# Why Do They Do What They Do?

*A Study of What Motivations Users to (Not) Follow Computer Security Advice*

Authored by: Michael Fagan and Mohammad Maifi Hasan Khan

*University of Connecticut*

Presented by: Michael Fagan

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# The Problem

- Users must navigate disparate and widespread threats
  - Malware, phishing, etc.
- Many tools and advice to stay safe
- BUT plenty of users still exhibit insecure behaviors
  - Bad passwords
  - Ignoring updates
- These decisions have consequences on others
- What makes some users follow security advice while others do not?
  - What are the perceptions each group has of the decision and how do those perceptions compare?

# Related Work

- Rational Choice Perspective (Herley 2009/2014)
  - Benefits vs. Cost
  - Common in related studies
- Significance of Risk (Howe 2012, Camp 2006, Asgharpour 2007)
  - Added to Benefits/Costs
  - Also a popular topic in usable security (for good reason)
- Social Motivations (Tyler 2010, Das et al. 2014)
  - Less studied than other concepts
- "Good" vs. "Bad" Actors (Ion et al. 2015, Kang et al. 2015)
  - Many have investigated from an expert vs. non-expert perspective

# Study Design and Execution

- Compare those who follow advice to those who don't
  - Use a rational decision framework to identify differences in perceptions
    - Add risk and social variables to the basic framework
  - Ask participants, "why?"
- Initial sample gathered from Mechanical Turk (N = 764)
  - Groups of 50 formed for 8 groups
    - One group only had 47 eligible participants
- Groups contacted with full survey

# Variables

- Common Security Advice
  1. Keeping your software up to date
  2. Using a password manager
  3. Using two-factor authentication
  4. Changing passwords frequently
- Decision Model
  - 12 total variables
  - 3 components: benefit, risk, and cost
  - 2 effect target groups: you (individual), and users of other computers (social)
  - 2 behavior contexts: following (the advice), and not following (the advice)

# Variables

- ## Common Security Advice

  1. Keeping your software up to date
  2. Using a password manager
  3. Using two-factor authentication
  4. Changing passwords frequently

- ## **Decision Model**

  - 12 total variables
  - 3 components: benefit, risk, and cost
  - 2 effect target groups: you (individual), and users of other computers (social)
  - 2 behavior contexts: following (the advice), and not following (the advice)

1. *Individual Benefit of Following*
2. *Social Benefit of Following*
3. *Individual Risk of Following*
4. *Social Risk of Following*
5. *Individual Cost of Following*
6. *Social Cost of Following*
7. *Individual Benefit of Not Following*
8. *Social Benefit of Not Following*
9. *Individual Risk of Not Following*
10. *Social Risk of Not Following*
11. *Individual Cost of Not Following*
12. *Social Cost of Not Following*

# Variable Definitions

**Yes Groups**

    A.   How much would you say [you / users of other computers] are [benefited / cost or inconvenienced / put at risk] by you [following the advice]?

    B.   How much would you say [you / users of other computers] would be [benefited / cost or inconvenienced / put at risk] if you did not [follow the advice]?

**No Groups**

    A.   How much would you say [you / users of other computers] are [benefited / cost or inconvenienced / put at risk] by you not [following the advice]?

    B.   How much would you say [you / users of other computers] would be [benefited / cost or inconvenienced / put at risk] if you did [follow the advice]?

# Variable Definitions

**Yes Groups**

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B. How much would you say [you / users of other computers] would be [benefited / cost or inconvenienced / put at risk] if you did not [follow the advice]?

**No Groups**

A. How much would you say [you / users of other computers] are [benefited / cost or inconvenienced / put at risk] by you not [following the advice]?

B. How much would you say [you / users of other computers] would be [benefited / cost or inconvenienced / put at risk] if you did [follow the advice]?

Defines *"Following"*

Defines *"Not Following"*

# Hypotheses

**H-1a** - For all decisions, the *Benefits of Following* will be seen as higher by the Yes groups compared to the No groups.

**H-1b** - For all decisions, the *Benefits of Not Following* will be seen as higher by the No groups compared to the Yes groups.

