Why Don’t People Use Two Factor?

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Why Not Adopt?

- People do not care about the risk
- People do not know about the risk
  - But would care
- People know and care
  - But cannot use

Testing the Possibilities

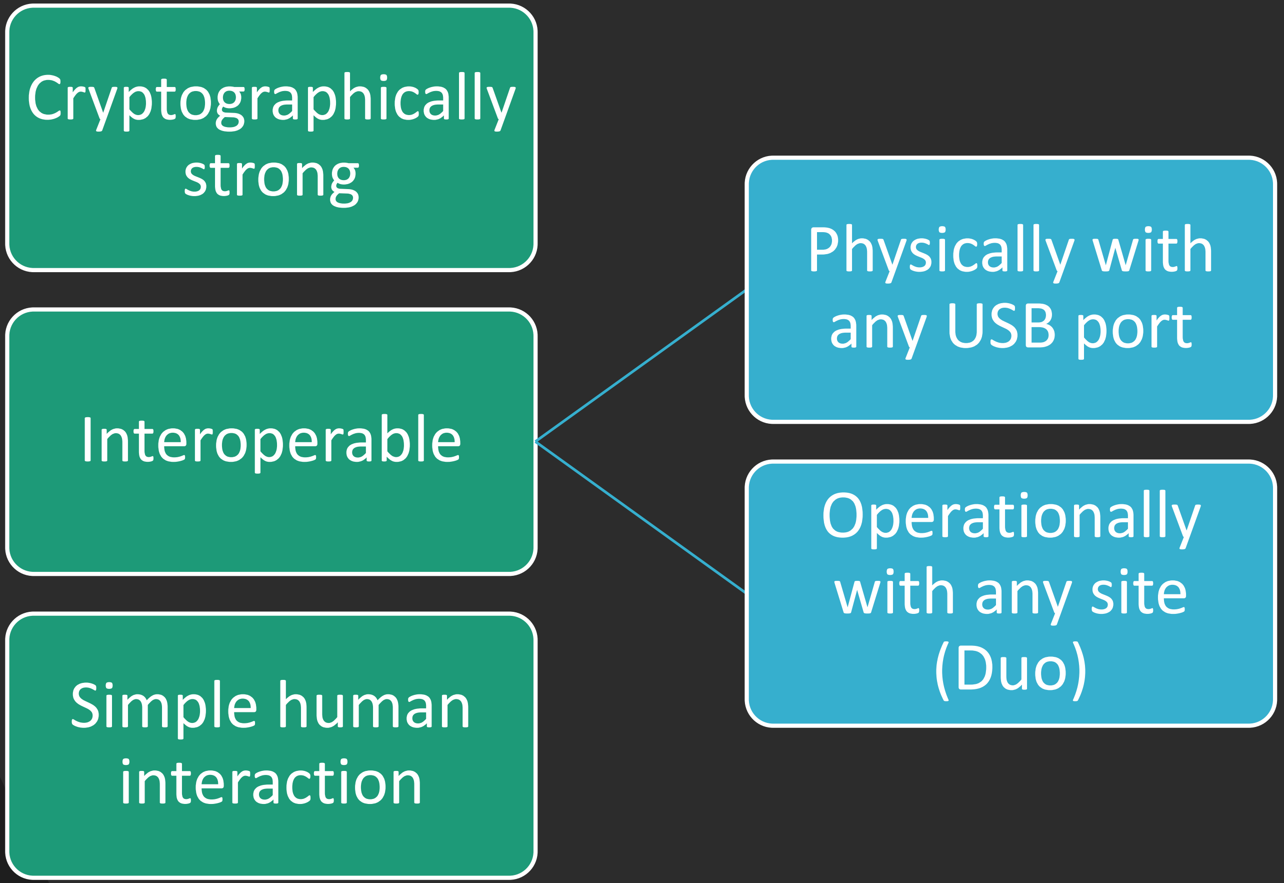
Don’t care?
Communicate the benefits.

Don’t know? Communicate the risks.

Can’t use?
Usable design and guidance

A Physical Token to Control Account Access

Yubico Security Keys



Cryptographically strong

Interoperable

Simple human interaction

Physically with any USB port

Operationally with any site (Duo)

Usability and Acceptability

Usability Checklist for Security: Norcie & Camp

- Installation procedes operation
- Ensure acurate awareness of trade-offs
- Say why, not how

Usability Checklist: Molich & Neilson

- Simple, natural dialogues
- Speaker the user’s language
- Minimize the memory load
- Be consistent
- Provide Feedback
- Clearly Mark exits
- Shortcuts
- Good error messages

Checklist for 2FA: Stajano

- Secure
- Memoryless
- Scalable
- Loss resistant
- Theft resistant

- Security key does introduce a physical burden, it is lightweight, and is physically effortless

Lang et al. refer to the use of a security key as “**brainless**”

Juan Lang et al. “Security Keys: Practical Cryptographic Second Factors for the Modern Web”. In: Financial Cryptography and Data Security. Financial Cryptography and Data Security. (Accra Beach Hotel & Spa, Barbados, Feb. 22–26, 2016). International Financial Cryptography Association. Feb. 2016. url: http://fc16.ifca.ai/preproceedings/25_ Lang.pdf.
Juan Lang et al. Security Keys: Practical Cryptographic Second Factors for the Modern Web. 2016

On Methods

Methods for Usability Evaluations

- Cognitive Walkthrough
- Facilitated Brainstorming
- Focus Group

Method: Cognitive Walkthrough

- The designer pretends to be a user
  - Are the correct options visible and available?
  - What is required of the user to find the options?
  - How are the options associated with the goal?
  - Are the correct actions clear?
  - Do the correct actions illustrate progress towards the goal?
  - Are there stop points?
- Generate success and failure cases

Method: Facilitated Brainstorming

- Can include designers and users
- Pretend to be user
- Use and refine
- Both for research protocols and products

Method: Focus Group

- Not the designers!
- Concerns of designers
- Test technology
- Refine experimental protocol
- Source for survey questions

Method: Think Aloud Protocol

- Task analysis
  - Ask what they are doing
  - Identify stop points
  - Mitigate & continue
- Ideally matches your cognitive walk-though
  - Never actually will

Method: Interviews

- Open discussion
- Question and answer
- Closed: pre-determined questions
- Open: questions arise during interview

