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AN EMPIRICAL ANALYSIS OF SNS USERS AND THEIR PRIVACY AND SECURITY AWARENESS OF RISKS ASSOCIATED WITH SHARING SNS PROFILES (ONLINE IDENTITIES)

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ABSTRACT

Social networking sites (SNS) like MySpace, Facebook and LinkedIn now have hundreds of millions of users. In this paper a quantitative approach was used to analyse primary data collected about SNS users. Our findings show that SNS users are dominated by younger adults, higher education levels and higher income levels. SNSs are more likely to be used for maintaining existing friendships as opposed to establishing new friendships and for building business networks. SNS users either have poor levels of privacy and security awareness or high levels of complacency in relation to SNS profile sharing and sharing their identity online.

Keywords: social network sites, privacy, social media, online identity

INTRODUCTION

Social networking is a phenomenon that has gained the attention of the general public, businesses and governments alike. The growth of social network sites like MySpace, Facebook and LinkedIn in a very short period of time has exceeded all expectations. Facebook, for instance, reputedly claimed to have more than 750 million users [15] which if true would make it the third largest country in the world. Application domains of Social Networking sites have extended from government, business, social, political, educational applications and beyond. However despite the exponential growth of social networking sites, there is a lack of empirical research which has endeavoured to understand the behaviours of social networking site users and the differences between the prominent social networking sites. This research investigates social networking site user characteristics and behaviours in relation to privacy of social networking users' identities by analysing empirical survey data collected on over 300 social networking site users.

We first review current literature in relation to SNSs with particular emphasis on understanding history and evolution of SNSs and how in particular privacy and security has become a concern. Next we present the research questions and describe methodology used in this research to collect data to answer these research questions. Then we present the results of our data analysis and discuss the key findings in relation to our research questions and frame a set of propositions for investigation in future work. We conclude by summarising our findings and their implications for research and practice.

LITERATURE REVIEW

In this section we review the existing literature that underpins this paper's three main research questions: RQ1: What are key demographic characteristics of SNS users? RQ2: What are

the main ways that SNSs are used by SNS users? Are they used differently in different types of SNSs? RQ3: What is the level of privacy and security awareness that SNS users have in relation to sharing their SNS profile and online identity in SNSs?

We begin with a short definition of social network sites (SNS). We then provide a brief history of the evolution and growth of SNSs followed by usage of SNS and some key privacy issues associated with SNSs.

Definition of SNS

Early virtual communities some of which started before the Internet were largely characterised as public discussion forums and structured by discussion topics or interests in a particular region, whereas social network sites (SNSs) are structured by "interactions among people" [14]. Given that SNSs enable people connections, it is not surprising that they have become deeply embedded in peoples' lives today [2].

For this research we adopt the definition of Boyd & Ellison who define Social Network Sites (SNS) as web-based services where users construct a public or semi-public profile, communicate with other users with whom they share a connection, and view and navigate their connections all within a system [2]. However, it should be noted that the terminologies used in these connections and system vary in different SNSs. Other distinguishing factors in SNSs include the culture it represents, its user-base (general vs shared-identity categories like country or language) or extent of features incorporated (mobile, blogging, instant messaging, video/ photo sharing and apps to name a few) [2].

Short history of the evolution and growth of SNS

As of this writing, there is a wide spectrum of active SNSs supporting a wide range of interests and features using different social networking models.

Table 1 shows some of the most popular SNSs that are active and has large number of registered users with an exception of *Six Degrees* which is the first SNS & not active but it is mentioned to provide the historical context into how SNSs began and the key SNSs that have emerged over time.

Year Started	Social Network Sites
1997	Six Degrees (First, Not Active)
1998	
1999	
2000	Habbo (for Teens)
2001	Meetup.com
2002	Friendster, MyLife
2003	Tribe.net, LinkedIn, MySpace, hi5
2004	Orkut, Facebook, Flickr, Tagged
2005	YouTube, Bebo, Qzone (Chinese), Renren (Chinese), Ning
2006	Twitter, V Kontakte (Russian), Badoo
2007	
2008	
2009	Sina Weibo (Chinese)
2010	
2011	Google Plus+

Table 1. Summary Table of major SNSs with their launch dates

Six Degrees was the first SNS that fits in our definition of a SNS but the service was closed in 2000 after being incapable of generating enough revenue [14]. Many online communities transformed themselves and re-emerged as SNSs over the next few years [2].

