

# Who do you trust?

## Information Sharing, Privacy Concerns and Trust in an online Social Network

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**Abstract** — Individual privacy concerns and perceptions of trust are believed to play an important role underlying the establishment of online social relationships. Here we report on the findings of a survey administered to college students on their usage of a popular social network site, Facebook, which measured perceptions of trust, privacy concerns, and willingness to share information. We find that the mere perception of privacy, whether warranted or not, is enough to create trust. We also identify several dichotomies between users' beliefs and behaviors, differences between online and offline social networking and between usage of the site by gender. We find that individuals reveal a tremendous amount of personal information on Facebook, which is typically accessible to all other users in their "network". Moreover, 61% of the individuals surveyed who have a facebook account admitted to adding total strangers to their "friends" list, thus giving these strangers access to their personal information, which may have widespread consequences. In general, we find that a Facebook-style forum is an effective communication tool, which is gaining popularity as 66% of respondents reported using Facebook more than e-mail to communicate.

**Keywords:** *Trust, privacy, online privacy, social networking sites, Facebook usage, information revelation, hedonic information systems.*

### INTRODUCTION AND RELATED WORK

A social networking site such as Facebook is a destination on the World Wide Web where users go to interact with existing friends and to build new relationships with other users who may be friends-of-friends, or complete strangers. Facebook, in particular, has become extremely popular, with one recent study ranking it as the most popular overall website in terms of time spent by a large margin, surpassing other well-known sites such as Yahoo and Google.<sup>[1]</sup> Facebook has now been released in more than 70 languages, and the number of active users is over 300 million<sup>[2]</sup>. Yet there are serious concerns about privacy and safety regarding the use of social networking sites such as Facebook. Some of the potential risks include identity theft, sexual predation, breaches by hackers, as well as impersonation and fraud. Nevertheless, relatively little research investigates the online behavior of Facebook users and the related issues of trust and privacy. Here we explore

the coupling between usage trends, privacy concerns and willingness to share information on Facebook among a sample of college students. We identify discrepancies between users' beliefs and behaviors, differences in usage of the site by gender, and identify characteristics predictive of which individuals are more likely to reveal information.

To examine the relationship between Facebook usage, privacy, trust, and online identity we designed and administered a survey to college freshman classes at the University of California, Davis between September 2007 and June 2008. (Surveys for each quarter can be found at: [http://www.ece.ucdavis.edu/~anayakpr/facebook\\_research.html](http://www.ece.ucdavis.edu/~anayakpr/facebook_research.html), Human Subjects Protocol Number: 200816234-1). Our study involves approximately one-thousand students surveyed longitudinally over a period of a complete academic school year.

Previous research investigating social networking behavior via surveys, see for instance<sup>[2], [3]</sup>, has had a different focus from our current work. Lampe et al.<sup>[4]</sup> surveyed users to analyze why and how one joins Facebook. A restricted study at Carnegie Mellon University<sup>[3]</sup>, reported in 2005, did survey users about privacy concerns but involved only fifty students, questioned solely at one particular block of time. A 2006 study by Stutzman<sup>[2]</sup> reported quantitative metrics on social networking community participation and information disclosure on a college campus, but this was when Facebook had enforced a requirement that only individuals with ".edu" ending e-mail accounts could join. Other relevant previous studies found that a sample of college students provided large amounts of personal information to other college students on Facebook.<sup>[5]</sup> Yet Facebook has now expanded its reach far beyond college campuses. One of the questions we investigate here is whether college students continue to provide a good deal of personal information when the seemingly safe boundary of a college campus is removed.

Our survey was administered and distributed each quarter (Fall, Winter, and Spring), to students in a variety of courses. The longitudinal nature of administering the survey enables us to track usage changes during the course of the year, to modify the survey each quarter to ask different questions and to delve more deeply into certain subject matters and trends observed in previous quarters. In particular, the survey was distributed and collected in the

classroom during a variety of freshmen courses, ranging from the humanities to physical sciences to engineering. A total of 269 completed surveys were collected in the Fall quarter, 527 were collected in the Winter quarter, and 245 in the Spring, for a total of 1041 surveys. Of those surveys, 55 were discarded due to lack of quality (from either not being fully completed or indicating multiple answers to questions), leaving us with 986 high quality, complete surveys. A reasonable gender balance was achieved, with 59% of the 986 respondents being female, and 41% male. Throughout this paper, all the percentages reported are aggregated over the three quarters unless otherwise specified.

