

Digital Privacy Legislation Awareness

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Abstract—Privacy is regarded as a fundamental human right and it is clear that the study of digital privacy is an important field. Digital privacy is influenced by new and constantly evolving technologies and this continuous change makes it hard to create legislation to protect people's privacy from being exploited by misuse of these technologies.

This study aims to benefit digital privacy legislation efforts by evaluating the awareness and perceived importance of digital privacy legislation among computer science students. The chosen fixed variables for the population are study year and gamer classification.

The use of location based services in mobile applications and games are a concern for digital privacy. For this reason the study focused on computer science students as they have a high likelihood to use and develop this type of software. Surveys were used to evaluate awareness and perceived importance of digital privacy legislation.

The results of the study show that privacy legislation and awareness of privacy legislation are important to people. The perception of the importance of privacy legislation increases with academic experience. Awareness of privacy legislation increases from non-gamers to pro gamers.

Keywords—Digital privacy, Legislation awareness, Gaming.

I. INTRODUCTION

TECHNOLOGY evolves and adapts faster than legislation [1], [2]. Legislation on digital privacy and data protection in South Africa has recently come into the spotlight with the introduction of the "Protection of Personal Information" (POPI) act [3]-[6]. As new technologies are developed and existing technologies evolve and are used in new ways, legislation also needs to evolve to protect the users from misuse of these technologies. Examples of these technologies are mobile computers (tablets) and smart phones with GPS technology and position monitoring systems. Software on these devices regularly collect and use personal information regarding the user and it is therefore important that the user's rights in terms of privacy and fair use of the information obtained have to be studied. This study aims to make a contribution by identifying awareness as well as perceived importance of digital privacy legislation in South Africa among computer science students. The reason for choosing computer science students is that they regularly use technologies that employ position monitoring systems and

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they will be involved in creating projects that will have to conform to privacy and information legislation in the near future. Using study year as a variable, the effect of academic experience can be evaluated. An increasing number of games contain location based services, especially mobile games. For this reason gamer classification is chosen as a variable.

II. REVIEW

Privacy as a fundamental human right is recognized in the UN Declaration of Human Rights as well as the constitution of numerous countries [7], [8]. A discussion of privacy in terms of technology, philosophical and legal concepts as well as society is given in [9]. The importance of privacy is also stated by [10], [11].

Current legislation regarding digital privacy and availability of information in South Africa include:

- Constitution of the Republic of South Africa 108 of 1996 [12]
- Promotion of Access to Information Act 2 of 2000 [13]
- Electronic Communications and Transactions Act 25 of 2002 [14]

According to Mark Heyink [15], an information attorney and information security consultant: "In South Africa we are probably 30 years behind most of the European countries relating to the implementation of privacy law and the education of our citizens about the importance of the protection of their personal information." He also states that because the citizens are not aware of their personal information rights they don't seem to take as much notice of violations of these rights. If the POPI act is passed it will help South Africa align its privacy laws with European countries, according to Heyink.

In other countries surveys and campaigns are used to improve awareness of privacy. A survey was commissioned by the Office of the Privacy Commissioner of Canada regarding privacy-related issues among Canadians [16]. Some of the topics covered are online information, behavioral advertising and tracking, privacy policies and mobile devices. An example of privacy awareness campaigns is the Privacy Awareness Week initiative of the Asia Pacific Privacy Authorities forum held yearly [17]. Other researches have also been done on the legal literacy and user's awareness of privacy, data protection, and copyright legislation [18]. Need for awareness has also been expressed by president Obama [19].

With the increase of location-based technology being used in software, protection mechanisms have been proposed to help users and legislation is revised to take into account privacy threats due to characteristics of modern and future information systems [20]-[27]. An overview of location based services and specific privacy issues are discussed in [28].

III. AIMS AND OBJECTIVES OF RESEARCH

The aim of this study is to investigate awareness of legislation on digital privacy among computer science students in South Africa as well as the perceived importance of such legislation. Awareness and perceived importance is measured according to study year and gamer classification.

IV. METHOD

A. Research Design

The positivism paradigm is used in this study because the key features and methods of this paradigm relate well to the research environment. Surveys by means of questionnaires will be used as research method.