Friendster became very popular since its launch in 2002 but soon fell apart in the US due to technical, social and trust issues [1] but continues to be popular in Southeast Asia [10]. *Orkut* is another SNS similar to *Friendster* where the US user base diminished but it continues to be popular in Brazil and India [14].

Other SNSs evolved around some specific features they provide. *LinkedIn* is the most popular SNSs for business and professional networking [14] and has recently surpassed *MySpace* to become number two social network behind *Facebook* in the US [17]. Likewise, *Youtube* features videos & video sharing; and *Twitter* features microblogging posts (called “tweets”) and differentiate themselves with their special attributes and are popular SNSs due to the distinct services they provide.

Some of the most popular SNSs evolved from other forms of virtual communities. For instance, *Facebook* was initially designed to support a very specific demographic (college networks) before expanding to support broad audience [2] and has now become the world’s most popular SNS [6, p.13] with membership grown to over 750 million [15].

Outside the US, there are limited dialogue and research activities around SNS growth and understandings largely because of linguistic barriers to analyse other popular SNSs that originated from other countries: mainly *QZone*, *Renren*, *Sina Weibo* (China) and *Vkontakte* (Russia). Likewise, a general assumption about other western countries regarding SNS usage tends to follow the US phenomena although there may be some distinct differences which is beyond the scope of our study.

The picture of SNS growth is still evolving with new ideas to expand user base using the benefits of the network effect and engage its users into innovative and interesting activities providing specialising services. For instance, *Google Plus+* is the recent addition in the SNS arena which is trying to challenge dominance of *Facebook* and provide one significant point of differentiation: sharing with groups [11].

Usage of SNS

The total number of social network sites users is growing rapidly and has nearly doubled in size since 2008 [6, p.3]. It is not just the number of users but the popularity of SNSs also demonstrates stickiness and addictive appeal across different cultures and generations. TNS 2008 survey suggests that adults from 16 industrialised countries on average spend one-third of their leisure time online, have at least two SNSs and keep regular contact with 16 people who they have “virtually” met on the Internet [16].

Broadly speaking, contrary to the technical possibility that users of a SNS can use its social network to explore and find strangers to make friends, most SNS users prefer to maintain and enhance their already existing offline social relations using SNSs [2][3][9]. Lampe, Ellison, & Steinfield (2006) found that Facebook users engage in “searching” people with existing offline connections more than looking for complete strangers to meet [9].

Kumar, Novak, & Tomkins (2006) suggested that there are three major categories of SNS users: “passive members” who do not have any friend connection, “inviters” who encourage offline users to migrate online, and “linkers who fully participate in the social evolution of the network” [8].

Privacy Issues in SNS

A critical element of a SNS that contributes to the growth of the network connection is its open public display [2]. Paradoxically, SNSs are also subject to privacy concerns due to this very feature and potential privacy threats are one of the key research areas in SNSs.

In general, privacy is governed by an individual’s ability to manage social contexts. In the context of SNSs, privacy issues are bound by the needs of privacy in the underlying social connections [13]. SNSs tackle privacy issues through profile visibility options or privacy settings where SNS users can specify their preferences [2]. However, these settings do not easily assist users to specify varying levels of privacy settings to each of their friends for handling different conceptions of privacy, for example while handling conflict with friends [13].

There are a lot of studies describing privacy concerns on SNSs. Gross & Acquisti (2005) argues that students’ personal information on their Facebook profiles could be used to potentially construct users’ social security numbers [5]. A “phishing” scheme used in a 2007 study to send messages that appeared to come from a friend on the network of users that had public profiles suggested that these users are vulnerable to give away information to this fake “friend” – this suggests serious privacy leakage and security issues exist within SNSs

[7].