#### GENERAL USAGE TRENDS

Of the 986 total respondents, 93% of them report currently having a Facebook account. Approximately 66% of those respondents report having established the account before entering university. This marks a significant change from Stutzman's 2006 study<sup>[3]</sup> (conducted when Facebook enforced a ".edu" email address policy), which observed a strong surge of students registering with Facebook during college orientation. Of our respondents, 84% of those with Facebook accounts report visiting Facebook at least once per day and spending on average a total of 45 minutes a day on the site. A more detailed breakdown is in Figure 1, which shows the responses to the Spring 2008 survey question "How much time do you spend on Facebook per day?" As seen in this graph, female respondents spend significantly more time per day (Mean = 27.4 minutes) when compared to males (Mean = 20.16 minutes), with a sizable fraction of males spending only 10 minutes on Facebook per day. The overall use of Facebook is striking when compared to an "essential site" such as a search engine. The number of visitors to Facebook averages 99.6 million per month while, Google averages 141 million page views per month.<sup>[1]</sup> As determined using the "statistics" tab posted on the Facebook site<sup>[2]</sup>, since Jan 2007 Facebook has experienced an average of 300,000 new registrations per day, with the number of active users on Facebook doubling approximately every 8 months, and each month about 70% of Facebook users engage with Platform applications and over 2 billion photos are uploaded.<sup>[6]</sup> In the Winter quarter, we asked respondents what they are doing while on the Facebook site. 12% reported using the Facebook "market place" to buy and sell goods. 50% post announcements on their Facebook page to invite friends to offline social events. But the most common activity, with 84% of males and 66% of females reporting they do so, is to "tag" friends' videos and pictures. To "tag" an image is to attach meta-data identifying individuals appearing in that image. By default, all individuals "tagged" in an image, as well as all their "friends", are allowed to view that picture or video. This makes the picture easier to locate by friends on Facebook, yet also reveals the identity of individuals without requiring any approval from those individuals tagged unless users modify their default privacy settings (discussed below).

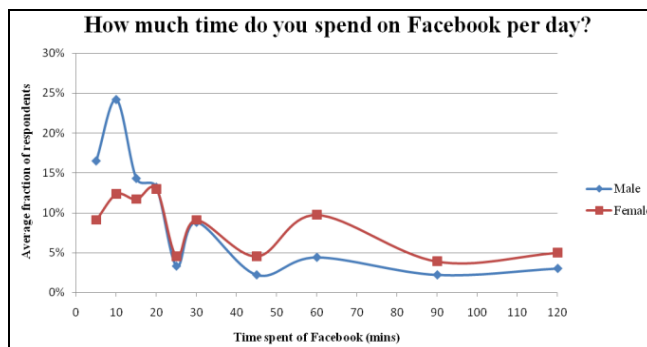


Figure 1. The amount of time spent on Facebook per day, sorted by gender. (Spring 2008 data)

#### INFORMATION REVEALED:

We asked respondents to provide us with the details of the types of information revealed on their Facebook profile. Figure 2 lists the type of information, and percentage of respondents including this information in their profile, sorted by gender. The graph is ordered with increasingly "private" information plotted towards the right. Here we see that respondents in our sample reveal a substantial quantity of detailed, private information on Facebook. For example, the large majority of respondents, over 80%, provide basic demographic information about themselves, including their gender, name, birthdate, and picture. Fewer people (less than 25%), however, reveal identifying data concerning their geographic location, such as their phone number, zip code or physical address. Moreover, gender differences in the tendency to reveal information appear to emerge. Males reveal their religion, political view, phone number and physical address more readily when compared to females. For instance 24% of males compared to 14% of females provide their phone numbers on the site, and 15% of males while only 6% of females provide their physical address. We will quantify the statistical significance of such gender differences, as well as other demographic differences, in subsequent multivariate statistical analyses. With the vast quantity of information revealed by both genders, a next natural question is whether or not this information is legitimate. Although the Facebook privacy policy states "You will not provide false personal information on Facebook, or create an account for anyone other than yourself without permission."<sup>[7]</sup>, no quantitative figures have been reported on how well this statement is being upheld by users. During the Winter and Spring quarters the survey contained the question do you "represent oneself the same way in real life and on Facebook?" to which 94% females and 86% of males answered yes.

