Friends Only: Examining a Privacy-Enhancing Behavior in Facebook

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ABSTRACT

Privacy practices in social network sites often appear paradoxical, as content-sharing behavior stands in conflict with the need to reduce disclosure-related harms. In this study we explore privacy in social network sites as a contextual information practice, managed by a process of boundary regulation. Drawing on a sample survey of undergraduate Facebook users, we examine a particular privacy-enhancing practice: having a friends-only Facebook profile. Particularly, we look at the association between network composition, expectancy violations, interpersonal privacy practices and having a friends-only profile. We find that expectancy violations by weak ties and increased levels of interpersonal privacy management are positively associated with having a friends-only profile. We conclude with a discussion of how these findings may be integrated into the design of systems to facilitate interaction while enhancing individual privacy.

Author Keywords

Social network sites, social networking, Facebook, privacy, behavioral modeling, communication

ACM Classification Keywords

H5.3 Group and Organization Interfaces; Asynchronous interaction; Web-based interaction

General Terms

Security, management, theory

INTRODUCTION

Studies of social network sites often reveal disparities between reported privacy attitudes and observed privacy behaviors [3,16,32]. This disparity, termed the "privacy paradox," [5] is generally attributed to lack of comprehension, awareness, or concern for privacy [cf. 31]. As large, heterogeneous audiences adopt social network sites, individuals are challenged to adapt privacy practices within shifting contexts [22]. For example, in a recent longitudinal study of undergraduate Facebook users at

Michigan State University, reported incidence of privacy utilization increased significantly from 2006 to 2008 [19] as the service expanded.

In a social network site, individuals have access to a variety of privacy controls. Common controls include limitation of profile access, item-level access control, as well as remedies such as blocking and hiding other site users. In socio-technical systems, the meanings attributed to privacy controls vary contextually and are shaped in practice [14]. Conceptualization of privacy controls and privacy-enhancing behaviors vary within and between social network sites. As such, this research focuses on a specific privacy-enhancing practice of a defined audience, undergraduate college students. In this research, we explore the increasingly popular behavior of setting one's Facebook profile to friends-only status. Friends-only status refers to the practice of making a profile private, so it is only viewable by articulated connections. This paper reports our analysis of a set of practices that are associated with having a friends-only profile.

Our analysis draws on a sample survey of undergraduate students at the University of North Carolina at Chapel Hill (UNC). Utilizing regression analysis, we model four potential factors associated with having a friends-only Facebook profile. As a base measure, we explore the relationship between demographic and Facebook use measures and having a friends-only profile. We then draw upon the theoretical process defined by Petronio [27] to explore this social network site privacy practice as a function of network composition, expectancy violations, and interpersonal privacy practices.

Going Friends Only

Setting a Facebook profile to friends-only status is a discrete, privacy-enhancing action with a range of implications. At the individual level, going friends-only exerts functional control over the audience of one's social network site disclosures. At the group level, a friends-only profile influences the amount of information available within a network. For example, when a person goes friends-only, second-degree contacts are no longer able to peruse information that may enhance person- and identity-perception [cf. 12,13]. A normative orientation towards friends-only status may also reduce the potential for

relational establishment, rendering the network less useful for people with such goals. Setting a profile to friends-only establishes a boundary that regulates the individual's *contributions to* and *perceptions by* the network.

In Facebook, the reciprocal nature of friendship creates equivalence between ties that is not representative of their inherent variable strength [cf. 17, 33]. This presents a challenge for disclosure regulation, as ties of varying strength have different maintenance requirements [33]. By setting the Facebook profile to friends-only, the individual focuses and limits access to the ongoing set of disclosures, which may inhibit access to the supportive resources available through the site. Facebook friends have been found to exert positive influences on measures of social capital [15], life satisfaction and civic engagement [34].

The transition of a social network profile to friends-only may also signal a shift in an individual's identity orientation. In virtual communities, a common identity orientation specifies attachment to larger group and social identities [28,29]. A new student may be more likely to adopt a common identity orientation in a social network site, as it affirms the social identity of the individual in their new role as university member. However, setting the profile to friends-only moves the orientation of interaction away from common identities and towards common bonds, representing the individual's attachment to smaller groups in the network. In setting the profile to friends-only, the individual will continue to draw benefit from support-provisioning strong ties, but they may miss some of the benefits of new or emergent ties.

