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Exploring Information Security and Domestic Equality

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Abstract. It is well known that men and women differ in terms of security behavior. For instance, studies report that gender plays a role in security non-compliance intentions, malware susceptibility, and security self-efficacy. While one reason for gender-based differences can be that women are vastly underrepresented in the community of security professionals, the impact that gender differences in security behavior have on equality is an underresearched area. This paper argues that cyber-inequality can impact domestic inequality and even be an enabler for domestic abuse. This paper intends to shed light on how digitalization works in households in order to problematize around equality in the digital era. It reports on a survey that measures different factors of personal information security and shows that men and women do indeed differ in personal information security behavior on a number of points such as men being more influential when it comes to ICT decisions in the household.

Keywords: security behaviour · gender · equality · domestic equality

1 Introduction

In terms of security behavior, it is well established that there are differences between men and women. For instance, Lévesque et al. (2017) [7] shows that men are more likely than women to encounter malware and Bansal et al. (2016) [4] shows that gender plays a role in information security non-compliance intention. McGill and Thompson (2018) [8] reports that men exhibit an overall stronger security behavior than women, especially for technically oriented tasks such as installing security software. However, they do not find such differences in less technical security tasks such as securing devices with passwords and using security software once it has been installed. McGill and Thompson (2018) [8] also reports that they do not find any differences in security self-efficacy, a result that conflicts with for instance Anvar et al. (2017) [3] in which differences were found, primarily in security self-efficacy, but also within experience and general computer skills. In a broader perspective, Peacock and Irons (2017) [12] reports that respondents of their survey considered computer security to be a “man’s job” and it is obvious that women are significantly underrepresented in the professional security community.

As described by West et al. (2019) [15], digital competences are no longer optional but required and the ability to use technology is increasingly important to a person's well-being. It is evident that skills in ICT is a necessity in order to fully participate in modern society and those who participate more enjoy advantages over those who do participate less [5]. Sey and Hafkin (2019) [13] describes that skills in security is one aspect that is needed for participation in the digital world making research into gender-based differences in personal security an important equality issue. We argue that equal, or similar participation and influence over digital matters is an important aspect of equality in a household, as well as in the workplace.

A darker aspect that is affected by security behavior is digital abuse. While physical domestic abuse is a well-known phenomenon to the wider public, the digital era brings other forms of abuse that can to a degree be tied to security behavior. Gagnier (2018) [6] described that digital abuse can for instance include identity theft, unlawful surveillance and cyberstalking, and the perpetrator is often a current or previous partner. Al-Alosi (2017) [2] reports that using different methods to get access to, and control, over the victims' digital accounts on social media, e-mail etc. is a common part of digital abuse. The ways used to get this control range from active hacking practices, such as using spyware, to asking for the passwords to said services. The extent of this phenomenon is hard to quantify, but recent studies indicate that as many as 10 % uses apps or software to spy on their current or former partners' messages, photos, phone calls etc. [1]. It is also clear that men are overrepresented as the part that monitors women. While it is hard to differentiate normal and trusting sharing of information in a relationship from sharing that can enable digital abuse, we argue that domestic digital inequality can be an enabler for digital abuse.

Gender differences in information security is an under-researched area [8] and gender differences in personal security skill and behavior is an equality matter. The aim of this paper is to look into equality factors of personal information security, such as password/account sharing and influence over decisions about digital devices and services in the household as well as perceived ICT skills. The paper intends to shed light on how digitalization works in households in order to problematize around equality in the digital era.

2 Methodology

The aim of this paper was met using a web-based survey, built and distributed using Limesurvey, that contained Likert-style questions around the following four themes:

- [influential] How influential the respondents are when it comes to ICT-related decisions in the household.
- [sharing] To what degree the respondents share passwords to various services with their partners.
- [autonomy] To that extent the respondents install ICT devices themselves or ask for help

- [router_skill] To what degree the respondents are comfortable carrying out various tasks on their home router.

Each question theme consisted of a number of questions, each with a five-graded answer scale.

In analysing the responses, all answers were dichotomized. The answers “Fully agree” and “Mostly Agree” was converted to 1 and the other options to 0. Thus, 1 represent an agreeing answer. The dichotomized variables were used to created indexes reflecting the respondents score in each theme. For data analysis, the survey data was grouped based on the respondents reported gender. It is reasonable to assume that IT-professionals will answer differently than others [14]. Thus, all responses from respondents reporting to be IT-professionals was grouped, and all metrics reported with and without the answers from the group of IT-professionals. The Shapiro-Wilks test was used to test whether the generated data was normally distributed [10], and the means and median are reported for the indexes. Based on central tendencies observed using descriptive statistics, hypothesis testing was used to evaluate if the tendencies were significant. Because of space limitations, the results are presented in condensed form. The hypotheses were expressed as follows:

H1: There is a difference between the gender groups regarding index X

H0: There is no difference between the gender groups regarding index X

Further, Mann-Whitney U-test was used for hypothesis testing. Mann-Whitney U-test was selected in favor of T-test since no samples was normally distributed and is therefore more suitable than T-test [9]. The significance level used in this study is the conventional 95% meaning that results are significant if $p < 0.05$. SPSS was used for statistical analysis.

