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ARE PEOPLE REALLY CONCERNED ABOUT THEIR PRIVACY?: PRIVACY PRADOX IN MOBILE ENVIRONMENT

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ABSTRACT

The wide spread of mobile devices enables people to use the Internet everywhere. It provides people convenience in various aspects. However, they also are exposed to the risk of personal information leakage and privacy invasion. No previous study has examined whether the behaviors of people are influenced by their awareness of privacy in a mobile environment. With the ever-increasing importance of privacy issues, our study examines the critical relationship between individual privacy concerns and its behavior. The data is the media diary of 10,174 individuals' media usage for three days, collected by the Korea Information Society Development Institute (KISDI) in 2014. Our result suggests that privacy concern has a positive influence on the smartphone usage, mobile application purchase and in-app purchase. It implies that the individual privacy concern does not correspond to his or her actual behaviors, which is paradoxical.

Keywords: Privacy Paradox, Privacy Concern, Mobile device, Mobile Environment

INTRODUCTION

With the development of mobile technology and low network charges, many people started to utilize mobile devices such as smartphones and tablets. Among the households in Korea, the penetration rate of smartphone is 84.1% in 2014 [14]. Smartphone usage continues to grow. The average daily usage time of a smartphone is 2 hours 51 minutes in 2014, which is the increase of 38 minutes from a year before. 45.7% of smartphone users spend more than 3 hours with a smartphone [17].

Despite the high penetration and daily usage of mobile devices, people are sensitive to security issues in a mobile environment. Especially, many people are concerned about personal information leakage. According to the Korea Internet & Security Agency, 88.2% of the users recognize personal information leakage and privacy invasion and 85.5% of users concern them as a top priority [15]. Moreover, users' privacy concern is higher on a mobile environment than on a laptop environment. They are reluctant to do sensitive tasks such as mobile banking or purchasing products because they do not trust security system applied on a mobile [7]. Also, users think that mobile applications require personal information excessively [16]. Privacy issue in a mobile environment has become an important topic in these days.

However, no previous study has examined whether the users' behaviors are influenced by their awareness of privacy in a mobile environment. We investigate the relationship of individual behavior and privacy concerns in mobile environment and explain the phenomenon. The data used in our research is the media diary of 10,174 individuals' media usage by every 15 minutes for three days, conducted by Korea Information Society Development Institute (KISDI) in 2014. Our results show that privacy concerns have a positive influence on the smartphone usage, mobile application purchase and in-app purchase. The findings explain the "privacy paradox" that the individual privacy concern does not correspond to his or her actual behavior. In other words, people keep using smart devices and do not demonstrate strong information-protecting behavior, even though they have significant concern on their private information.

RELATED LITERATURE

Privacy

Privacy is applied to a variety of fields, but there are various definitions without a general consensus. [28] conceptualized privacy with the right to be let alone, limited access to the self, secrecy, control of personal information, personhood, and intimacy. An online environment mainly deals with information privacy and it is one part of whole privacy concept [6]. [26] treated the information privacy as a contrasting concept with the physical privacy which is related with physical access and private space. [30] defined the information privacy as the ability to control personal information individually. [8] also defined it as the claim to protect and control individual data.

Privacy Concern

Privacy concern is the anxiety about the information privacy mentioned above. [27] explained that the privacy concern is associated with collection, errors, unauthorized secondary use, and improper access. This research defines the privacy concern as the degree of personal cares and worries about the possibility of privacy invasion in an online environment [13].

Many researchers used privacy concerns as a dependent variable or an independent variable. [20] explained the privacy-protecting behavior with privacy concern through teenagers' survey on Internet usage. [25] observed that education level increases privacy concerns through email survey. In addition, a female has higher privacy concerns in SNS and mobile environment and is more willing to do privacy-related behaviors [12][24]. [2] revealed that privacy concern decreases the purchase in an online environment through email survey. [35] demonstrated that privacy concern is mediated by perceived advantage from information exchange and perceived risk from data disclosure through the survey of young adolescents. Prior works examined the difference

of privacy concern by demographic information or privacy-protecting behavior by privacy concerns. The studies were conducted by survey and these usually studied privacy concerns in online environment. With growing importance of a mobile, we investigate the smartphone usage through the media diary which users filled in their actual use for three days. We examine actual user behaviors with smartphone by privacy concern empirically.

Privacy Paradox

Existing research results present that privacy concern increases privacy-protecting behavior and people are not willing to provide personal information. However, privacy paradox indicates the counterintuitive phenomenon that the concern or attitude on privacy and the actual behavior are inconsistent [21][22][26]. [29] observed that people provide most of their personal information in online shopping environment even though they have high privacy concern. [21] revealed that people tend to give more personal information in actual behavior than their intention to provide. As people who have privacy concern have high intention to access to new information or service, they tend to provide their information more. This indicates that users can take irrelevant actions on their concern for personal information leakage and privacy invasion, if they find much value on the information or service. Privacy paradox researches have focused on the privacy-protecting behavior and the extent to provide personal information. We extend earlier works on privacy paradox observing actual individual behaviors in mobile environment. Specifically, this work studies the usage of various services in a smartphone based on privacy paradox.