Previous Work on Privacy in Social Network Sites
There is a growing body of literature exploring privacy behaviors in social network sites. Acquisti and Gross' study of privacy behaviors in Facebook revealed a disconnect between stated privacy attitudes and observed behaviors; individuals reported concern for privacy, but disclosed large amounts of information in the network [3]. Acquisti and Gross theorize that privacy is a function of one's audience, and in the case of Facebook, an imagined audience constructed of others who view the profile. Tufekci's [32] analysis models the effect of imagined audience perception on disclosure behaviors, finding a significant negative association between unwanted profile gaze and maintaining a publicly-viewable profile across social network sites.

Lewis et al. [23] used a large social network site dataset to explore the relationship between intensity of use and having a private profile. They found that privacy decisions are influenced by one's network, and that active users are more likely to use privacy features. Recent work by Lampinen et al. [21] and Skeels and Grudin [30] highlight the challenge of privacy management in the era of ubiquitous adoption: the management of the persona in multiple contexts. As more individuals join social network sites [22], the presentation of self in multiple contexts becomes increasingly complex. Shifting the profile to friends-only emerges as a strategy for management of this challenge.

Privacy as Information and Boundary Regulation Practice
Dourish and Anderson situate privacy as an information practice. Their definition of information practice refers to the "ways in which we collectively share, withhold, and manage information; how we interpret such acts of sharing, withholding and managing; and how we strategically deploy them as part and parcel of everyday social interaction" [14: 335]. Applied to social network sites, conceptualizations of privacy vary between sites, groups, and individual users.

Altman [4, cf. 24], Derlega and Chaikin [11] and Petronio [27] have elaborated privacy as a boundary regulation process. This analysis in this paper will draw primarily on Petronio's theory of Communications Privacy Management (hereafter, CPM). According to Petronio, CPM is an iterative process of *rule development*, *boundary coordination*, and *boundary turbulence*. **Rule development** is the process of developing regulation about *who* to tell *what*. These regulations guide our everyday disclosures, and are a function of context and disclosure goals. As ties of differing strength have varying disclosure norms, we operationalize rule development as a function of network composition. For example, a network that is more heavily focused on strong ties may require higher levels of privacy, as disclosures among strong ties are more personal in nature [33]. **Boundary coordination** refers to the process of developing and applying disclosure ownership and permeability rules in one's network. A disclosure about a medical condition to a trusted friend, for example, may be considered non-permeable (the friend is not expected to share the news with others), whereas office gossip may be permeable (communicants have expectancy of third-party transmission). We test boundary coordination by looking at the effect a communications expectancy violation, in which disclosure is perceived to escape one's intended audience. An individual who has experienced such a violation may coordinate boundaries through the use of enhanced privacy settings. Finally, **boundary turbulence** refers to the dynamic process of maintaining and negotiating boundaries to manage personal disclosures [27]. We operationalize boundary turbulence as a function of interpersonal privacy management in the social network site. In the following research, we test each stage of the CPM process using demographic, network, and behavioral data. We believe that each stage of the CPM process can be uniquely supported in HCI, and our goal is to identify and prioritize the most salient stages of CPM for developers of privacy systems.

Notably, the stages of CPM represent a subset of potential disclosure boundaries in HCI. Palen and Dourish's [26] exploration of boundary regulation in HCI identified three salient boundaries: the *disclosure*, *identity*, and *temporal* boundaries. The temporal boundary is particularly interesting in the context of social network sites.

Information disclosures may be viewed in relation to the boundary, having different meaning at the time of disclosure t_1 and time t_2. At a general level, boundaries in a socio-technical system are metaphors that inform conceptions of the range and audience of disclosures.

In Facebook, individuals construct rules for disclosure based on technological affordances and contextual norms [21]. The setting of the profile to friends-only marks a discrete boundary through which disclosure can be regulated. Of course, having a friends-only profile does not eliminate subsequent boundary-regulation, as privacy boundaries continue to be managed within the existing networks of connections.

In this analysis, we first explore the association of demographic and Facebook use levels with friends-only status. We then focus on *rule development*, exploring the association of network composition with having a friends-only profile, as networks of varying tie strength will have different disclosure norms. In the following analysis, we explore *boundary coordination* by modeling the association between expectancy violations and friends-only status. An expectancy violation refers to an incongruity between expected and intended disclosure audience, and a friends-only profile is one way to manage such incongruities. Finally, we model *boundary turbulence* as reported interpersonal privacy management, examining the association between increasing levels of interpersonal privacy management and having a friends-only profile. Upon completion of the analysis, we evaluate the models and conclude by providing implications for design.