B. Questionnaire Design

To create the questionnaire, 73 preliminary questions were chosen and divided into four sections. The first section contained biographical questions, the second section contained questions on technology use and computer, console and mobile gaming. The third section contained questions on the use of location based technologies as well as awareness of security implications regarding these technologies. The fourth section contained questions on the awareness of legislation regarding digital privacy and the use of location data as well as the importance of specialized legislation and awareness campaigns regarding digital privacy and the use of location data.

After choosing preliminary questions, a pilot study was done to improve the questionnaire. The pilot study population included two students from each year group, with one person being a gamer with technical knowledge and the other person not. During the pilot study the students were asked the questions in the form of an interview. They had to respond with their answer, an explanation of how they understood the question as well as general comments on the question and possible answers. These interviews were recorded and used to improve the questionnaire.

C. Data Collection

An online system was created that can import a list of questions and options and create a web-based questionnaire that can accept multiple choice answers as well as open answers. Additional questions can be displayed when a specific answer is given for a question. This system was used to create a web-based questionnaire based on the chosen questions from the pilot study.

IT students at the Potchefstroom campus of NWU (North-West University, South Africa) were given login details during a chosen practical class for each year group and asked to complete the questionnaire. The login details distinguished between the different year groups. After the cut-off time all records were consolidated and prepared for processing.

D. Data Processing

The consolidated dataset containing the records of the four different year groups was exported from Microsoft™ SQL Server Express 2012 to Microsoft™ Excel and all records with

corrupt data were removed and columns with relevant data were chosen and exported to MATLAB™.

MATLAB™ was chosen because of familiarity and availability. The following functions were written in MATLAB™:

- Apply *factoran* function to do factor analysis on chosen data and draw relevant graphs.
- Calculate factors from items identified in factor analysis and calculate Cronbach's alpha for factor.
- Apply *anova1* function to do single factor ANOVA on factors calculated and display results.
- Calculate *cross tabulation* using *crosstab* function on chosen items and export results to Microsoft™ Excel.

Factor analysis for two components using a *promax* rotation was done on the items in Table I that had values expressed in a four-point Likert scale:

TABLE I
 RESEARCH VARIABLES USED IN FACTOR ANALYSIS

Item	Description
1	Perceived sensitivity of location data.
2	Perceived harm if location data is compromised.
3	Importance of awareness of the security implications regarding digital privacy.
4	Importance of specialized legislation regarding digital privacy.
5	Importance of specialized legislation regarding the use of location data.
6	Importance of awareness of legislation regarding digital privacy and the use of location data.
7	Need for properties of applications and games that influence digital privacy to be listed separately in terms in condition.

Other research variables that are not expressed as a Likert scale are evaluated using cross tabulation. These research variables are given in Table II:

TABLE II
 RESEARCH VARIABLES USED IN CROSS TABULATION

Item	Description
1	Read terms and conditions of software and games.
2	Awareness of legislation regarding digital privacy.
3	Awareness of legislation regarding the use of location data.

After calculating the factors identified with factor analysis, ANOVA was applied to measure the statistical significance of the variation in the factors according to the chosen fixed variables. The fixed variables were study year and gamer classification. Study year is a variable ranging from one to four indicating the current study year and gamer classification is a variable ranging from zero to four indicating one of the following gamer classifications:

0. Non-gamer
1. Casual
2. Avid
3. Extreme
4. Pro

The classifications indicate an increasing amount of time spent playing games, as well as the importance of gaming to the respondent. Non-gamers might occasionally play games and pro gamers would play games for profit. Cross tabulation

was done on variables not included in the factor analysis to provide an overview of the interrelation between variables. The same fixed variables were used for ANOVA and cross tabulation, namely Study year and gamer classification.

V. RESULTS

A. Descriptive Statistics

The population consisted of 77.4% male and 22.6% female respondents. The number of respondents according to study year is given in Table III.

TABLE III
DISTRIBUTION OF POPULATION BY STUDY YEAR

Group	Respondents	Percentage of population	Total	Percentage of Group participated
First year	178	62.9%	218	81.7%
Second year	42	14.8%	102	41.2%
Third year	35	12.4%	63	55.6%
Fourth year	28	9.9%	33	84.8%
Total	283		416	68.0%

The participants were asked to classify themselves according to their level of gaming and the result is given in Table IV.