One recent critical review of Facebook in terms of its privacy issues is presented by Fuchs (2011) [4]. Fuchs argues that “Facebook commodifies and trades user data and user behaviour data” and suggests “sharing” on Facebook in economic terms means giving away information to advertising clients which raises grave concerns on privacy. A number of strategies to tackle these privacy issues are suggested: provision of opt-in online advertising, strict civil surveillance of Internet companies, and advancements of alternative social networking platforms that respects total privacy [4].

This literature review is not thorough due to space limitations, does not focus much on languages other than English used in SNSs and since it is a constantly evolving field, new breakthroughs and ventures providing refreshing arguments in the SNS usage landscape appear frequently.

Research questions

The literature reviewed regarding the characteristics and usage patterns of SNS users and their security and privacy awareness, leads us to investigate the following research questions:

RQ1: What are key demographic characteristics of SNS users?

RQ2: What are the main ways that SNSs are used by SNS users? Are they used differently in different types of SNSs?

RQ3: What is level of privacy and security awareness of SNS users in relation to sharing their SNS profile and online identity in SNSs?

METHODOLOGY

A quantitative positive approach was used in this research to analyse survey data collected for Pew Research’s May 2008 cloud computing and adult social networking report which was released in January 2009 [12]. This survey data included 326 respondents from adults (18 years and older) who are using social networking sites. This data was collected in a rigorous manner and provides a large data set and comprehensive snapshot of the behaviours of SNS users at a recent point of time. These responses were analysed using descriptive statistics techniques such frequency tables, cross tabulations and ANOVAs to provide answers to the research questions posed in this research.

DISCUSSION OF RESULTS OF DATA ANALYSIS

Demographics of the SNS users that responded to the Pew Research survey are presented next with some descriptive statistics. After that, we observed some behavioural aspects of SNS users to understand different ways SNS sites were used and how usage vary based on SNS types; and then finally, we analysed SNS users awareness of their privacy leaks and resulting action of modifying SNS privacy settings to avoid such leaks.

SNS users demographic information

Usage of SNSs by gender was evenly split in the survey responses. Table 2 show the distribution of Internet Experience in years across SNS users.

	Frequency	Valid Percent	Cumulative Percent
Missing	3	.9	.9
1-5yrs	53	16.4	17.3
6-10 yrs	153	47.4	64.7
11-15 yrs	81	25.1	89.8
16-20 yrs	22	6.8	96.6
21-25 yrs	6	1.9	98.5
26-30 yrs	5	1.5	100.0
Total	323	100.0	
Missing	3		
Total	326		

Table 2. Internet Experience of SNS users

In regards to their Internet experience, about half of SNS users have significant Internet experience of 6-10 years and almost a quarter of SNS users had up to 15 years of Internet experience. This suggests more than 80% of SNS users had used Internet for over 5 years, suggesting SNS users are very Internet-savvy.

Table 3 presents SNS users in terms of their income levels.

	Frequency	Valid Percent	Cumulative Percent
Less than \$10,000	21	7.6	7.6
\$10,000 to under \$20,000	24	8.7	16.3
\$20,000 to under \$30,000	31	11.2	27.5
\$30,000 to under \$40,000	33	12.0	39.5
\$40,000 to under \$50,000	30	10.9	50.4
\$50,000 to under \$75,000	34	12.3	62.7
\$75,000 to under \$100,000	48	17.4	80.1
\$100,000 or more	55	19.9	100.0
Total	276	100.0	
Missing	50		
Total	326		

Table 3. Income Level of SNS users

The use of SNSs is dominated by the higher income groups with over 35 percent of respondents falling into the \$75,000 or higher income categories.

Similarly Table 4 shows that SNS users are highly represented by higher education levels (college education and higher) in the survey responses.