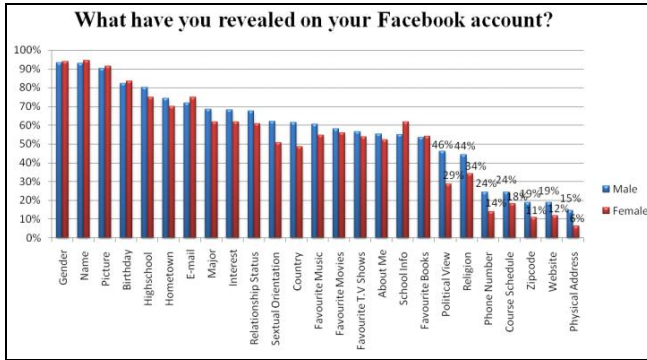


Figure 2. The types of information revealed on Facebook profiles and the fraction of respondents revealing this information.

CONDONED INFORMATION SHARING:

In the Winter and Spring surveys, we asked respondents “Who are you OK with looking at your Facebook profile?”. The responses are presented in Figure 3. Again, the general trend that males are more willing to expose their information is seen here. Willingness to share information with classmates was expected. Yet we also find that a large proportion of respondents are willing to reveal their information to strangers, with 46% of males and 24% of females willing to do so. This also manifests misconceptions in user’s understanding of Facebook. A relatively high percentage of males (46%) are willing to reveal information to strangers, while fewer (males and females) will share with the government (32%) or employers (35%). Furthermore 12% of total respondents (male and female) who indicated that they are “OK with strangers” said they are not “OK with the government”. In reality, government officials or employers, posing as strangers, could parse any information made available to total strangers.

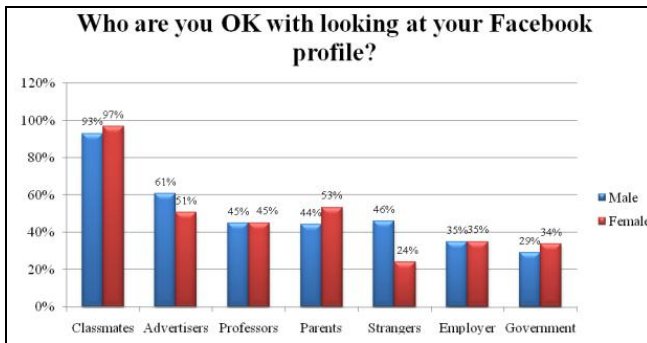


Figure 3. Respondents are comfortable with a variety of entities accessing their profiles, with 46% of males and 24% of females comfortable even with total strangers.

One reason why individuals may be “OK with strangers” viewing their profile is that they provide very little private information on their Facebook location. Thus, we next analyze what information is actually revealed by respondents who report being “Ok with strangers” (see Figure 4). In females, the expected trend holds; that is, these females

provide relatively little information on Facebook. Males, in contrast, reveal substantial amounts of information regardless of whether or not they are “OK with strangers” looking at their profile.

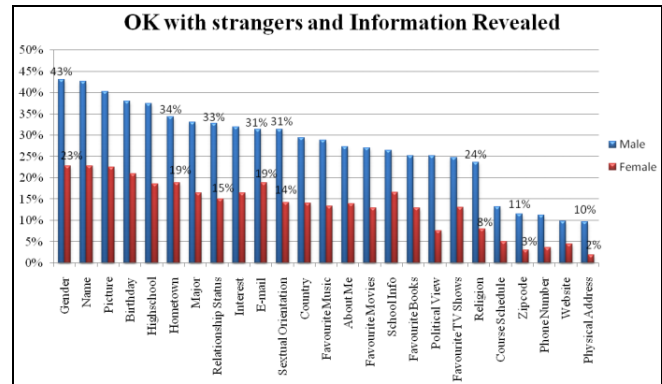


Figure 4. The types of information revealed by respondents who are “OK with strangers” viewing their Facebook profiles, sorted by gender.