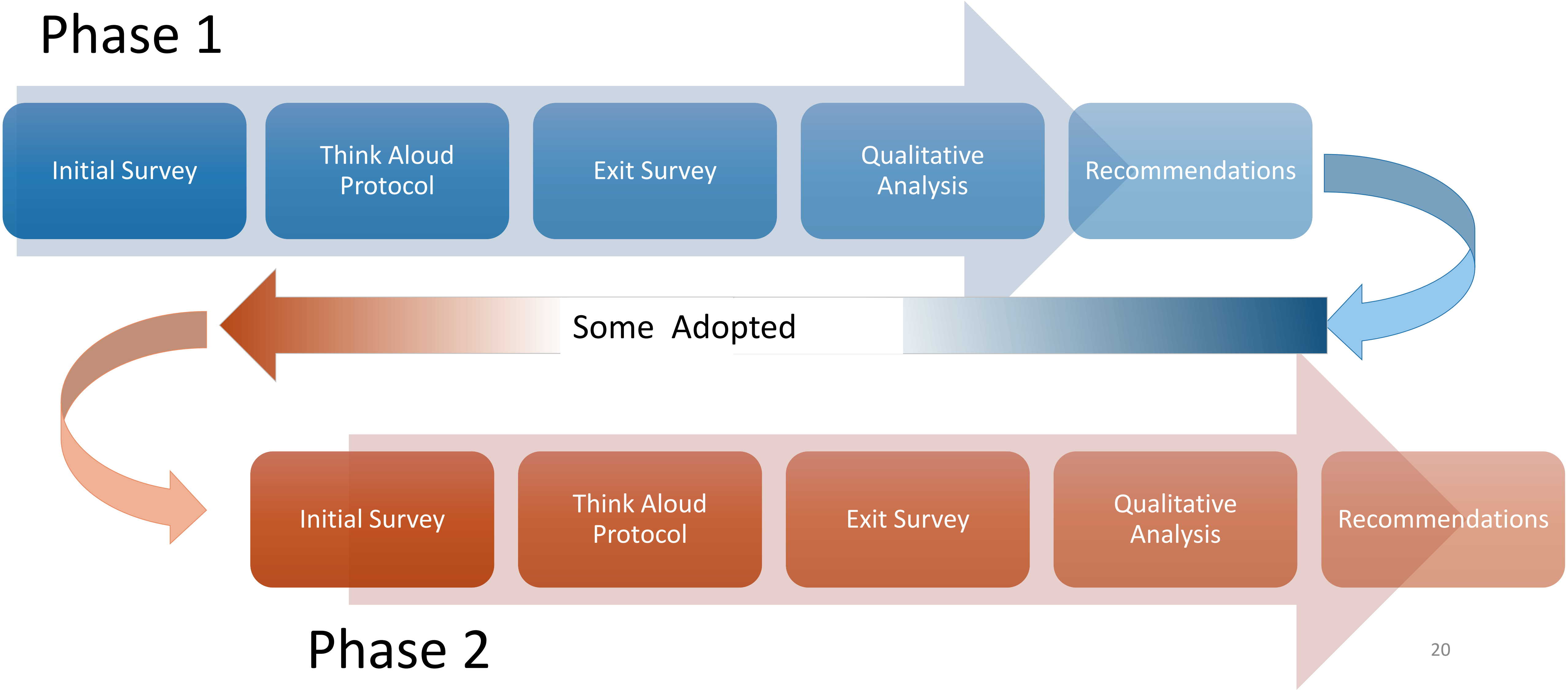
Lost and Confused

Two Phases

Phase-I

Phase-II

Identical Experimental Protocol



Phase 1

Initial Survey

Think Aloud Protocol

Exit Survey

Qualitative Analysis

Recommendations

Some Adopted

Initial Survey

Think Aloud Protocol

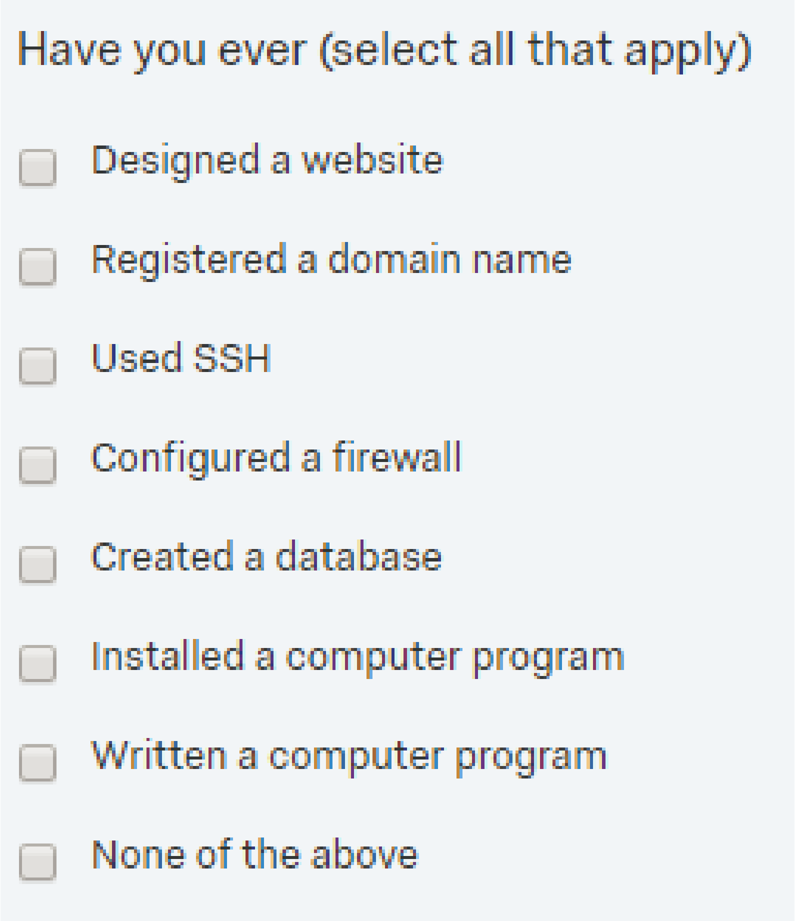
Exit Survey

Qualitative Analysis

Recommendations

Phase 2

Pre-survey Expertise, Demographics, Experience



Have you ever (select all that apply)

□ Designed a website

□ Registered a domain name

□ Used SSH

□ Configured a firewall

□ Created a database

□ Installed a computer program

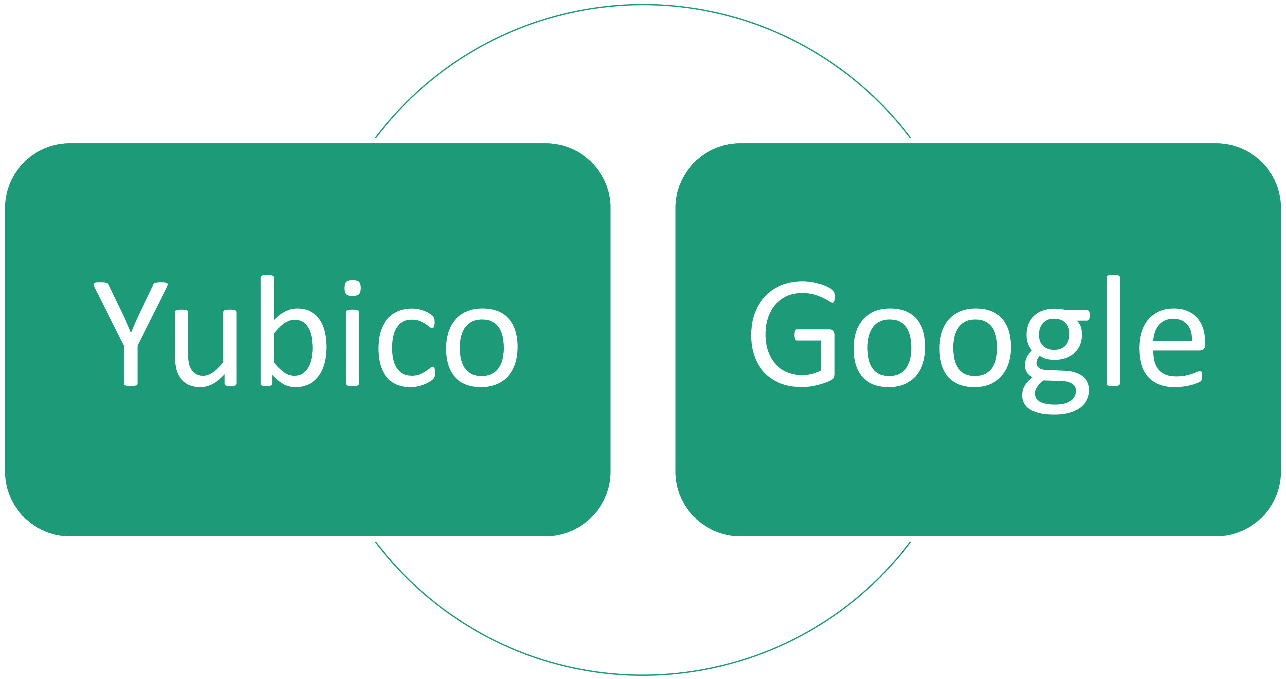
□ Written a computer program

□ None of the above

- I often ask others for help with the computer.
- Do you know any computer programming languages?
- Have you ever suffered data loss for any reason? (ex. Hacking, data corruption, hard drive failure.)

Rajivan, P., Moriano, P., Kelley, T., & Camp, L. J. (2016). What Can Johnny Do?–Factors in an End-User Expertise Instrument. In *HAISA* (pp. 199-208).

Instructions



Yubico

Google

Reasons for the interview

Participant perceptions of key utility

Ensure that we would not harm the participants by locking them out of their accounts

Ensure that they had the contact information of the team and a specific researcher before they left

Offer them the security keys as a token of appreciation for their participation

Follow-up Survey

No one responded or showed any sign of using the Yubico security keys

Many discarded the security keys after the survey

They discussed they do not find any value by using the keys to secure their accounts

Participant Choices

- Participants dropped keys into handy “free stuff” bin
- None reported continuing use after the study

Participant Evaluation

People Don’t Know

“No, my password is secure enough and alerts are active.”

“Why is it still asking for a password?”

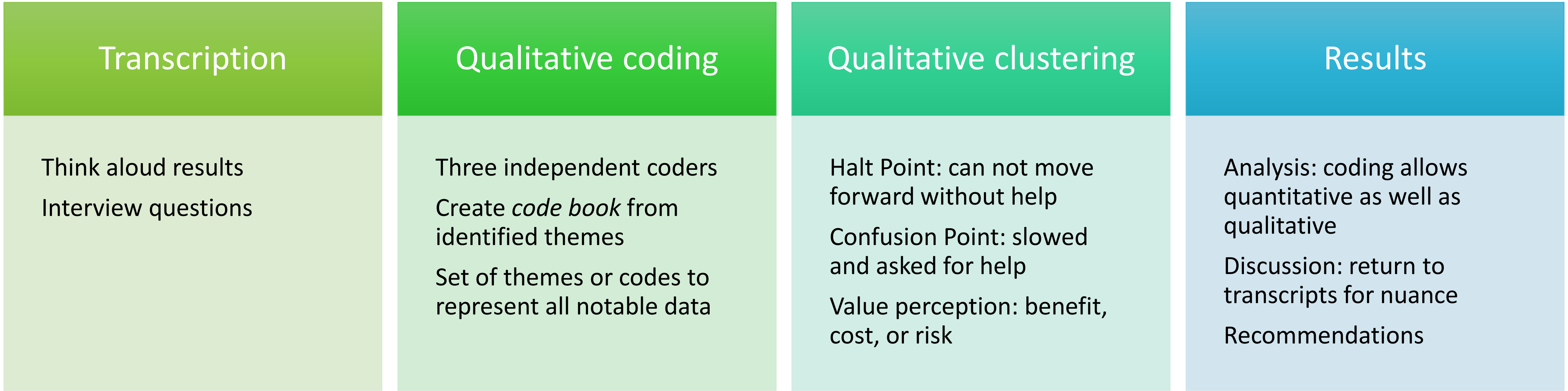
“use it out of curiosity, [as it] might not be practical.”

well… I don’t really understand the point of the key if I still need to enter my username and password.”

“Probably not [on] gmail is not important. Would have used for work”.

“For my use, No, it is inconvenient to use. The reason is that I don’t have any sensitive information.”