	Frequency	Valid Percent	Cumulative Percent
Less than High School	31	9.6	9.6
High School Graduate	74	22.9	32.5
Some College	105	32.5	65.0
College +	113	35.0	100.0
Total	323	100.0	
Missing	3		
Total	326		

Table 4. Education Level of SNS users

Two thirds of SNS users have higher education level as illustrated in Table 4. An ANOVA of frequency of SNS usage by education levels revealed there are significant

differences across different educational categories. A Post Hoc Tukey Test determined that SNS users with college or higher education were significantly different in numbers to the other three educational groups. Tables 5 and 6 present the ANOVA and Post Hoc Tests results.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	47.851	3	15.950	8.900	.000
Within Groups	557.336	311	1.792		
Total	605.187	314			

Table 5. ANOVA – Frequency of SNS visits by Education

Multiple Comparisons							
Dependent Variable: Frequency of SNS visits							
	(I) Receduc	(J) Receduc	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	LT HS	HS Grad	-.015	.289	1.000	-.76	.73
		Some College	-.354	.274	.568	-1.06	.35
		College +	-.949	.272	.003	-1.65	-.25
	HS Grad	LT HS	.015	.289	1.000	-.73	.76
		Some College	-.339	.207	.359	-.87	.20
		College +	-.934	.205	.000	-1.46	-.41
	Some College	LT HS	.354	.274	.568	-.35	1.06
		HS Grad	.339	.207	.359	-.20	.87
		College +	-.595	.183	.007	-1.07	-.12
	College +	LT HS	.949	.272	.003	.25	1.65
		HS Grad	.934	.205	.000	.41	1.46
		Some College	.595	.183	.007	.12	1.07

Table 6. Post Hoc Tukey Tests - SNS visits by Education

SNS users are largely represented by younger generation with over 75% users under the age of 44 and more than half of them under the age of 35 years. Frequency table of SNS users by age (Table 7) reveals that 18-24 years group have the highest representation of SNS users amongst the survey respondents.

	Frequency	Valid Percent	Cumulative Percent
18-24	94	29.3	29.3
25-34	80	24.9	54.2
35-44	68	21.2	75.4
45-54	47	14.6	90.0
55-64	23	7.2	97.2
65 and over	9	2.8	100.0
Total	321	100.0	
Missing	5		
Total	326		

Table 7. Age groups of SNS users

An ANOVA of frequency of SNS usage by Age categories revealed there are significant differences across age categories. A Post Hoc Tukey Test determined that SNS users in the Age category 18-24 yrs were significantly different in numbers to the other four age groups other than 65 yrs and over age group. Tables 8 and 9 present the ANOVA and Post Hoc Tests results.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	101.205	5	20.241	12.391	.000
Within Groups	501.485	307	1.634		
Total	602.690	312			

Table 8. ANOVA – Frequency of SNS visits by Age

Multiple Comparisons							
Dependent Variable: Frequency of SNS visits							
	(I) recage	(J) recage	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	18-24	25-34	-.993*	.196	.000	-1.55	-.43
		35-44	-1.277*	.203	.000	-1.86	-.69
		45-54	-1.504*	.232	.000	-2.17	-.84
		55-64	-.960*	.315	.030	-1.86	-.06
		65 and over	-.785	.471	.555	-2.13	.57
	25-34	18-24	.993	.196	.000	.43	1.55
		35-44	-.284	.212	.762	-.89	.32
		45-54	-.511	.239	.271	-1.20	.18
		55-64	.033	.320	1.000	-.89	.95
		65 and over	.208	.474	.998	-1.15	1.57
	35-44	18-24	1.277	.203	.000	.69	1.86
		25-34	.284	.212	.762	-.32	.89
		45-54	-.227	.246	.940	-.93	.48
		55-64	-.318	.325	.925	-.61	1.25
		65 and over	.493	.478	.907	-.88	1.86
45-54	18-24	1.504	.232	.000	.84	2.17	
	25-34	.511	.239	.271	-.18	1.20	
	35-44	.227	.246	.940	-.48	.93	
	55-64	.544	.343	.609	-.44	1.53	
	65 and over	.719	.490	.686	-.69	2.13	
55-64	18-24	.960	.315	.030	.06	1.86	
	25-34	-.033	.320	1.000	-.95	.89	
	35-44	-.318	.325	.925	-1.25	.61	
	45-54	-.544	.343	.609	-1.53	.44	
	65 and over	.175	.535	.999	-1.36	1.71	
65 and over	18-24	.785	.471	.555	-.57	2.13	
	25-34	-.208	.474	.998	-1.57	1.15	
	35-44	-.493	.478	.907	-1.86	.88	
	45-54	-.719	.490	.686	-2.13	.69	
	55-64	-.175	.535	.999	-1.71	1.36	

Table 9. Post Hoc Tukey Tests – SNS visits by Age

The age group 18-24 have the highest representation in SNS users. The results of the ANOVA and a Post Hoc Tukey test in Tables 8 and 9 show that this age group are significantly different from all the other age groups except for the 65 and over who are anyway under-presented in the survey responses.