METHOD

Sample
Utilizing a list provided by the university registrar, 5,000 undergraduate students at UNC were solicited via email to take part in a web survey of social network site use. The survey utilized LimeSurvey, an open source web surveying platform. Participants were offered a chance to win an iTunes gift certificate for taking the survey. The majority of questions dealt with Facebook, so a skip logic routed non-Facebook users around the Facebook-centric questions. A total of 494 individuals, 94.94% of which indicated use of Facebook, responded to the survey. 444 of the respondents completed the full instrument. The response rate for the survey is 8.8% following AAPOR definition one [1].

The survey was fielded between June 30, 2008 and August 26, 2008. The mean age of respondents was 21 years ($SD = 2.86$), with 50% of the respondents being either 20 or 21 years old. Females accounted for 68.4% of the respondents. The majority of respondents self-identified as white, not of Hispanic origin (79.52%), followed by Asian or Pacific Islander (8.43%) and black, not of Hispanic origin (6.75%). Based on status at the time of list generation, 16.8% were freshmen, 36.2% were sophomores, 27.66% were juniors, and 19.4% were seniors (Table 1).

	Variable	Descriptive Statistics
DV	Pr. Fr.-Only (n=422)	Yes (58.29%), No (41.71%)
Model 1 and 1a: Dem. and FB	School Year (n=423)	Fr. (16.78%), So. (36.17%), Jr. (27.66%), Sr. (19.39%)
	Gender (n=421)	Fe. (68.41%), Ma. (31.59%)
	Race (n=415)	Wh. (79.52%), As. (8.43%), Black (6.75%), Other (5.3%)
	FB Min/Day (n=423)	M=51.7, SD=103.65, (0|1600)
	FB Mem Length (n=425)	<1yr (4%), 1<2yr (15.53%), 2<3yr (44.7%),>3yr (35.7%)
	# FB Friend (n=423)	M=465, SD=303.2, (5|2000)

Table 1. Summary statistics.

While response rates on email-solicited Internet surveys are often low [10], a low response rate does not necessarily produced biased estimates [18]. To identify potential sources of bias, we conducted a nonresponse analysis [cf. 6]. Utilizing data provided by the registrar, we ran a series of one-sample and group means comparison tests to identify how our undergraduate sample differed from the average undergraduate at UNC. We found significant overrepresentation by females (p=0.000), older students (p=0.000), and white students (p=0.002). We then utilized a median split to look at the effect of response time. Early responders tended to be younger than late responders (t_1: 20.67, t_2: 21.36, p=0.012) but we did not see a significant time difference for gender (p=0.838).

Measures
In this study we are interested in variables associated with an individual's privacy behavior in Facebook. We use a mixture of demographic, network, and behavioral measures. The demographic measures used in the analysis were presented in the previous section. We now describe the remaining variables used in the analysis.

Facebook Privacy Choice
In a social network site, privacy regulation is a socio-technical activity involving interaction with the technological system and the group context. An individual's privacy behavior in a social network site involves a mixture of technical and mental strategies. An technical strategy may involve the use of privacy settings to regulate content distribution to select audiences. A mental strategy may involve an individual engaging in self-censorship to limit disclosures to certain audiences [21].

In this study, we focus on a technical strategy of privacy regulation: having set a Facebook profile to friends-only. An individual with a friends-only profile only allows their content to be viewed by established social network site contacts. This privacy-enhancing phenomenon has become popular in recent years [19,32]. We collected privacy-

behavior data at two levels: First, we asked participants if they used *any Facebook privacy settings*, and second, we assessed if the profile was *friends-only*. 83.2% of respondents indicated using any Facebook privacy settings, and 58.29% of respondents indicated they had made their Facebook profile friends-only. These measures were positively and significantly correlated (r=.4526), indicating a relationship between setting the profile friends-only and engaging in privacy-enhancing behaviors. The dependent measure in this study is having a friends-only profile.

Facebook Use Measures

Length and amount of Facebook use, as well as the size of the Facebook network were assessed to provide measures of Facebook activity. Length of Facebook use was assessed by asking participants *how many years* they used the site. Amount of Facebook use was assessed by asking participants, on average, how many *minutes per day* they spent on the service in the last week. Finally, network size was assessed by asking how many connections the individual has established in Facebook.