Analysis



Transcription

- Think aloud results
- Interview questions

Qualitative coding

- Three independent coders
- Create *code book* from identified themes
- Set of themes or codes to represent all notable data

Qualitative clustering

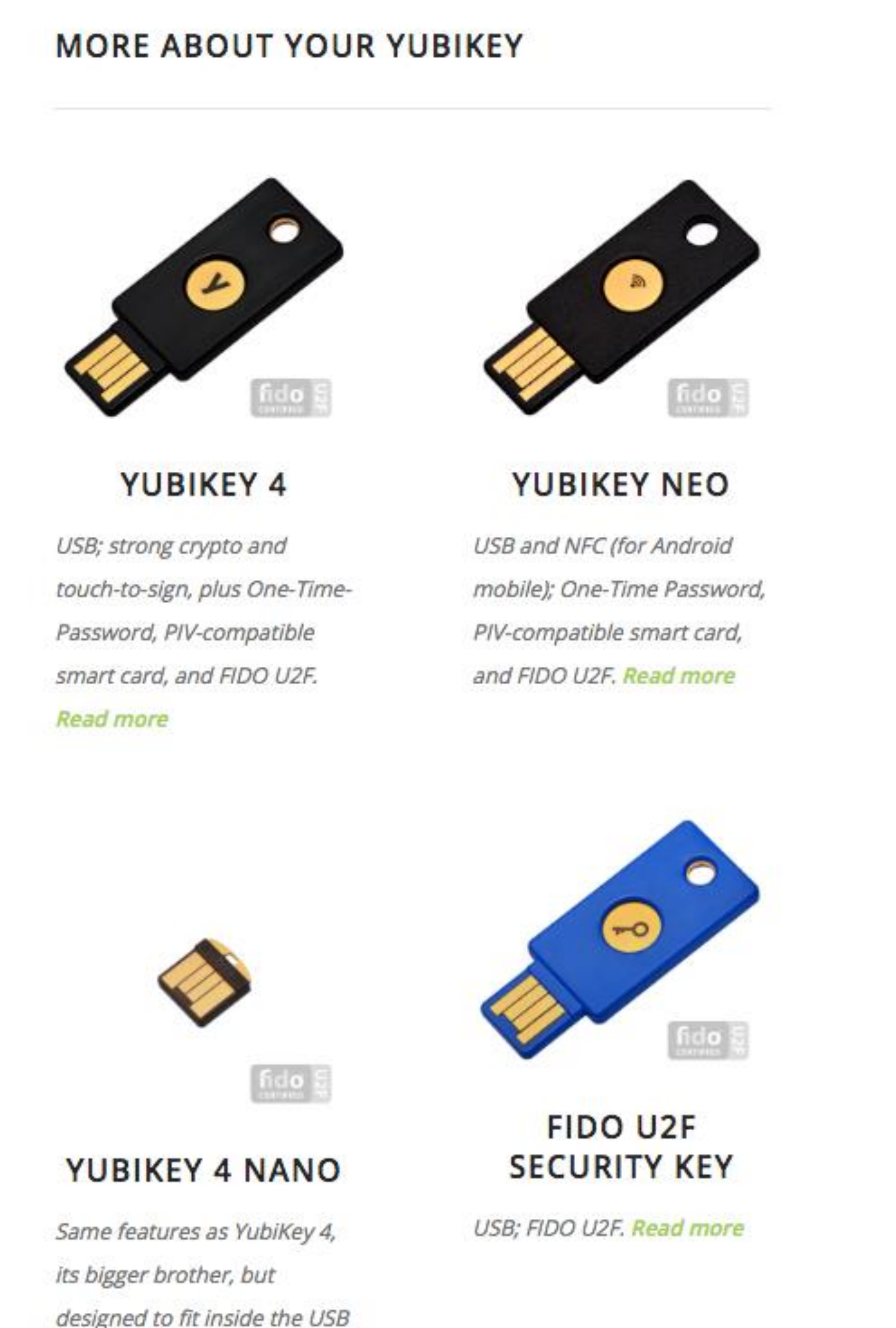
- Halt Point: can not move forward without help
- Confusion Point: slowed and asked for help
- Value perception: benefit, cost, or risk

Results

- Analysis: coding allows quantitative as well as qualitative
- Discussion: return to transcripts for nuance
- Recommendations

Recommendations

Phase- I security key comparisons



MORE ABOUT YOUR YUBIKEY

YUBIKEY 4

USB; strong crypto and touch-to-sign, plus One-Time-Password, PIV-compatible smart card, and FIDO U2F. Read more

YUBIKEY NEO

USB and NFC (for Android mobile); One-Time Password, PIV-compatible smart card, and FIDO U2F. Read more

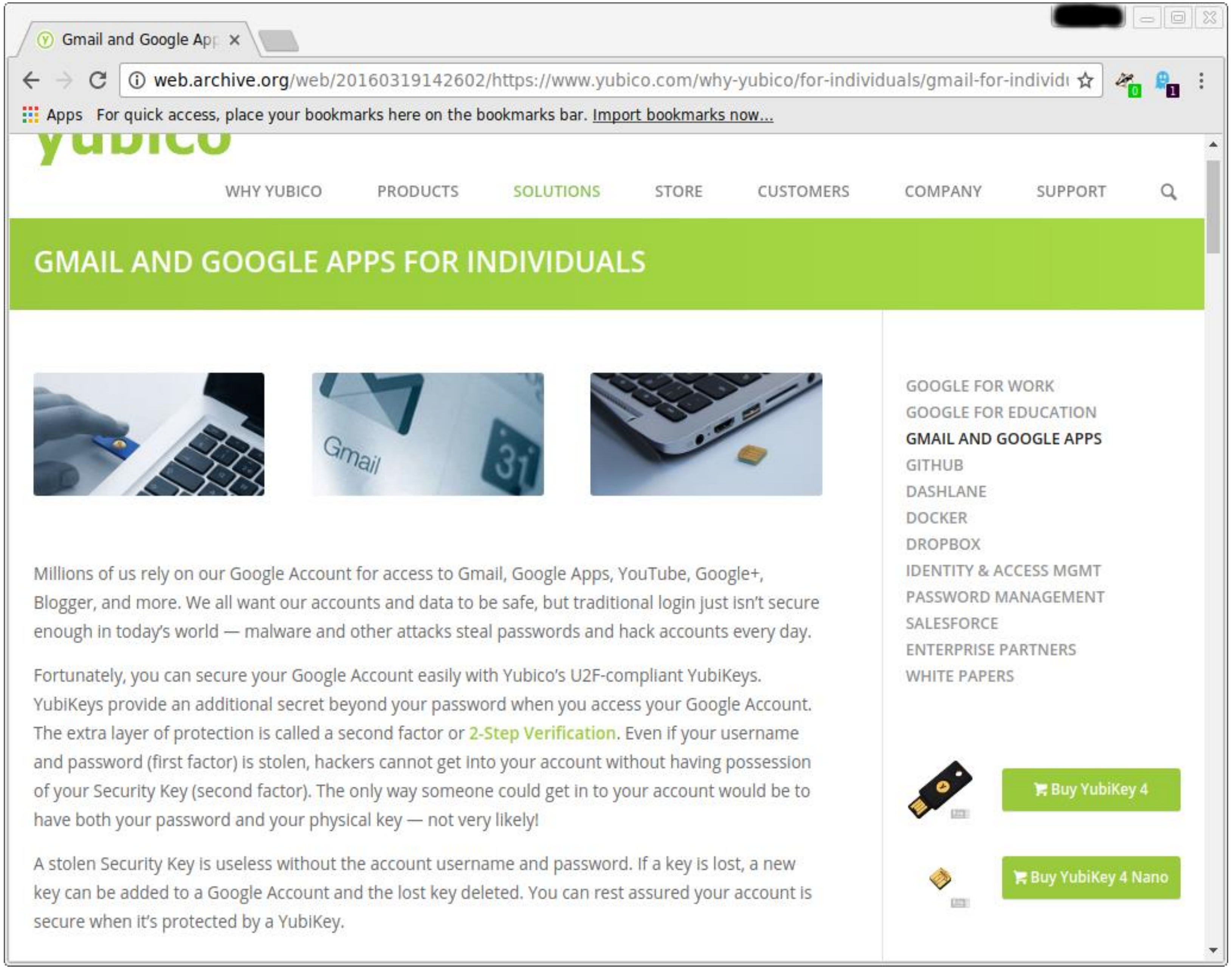
YUBIKEY 4 NANO

Same features as YubiKey 4, its bigger brother, but designed to fit inside the USB

FIDO U2F SECURITY KEY

USB; FIDO U2F. Read more

Old Setup Instructions



GMAIL AND GOOGLE APPS FOR INDIVIDUALS

Millions of us rely on our Google Account for access to Gmail, Google Apps, YouTube, Google+, Blogger, and more. We all want our accounts and data to be safe, but traditional login just isn't secure enough in today's world — malware and other attacks steal passwords and hack accounts every day.

Fortunately, you can secure your Google Account easily with Yubico's U2F-compliant YubiKeys. YubiKeys provide an additional secret beyond your password when you access your Google Account. The extra layer of protection is called a second factor or 2-Step Verification. Even if your username and password (first factor) is stolen, hackers cannot get into your account without having possession of your Security Key (second factor). The only way someone could get in to your account would be to have both your password and your physical key — not very likely!