USER’S BELIEFS ABOUT PRIVACY AND INFORMATION SHARING:

We also probed respondents to assess with whom they think Facebook is sharing their data and to assess their trust of Facebook with regards to protecting their privacy. When asked, “Have you read Facebook’s privacy policy?” only 7% of males and 9% of females answered “yes”. A study conducted in 2005 asked the same question<sup>[3]</sup> and a higher percentage (20%) stated that they had read the Facebook privacy policy. This might indicate a change in how perceptions of privacy have evolved in the past 2-3 years. Despite not reading this privacy policy, we find the majority of respondents, 59% of males and 66% of females, answer “yes” to the question – “Have you changed your privacy settings on your Facebook account?” Finally, each quarter we asked “Do you feel that your identity is well protected by Facebook?” Aggregating over the three quarters, 48% of males and 47% of females answered “yes” to this question. We conducted a cross-tabulation analysis and find no evidence of a significant association between individuals “changing their privacy settings” and “feeling well-protected by Facebook” (p > 0.5). In other words, people who change their privacy settings on Facebook may still feel that their identity is not well protected. Furthermore, we find that female Facebook users are on average more likely to believe that their identity is well protected by Facebook if they spend more time on Facebook. This correlation does not hold for male users. To delve more deeply into respondents’ perceptions of information sharing, during Spring quarter 2008 we asked – “Does Facebook share your profile information with advertisers?” 62% of males and 69% of females answered “I don’t know” while 20% of males and 28% of females answered incorrectly “no”. Furthermore, when asked, “What information would you give to advertisers?” (Winter and Spring 2008), 59% of females and 43% of males do not want to give any information to

advertisers. For a detailed breakdown of responses, see Figure 5. Though individuals may not want to divulge information to anyone other than their friends, all information posted on user profiles can be disclosed to advertisers in an “aggregated” manner, as seen in the Facebook privacy policy described here: “Facebook may use information in your profile without identifying you as an individual to third parties. We do this for purposes such as aggregating how many people in a network like a band or movie and personalizing advertisements and promotions so that we can provide you Facebook. We believe this benefits you. You can know more about the world around you and, where there are advertisements, they’re more likely to be interesting to you. For example, if you put a favorite movie in your profile, we might serve you an advertisement highlighting a screening of a similar one in your town. But we don’t tell the movie company who you are.”<sup>[7]</sup>

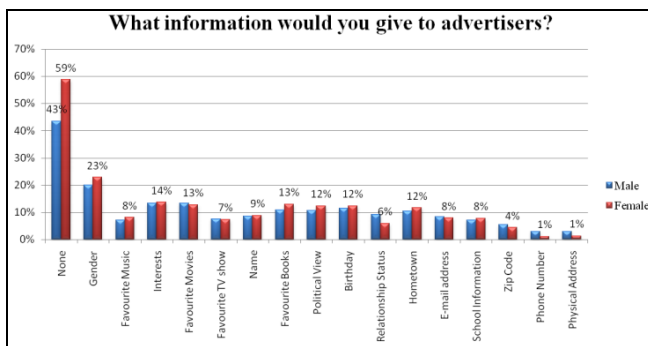


Figure 5. Information students are willing to give advertisers. (Winter & Spring 2008)

#### ADDING STRANGERS AS “FRIENDS”:

Administrators at Facebook get access to a user’s profile and his or her behaviors while using Facebook, as do advertisers, and developers of any plug-in application that the user has added (discussed in detail below). Access to a user’s profile information is, by default privacy settings, also available to any other Facebook users in one’s “network”, members of any “group” that one has joined, and of course other users connected as “friends”. So who are these “friends”? We find that the majority of Facebook users in our surveyed population add complete strangers as “friends”. In response to the survey question “How many “friends” have you added without actually knowing who they are?” 67% of males and 66% of females admitted to adding at least one such unknown person as a friend. Out of those males, 30% say that they are not “OK with strangers” looking at their profile, but still have added “[at least one] ‘friend’ without actually knowing who they are.” A higher percentage of females (41%) say that they are not “OK with strangers” looking at their profile, but still report adding “[at least one] ‘friend’ without actually knowing who they are.” These strangers now have “friend”-level access to information revealed in a profile. To delve more deeply, in the Spring 2008 survey respondents were asked “On a scale of 0-10 do you feel that your identity information is well-protected by Facebook?” with 10 being “Yes” and 0 being “No”. The