TABLE IV
DISTRIBUTION OF POPULATION BY GAMING CLASSIFICATION

Group	Respondents	Percentage of population
Non-gamer	57	20.1%
Casual gamer	143	50.5%
Avid gamer	48	17.0%
Extreme gamer	14	4.9%
Pro gamer	21	7.4%
Total	283	

To measure security awareness respondents were asked if read the terms and conditions of software and games. 80.2% replied that they did not read the terms and conditions and 19.8% replied that they did. They were also asked to rate the following statements from strongly disagree to strongly agree:

- My location data is sensitive and should be kept private at all cost.
- It will be very harmful to me if my location data is compromised.
- It is important that people are aware of the security implications regarding location data.

The results are given in Table V.

TABLE V
SENSITIVITY OF LOCATION DATA

Statement	Strongly disagree	Disagree	Agree	Strongly agree
Location data sensitive	1.1%	8.8%	38.9%	48.1%
Harmful if location data compromised	1.8%	23.0%	42.0%	30.0%
Importance of security awareness of location data	1.4%	3.2%	47.7%	44.2%

When asked if they are aware of any legislation regarding **digital privacy**, 55.8% answered yes. 38.2% said they are aware of legislation regarding **the use of location data**. Participants were asked if, in their opinion, specialized legislation regarding digital privacy and the use of location data is important. The results are given in Table VI. Also in Table VI are the results for participants' opinion on the importance of awareness of legislation and the importance of separately listed privacy properties in terms and conditions of software and games.

TABLE VI
IMPORTANCE OF LEGISLATION, AWARENESS AND STRUCTURE OF TERMS AND CONDITIONS

Legislation	Strongly disagree	Disagree	Agree	Strongly agree
Digital privacy legislation	1.8%	3.9%	62.2%	32.2%
Use of location data	1.1%	6.0%	61.8%	29.3%
Importance of awareness of legislation	0.4%	5.3%	65.7%	27.2%
Separate privacy properties	1.4%	7.1%	58.7%	30.7%

B. Factor Analysis

The result of factor analysis as discussed in the previous section is given in Table VII and Fig. 1.

TABLE VII
FACTOR ANALYSIS FOR TWO COMPONENTS USING PROMAX ROTATION

Item	Loading1	Loading2	Factor (Component)
1	0.93	-0.04	1
2	0.72	-0.06	1
3	0.69	0.06	1
4	0.16	0.53	2
5	0.02	0.70	2
6	-0.06	0.80	2
7	-0.08	0.69	2

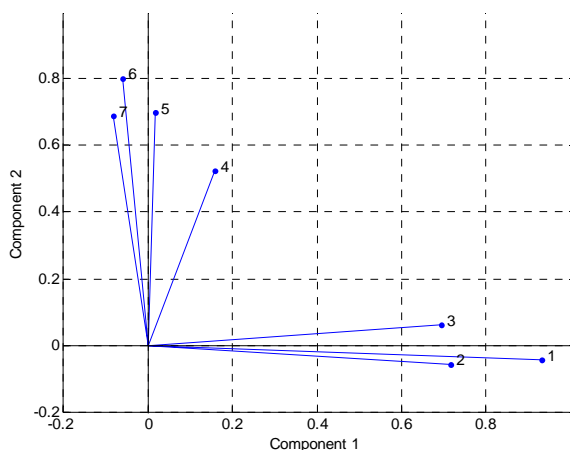


Fig. 1 Factor analysis using two components and promax rotation

Calculating the factors yielded Cronbach's alpha values given in Table VIII.

TABLE VIII
CRONBACH'S ALPHA VALUES FOR FACTORS

Factor	Description	Cronbach's alpha	Items
1	Sensitivity to digital privacy	0.81	1,2,3
2	Importance of legislation, awareness and structure of terms and conditions	0.77	4,5,6,7

Factor 1 shows the participant's sensitivity to digital privacy. Factor 2 shows the participant's opinion on the importance of legislation, awareness and structure of terms and conditions

C. ANOVA

The results of single factor ANOVA applied to factor 1 (sensitivity to digital privacy) and factor 2 (importance of legislation, awareness and structure of terms and conditions) according to fixed variables study year and gamer classification is shown in Table IX. The mean values are given in Table X. The box chart for factor 2 according to study year is shown in Fig. 2.