A stolen Security Key is useless without the account username and password. If a key is lost, a new key can be added to a Google Account and the lost key deleted. You can rest assured your account is secure when it's protected by a YubiKey.

The Yubico security key is a 2FA device designed to be user friendly. We examined the usability of the device by implementing a think-aloud protoco and documented the halt and confusion points. We provided this analysis to Yubico, who implemented many of the recommended changes. We the repeated the study in the same context; noting significant improvements in usability. However, increase in usability did not affect the acceptability o the device, affecting the prolonged usage of the device. In both phases we interviewed the study participants about the acceptability of the device, finding similar concerns about lack of benefits and the invisibility of risk. A source of opposition to adoption is the concern for loss of access, with participants prioritizing availability over confidentiality. Another concern is that these do not lessen or simplify interaction with services as passwor are still required. We close with open questions for additional research, and further recommendations to encourage online safety through the adoption of 2FA.

We analyzed acceptability and usability of the Yubico security key, a Two Factor Authentication (2FA) hardware token implementing FIDO. This toker has notable usability attributes: tactile interaction, convenient form factor, physical resilience, and the design goal of ease of use. Despite the Yubico security key being among best in class for usability, participants in a think-aloud protocol still encountered several difficulties in use. Based on these findings, we proposed design changes, some of which Yubico adopted. We repeated the experiment, showing that these recommendations enhanced ease of use but not necessarily acceptability. With the primary halt points mitigated, we could identify the principal remaining reasons fo rejecting 2FA. These reasons were the fear of losing the device and perceptions that there is no individual risk of account takeover. Our results illustrate both the importance and limits of usability on acceptability, adoption, and adherence in two-factor authentication.

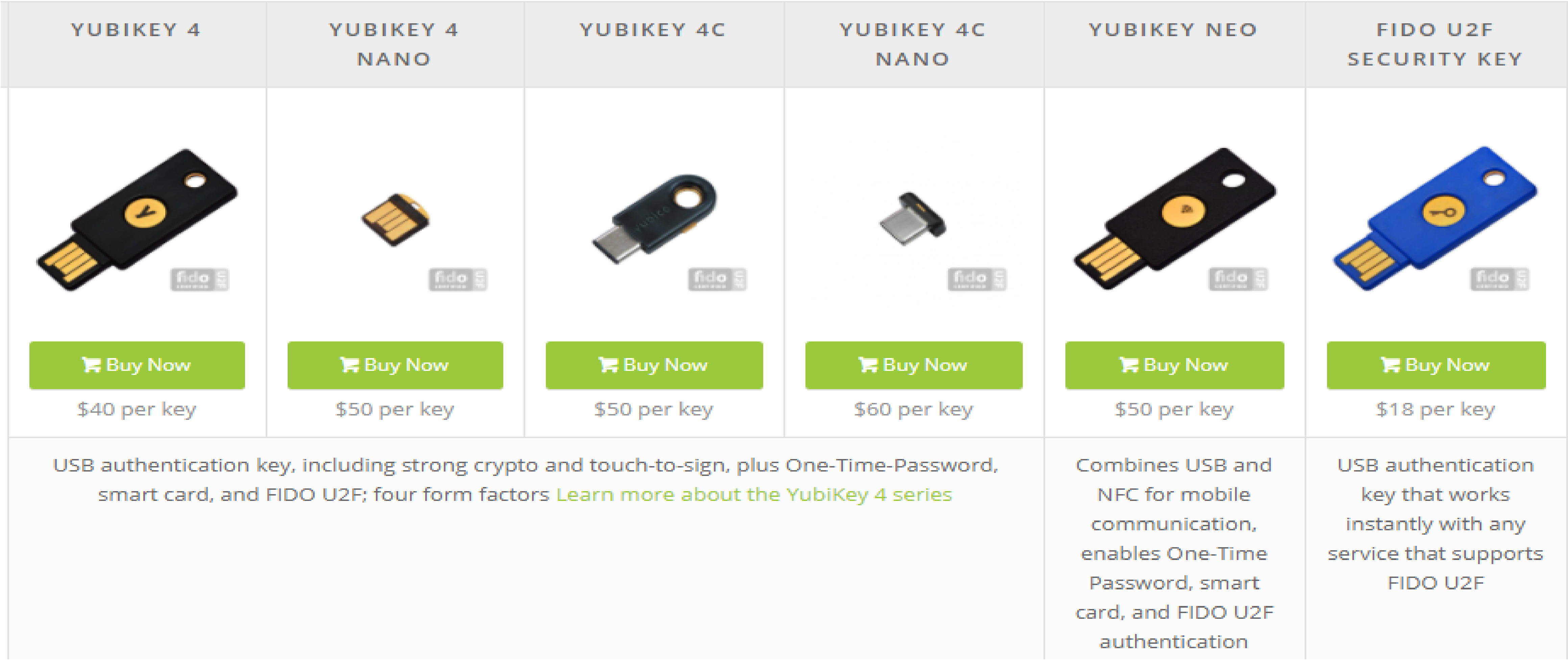
%The risk of loss of availability was perceived as greater than the risk of loss of control. Participants believed that their passwords were strong enough, and that their accounts were sufficiently secured by their own acumen. We report on both experiments, and detail the progress between them. Our results illustrate both the importance and limits of usability on acceptability, adoption, and adherence in two-factor authentication. Specifically, we implemented a think-aloud protocol to identify stop points, perceived benefits, and perceived costs. We reported the findings along with recommendations to Yubico and documented the consequent changes for a second iteration of the study implementing these modifications. W focused on participants with above average technical literacy by recruiting students from STEM degree programs. Our goal was to identify difficultie that might be barriers to Adoption for technically literate participants, particularly those who were likely to use GitHub, DropBox, or other sharing platforms.

We conducted the entire experiment in two-phases. In both the phases we asked the participants to configure a FIDO U2F security key for their Google account. Significant improvements in usability were noted in Phase-II over Phase-I. However, the overall acceptability did not change. Subsequently, we provided additional recommendations, such as confirmation of successful completion of the login, and the need to communicate the benefits of the device.Our contributions are the specific suggestions for Yubico, the instrument we developed for evaluating perceived costs anc benefits, the coding for these results, and the final analysis indicating the primary reasons for individuals not adopting 2FA. The specific suggestions

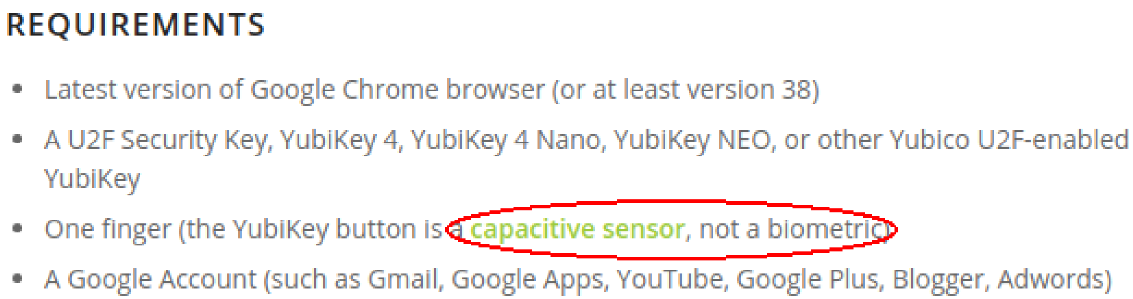
Recommendations-Phase-I

- Finding instructions
- Demo versus reality
- Device identification
- Biometric versus touch
- Confirmation of operation
- Communicate the benefit
- Communicating the risks

Phase- II security key comparisons



YUBIKEY 4	YUBIKEY 4 NANO	YUBIKEY 4C	YUBIKEY 4C NANO	YUBIKEY NEO	FIDO U2F SECURITY KEY
Buy Now $40 per key	Buy Now $50 per key	Buy Now $50 per key	Buy Now $60 per key	Buy Now $50 per key	Buy Now $18 per key
USB authentication key, including strong crypto and touch-to-sign, plus One-Time-Password, smart card, and FIDO U2F; four form factors Learn more about the YubiKey 4 series				Combines USB and NFC for mobile communication, enables One-Time Password, smart card, and FIDO U2F authentication	USB authentication key that works instantly with any service that supports FIDO U2F



REQUIREMENTS

- Latest version of Google Chrome browser (or at least version 38)
- A U2F Security Key, YubiKey 4, YubiKey 4 Nano, YubiKey NEO, or other Yubico U2F-enabled YubiKey
- One finger (the YubiKey button is a capacitive sensor, not a biometric)
- A Google Account (such as Gmail, Google Apps, YouTube, Google Plus, Blogger, Adwords)

Instruction modifications

User Approval and Device Use

1

Enter username and password in the login field of any app that supports FIDO U2F.

2

Insert the Security Key in a USB port with the **gold side up**.