**H-2a** - For all decisions, the *Risks of Not Following* will be seen as higher by the Yes groups compared to the No groups.

**H-2b** - For some decisions, the *Risks of Following* will be seen as higher by the No groups compared to the Yes groups.

**H-3a** - For all decisions, the *Costs of Not Following* will be seen as higher by the Yes groups compared to the No groups.

**H-3b** - For all decisions, the *Costs of Following* will be seen as higher by the No groups compared to the Yes groups.

**H-4a** - Those who follow each advice will do so, generally, to increase their security and/or for convenience purposes.

**H-4b** - Those who do not follow each advice will do so, generally, to avoid a cost/inconvenience or due to confidence in current behavior (i.e., they might know they should change, but don't want to).

**H-5** - Social considerations will be lower than Individual concerns for all decisions.

# Sample and Group Descriptions

| Advice | Group | n | Gender | | Age | | Comp. Expertise | | Sec. Expertise | | Often Use Comp | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | *Male* | *Female* | *Avg.* | *St.D.* | *Avg.* | *St.D.* | *Avg.* | *St.D.* | *Avg.* | *St.D.* |
| Update | Yes | 39 | 20 | 19 | 38.4 | 14 | 4.15 | 0.7 | 3.56 | 0.8 | 4.79 | 0.4 |
| | No | 30 | 12 | 18 | 35.8 | 11 | 3.77 | 0.8 | 2.93 | 0.6 | 4.40 | 0.9 |
| Password Manager | Yes | 41 | 19 | 22 | 33.2 | 8.7 | 4.24 | 0.6 | 3.63 | 0.9 | 4.61 | 0.4 |
| | No | 38 | 16 | 22 | 34.0 | 9.7 | 4.30 | 0.7 | 3.50 | 0.7 | 4.79 | 0.4 |
| 2FA | Yes | 36 | 20 | 16 | 36.6 | 13 | 4.31 | 0.7 | 3.86 | 0.9 | 4.69 | 0.5 |
| | No | 31 | 19 | 12 | 32.9 | 9 | 4.26 | 0.7 | 3.77 | 0.7 | 4.58 | 0.6 |
| Change Password | Yes | 37 | 20 | 17 | 36.0 | 10 | 4.22 | 0.6 | 3.78 | 0.8 | 4.73 | 0.6 |
| | No | 38 | 19 | 19 | 34.1 | 9.6 | 4.05 | 0.7 | 3.39 | 0.8 | 4.68 | 0.5 |

# Perceptions - *Benefits*

**H-1a** - For all decisions, the **Benefits of Following** will be seen as higher by the Yes groups compared to the No groups.

**H-1b** - For all decisions, the **Benefits of Not Following** will be seen as higher by the No groups compared to the Yes groups.

## *Individual Benefit of Following*

| | Yes | No | M-W U-Test | | |
|---|---|---|---|---|---|
| | *A(M)* | *A(M)* | *U* | *p* | *d* |
| Update | 3.77(4) | 2.97(3) | 274.5 | <0.001 | 0.51 |
| Pass.Man. | 3.78(4) | 2.5(2.5) | 154.5 | <0.001 | 0.73 |
| 2FA | 3.71(4) | 2.90(3) | 243.5 | <0.001 | 0.49 |
| Chg.Pass. | 3.47(4) | 2.53(3) | 256 | <0.001 | 0.57 |

## *Individual Benefit of Not Following*

| | Yes | No | M-W U-Test | | |
|---|---|---|---|---|---|
| | *A(M)* | *A(M)* | *U* | *p* | *d* |
| Update | 1.51(1) | 2.13(2) | 347.5 | 0.002 | 0.38 |
| Pass.Man. | 1.68(1) | 2.70(3) | 302 | <0.001 | 0.49 |
| 2FA | 1.6(1.5) | 2.62(3) | 161.5 | <0.001 | 0.61 |
| Chg.Pass. | 1.70(2) | 3.03(3) | 176 | <0.001 | 0.66 |

# Perceptions - *Risks*

**H-2a -** For all decisions, the ***Risks of Not Following*** will be seen as higher by the Yes groups compared to the No groups.