Major purposes of using SNSs

After providing insights and understanding of the demographics of SNS users, we analysed some behavioural observations of SNS users to attempt to understand how they are using SNS sites (See Table 10) as and if users had multiple profiles in different SNSs, how did they use them for different purposes?

SNS Main Uses	Responses		Percent of Cases
	N	Percent	
Make new friends	156	15.8%	50.5%
Stay in touch with friends	281	28.4%	90.9%
Flirt with someone	64	6.5%	20.7%
Make plans with your friends	176	17.8%	57.0%
Make new business or professional contacts	92	9.3%	29.8%
Promote yourself or your work	89	9.0%	28.8%
Organize with other people for an event, issue or cause	131	13.2%	42.4%
Total	989	100.0%	320.1%

Table 10. Summary of main types of SNS usage

Our first observation is obvious: all aspects of friendship - making friends, staying in touch with friends and making plans with friends are one of the main uses of SNSs in general. It is interesting to find a greater share of SNS users engage in staying in touch with friends (91%) and making plans with friends (57%) rather than making new friends (51%). This observation is an empirical support of the

findings by previous researchers suggesting that SNS is used more to connect with existing friends rather than looking for strangers to befriend [2][3][9]. In terms of understanding user preferences of SNS sites over different usage purposes, Table 11 shows that MySpace and Facebook are more widely used to establish new friendships than are other SNSs.

		Make friends		Total
		No	Yes	
Types of SNS sites	MySpace	75	77	152
	Facebook	33	34	67
	LinkedIn	21	3	24
	YouTube	1	1	2
	Flickr	1	0	1
	Others	14	21	35
Total		145	136	281

Table 11. Types of SNS sites * Make friends Cross Tabulation

Likewise, a cross tabulation between types of SNS sites and intentions to make new business or professional contacts (Table 12) shows that LinkedIn is used more widely for making new business or professional contacts relatively than are MySpace or Facebook.

		Make new business or professional contacts		Total
		No	Yes	
Types of SNS sites	MySpace	114	38	152
	Facebook	53	14	67
	LinkedIn	7	17	24
	YouTube	1	1	2
	Flickr	1	0	1
	Other	24	11	35
Total		200	81	281

Table 12. Types of SNS sites * Make new business or professional contacts Cross Tabulation

Similarly, LinkedIn is also used extensively to self-promote or to promote business than MySpace and Facebook (Table 13). Both these findings empirically validate the preference of LinkedIn for business and professional networking. This is expected finding given that LinkedIn is the most popular business networking SNS today [14].

		Promote yourself or your work		Total
		No	Yes	
Types of SNS sites	MySpace	115	37	152
	Facebook	54	13	67
	LinkedIn	11	13	24
	YouTube	0	2	2
	Flickr	1	0	1
	Other	22	13	35
Total		203	78	281

Table 13. Types of SNS sites * Promote yourself or your work Cross Tabulation

SNS users: privacy awareness and action

In order to understand level of privacy awareness of SNS users, we analysed the data on the survey question that assessed users’ perceptions on how easily they thought their online identity could reveal their identity/person in the physical world. It is quite interesting to observe that the majority of SNS users (almost 80%) realise that they could be identified physically from their online profile in SNSs. This suggests that they realise the possibility that SNS usage can expose their identity to complete strangers. This observation can be illustrated in Table 14 below.

	Frequency	Valid Percent	Cumulative Percent
Missing	11	3.4	3.4
It would be pretty easy	144	44.2	47.5
They would have to work at it but they could figure it out eventually	107	32.8	80.4
It would be very difficult for someone to find out who you are from your profile	64	19.6	100.0
Total	326	100.0	

Table 14. Perception of security of SNS identity (How easy it would be for someone to find out who you are based on your SNS profile?)