3

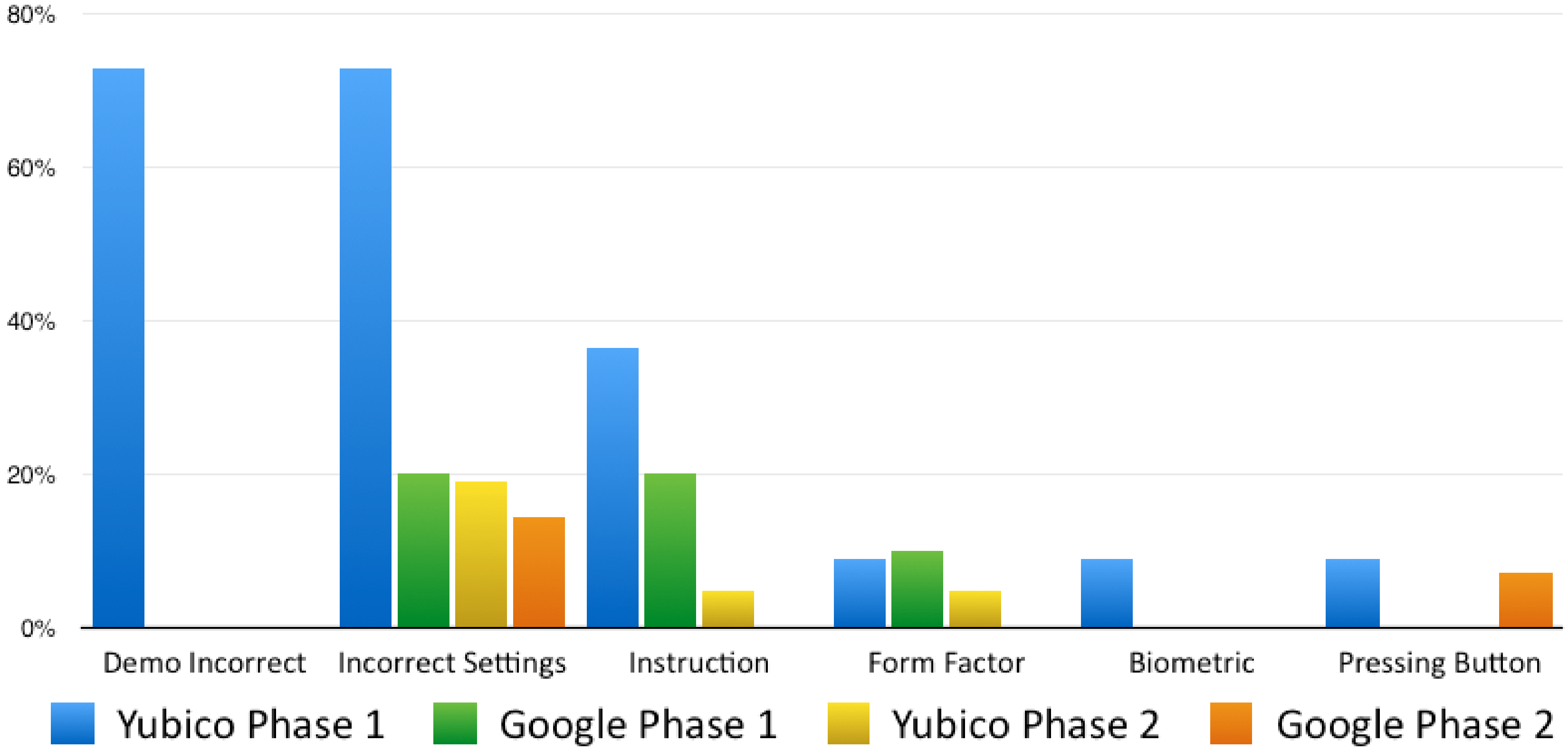
Touch the gold button on the Security Key to generate the secure login credentials.

Results

Halt Points

Halt Points

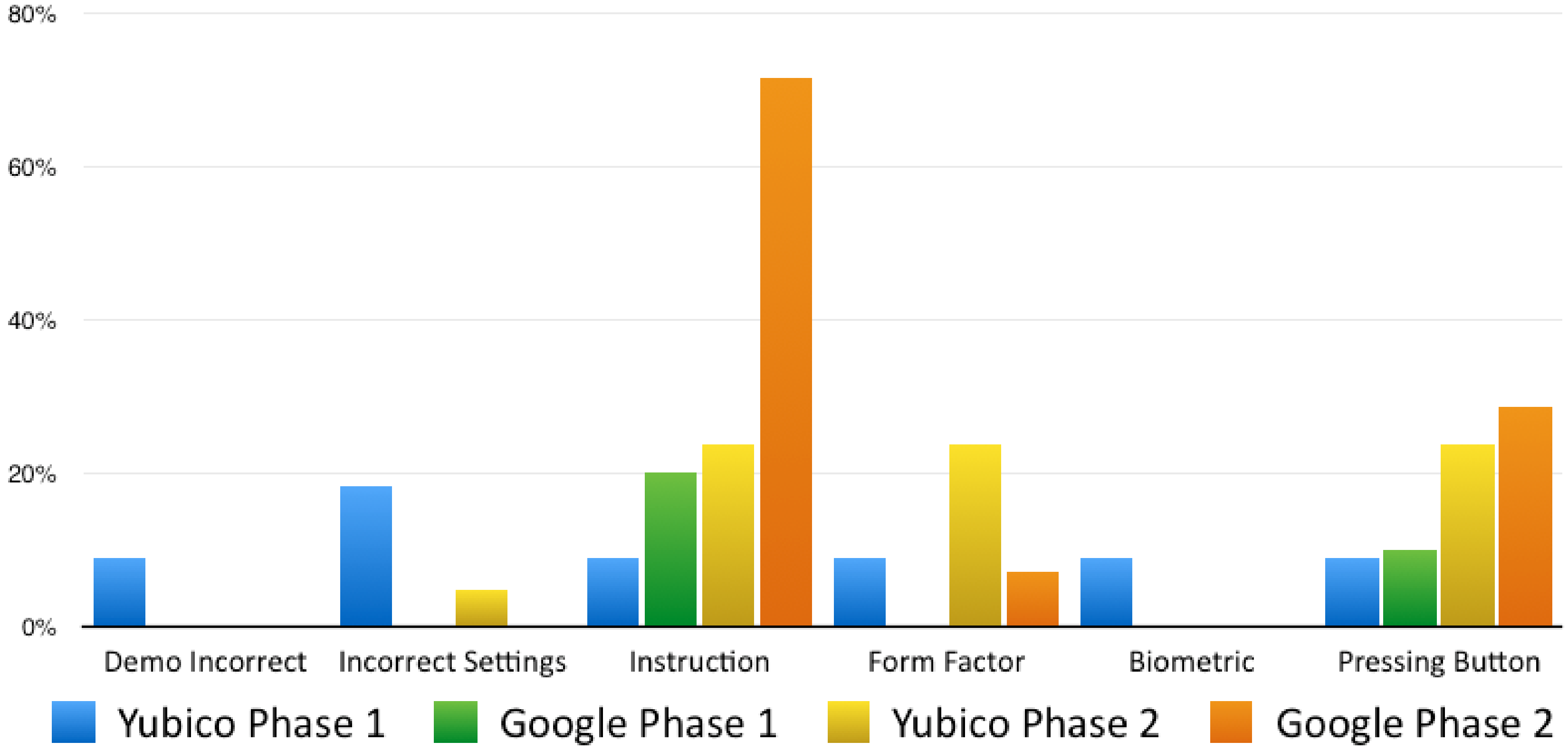
Halt Points	Yubico Phase 1	Google Phase 1	Yubico Phase 2	Google Phase 2
Demo Incorrect	72.7%	0%	0%	0%
Incorrect Settings	72.7%	20%	19.04%	14.29%
Instruction	36.4%	20%	4.76%	0%
Form Factor	9%	10%	4.76%	0%
Biometric	9%	0%	0%	0%
Pressing Button	9%	0%	0%	7.14%