**H-2b -** For <u>some</u> decisions, the ***Risks of Following*** will be seen as higher by the No groups compared to the Yes groups.

## Risk of Following



*U* = 342.5
*p* < 0.001
*d* = 0.49

Legend: Pass. Man. Yes, Pass. Man. No
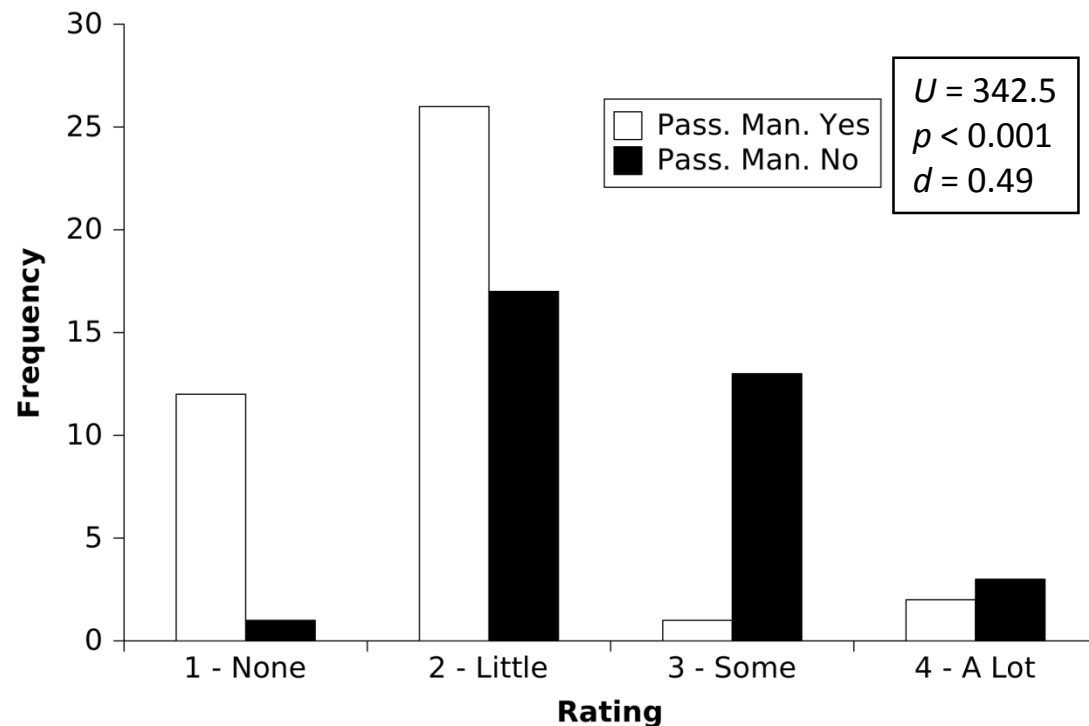
## Risk of Not Following

| | | Yes | No | M-W U-Test | | |
|---|---|---|---|---|---|---|
| | | *A(M)* | *A(M)* | *U* | *p* | *d* |
| **Individual** | Update | 3.42(4) | 2.77(3) | 336.5 | 0.002 | 0.37 |
| | Pass.Man. | 2.88(3) | 1.80(2) | 302.5 | <0.001 | 0.52 |
| | 2FA | 3.42(3) | 2.61(3) | 243.5 | <0.001 | 0.53 |
| | Chg.Pass. | 3.14(3) | 2.63(3) | 440.5 | 0.003 | 0.34 |
| **Social** | Update | 2.67(3) | 1.76(1) | 262.5 | <0.001 | 0.44 |
| | Pass.Man. | 1.92(2) | 1.29(1) | 409 | 0.002 | 0.37 |
| | 2FA | 2.48(3) | 1.79(2) | 289 | 0.013 | 0.32 |
| | Chg.Pass. | 1.70(1) | 1.29(1) | 483 | 0.044 | 0.24 |

*Change Passwords: *U* = 498.5, *p* = 0.014, *d* = 0.28

# Perceptions – *Costs*

**H-3a** - For all decisions, the **Costs of Not Following** will be seen as higher by the Yes groups compared to the No groups.