Intended and Expected Audiences

In a social network site, individuals manage their identity and disclosure behaviors for a range of audiences [7]. One of these audiences is the friend network, constructed of individuals with which the user of the social network site has established articulated connection [8]. Other pertinent audiences include the *intended audience* and the *expected audience*. The intended audience refers to the people for whom the profile is managed and updated, whereas the expected audience represents the individual's perception of who is actually viewing the profile, regardless of intent or privacy settings.

To measure various aspects of an individual's network, we used a position generator instrument that presented a list of eight social groups to the participant. Individuals were asked to select the groups that comprised their respective networks (full network, intended audience, expected audience). Family members and best friends comprised the strong tie category. Casual friends and campus acquaintances comprised the weak tie category. The outsiders category included faculty or campus administrators, potential employers, marketers or corporations and law enforcement. To assess the full network, we asked people if their "*Facebook friends include any of the following groups*." Assessment of the intended audience was conducted by asking people "*Who do you hope views your Facebook Profile?*" The expected audience was assessed by asking "*Who do you think may have looked at your Facebook profile in the last week*." The position generator allows us to examine the impact of varied network audience membership on privacy behavior.

Profile Management Effort

We hypothesize that level of effort spent maintaining a Facebook profile may mediate privacy behaviors. For example, a person who pays careful attention to her or his profile may not need to rely as heavily on technical privacy measures. To assess level of effort, we asked participants if they "*spend a lot of time managing [their] Facebook profile*" and if they "*think it is important to update [their] Facebook profile regularly*." Response was provided on a 7-point Likert scale. These measures were highly correlated (r=.6637), therefore scale items were averaged to produce an estimate of profile management effort (α= .79).

Interpersonal Privacy Management

In a social network site, privacy is a function of one's disclosures, and the disclosures about one's self by others in the site [7]. A mention in a wall post or being tagged in a picture may lead to disclosure about an individual without knowledge or consent. Therefore, privacy requires interpersonal management and coordination. Brainstorming this concept with Facebook users revealed a number of interpersonal management strategies.

Interpersonal privacy management was measured with a 7-point Likert scale measuring level of agreement with the following statements:

- Advised someone to change their Facebook profile.
- Changed [their] Facebook profile based on advice from someone else.
- Asked someone to make private a Facebook photo containing [their] image.
- Asked someone to completely remove a Facebook photo containing [their] image.
- Untagged one's self from a Facebook photo.
- Deleted a wall post [they've] left on someone else's wall.
- Deleted a wall post someone else left on [their] wall.

We assessed these questions using a Likert scale to allow for variation in saliency and recall of the specific behaviors. Overall, Cronbach's alpha for the scale was .726. A principal components analysis with varimax rotation was preformed on scale items, indicating loadings on two factors (eigenvalues of 2.822 and 1.171). Using the .60/.40 criterion [25], we created two subscales to measure the identified factors.

All items, with the exception of one, loaded within the criterion ("Untagged one's self from a Facebook photo" was therefore dropped). The first subscale, termed *Wall Management* (α=.73), covers the items "Deleted a wall post you've left on someone else's wall" and "Deleted a wall post someone else left on your wall." The second subscale, *Conversant Privacy* (α=.69) covers the items "Advised someone to change their Facebook profile", "Changed your Facebook profile based on advice from someone else", "Asked someone to make private a Facebook photo containing your image" and "Asked someone to completely remove a Facebook photo containing your image."

RESULTS

In our analysis, we use a series of logistic regressions to model the odds that an individual has a friends-only Facebook profile. Logistic regression is an appropriate

form of analysis for this research, as the dependent variable is a binary categorical.

Baseline Demographic and Facebook Use Measures

To provide baseline estimates, we first explore the association between demographic measures, Facebook use and having a friends-only profile. Our demographic measures are gender, race, and school year. Facebook use measures are number of friends, length of membership, and minutes of use Facebook use per day.

In the first step of the analysis, we enter the block of demographic variables: gender, race and school year. Due to the prevalence of white, non-Hispanic students, race was recoded into a binary white/non-white variable[1]. Gender emerges as the only significant variable; the odds of a male having a friends-only Facebook profile are 59% of the odds of a female having a friends-only Facebook profile. This finding replicates similar observed gender differences in privacy behaviors in social network sites. As gender is linked to differential practice on the Internet and in social network sites [cf. 2, 16, 22, 23, 32], it will be retained as a covariate in the remaining models. The output of the regression is reported in Table 2.