Pearson’s correlation between the response to this question and the response to the number of strangers added as “friends” on Facebook was 0.098 and insignificant, indicating that these two responses are essentially uncorrelated. That is, the tendency to add strangers as “friends” was not related to the degree to which people believed their identity was protected. Total strangers are gaining access to the data of the majority of our participants because of the common practice of adding unknown individuals as “friends.” Those potentially gaining access include the government, employers, potential employers, parents, coworkers, health insurance companies, and so on. The amount of information revealed could have long-term ramifications. There have already been several cases reported where Facebook users have lost opportunities and jobs because an employer found something disagreeable in their profiles<sup>[8]</sup>. The contrary can also be seen. Having a Facebook account and maintaining it in a professional manner can facilitate one getting a job.<sup>[9]</sup>

#### THIRD-PARTY APPLICATIONS:

Another way in which Facebook profile information is revealed is through installation of “Facebook applications,” that is, plug-in applications such as friend wheels, and games. These applications are a prime part of the Facebook experience, as seen in Figure 6. By installing an application a user gives the developer of that application access to much of the information posted on their Facebook profile. Facebook’s published Platform Application Terms of Use [10], in effect during the time of our survey, states that Facebook is allowed to disclose to developers: “... without limitation, the following information, to the extent visible on the Facebook Site: your name, your profile picture, your gender, your birthday, your hometown location (city/state/country), your current location (city/state/country), your political view, your activities, your interests, your musical preferences, television shows in which you are interested, movies in which you are interested, books in which you are interested, your favorite quotes, the text of your “About Me” section, your relationship status, your dating interests, your relationship interests, your summer plans, your Facebook user network affiliations, your education history, your work history, your course information, copies of photos in your Facebook Site photo albums, metadata associated with your Facebook Site photo albums (e.g., time of upload, album name, comments on your photos, etc.), the total number of messages sent and/or received by you, the total number of unread messages in your Facebook in-box, the total number of “pokes” you have sent and/or received, the total number of wall posts on your Wall™, a list of user IDs mapped to your Facebook friends, your social timeline, and events associated with your Facebook profile.”<sup>[10]</sup>

Since “a list of user IDs mapped to your Facebook friends”, along with other personal identifiers, can be tracked by the application, a user ends up revealing information about his or her friends to the developers of applications. As stated in the Facebook Privacy Policy<sup>[7]</sup>, “If you, your friends, or members of your network use any third-party

applications developed using the Facebook Platform ("Platform Applications"), those Platform Applications may access and share certain information about you with others in accordance with your privacy settings."<sup>[7]</sup> Facebook does not screen platform developers and has minimal control over their use and disclosure of the information garnered. As noted explicitly in the Facebook Privacy Policy, "while we have undertaken contractual and technical steps to restrict possible misuse of such information by such Platform Developers, we of course cannot and do not guarantee that all Platform Developers will abide by such agreements."<sup>[7]</sup> Only 16% of all respondents have not added a Facebook application. The remaining 84% of users are not only giving much of their own information to the developers of applications, they can also jeopardize their friends' privacy information. (As of August 2009, due to concerns of Canadian privacy officials, Facebook is in the process of revamping policies on disclosure of information to application developers. See the Office of the Privacy Commissioner of Canada for more details, [http://www.priv.gc.ca/media/nr-c/2009/nr-c\\_090827\\_e.cfm](http://www.priv.gc.ca/media/nr-c/2009/nr-c_090827_e.cfm), as well as Facebook's statement<sup>[2]</sup>)

Figure 6 contains details of what types of third-party applications are installed by users. Here again gender differences are apparent, with a larger fraction of females installing applications. Thus while females reveal on average less private information in their profiles (as seen in Figure 2) than males, by installing more applications, females expose this information, and information from people in their network, more broadly.