3 Results

The survey was distributed as an online survey and 152 respondents completed the survey. The answers were used to compute and analyze indexes for the four different themes of interest in this paper. The remainder of this chapter will describe how the indexes was calculated, and the results of the analysis.

3.1 Influential Index

Under the influential theme, the respondents were asked the following questions:

- When you are in a committed relationship, how influential are you when you decide what streaming service to use (Netflix, HBO etc)?
- When you are in a committed relationship, how influential are you when you decide what Internet service provider to use?
- When you are in a committed relationship, how influential are you when you decide what new computer/cell phone to buy for yourself?

- When you are in a committed relationship, how influential are you when you decide what new common use digital devices to buy together?

Each question had a five-graded answer scale labelled as follows; 1 = My partner is much more influential than me, 3=me and my partner are equally influential, 5 = I am much more influential than my partner. The answers to the questions were dichotomized so that the two most positive answer options were represented by 1 and the three least positive answers were represented by 0. An index of all questions was computed by adding the variables together. To exemplify, if a respondent provided positive answers to all four questions, the index value became 4, if a respondent provided positive answers to two of the questions, the index value became 2. Table 1, below, presents the mean and median values for male and female respondents. The results are first presented for the entire sample (all) and then only for respondents reporting that they are not IT-professionals (NoIT).

Group	Mean	Median	Mann-Whitney U-test
All Male (n=99)	3.04	3	p=0.000
All Female (n=53)	2.15	2	
NoIT Male (n=54)	2.73	3	p=0.002
NoIT Female (n=38)	1.84	1	

Table 1. Statistics in the "influential" theme. Results are significant if $p < 0.05$

As seen in Table 1, male respondents report being more influential than female respondent. The same tendency is seen even if respondents who report being IT-professionals are removed from the analysis. The results of the Mann-Whitney U-test show that the difference is significant showing that the hypothesis "There is a difference between the gender groups regarding index influential" holds.

3.2 Sharing Index

Under the sharing theme, the respondents were asked the following questions:

- When you are in a committed relationship, how likely are you to share passwords to social networks (Facebook, Instagram etc) with your partner?
- When you are in a committed relationship, how likely are you to share passwords to your personal e-mail with your partner?
- When you are in a committed relationship, how likely are you to share passwords to work related accounts with your partner?
- When you are in a committed relationship, how likely are you to share passwords/pins to your computer with your partner?
- When you are in a committed relationship, how likely are you to share passwords/pins to your cellphone with your partner?
- When you are in a committed relationship, how likely are you to share passwords to "streaming services" (Spotify, Netflix, HBO etc) with your partner?

- When you are in a committed relationship, how likely are you to share passwords to online stores (Amazon, Steam, Ebay etc) with your partner?

Each question had a five-graded answer scale labelled as follows; 1=very unlikely, 3=neutral, 5=very likely. An index was computed using the same procedure as previously, resulting in an index that ranged from 0 to 7. Table 2, below, presents the mean and median values for male and female respondents. The results are first presented for the entire sample (all) and then only for respondents reporting that they are not IT-professionals (NoIT).

Group	Mean	Median	Mann-Whitney U-test
All Male (n=99)	3.30	3	p=0.573
All Female (n=53)	3.48	3	
NoIT Male (n=54)	2.72	2	p=0.458
NoIT Female (n=38)	3.02	3	

Table 2. Statistics in the "sharing" theme. Results are significant if $p < 0.05$

As seen in table 2, a slight tendency suggesting that female respondents are somewhat more prone to share their passwords is shown. However, the results are not significant meaning that the null hypotheses, that there is no observable difference, cannot be discarded.

3.3 Autonomy Index

Under the autonomy theme, the respondents were asked the following questions:

- When you receive a new digital device, such as an apple TV, home router or likewise. How likely is it you will install it yourself?
- When you receive a new digital device, such as an apple TV, home router or likewise. How likely is it that you will ask your partner for help installing it together with you?
- When you receive a new digital device, such as an apple TV, home router or likewise. How likely is it you will ask a friend or family member for help installing it together with you?
- When you receive a new digital device, such as an apple TV, home router or likewise. How likely is it that you will ask your partner to install it for you (you will not take part in the installation)?
- When you receive a new digital device, such as an apple TV, home router or likewise. How likely is it that you will ask a friend or family member to install it for you (you will not take part in the installation)?

Each question had a five-graded answer scale labeled as follows; 1=very unlikely, 3=neutral, 5=very likely. An index was computed using the same procedure as previously, except that the first question was computed as a one for answers 1 or 2. This resulted in an index that ranged from 0 to 5 that reflects how likely the

respondents are to get help with the installation of new digital devices. Table 3, below, presents the mean and median values for male and female respondents. The results are first presented for the entire sample (all) and then only for respondents reporting that they are not IT-professionals (NoIT).