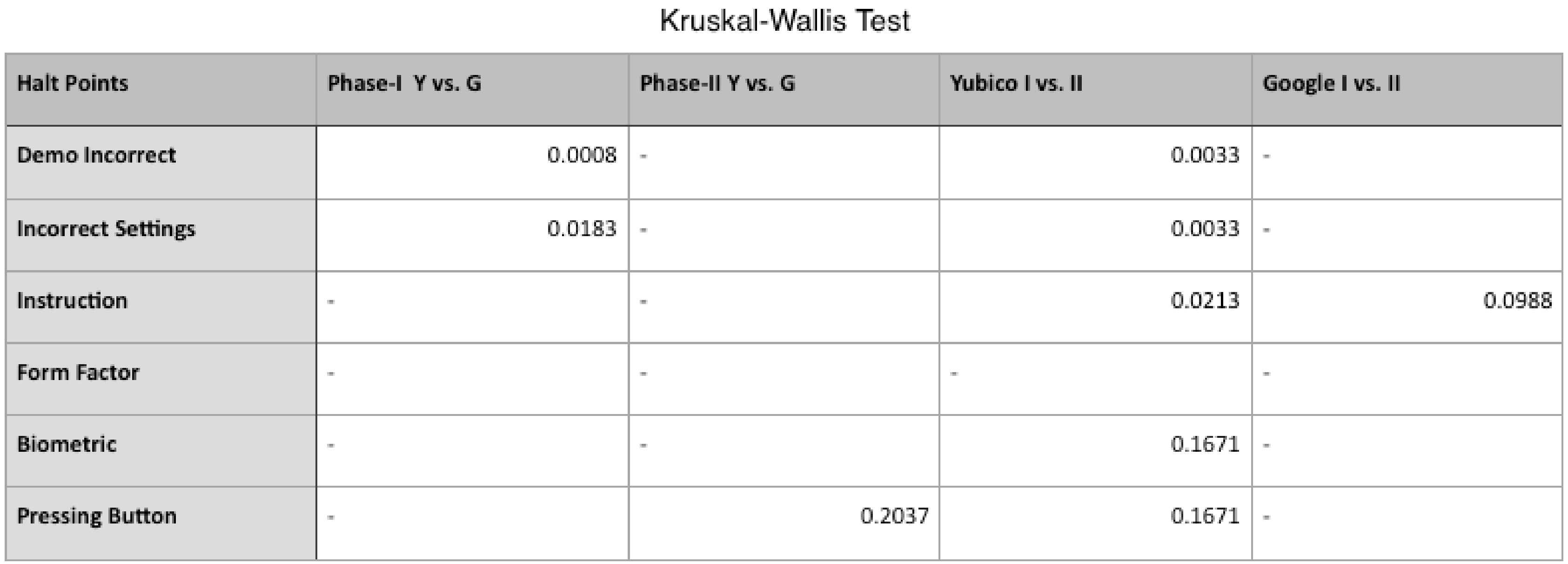
Confusion Points

Confusion Points

Confusion Points	Yubico Phase 1	Google Phase 1	Yubico Phase 2	Google Phase 2
Demo Incorrect	9%	0%	0%	0%
Incorrect Settings	18.2%	0%	4.76%	0%
Instruction	9%	20%	23.8%	71.43%
Form Factor	9%	0%	23.8%	7.14%
Biometric	9%	0%	0%	0%
Pressing Button	9%	10%	23.8%	28.57%



Kruskal-Wallis Test



Kruskal-Wallis Test

Halt Points	Phase-I Y vs. G	Phase-II Y vs. G	Yubico I vs. II	Google I vs. II
Demo Incorrect	0.0008	-	0.0033	-
Incorrect Settings	0.0183	-	0.0033	-
Instruction	-	-	0.0213	0.0988
Form Factor	-	-	-	-
Biometric	-	-	0.1671	-
Pressing Button	-	0.2037	0.1671	-

Finding instructions

Demo versus reality

Correctly identifying the device

Biometric versus touch

Confirmation of operation

Communicate the Intrinsic Benefit

Communicating the risk

Recommendations- Phase-II

Recommendations- Phase-II

Finding instructions

Demo versus reality

Correctly identifying the device

Biometric versus touch

Confirmation of operation

Communicate the Intrinsic Benefit

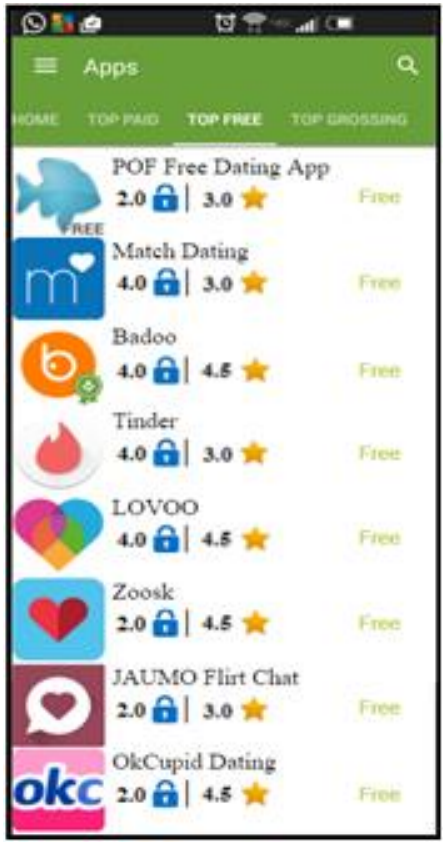
Communicating the risks

Risk Communication

Risk Communication for Actual Humans

Design for Humans Requires Designing for Humans

Smoking is a factor which contributes to lung cancer. Most cancers that start in lung, known as primary lung cancers, are carcinomas that derive from epithelial cells. Depending on the type of tumor, so-called paraneoplastic phenomena may initially attract attention to the disease. In lung cancer, these phenomena may include Lambert-Eaton myasthenic syndrome (muscle weakness due to auto-antibodies), hypercalcemia, or syndrome of inappropriate antidiuretic hormone (SIADH). Tumors in the top (apex) of the lung, known as Pancoast tumors, may invade the local part of the sympathetic nervous system, leading to changed sweating patterns and eye muscle problems (a combination known as Horner's syndrome) as well as muscle weakness in the hands due to invasion of the brachial plexus.



POF Free Dating App 2.0 🔒 | 3.0 ★ Free

Match Dating 4.0 🔒 | 3.0 ★ Free

Badoo 4.0 🔒 | 4.5 ★ Free

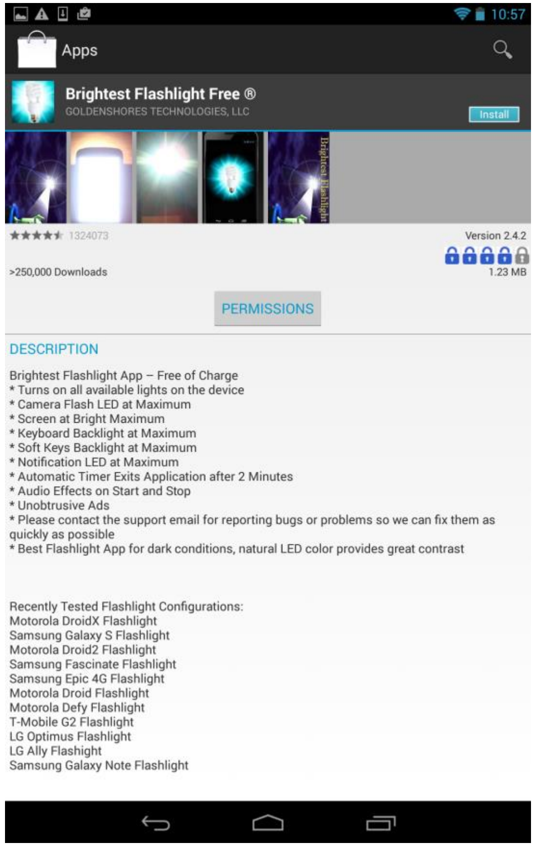
Tinder 4.0 🔒 | 3.0 ★ Free

LOVOO 4.0 🔒 | 4.5 ★ Free

Zoosk 2.0 🔒 | 4.5 ★ Free

JAUMO Flirt Chat 2.0 🔒 | 3.0 ★ Free

OkCupid Dating 2.0 🔒 | 4.5 ★ Free



Brightest Flashlight Free ®
GOLDENSHORES TECHNOLOGIES, LLC

★★★★★ 1324073

Version 2.4.2

>250,000 Downloads

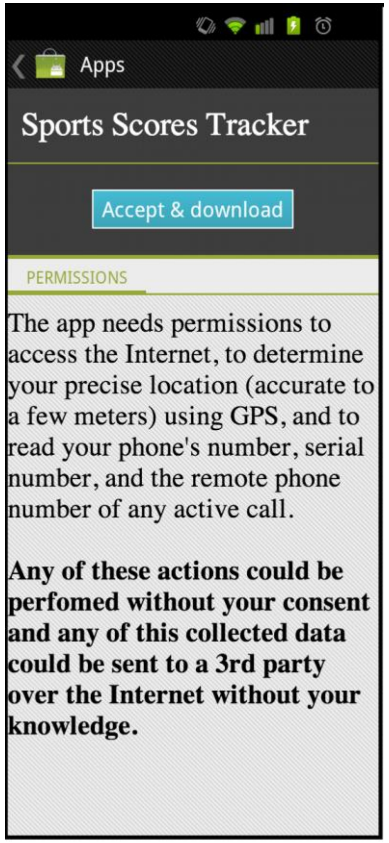
1.23 MB

PERMISSIONS

DESCRIPTION

Brightest Flashlight App – Free of Charge
* Turns on all available lights on the device
* Camera Flash LED at Maximum
* Screen at Bright Maximum
* Keyboard Backlight at Maximum
* Soft Keys Backlight at Maximum
* Notification LED at Maximum
* Automatic Timer Exits Application after 2 Minutes
* Audio Effects on Start and Stop
* Unobtrusive Ads
* Please contact the support email for reporting bugs or problems so we can fix them as quickly as possible
* Best Flashlight App for dark conditions, natural LED color provides great contrast

Recently Tested Flashlight Configurations:
Motorola DroidX Flashlight
Samsung Galaxy S Flashlight
Motorola Droid2 Flashlight
Samsung Fascinate Flashlight
Samsung Epic 4G Flashlight
Motorola Droid Flashlight
Motorola Defy Flashlight
T-Mobile G2 Flashlight
LG Optimus Flashlight
LG Ally Flashlight
Samsung Galaxy Note Flashlight