RESEARCH HYPOTHESES

Companies want to increase their value and customer loyalty by providing personalized services. To implement it, they need to use personal information or transactional data. Openness, the unique nature of Internet, enables companies to collect, store and utilize customer's information easily [22]. As companies analyze the information and select proper target group, they understand more about their customers and provide successful customized services [10]. The recommendation systems of Amazon and Netflix are typical examples. However, information collection of customers causes privacy concerns [4]. When served by these systems, users encounter a difficulty to compromise with their privacy [33]. They have to give up a part of their privacy by providing their information and personal information being stored in servers. Privacy concern has negative influence on the adoption of personalized services [18] and users who have high concern are less inclined to enroll in the web sites [25]. Personal information has a possibility to be traded and used in an unexpected way, and the concern on privacy invasion becomes more significant [24].

As the number of smartphone users increases with the popularity of mobile application, privacy concern in a mobile environment has increased drastically. Even though mobile applications make our lives comfortable and easier with personalized service, they cause anxiety to users [32]. The users are strongly reluctant to provide their contact information to seller in a mobile payment system [11] because privacy assurance is the most influencing factor on the purchase intention for mobile application [23]. In addition, teenagers easily open their and their family information on the Internet in spite of their parents' worries [5]. Therefore, the following hypotheses regarding privacy concern are proposed.

H1: Privacy concern has a negative influence on the frequency of smartphone usage.

H2: Privacy concern has a negative influence on expense on mobile applications.

H3: People who have high privacy concern are less likely to purchase paid mobile application.

H4: People who have high privacy concern are less likely to make in-app purchase.

METHODOLOGY

Data

The data consist of survey and media diary of 10174 people (4313 households) collected by KISDI in 2014. Survey includes demographic information, possession of electronic devices, and experience of Internet and mobile services. Participants filled in the media diary about the place they used a mobile device and what they did using a mobile device every 15 minutes for 3 days. We excluded people who didn't answer the items on privacy concern, who don't use smartphone, and who are under 10 and over 60 years old. After screening out based on the previous criteria, behavioral data of 6817 people are analyzed. Their demographic information is as below (Table 1).

Table 1. Demographic information

Item		<i>n</i>	%
Gender	Female	3611	53.0
	Male	3206	47.0
Age	Under 10	0	0.0
	10s	1142	16.8
	20s	877	12.9
	30s	1303	19.1
	40s	2031	29.8
	50s	1464	21.5
Education	Preschool	0	0.0
	Elementary School	341	5.0
	Middle School	610	8.9
	High School	2885	42.3
	College	2853	41.9
	Graduate School	128	1.9
Monthly Income (Unit : Million Won)	0	2981	43.7
	Under 0.5	115	1.7
	0.5 ~ 1	297	4.4
	1 ~ 2	1182	17.3
	2 ~ 3	1126	16.5
	3 ~ 4	655	9.6
	4 ~ 5	282	4.1
	Over 5	179	2.6
Employment	Unemployed	3037	44.6
	Employed	3780	55.4
		6817	100

Measures

Six items of privacy concern were borrowed from [13]. It consists of Likert five-point scale. With the reliability analysis, Cronbach's alpha coefficient is 0.949 which is high enough to confirm reliability. All factor loading values are over 0.875, satisfying common standards 0.5 (Table 2).

Table 2. Factor analysis & reliability

Item	Content	Factor loading	Reliability
PC 1	Are you concerned about people you do not know obtaining personal information about you from your online activities?	0.894	0.949
PC 2	Are you concerned that information about you could be found on old devices?	0.875	
PC 3	Are you concerned that you are asked for too much personal information when you register?	0.888	
PC 4	Are you concerned about online identity theft?	0.897	
PC 5	In general, how concerned are you about your privacy while you are using the Internet?	0.917	
PC 6	Are you concerned about people online not being who they say they are?	0.886	

To measure the intrinsic influence of privacy concern on smartphone usage, we included control variables which can affect the usage potentially. Gender, age, education, income, employment, and frequency of smartphone usage have influence on the usage of smart device and mobile service [19][31][34][36]. Frequency of smartphone usage is calculated by sum of records to use in media diary and other variables are set by demographic information on survey. To check multi-collinearity, we conducted correlation analysis between variables. Age and monthly income have highest coefficient, 0.452. All other coefficients are less than 0.4, so it is not serious to concern multi-collinearity. In addition, we checked VIF in regression and reconfirmed to exclude multi-collinearity issue (Table 3).