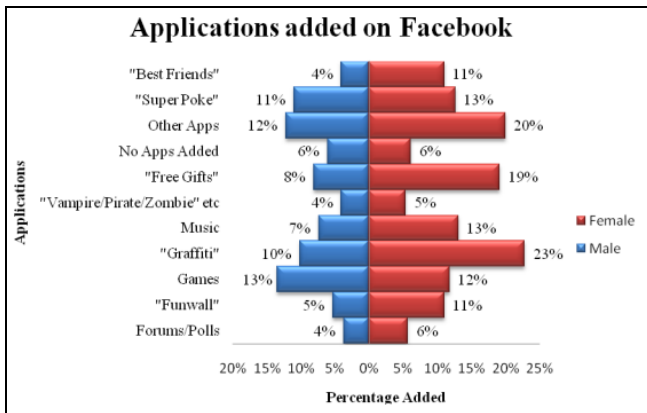


Figure 6. The types of applications added broken down by gender. (Spring 2008)

**ONLINE VERSUS OFFLINE SOCIAL NETWORKING:**

Given the propensity of users to add strangers as friends on Facebook, it is interesting to tabulate the number of "friends" reported in the online community. As shown in Figure 7 (a), 32% of females and 31% of males report having "200 or more" friends on Facebook. Moreover, the number of respondents reporting having 200+ friends on Facebook increases from quarter to quarter. There is a 10% gain (from 20% to 30%) from Fall to Winter quarter and a 15% gain (30% to 45%) from Winter to Spring quarter. However,

when asked "How many "Facebook friends" do you associate closely with outside of Facebook?" that number drops precipitously, as expected (see Figure 7 (b)). Past research has shown that offline, on average, one has about 5 close friends.<sup>[11]</sup> Consistent with this, our results show that 44% of males and 41% of females have "20 or less friends" offline. Consistent with the results of previous research,<sup>[12-13]</sup> we find there are key differences between online relationships when compared to offline ones. As noted above, the number of friends that are made online is drastically larger than friends made offline. However most online friends never interact in person. When asked "How many "Facebook friends" do you associate closely with outside of Facebook?" only 2% of all respondents answered "200 or more". 24% said that they associated with "20 or less" and 13% answered "10 or less". We also probed whether geographical location was a limiting factor in preventing Facebook friends from meeting offline. Yet we found 45% and 47% of males and females (respectively) answered yes to the question "Are most of your "friends" on Facebook attending UC Davis?", suggesting that geographic distance did not act as a barrier to getting together in person.

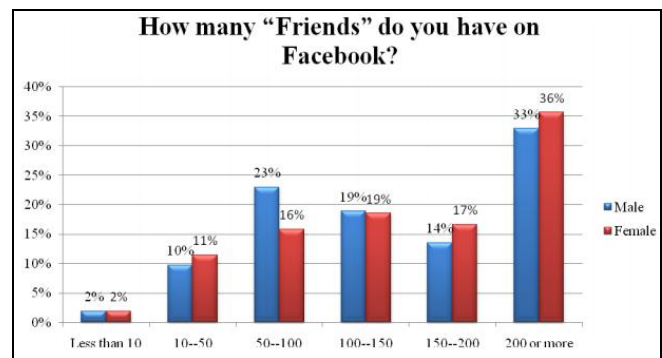


Figure 7a) The number of "friends" on Facebook.

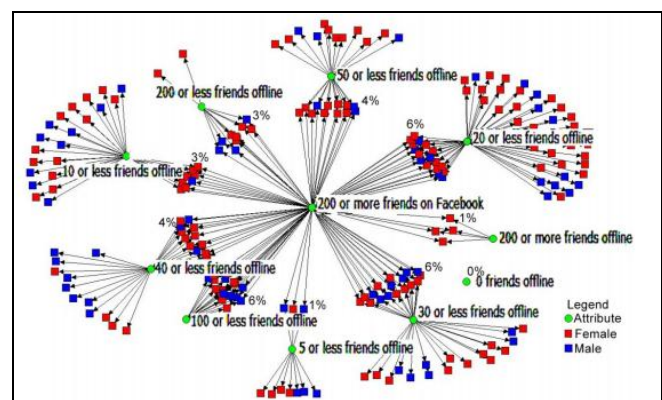


Figure 7b) Responses to two questions, "How many friends do you have on Facebook" and "How many 'Facebook friends' do you associate closely with outside of Facebook?". Each square represents an individual respondent, connected to his/her responses (circles) by edges. Most "Facebook friends" do not socialize offline.