In the second step, we introduce Facebook use variables as covariates. The variables are number of Facebook friends, numbers of minutes spent on Facebook per day in the last week, and length of Facebook membership. The first two variables provide us intensity-of-use data, and the length variable lets us control the effect extended use may have on privacy behaviors. In this step, we find that gender and number of Facebook friends are significant. Interpreting the odds ratio, the addition of ten Facebook friends is associated with a 1% increase in the odds of having a friends-only Facebook profile. This finding is in line with other analyses exploring the relationship between friend networks and privacy behaviors [23].

Utilizing the likelihood ratio test, we find that the second step of the model is significant, and the overall model is significant.   The model Bayesian Information Criterion (BIC) is 566.65 (BIC of the null model = 579.4), and the model Akaike Information Criterion (AIC) is 538.7799 (AIC of the null model = 575.351). The AIC and BIC provide goodness-of-fit estimates used to compare between non-nested models.   To interpret these estimates, lower values are better, and a score difference of 10 or more between models reflects a strong model fit improvement.

We see that demographic and activity measures are associated with having a friends-only Facebook profile. The relationship between the number of friends one has in Facebook and having a friends-only profile may indicate that once a friend network achieves a degree of saturation,

	Variable	e^s	z	p>|z|
Step 1	School Year	.9969501	-0.03	0.977
	Gender (M=1)	.5969441	-2.35	0.019*
	Race (W=1)	1.340593	1.15	0.258
Step 2	School Year	1.089634	0.75	0.456
	Gender (M=1)	.6205255	-2.13	0.033*
	Race (W=1)	1.44409	1.40	0.163
	# FB Friends	1.001264	3.19	.001**
	FB Mem Len	.8817067	-0.90	0.371
	FB Min/Day	.9997202	-0.27	0.789
Step 1: χ^2:6.75, Pr > F:0.0803			Step 2: χ^2:10.18, Pr > F:0.0171*	
n=396, AIC=538.7799, BIC=566.6498				

Table 2: Odds ratios, model tests and goodness-of-fit measures for baseline models (*p<.05 **p<.01).

there is a potential inflection point that encourages transformation of the network from open to friends-only.

To explore this possibility, we conducted a two-sample t-test to look at differences between number of friends between people whose profiles are friends-only and those that are not. People whose profiles are not friends-only have significantly (p=0.003) less friends (411.4 friends, SD=276.9) than people who have a friends-only profile (500 friends, SD=314.56). A potential explanation may be that going friends-only is a function of salient network saturation; when a person has a high level of coverage in their disclosure network, maintaining a profile that is open to the world is either unnecessary, too risky, or offers too little marginal benefit.

Network Composition and Rule Development

The first element of the CPM process is *rule development*, in which individuals decide what types information they will share with others.   As ties of different strength have varied disclosure norms, we hypothesize that network composition influences privacy behavior. For example, a network including strong ties may have higher incidence of privacy use, as communication between strong ties is more personal in nature. We conducted nested logistic regression to explore the relationship between tie strength, social group and having a friends-only Facebook profile.

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[1] Model was run with race as a full categorical predictor with no additional effect.
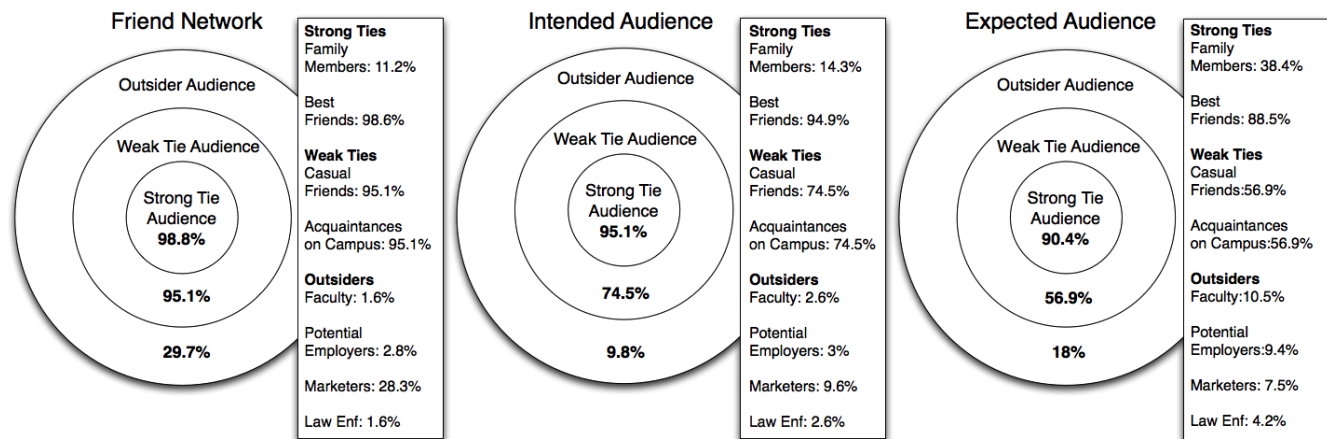
Figure 1. Exploring differences in the network compositions in friend networks, intended audience, and expected audience. Percentages correspond to amount of sample indicating membership of the particular social group in their audience. For example, 14.3% of the sample reports family members are part of the intended audience of their Facebook profile.