TABLE IX
SINGLE FACTOR ANOVA OF FACTOR 1 (SENSITIVITY TO DIGITAL PRIVACY) AND FACTOR 2 (IMPORTANCE OF LEGISLATION, AWARENESS AND STRUCTURE OF TERMS AND CONDITIONS) ACCORDING TO STUDY YEAR AND GAMER CLASSIFICATION

Factor	Fixed variable	p	MSE	F
1	Study year	0.92	0.67	F(3,279)=0.17
1	Gamer classification	0.56	0.67	F(4,278)=0.75
2	Study year	0.05	0.32	F(3,279)=2.63
2	Gamer classification	0.59	0.33	F(4,278)=0.71

TABLE X
MEAN VALUES FOR SINGLE FACTOR ANOVA OF FACTOR 1 (SENSITIVITY TO DIGITAL PRIVACY) AND FACTOR 2 (IMPORTANCE OF LEGISLATION, AWARENESS AND STRUCTURE OF TERMS AND CONDITIONS) ACCORDING TO STUDY YEAR AND GAMER CLASSIFICATION

Fixed variable	Value	Mean for factor 1	Mean for factor 2
Study year	1	3.2	3.2
	2	3.2	3.3
	3	3.2	3.4
	4	3.3	3.4
Gamer classification	0	3.3	3.3
	1	3.2	3.3
	2	3.1	3.1
	3	3.0	3.3
4	3.3	3.2	

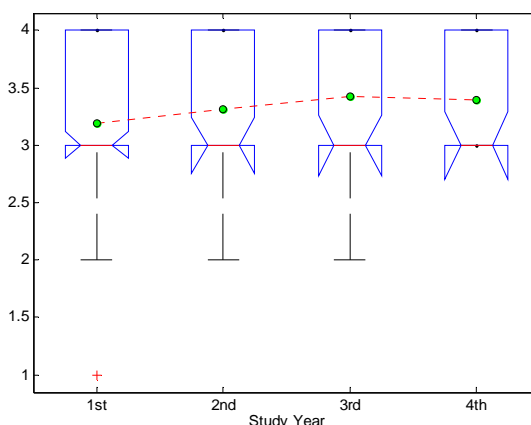


Fig. 2 Box plot of single factor ANOVA of importance of legislation, awareness and structure of terms and conditions according to study year. Dotted line indicates mean values

The results for single factor ANOVA of the 7 elements in Table I are given in Tables XI (according to study year) and XII (according to gamer classification).

TABLE XI
SINGLE FACTOR ANOVA OF VARIABLES ACCORDING TO STUDY YEAR

Variable	p	MSE	F
Perceived sensitivity of location data.	0.85	0.83	F(3,279)=0.26
Perceived harm if location data is compromised.	0.79	0.89	F(3,279)=0.35
Importance of awareness of the security implications regarding digital privacy.	0.33	0.77	F(3,279)=1.13
Importance of specialized legislation regarding digital privacy.	0.07	0.37	F(3,279)=2.34
Importance of specialized legislation regarding the use of location data.	0.14	0.53	F(3,279)=1.83
Importance of awareness of legislation regarding digital privacy and the use of location data.	0.90	0.44	F(3,279)=0.19
Need for properties of applications and games that influence digital privacy to be listed separately in terms in condition.	0.02	0.59	F(3,279)=3.43

TABLE XII
SINGLE FACTOR ANOVA OF VARIABLES ACCORDING TO GAMER CLASSIFICATION

Variable	p	MSE	F
Perceived sensitivity of location data.	0.51	0.83	F(4,278)=0.83
Perceived harm if location data is compromised.	0.92	0.90	F(4,278)=0.23
Importance of awareness of the security implications regarding digital privacy.	0.93	0.78	F(4,278)=0.22
Importance of specialized legislation regarding digital privacy.	0.19	0.37	F(4,278)=1.53
Importance of specialized legislation regarding the use of location data.	0.09	0.52	F(4,278)=2.04
Importance of awareness of legislation regarding digital privacy and the use of location data.	0.40	0.44	F(4,278)=1.02
Need for properties of applications and games that influence digital privacy to be listed separately in terms in condition.	0.92	0.61	F(4,278)=0.24

D. Cross Tabulation

Cross tabulation of awareness of legislation regarding digital privacy according to gamer classification is given in Table XIII.

TABLE XIII
CROSS TABULATION RESULTS

	Study year		Gamer classification	
	p	CHI2	p	CHI2
Awareness of legislation regarding digital privacy	0.48	2.49	0.02	11.34
Awareness of legislation regarding the use of location data	0.22	4.32	0.001	17.8

Cross tabulation of awareness of legislation regarding digital privacy according to gamer classification is given in Table XIV.