Group	Mean	Median	Mann-Whitney U-test
All Male (n=99)	1.20	0	p=0.017
All Female (n=53)	1.87	2	
NoIT Male (n=54)	0.60	0	p=0.001
NoIT Female (n=38)	1.66	2	

Table 3. Statistics in the "autonomy" theme. Results are significant if $p < 0.05$

As seen in Table 3, female respondents report being more prone to ask for help than male respondents. The same tendency is seen even if respondents who report being IT-professionals are removed from the analysis. The results of the Mann-Whitney U-test show that the difference is significant showing that the hypothesis "There is a difference between the gender groups regarding index autonomy" holds.

3.4 Router Skill Index

Under the router skill theme, the respondents were to rate the following statements about their home router using a five graded scale labeled; 1=do not agree at all, 3=neutral, 5=agree fully. This short description of what a home router is was also supplied; The router is the device that that connects your home with the Internet and provides WiFi. An index was computed using the same procedure as previously, resulting in an index that ranged from 0 to 4 Table 4, below, presents the mean and median values for male and female respondents. The results are first presented for the entire sample (all) and then only for respondents reporting that they are not IT-professionals (NoIT).

- I know my WiFi password
- I know how to login to the router
- I feel comfortable changing the WiFi password
- I feel comfortable doing advanced configuration tasks

As seen in Table 4, male respondents report being more comfortable with configuring the home router than female respondents. The same tendency is seen even if respondents who report being IT-professionals are removed from the analysis. The results of the Mann-Whitney U-test show that the difference is significant showing that the hypothesis "There is a difference between the gender groups regarding index router_skill" holds.

Group	Mean	Median	Mann-Whitney U-test
All Male (n=99)	3.48	4	p=0.001
All Female (n=53)	2.92	3	
NoIT Male (n=54)	3.30	4	p=0.001
NoIT Female (n=38)	2.56	3	

Table 4. Statistics in the "router skill" theme. Results are significant if $p < 0.05$

4 Conclusions

The aim of this paper is to look into equality factors of personal information security, such as password/account sharing and influence over decisions about digital devices and services in the household as well as perceived ICT skills. The study was performed using a survey where respondents were asked about their security behavior and asked to rate their skills in relation to their home router. The answers were used to compute indexes intended to reflect:

- How influential the respondents are regarding domestic ICT decisions
- To what degree the respondents share passwords with their partners
- How autonomous the respondents are when it comes to installing new ICT devices
- How comfortable the respondents are with their home router

The results suggest that men are more influential than women when it comes to domestic ICT decisions, as well as more autonomous when it comes to installing new ICT devices and are more comfortable carrying out tasks on the home router. The results of the survey were statistically significant concerning these conclusions. The results could not find any differences in terms of password sharing even if an insignificant tendency, that females shared passwords to a greater level than males, was observed.

As with all surveys that collect self-reported data, socially desirable responding (SDR) bias should be considered a risk [11]. In this particular case, it is interesting to consider the possible connection between SDR bias and self-efficacy. It is suggested in the literature that computer security is generally considered to be a man's job [12] and it could be interpreted as socially desirable for males to be good at security and for females to be bad at it. This aligns well with the authors' experience of teaching in the technical domain. Although not scientifically researched, male students we talked to report that male students are never questioned about their choice to follow a career in IT while female students very frequently have to justify their decision to family and friends. As such, the possible prevalence of an SDR bias in this context could in itself be a sign of equality problems that need to be addressed in a broad societal context. There might also be a reversed problem among males. If it is perceived to be unmanly to ask for help in technical domains, this may lead to men actually spending more time to learn about these matters, as well as helping others, predominantly women, and thus actually having more knowledge. It might however

also lead to under-reporting and perhaps even worse, a general false self-image of competence among males leading to ignorance related to unsafe behavior.

In this study we took, by necessity, a traditional hetero-normative approach to the concept of gender and asked about male and female; this is not a statement in itself, but a choice made due to the fact that we expected to not receive enough answers to have any relevant data to work with anything else than the two traditional genders. We did take care to not assume that people were living in a heteronormative relationship by asking for “partners” and not boyfriend/girlfriend etc. so the study is not focused on the type of relationship a person might be in, but the self-experienced gender dynamics themselves.

We do argue that this, and other research, indicates that gender has a significant impact on security behavior, and it is thus crucial to study this further in the future. Building only on this study, in which we only focused on the subjects’ own self-reporting of their own competency, without any actual testing of knowledge. It would be interesting to measure self-image combined with actual knowledge in a larger domain to see if there is an actual difference between the genders, as well as doing interviews trying to get a deeper understanding on if, and why, these differences exist. Even if our results focus on the home environment, those values and differences might also be relevant in the work environment, and relevant to investigate further.

As this study took a binary approach to gender (male/female) it would be very interesting to extend this research into other genders, especially if a large enough dataset can be acquired.

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