Network composition was measured with the position generator described in the Methods section. Social groups were clustered into tie categories; nested regression allows estimation of social group and category effect. The following statistics indicate the percentage of respondents reporting inclusion of the social category and group in the individual's Facebook network (Figure 1). The first category, *strong ties*, is composed of family members (11.24%) and close friends (98.59%), with an overall incidence of 98.93%. The second category, *weak ties*, is composed of casual friends (95.08%) and campus acquaintances (95.08%), with an overall incidence of 95.08%. The third category, *outsiders*, is composed of campus administration and faculty (1.64%), potential employers (2.81%), marketers or corporations (28.34%) and law enforcement (1.64%), with an overall incidence of 29.74%. For clarity, we can say that 2.81% of our sample was friends with a potential employer, and that 29.74% of our sample had at least one *outsider* category friendship.

In this logistic regression model, the first step was composed of strong ties and gender. The first block was not significant, though the gender variable remained significant (e= .6341, z=-2.13, p=0.033). In the second step, we added weak ties, and only the gender variable remained significant (e= .6291, z=-2.15, p=.0.031). In the third step, we added outsider categories, and once again only gender was significant (e= .6258, z=-2.16, p=.0.031). Overall, the model was not significant (p=.2593).

Therefore, we did not see an effect of network composition on privacy *rule development*. The lack of explanatory power is likely a function of the saturated nature of Facebook networks. In the particular context of this study, it is normative for respondents to friend both strong and weak ties. This normative bearing leads to homogeneity in network composition, and privacy rules may be better reflected through mental strategies (e.g. censoring what one says) than the use of broad technical measures (e.g. going friends-only).

Expectancy Violations and Boundary Coordination
In Facebook, an individual's profile has a range of audiences. The *friend network*, the *intended audience*, and the *expected audience*, described in the Methods section, are three such disclosure networks. The friend network represents all connections publicly articulated in the social network site. As friend networks are normatively large, individuals in our sample focus profile-viewing attention on a smaller subset of their friends list. In an explicit test, we asked participants how many Facebook profiles they had looked at in the past week. The mean answer, 6.4 (SD=9.3, 0|100) indicated that profile-viewing attention is focused primarily on a subset of the friend network. It should be noted that the focus on a subset of profiles does not necessarily preclude the transmission of information; the News Feed and other targeted channels (direct messages, chatting) serve this purpose.

Exploring *boundary coordination*, we are interested in the relationship between expectancy violations and privacy behavior. Using the position generator, we asked respondents to classify their *intended* and *expected* profile audiences. The intended audience is comprised of the social categories and groups the respondent hopes views the profile. The expected audience reflects the social categories and groups expected to view the profile. Response to the position generator is provided in Figure 1. Approximately 14% of respondents indicated that family members were an intended audience of the profile, whereas 38% of respondents indicated that they expected family members to view their profile.