**H-3b** - For all decisions, the **Costs of Following** will be seen as higher by the No groups compared to the Yes groups.

## Cost of Following

| | | Yes | No | M-W U-Test | | |
|---|---|---|---|---|---|---|
| | | *A(M)* | *A(M)* | *U* | *p* | *d* |
| **Individual** | Update | 2.03(2) | 2.10(2) | 527.5 | 0.444 | 0.09 |
| | Pass.Man. | 1.73(2) | 2.18(2) | 533 | 0.011 | 0.28 |
| | 2FA | 2.00(2) | 2.39(2) | 405.5 | 0.036 | 0.26 |
| | Chg.Pass. | 2.35(2) | 2.97(3) | 449.5 | 0.005 | 0.33 |
| **Social** | Update | 1.22(1) | 1.29(1) | 431 | 0.781 | 0.04 |
| | Pass.Man. | 1.28(1) | 1.52(1) | 565.5 | 0.213 | 0.15 |
| | 2FA | 1.52(1) | 1.44(1) | 403.5 | 0.786 | 0.04 |
| | Chg.Pass. | 1.28(1) | 1.64(1) | 491 | 0.073 | 0.21 |

## Cost of Not Following

| | | Yes | No | M-W U-Test | | |
|---|---|---|---|---|---|---|
| | | *A(M)* | *A(M)* | *U* | *p* | *d* |
| **Individual** | Update | 2.95(3) | 2.00(2) | 247.5 | <0.001 | 0.48 |
| | Pass.Man. | 3.15(3) | 1.75(1) | 244.5 | <0.001 | 0.60 |
| | 2FA | 1.76(1) | 1.57(1) | 446.5 | 0.451 | 0.09 |
| | Chg.Pass. | 2.28(3) | 1.61(1) | 425.5 | 0.003 | 0.35 |
| **Social** | Update | 2.32(2) | 1.59(1) | 248 | 0.001 | 0.41 |
| | Pass.Man. | 1.84(1) | 1.03(1) | 354 | <0.001 | 0.49 |
| | 2FA | 1.69(1) | 1.41(1) | 343 | 0.356 | 0.12 |
| | Chg.Pass. | 1.50(1) | 1.24(1) | 525.5 | 0.174 | 0.16 |

# Perception Gaps

- Participants generally rated the benefits of *their decision* higher than the projected benefits from switching
  - Expected, but interesting
- For risk, Yes groups rated the risks avoided as higher than the risk reported by No groups
  - Both can't be right, but hard to tell who is
- Overall, participants' ratings reflected a confidence in their decision, either to follow or not follow

# Why they do what they do…

**H-4a** - Those who follow each advice will do so, generally, to increase their security and/or for convenience purposes.
**H-4b** - Those who do not follow each advice will do so, generally, to avoid a cost/inconvenience or due to confidence in current behavior.

- Updating
  - *Yes*: desire to increasing security and want to avoid bugs and/or issues
  - *No*: avoid inconvenience, say they don't need updates, or are too "lazy"

- Using a Password Manager
  - *Yes*: most like the convenience, but many also not the security benefits
  - *No*: many are avoiding a perceived security risk, centralization of passwords

- Using 2FA
  - *Yes*: most are using to increase security, with some (9/36) saying it "feels better"
  - *No*: some are confident in their current security and many are avoiding a cost

- Changing Passwords Frequently
  - *Yes*: added security and avoiding theft top reasons
  - *No*: many are avoiding an inconvenience and/or see no reason to change behavior