Sports Scores Tracker

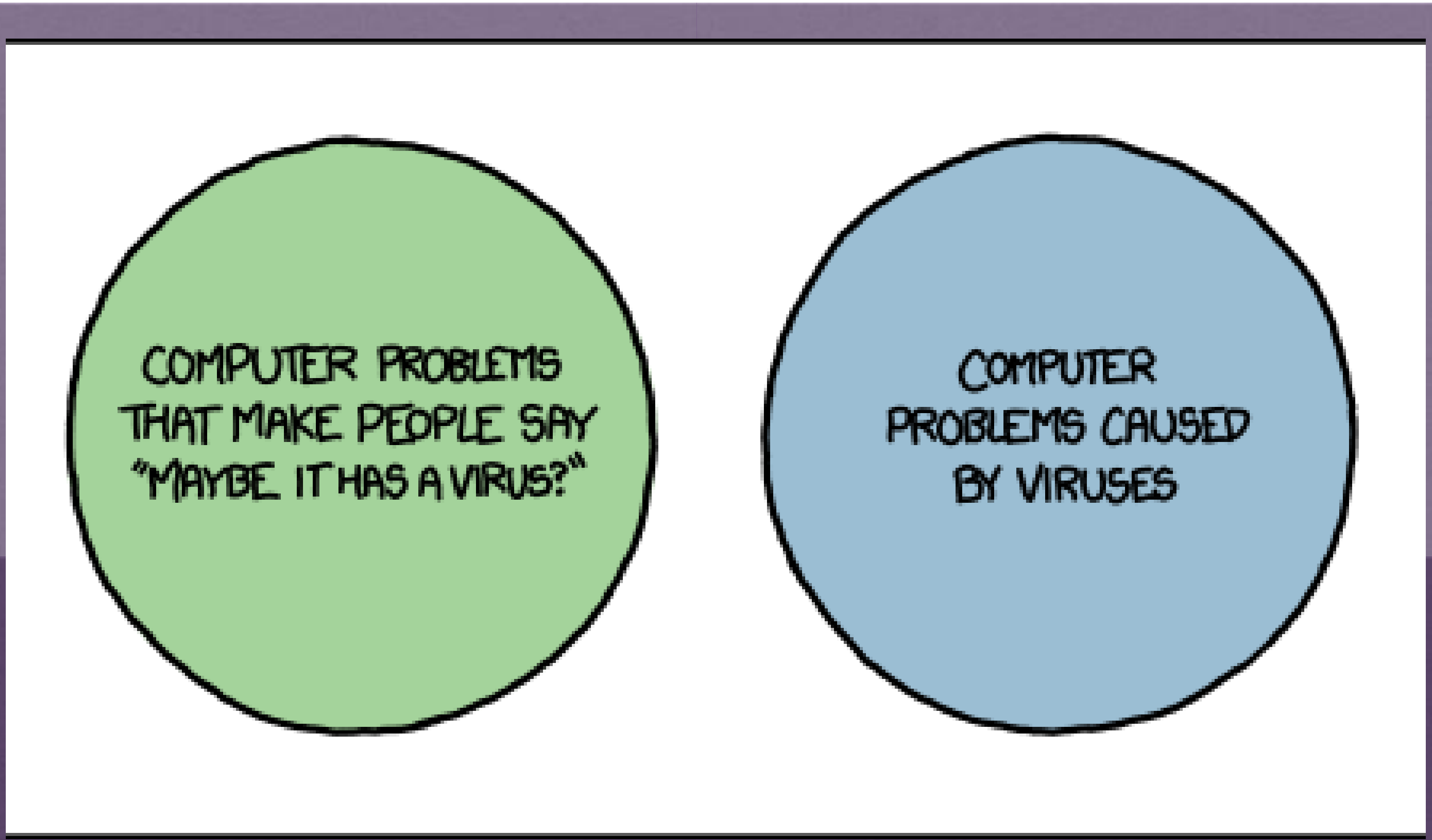
PERMISSIONS

The app needs permissions to access the Internet, to determine your precise location (accurate to a few meters) using GPS, and to read your phone's number, serial number, and the remote phone number of any active call.

Any of these actions could be perfomed without your consent and any of this collected data could be sent to a 3rd party over the Internet without your knowledge.

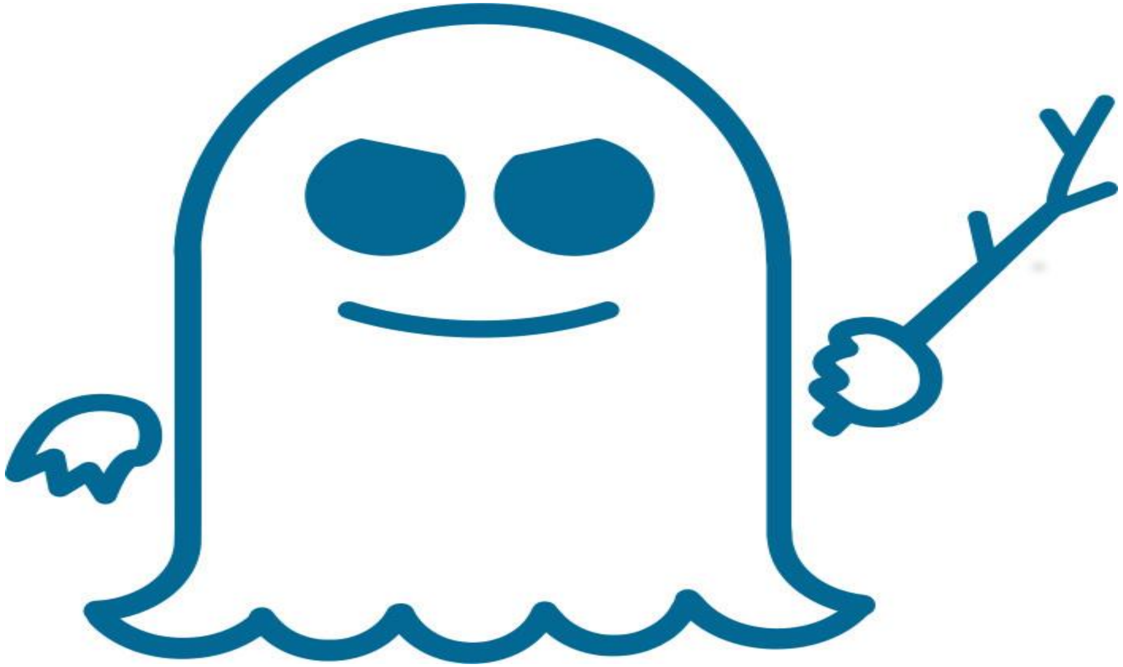
Summarize, Simplify Risks

Use Mental Models


COMPUTER PROBLEMS THAT MAKE PEOPLE SAY "MAYBE IT HAS A VIRUS?"
COMPUTER PROBLEMS CAUSED BY VIRUSES

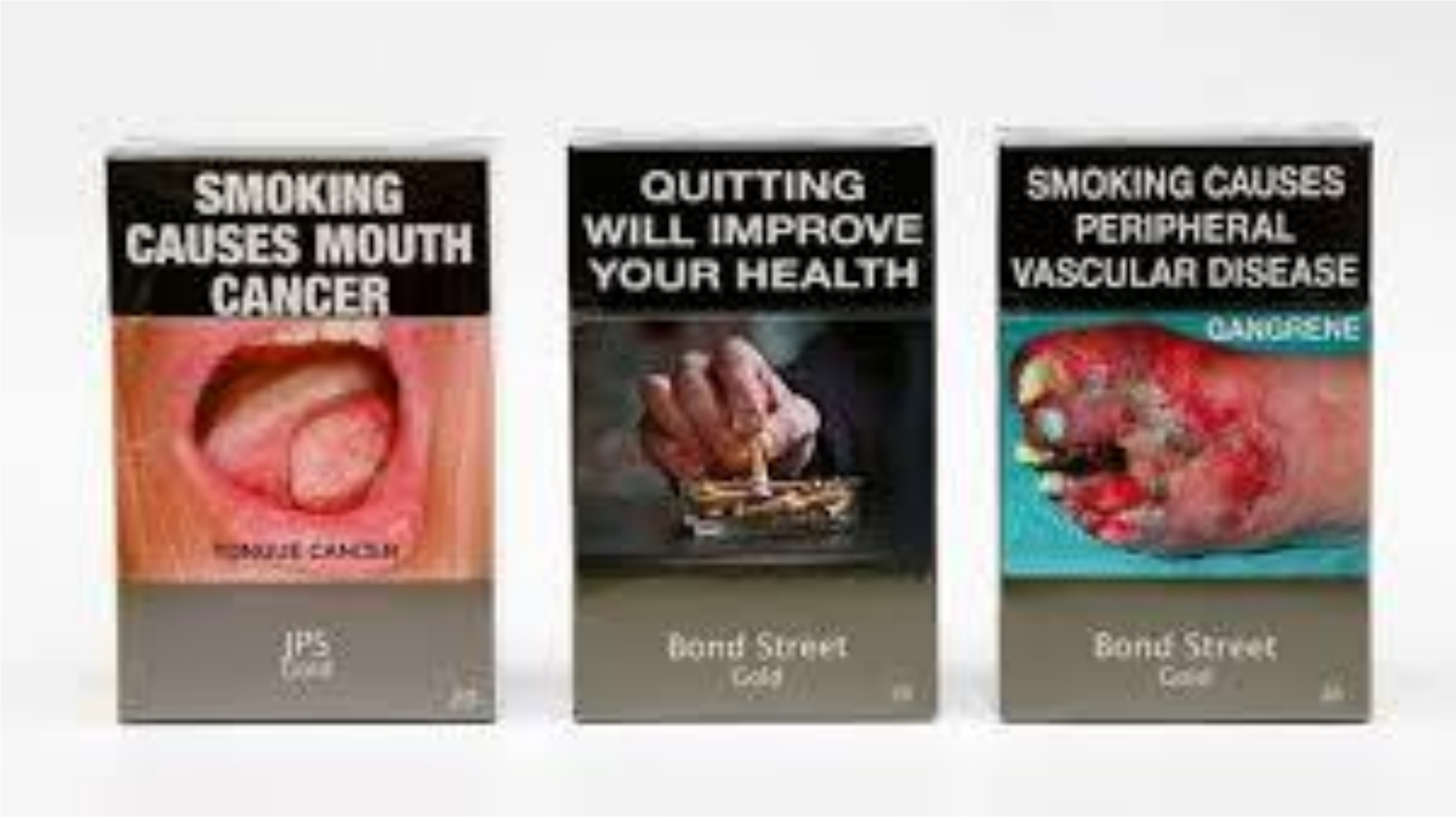
https://www.youtube.com/watch?v=zicpivBH8p8 https://www.youtube.com/watch?v=gIYINvH62ZY