Table 3. Correlation Coefficient

PC	AGE	EDU	IC	FSU	EMA
Privacy Concern (PC)	-0.054**	0.188**	0.055**	0.163**	0.097**
Age (AGE)		0.141**	0.452**	-0.208**	-0.098**
Education (EDU)			0.313**	0.164**	0.082**
Monthly Income (IC)				-0.016**	0.016**
Frequency of Smartphone Usage (FSU)					0.235**
Expense on Mobile Application (EMA)					

* $p < 0.05$, ** $p < 0.01$

RESULTS

We conducted linear regression analysis and logistic regression analysis to test hypotheses. Table 4 and 5 show the result of linear regression and table 6 shows the result of logistic regression analysis for binary dependent variables. Except hypothesis 1, we added frequency of smartphone usage as control variable to control the potential influence on dependent variables. Hypothesis 1 shows that privacy concern has a positive influence on smartphone usage. This analysis result rejects the hypothesis and shows the opposite direction contrary to our expectation (Table 4).

Table 4. Regression result of hypotheses 1

Independent Variable	Dependent Variable: Frequency of Smartphone Usage			
	B	S.E.	Std. B	p-value
Privacy Concern	1.795	0.186	0.114	< .001
Gender	-1.267	0.427	-0.040	.003
Age	-0.284	0.016	-0.247	< .001
Education	3.055	0.232	0.163	< .001
Monthly Income	0.631	0.179	0.087	< .001
Employment	-1.146	0.727	-0.036	.115
Constant	9.047	1.170	-	< .001

$R^2 = 0.097$, Adjusted $R^2 = 0.096$, $F = 122.068$ (p -value < 0.001)

Hypothesis 2 shows that privacy concern has a positive influence on the expense on mobile applications. This analysis result also rejects the hypothesis, and demonstrates the opposite direction (Table 5).

Table 5. Regression result of hypotheses 2

Independent Variable	Dependent Variable: Expense on Mobile Applications			
	B	S.E.	Std. B	p-value
Privacy Concern	1.295	0.423	0.103	.002
Gender	2.179	0.766	0.105	.005
Age	-0.065	0.035	-0.077	.063
Education	0.672	0.475	0.050	.158
Monthly Income	0.156	0.331	0.033	.638
Employment	-0.200	1.368	0.218	< .001
Frequency of Smartphone usage	0.142	0.023	0.218	< .001
Constant	-4.985	2.581	-	.054

$R^2 = 0.085$, Adjusted $R^2 = 0.077$, $F = 10.986$ (p -value < 0.001)

Hypotheses 3 and 4 show that people who have high privacy concern are more likely to purchase paid mobile application and make in-app purchase. This analysis result rejects the hypotheses, too. People use their smartphone and spend money on mobile applications in spite of the privacy concern (Table 6).

Table 6. Regression result of hypotheses 3, 4

Independent Variable	Dependent Variables	
	Experience of Paid Mobile App Purchase (H3)	Experience of In-app Purchase (H4)
Privacy Concern	1.295	0.423
Gender	2.179	0.766
Age	-0.065	0.035
Education	0.672	0.475
Monthly Income	0.156	0.331
Employment	-0.200	1.368
Frequency of Smartphone usage	0.142	0.023
Constant	-4.985	2.581

H3: $-2LL = 2364.881, x^2 = 191.677$ (7 DOF, $p < 0.001$)

H4: $-2LL = 4185.854, x^2 = 80.454$ (7 DOF, $p < 0.001$)

* $p < 0.05$, ** $p < 0.01$

CONCLUSION

This study examined the relationship between privacy concern and individuals' smartphone usage from the privacy paradox perspective. We formulated hypotheses in a mobile environment and used demographical data to analyze them. The result indicates that four hypotheses about smartphone usage, expense on mobile application, mobile application and in-app purchase experiences were not supported, or confirmed in the other direction. It shows privacy paradox that people do not actually behave reasonably despite their privacy concern.

According to theory of cognitive dissonance [9], individuals seek consistency between their expectations and their reality. Based on the principle, individuals try to protect their information and minimize the usage of service when they worry about privacy invasion. This study represents that we need to examine another facet of individual behavior on privacy. Although most of users know dangers that their information is exposed to others, they do not actually know how dangerous it is or do not care about it. Previous research has shown that individuals carelessly disclose personal information such as a social security number or contact information despite of privacy concern [1]. Also, they do not check how their information is saved and utilized by application developers [3]. Government needs to inform people this situation and suggest a policy to minimize it.

In contrast with the previous studies, we examined the usage on mobile devices empirically by using individual actual data. Previous studies examined individual behaviors on privacy issues through surveys, but we quantified their empirical behavior. Participants recorded their behavior every 15 minutes in media diary. In addition, we extended privacy paradox study by examining details (app purchase, restriction, etc.).

This study has a few limitations. First, we found the privacy paradox in a mobile environment but we do not have the proper explanation why individuals behave in the way we have observed. Further study is warranted to find reasons why. Second, this data includes individual behavior for 3 days. It can be a short period to conclude their behavior. Thus, if we have data which is observed for a longer period of time, we will be able to examine more detailed behavior and perform rich analysis. Lastly, participants record their usages of devices by themselves. It is possible that they do not record them correctly. Collecting objective data is needed in the follow-up study.

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