### GROWING FACEBOOK “ADDICTION”:

Approximately, 84% of males and 83% females visit Facebook at least once a day. Amongst them are many students who readily coin the term “Facebook addicts” to describe themselves, spending hours and hours browsing their friends’ profiles and looking through posted photos and videos. 22% of the students surveyed during Winter and Spring 2008 indicate that they visit the social networking site “7-or more” times a day while 8% say that they stay on Facebook for “2 hours or more” per day. The Spring quarter survey was modified to explore the extent to which students consider Facebook a waste of time. Approximately 14% of males and 10% of females responded that they strongly believe that Facebook is a waste of time (a response of “10” on a 10 point scale).

### ACTIONS AND BELIEFS INCOMMENSURATE:

Several of the results presented above manifest discrepancies between users’ beliefs and behaviors. First we find users add “[at least one] ‘friend’ without actually knowing who they are” even if they are not “OK with strangers” viewing their profiles and even if they strongly do not trust Facebook to protect their privacy. Next, a large fraction of males, 46%, are comfortable revealing information to strangers, but only 32% are comfortable revealing that information to the government. Overall across both genders, 11% of total respondents are comfortable revealing information to strangers but not to the government. A large percentage (45%) of respondents feels their identity is well protected by Facebook despite not ever having read the privacy policy. The Facebook privacy policy clearly indicates that Facebook discloses users’ personal information to third-parties such as advertisers and application developers. The majority of students surveyed in Spring 2008 (62% of males and 69% of females respectively) do not know whether Facebook shares their information with advertisers. Furthermore, 20% of males and 28% of females believe incorrectly that Facebook does not share their private profile information with advertisers and 59% of females and 43% of males do not want to give any information to advertisers. Thus responses to “what information would you give to advertisers” are inconsistent with the information they are actually revealing. Finally, even though the vast majority of respondents (84%) have not read the privacy policy, 63% of them have changed their personal privacy settings. Overall, many students show strong concerns about their online privacy but, surprisingly, engage in activities that compromise it.

### CONCLUSIONS:

Facebook is used by millions of college students and is drawing them in to interact with their online friends and spend hours browsing profiles, making new connections, and building new relationships. The college students surveyed in our study reveal significant amounts of private information

in their Facebook profiles and this information is, for the most part, legitimate.

The students we surveyed showed concerns for their online privacy, yet do not necessarily safeguard it. The vast majority of students (92%) have not read the privacy policy. Likewise, a majority of respondents are unsure if Facebook shares their information with advertisers, and in fact about a quarter of the population surveyed believes incorrectly that Facebook does not share any information with advertisers. Students compromise their privacy repeatedly. They add complete strangers as friends, whether or not they feel well-protected by Facebook and whether or not they are “OK with strangers” viewing their profiles. By adding them, they typically give these strangers access to all their personal information. By installing applications, users give application developers access to their profile information and to their usage behaviors. Furthermore, “friends” expose attributes of one another, most commonly by installing the third-party applications (which track behaviors), and by “tagging” photos. By enabling widespread access to personal data, Facebook is in reality close to a public forum, though it gives a feeling of (and is perceived to be) a private community forum. Students believe that they are uploading their profiles for their friends and peers, but because their Facebook profile is, in essence, a public diary, many additional people, from marketers, to parents, to potential employers, may be gaining access to the information.

Of course there are tremendous opportunities gained by joining Facebook. Facebook is the new medium by which students communicate with their peers. 70% of females and 62% of males report that they “‘Facebook’ people more than email them.” This suggests that Facebook, which allows interacting on multiple levels, is a particularly enjoyable, rich medium for interacting. The Internet now has made it possible for anyone to publish and search for personal information online, but social networks are unique in that they make the user the center of information and filter information that is of interest to the user. We find that the mere perception of privacy engenders trust in a social networking community. Yet consequences of excessive disclosure of personal information are starting to emerge. This paper has aimed to inform about the trends in the privacy, trust and the usage of Facebook and how it’s different from offline social networking.

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