Identifying Expectancy Violations
Expectancy violations have been studied in a range of disciplines. In theories of social cognition, an expectancy violation occurs when events do not match pre-defined

Audience	Intended	Expected
Family	14.29%	38.41%***
Best Friends	94.85%	88.52%***
Total Str. Tie	**95.08%**	**90.40%***
Casual Friends	74.47%	56.91%***
Camp. Acq.	74.47%	56.91%***
Total Weak Tie	**74.47%**	**56.91%***
Fac./Adm.	2.58%	10.54%**
Pot. Employer	3.04%	9.37%**
Mktr./Corp	9.60%	7.49%
Law. Enf.	2.58%	4.22%
Total Outsider	**9.84%**	**18.03%***

Table 3: Percentage of participants indicating social group membership of intended and expected audience, with paired t-tests (* p<.05 **p<.01 ***p<.001).

schema. In communications theory, an expectancy violation occurs when behavior does not match the communicative setting [cf. 9]. We draw on these conceptions when defining expectancy violation as an instance where an individual reports an expected audience that is not an intended audience. The previously described disconnect between intended and expected familial audience is an example. In perceiving unwanted gaze, the individual may be forced to renegotiate or coordinate the communicative setting anew. Using paired t-tests, we identify significant expectancy violations occurring at three social category levels and six enumerated social groups (Table 3). Following Petronio's conception of *boundary coordination*, we hypothesize that an expectancy violation may be associated with increased levels of privacy in an attempt to decrease permeability of the disclosure boundary. We further hypothesize that expectancy violations have differing magnitude by social group. For example, an expectancy violation by family members may not be viewed with the same intensity as an expectancy violation by outsider audiences.

Expectancy violations were identified as instances where an expected audience was not jointly identified as an intended audience, and were coded with a binary identifier for the analysis. Among *strong ties*, 30.44% of participants reported an expectancy violation by family members, and 2.11% of participants reported an expectancy violation by best friends. Among *weak ties*, response was identical between campus acquaintances and close ties, with 9.84% of individuals reporting an expectancy violation by the groups. These two measures were therefore collapsed to a single variable. Among *outsiders*, expectancy violations

were reported at the following levels: 9.6% for campus administration and faculty, 9.13% for potential employers, 7.03% for marketers or corporations, and 3.75% for law enforcement. For clarity, this measure means that 9.13% of the sample reported expectancy violation by potential employers.

Expectancy Violations and Privacy Management
To estimate the effect and magnitude of expectancy violations, we utilized a nested logistic regression. This allows us to explore the impact of expectancy violations by social groups and social categories. Post-estimate likelihood ratio tests revealed that only the gender covariate and weak ties block were significant (χ^2:7.32, $p > F$:0.0068). Therefore, we do not report block level estimates; the full model is reported in Table 4.

Interpreting the estimates, we find that the gender is significant (e^{β}= .6294, z=-2.09, p=.0.036), in line with existing specification. We see that having an expectancy violation by weak ties (e^{β}= 3.316345, z=2.74, p=0.006) increases the odds of having a friends-only profile by 3.31 times the odds of someone who has not experienced an expectancy violation by weak ties.

In the reported network compositions (Figure 1), we saw that Facebook friend networks and audiences are primarily composed of strong and weak ties. This may be an artifact of Facebook's origins as a limited network, with a normative orientation towards real-world, close friends [20]. Reading into the findings, it is possible that weak ties represent the functional periphery of the undergraduate Facebook network; having an expectancy violation by weak ties may generate substantial privacy concerns motivating boundary coordination. The small size of the outsider audience lends credibility to this notion, as most respondents do not perceive outsiders as part of their functional audience.

Variable	e^{β}	z	p>|z|
Gender (M=1)	.6294311	-2.09	0.036*
Family Members	1.105011	.021	0.833
Best Friends	.8508843	-.020	0.842
Coll. Weak Tie	3.316345	2.74	0.006**
Campus Adm./Fac.	.5204356	-1.47	0.141
Potential Employ.	.8664358	-0.33	0.738
Marketers/Corp.	.8950096	-0.22	0.822
Law Enforcement	1.165174	0.66	0.511
n=416, *p*=0.0300, AIC=566.5188, BIC=602.795			

Table 4: Odds ratio, z tests and goodness-of-fit measures for expectancy violations model (* *p*<.05 ** *p*<.01).

Interpersonal Privacy Management and Boundary Turbulence

In our final model, we operationalize *boundary turbulence* as interpersonal privacy management. Boundary turbulence refers to the ongoing process of maintaining and renegotiating disclosure boundaries. An example of boundary turbulence might be assigning new disclosure rules to a friend. This process is mental and behavioral; we focus on behavioral aspects of boundary turbulence, particularly how privacy behaviors are communicated within groups.