In regards to application of privacy settings by SNS users, it is observed that 2 out of 5 SNS users are not mindful about privacy of their information in SNS since they do not modify settings to restrict or limit access to their profile or wall postings by others. Table 15 and 16 present these findings in regards to SNS privacy protection by restricting access to full SNS profile and by limiting who can see certain information.

This could be explained due to their lack of understanding of privacy implications of their SNS usage and risks of identity theft and fraud or a complex learning curve in providing a “safe” privacy setting, or a combination of both.

SNS Privacy Awareness Frequencies				
		Responses		Percent of Cases
		N	Percent	
SNS Privacy Awareness ^a	Restrict access to full profile	180	50.3%	87.0%
	Limit who can see certain information	178	49.7%	86.0%
Total		358	100.0%	172.9%

a. Dichotomy group tabulated at value 1.

Table 15. SNS Privacy Awareness levels in relation to SNS profile

This also presents a situation where a significant number of SNS users either unknowingly or knowingly (over 40% when allowing for missing responses) are vulnerable allowing their profile and wall information (like photos or posts) to be accessible to strangers albeit unknowingly. This finding raises a number of privacy and security concerns regarding the awareness of SNS users.

We ran a cross tabulation to further investigate SNS users awareness regarding security of their SNS identity against their intention to restrict access to their full profile and protect their privacy on their SNS (Table 16). In this scenario, it will be interesting to observe if SNS users’ perception of ease in which their identity may be revealed due to online SNS profiles has impacted their action of adjusting privacy settings to their profile.

		Perception of security of SNS identity (How easy it would be for someone to find out who you are based on your SNS profile?)			Total
		It would be pretty easy	They would have to work at it but they could figure it out eventually	It would be very difficult for someone to find out who you are from your profile	
SNS privacy protection – restrict access to full profile	No	68	31	22	121
	Yes	67	72	35	174
Total		135	103	57	295

Table 16. SNS privacy protection – restrict access to full profile *
Perception of security of SNS identity cross tabulation

An interesting observation is that about one-third of SNS users believe they would not be easily identified by their SNS profiles, and possibly as a consequence of this, they do not modify their privacy settings in their SNS profiles.

Almost half of SNS users who think that it will be easy to find out about their physical identity due to their SNS profiles, still do not modify their profile privacy settings to try to take measures to prevent potential privacy leakage. Since these SNS users are aware of SNS profile privacy issues but still do not do anything about it, it might imply that they must be either not seriously understanding the repercussions of strangers identifying them from online profiles, or ignoring the situation altogether since there is no way around it and a majority of SNS users fall into these two categories.

Limitations and suggestions for future work

This study looks at limited number of SNSs, and the data collected presented a snap shot of SNS users’ perceptions at a point in time. While the findings here most pertain to one dataset, we feel that the behavioral findings for SNSs represent a general contribution to the study and understanding of SNS sites usage and the apparent lack of security and privacy awareness of SNS users.

Our quantitative approach did not allow us to fully explain the behavior of SNS users on all aspects. While theory and prior work often offer compelling possibilities, interviews would add to the overall picture. Furthermore with the exponential growth of the Internet in Asia, Africa and also in the Middle East means there are large populations of SNS users specific to these regions and location- and interest-specific types of SNSs with quite different cultural and socio-economic backgrounds which were not addressed in this study. These limitations provide fertile grounds for future research in SNS user behaviours and usage understandings with different social, geographic and cultural settings and across different SNS types.

CONCLUSIONS

This paper using empirical data examined the characteristics, types of usage and the privacy and security awareness levels of SNS users. We identified that SNS users are dominated by the following demographics: younger adult age groups, college and higher education levels, and higher income levels. SNSs are used primarily for maintaining friendships and building business networks. SNS users have either poor

understanding or are complacent to the risks associated with not ensuring adequate privacy and security of their SNS profiles and online identities. This may be a result also of SNSs not providing sufficient system controls and information to allow SNS users to adequately protect the security and privacy of their SNS profiles and online identities. It will also be interesting to see how governments respond with strengthened security and privacy legislation with a number high profile cases already occurring of social network sites in regards to privacy being compromised. Our work further emphasises how a priori social patterns manifest themselves in social media even when the technology could be used to change the patterns.

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