# Individual vs. Social Concerns

**H-5** - Social considerations will be lower than Individual concerns for all decisions.
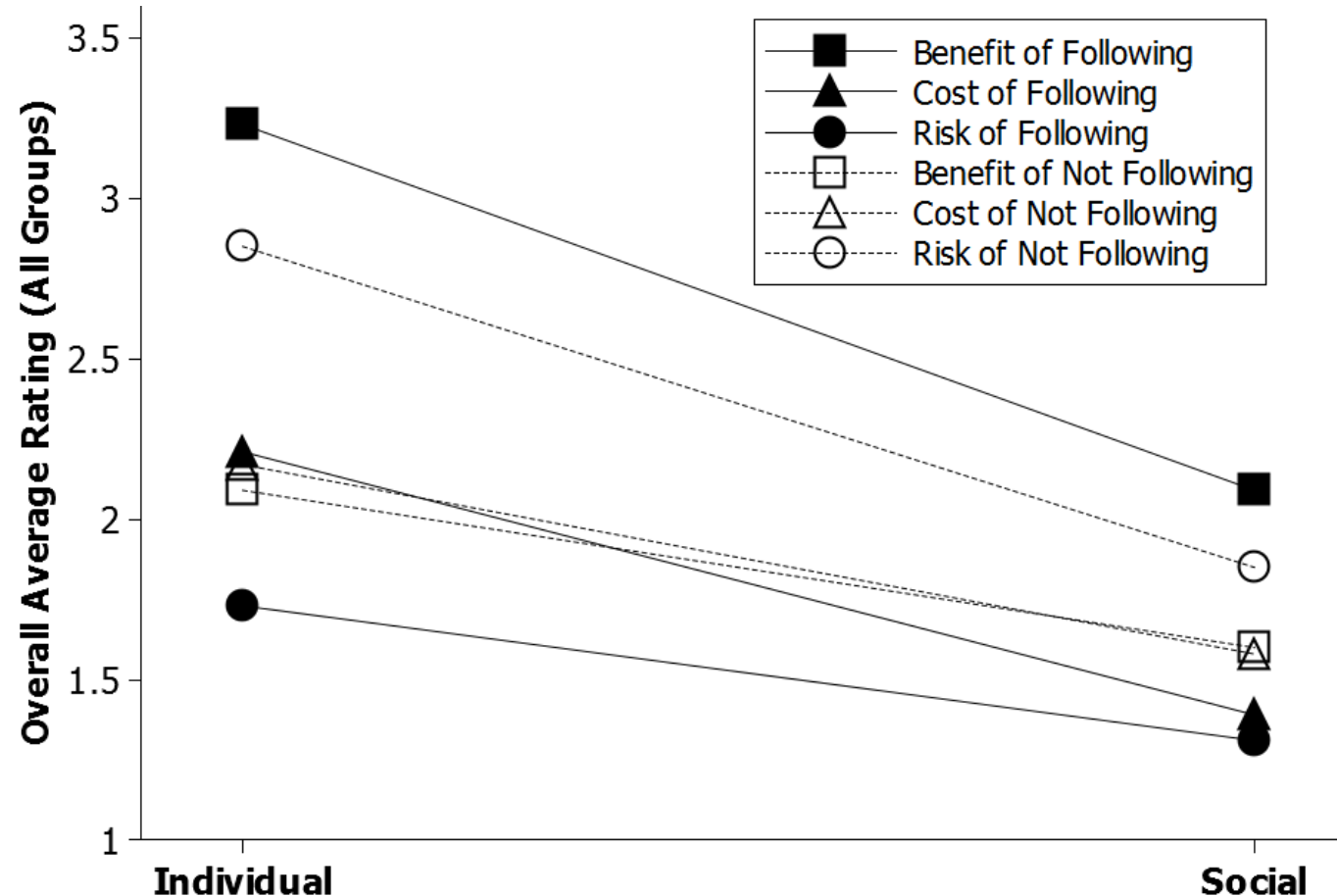


For all, a Sign test of these differences yielded:
Z < -5, p < 0.001

# Conclusion

- Key points:
  - Perception gaps found between Yes/No groups
  - Added convenience can be powerful
  - Low social motivations

- Limitations
  - Larger samples from different populations would help generalize
  - Extended framework could give more insights

# Thank You!
## Questions?

michael.fagan@uconn.edu