Clear, Urgent Communication

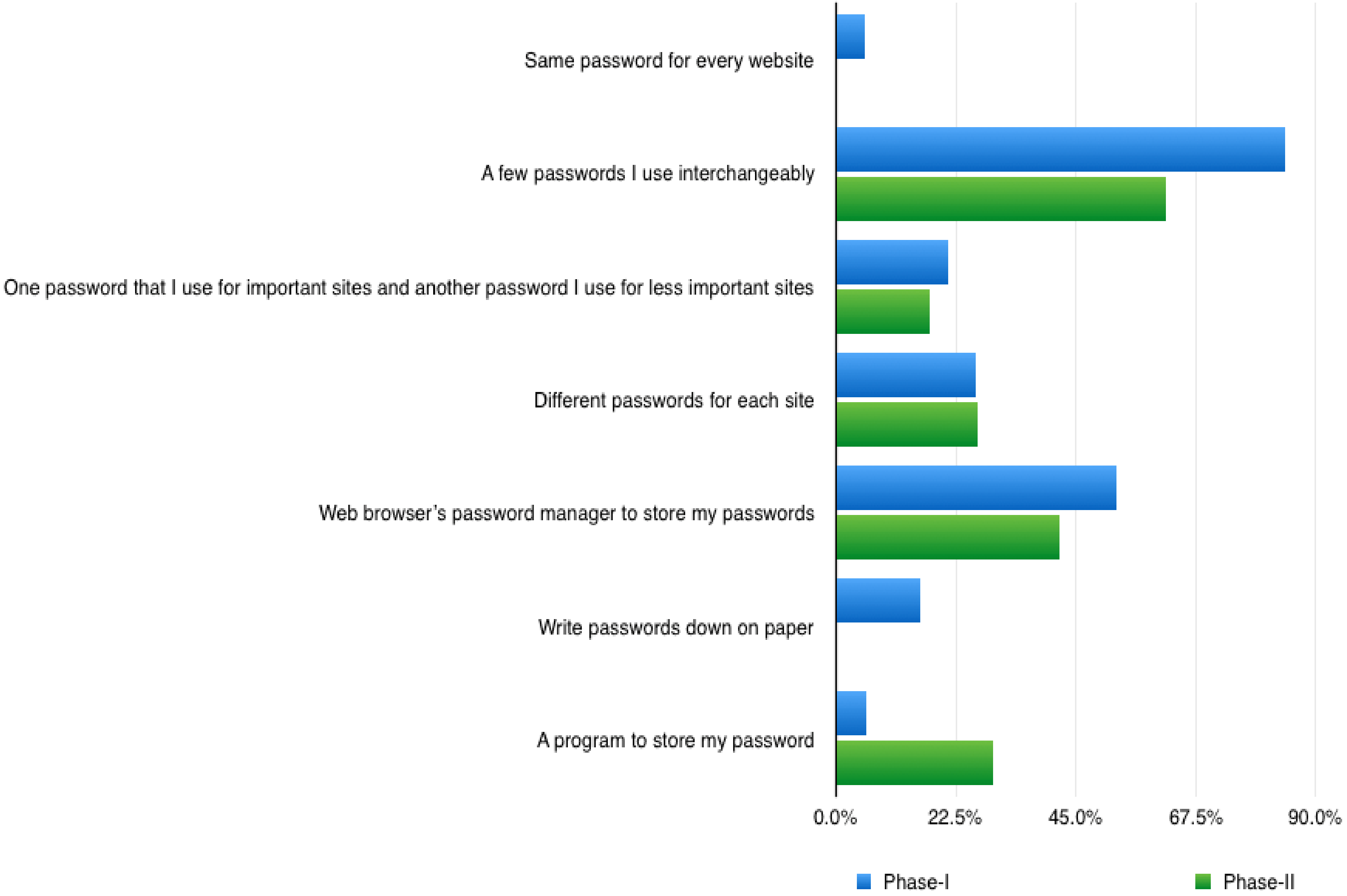


Multiple CPU Hardwares Information Disclosure Vulnerability: CVE-2017-5753

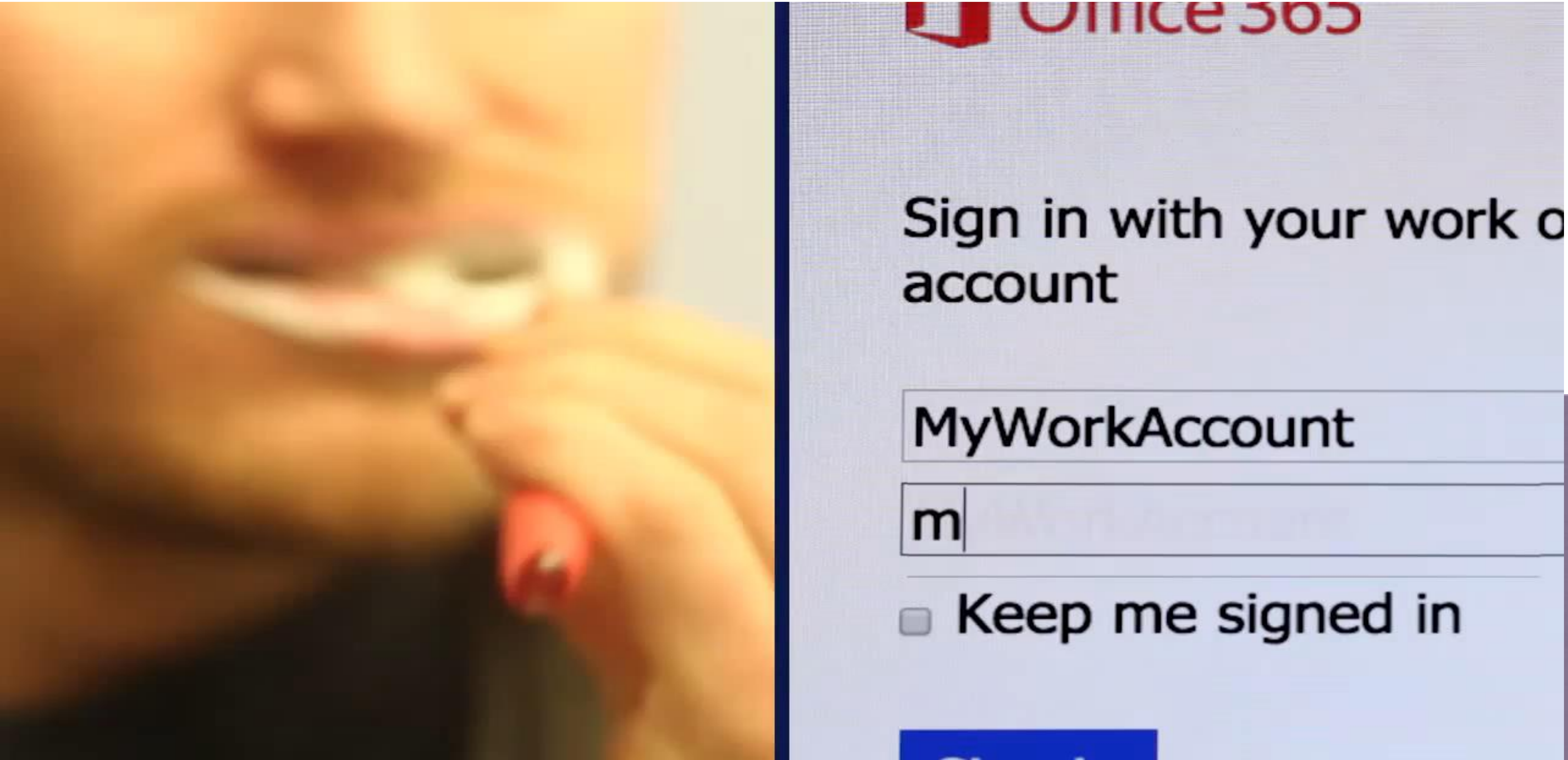
Visceral Risk Communication


SMOKING CAUSES MOUTH CANCER
TONGUE CANCER
JPS
Gold
QUITTING WILL IMPROVE YOUR HEALTH
Bond Street
Gold
SMOKING CAUSES PERIPHERAL VASCULAR DISEASE
GANGRENE
Bond Street
Gold

Password Behavior



Visceral Risk Communication



Sign in with your work o
account

MyWorkAccount

m

□ Keep me signed in

Takeaways

Providing the technology is not enough

Communicate why

Risk communication for motivation

Periodic positive feedback

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Future Work

- Vulnerable populations
- Short targeted benefit communication
- Multilevel access with 2FA

Secure

Safe

Clean

Usablesecurity.net