TABLE XIV
CROSS TABULATION OF AWARENESS OF LEGISLATION REGARDING DIGITAL PRIVACY ACCORDING TO GAMER CLASSIFICATION (P= 0.02, CHI2=11.34)

	Non-gamer	Casual	Avid	Extreme	Pro	Row Total
No	33	65	17	6	4	125
% of row	26%	52%	14%	5%	3%	
% of column	58%	45%	35%	43%	19%	
% of total	12%	23%	6%	2%	1%	
Yes	24	78	31	8	17	158
% of row	15%	49%	20%	5%	11%	
% of column	42%	55%	65%	57%	81%	
% of total	8%	28%	11%	3%	6%	
Column Total	57	143	48	14	21	283

Cross tabulation of awareness of legislation regarding the use of location data according to gamer classification is given in Table XV.

TABLE XV
CROSS TABULATION OF AWARENESS OF LEGISLATION REGARDING THE USE OF LOCATION DATA ACCORDING TO GAMER CLASSIFICATION (P=0.001, CHI2=17.8)

	Non-gamer	Casual	Avid	Extreme	Pro	Row Total
No	42	83	36	8	6	
% of row	24%	47%	21%	5%	3%	
% of column	74%	58%	75%	57%	29%	175
% of total	15%	29%	13%	3%	2%	
Yes	15	60	12	6	15	
% of row	14%	56%	11%	6%	14%	
% of column	26%	42%	25%	43%	71%	108
% of total	5%	21%	4%	2%	5%	
Column Total	57	143	48	14	21	283

VI. DISCUSSION

A. Descriptive Statistics

A total of 68% of possible respondents completed the survey. Only 20.1% of the respondents categorized themselves as non-gamers. Of the non-gamers, 9% indicated that they do play computer games, 9% console games and 14% mobile games, but not frequently. The majority of respondents did play games in one form or another. The majority of respondents (80.2%) replied that they did not read the terms and conditions of software. People don't like to read the terms and conditions for software and just click on "next".

Even though 55.8% of respondents said that they are aware of digital privacy legislation, answers to open questions indicated that they do not understand what the legislation entails.

94.4% of respondents agreed that specialized legislation for digital privacy is important. 91.1% agreed that specialized legislation regarding the use of location data is important. 92.9% indicated that that awareness of legislation is important. 89.4% agreed that privacy properties should be separately listed in terms and conditions. These results show that people are concerned about privacy, legislation and awareness of legislation. Even though very few people read the terms and conditions, most people want the properties of software that influence privacy listed separately in the terms and conditions.

B. Factor Analysis and ANOVA

Two factors were identified using factor analysis. The first factor indicated sensitivity to privacy and the second factor the importance of legislation. The Cronbach alpha values of both factors are high (Table IX). The only ANOVA that yielded meaningful results is of importance of legislation according to study year (Table XI). This result shows that there is an increased perception of importance of legislation, awareness and structure of terms and conditions with study year.

C. Cross Tabulation

Two of the cross tabulation results had p-values lower than 0.05. They were for awareness of legislation regarding digital privacy according to gamer classification and awareness of legislation regarding the use of location data according to gamer classification (Tables XIV and XV). These results show that there is increased awareness of privacy legislation among

people who play more games (gamer classification). Gamers are often more exposed to location based services and their influence on digital privacy, and with these they have an increased awareness of privacy legislation.

VII. CONCLUSION

Privacy legislation and awareness of legislation is important to people, but they do not want to read through long documents written in a foreign language (as most people see the legalese of terms and conditions).

Even though the majority of respondents did not read the terms and conditions of software, it is important to them that the properties of the software that influence privacy should be listed separately in the terms and conditions. This is an opportunity to increase awareness of privacy and legislation.

Academic experiences increase the perception of the importance of legislation and the importance of awareness of legislation pertaining to privacy. Lastly, the awareness of digital privacy legislation is average, but when asked about legislation regarding the use of location data, awareness is lower. Awareness is increased among gamers.

To conclude, digital privacy legislation is perceived as very important, but awareness of privacy legislation is not high.

Future work will be to expand the study to include people with work experience and to evaluate the understanding of privacy legislation.

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