	Orange	White	White	White
White	White	White	White	White
Orange	White	White	White	White
White	White	White	White	White
White	White	White	Orange	White
Orange	White	White	White	White
White	White	White	White	White
White	Orange	White	Orange	White
Orange	White	White	Orange	White
Orange	Orange	White	White	White
White	White	White	White	White
White	White	White	Orange	White
Orange	White	White	White	White
White	White	White	White	White
White	White	White	White	White

Would Use Again	Would Suggest to Others
Green	Green
Green	Green
White	Green
Green	Green
White	Green
Green	Green
Green	Green
White	Green
Green	Green
Green	Green
White	Green
Green	Green
White	Green
Green	Green
Green	Green

Blue	Blue
White	White
White	White
White	White
Blue	White
White	White
White	White
White	White

White	White	White	Orange	White
White	White	Orange	Orange	White
Orange	White	White	White	White
White	White	White	Orange	White
Orange	White	White	Orange	White
White	White	White	White	White
Orange	White	White	White	Orange
White	White	White	White	White
White	White	Orange	Orange	White

Green	Green
White	White
White	White
Green	Green
White	White
White	White
Green	Green
White	White
White	White

OUT-OF-CLASSROOM

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

OUT-OF-CLASSROOM

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

OUT-OF-CLASSROOM

Social / Engagement	Awareness

- ACM play session with undergrads
- Instructor vetting with graduate students, faculty, staff
- Staff lunch
- Available to take home as a checkout
- Instructor vetting (4)

OUT-OF-CLASSROOM

Social / Engagement	Awareness

Takes a long time to learn	Takes a long time to play	Not enough fun	Not enough educational value	Has inappropriate content

OUT-OF-CLASSROOM

Not enough educational value

“The game could use more specificity around computer activity. My students were hoping for a higher level of rigor.”

Mismatched Expectations /
Chose Not to Use

	Not enough educational value	Has inappropriate content
Not enough n		

SUMMARY

- Designed and produced a recreational game created to implicitly increase awareness of computer security
- ~3000 educational copies distributed
- Evaluated via analysis of educator surveys
 - ↑ Awareness
 - ↑ Engagement
 - Critiques reflected design-time tradeoff decisions
 - Potentially reached new audiences

THANKS TO!



Questions?

Tamara Denning

<http://www.cs.washington.edu/homes/tdenning/>