Due to the persistent digital nature of social network sites, disclosure boundaries must be continually managed through interpersonal communication. The temporal boundary identified by Palen and Dourish [26] is of particular salience. In a social network site, an individual may disclose something on a wall that they later regret. Erasing the wall may require interpersonal privacy management, reflecting coordination between two actors.

We hypothesize that individuals who engage in increased levels of interpersonal privacy management are more likely to engage in privacy-enhancing behavior. To conduct this analysis, we utilize logistic regression to model the association between interpersonal privacy management (described in the Methods section) and having a friends-only Facebook profile. Gender and profile management effort are included as covariates. The results of the analysis are reported in Table 5.

Overall, the conversant privacy subscale (*p*=0.002) and the model (*p*=0.0272) are significant. For each one-unit increase on the conversant privacy subscale, odds of having a friends-only profile increase by 27 percentage points. Conversant privacy involves management of disclosures through interpersonal communication that do not fall under the scope of Facebook's traditional privacy controls. When employing conversant privacy, individuals engage in a boundary turbulence process as they negotiate and coordinate new disclosure boundaries.

DISCUSSION AND EVALUATION

This research has explored the association between specific stages of the CPM process of boundary regulation and privacy enhancing behavior in Facebook. Particularly, we

Variable	e^ϑ	z	p>|z|
Gender (M=1)	.681877	-1.73	0.083
Effort	.9520808	-0.57	0.571
Wall Mgmt.	.9674305	-0.54	0.587
Conversant Privacy	1.277693	3.05	0.002**
n=411, *p*=0.0272, AIC=553.5745, BIC=573.6675			

Table 5: Odds ratio, z tests and goodness-of-fit measures for interpersonal privacy management (* *p*<.05 **p<.01).

Model	p>χ^2	Pseudo R^2	AIC	BIC
Baseline	0.758	*n.s*		
FB Use	0.0066	0.0329	538.78	566.649
Friend Net.	0.2593	*n.s.*		
Expectancy Violation	0.0300	0.0301	566.519	602.795
Inter. Priv.	0.0043	0.0272	553.575	573.667

Table 6: Model goodness-of-fit statistics for the baseline, Facebook use measure, friend network, expectancy violations and interpersonal privacy models.

explored the relationship between social-network specific instantiations of *rule development*, *boundary coordination* and *boundary turbulence* and having a friends-only profile in Facebook. Our models employed baseline demographics and Facebook use, friend network composition, expectancy violations, and interpersonal privacy behaviors.

To evaluate the models, we utilize the AIC and BIC statistics for the full models. The AIC and BIC provide goodness-of-fit estimates used to compare between non-nested models. To interpret these estimates, lower values are better, and a score difference of 10 or more between models reflects a strong model fit improvement. Summary statistics are presented in Table 6. Overall, three of the proposed models were significant. From this research, we have identified four variables associated with having a friends-only profile in Facebook. These variables are gender, friend network size, weak-tie expectancy violations, and conversant privacy practices.

The strongest model was our demographic model, which used gender and network size to predict friends-only status. An increased friend network size may push an individual's friend network close to saturation; there may be a transition point at which point there is no marginal gain for maintenance of an open profile.

Interpersonal privacy behavior proved to be the second strongest model. This may indicate that engaging in conversational management of privacy increases salience towards privacy issues, as well as establishing and reinforcing group norms of privacy.

The expectancy violations model was the third strongest model, with gender and weak tie expectancy violations being the significant predictors. This finding may indicate that weak ties establish the functional boundary of Facebook for undergraduates, and that expectancy violations by weak ties reflect a meaningful privacy transgression. Due to a normative lack of interaction with outsiders, Facebook users may have constructed a boundary of privacy with weak ties, the functional outside audience of a Facebook profile.

Implications for Design

In this study, privacy-enhancing behavior in Facebook was examined as a function of one's network, audiences, and interpersonal regulation processes. Our goal in doing this research was to identify and prioritize salient stages of CPM for developers of social media privacy systems, as we believe that each stage of the CPM process can be uniquely supported in HCI.

Previous research has highlighted the effects of network size on privacy behaviors. In our baseline model, we replicated these findings, indicating a positive relationship between network size and having a friends-only profile. Descriptive analysis highlighted the focused natured of tie composition in our sample (Figure 1). Outsiders are generally not part of the Facebook audience of our sample. This has meaningful implications for organizations and "social networkers" who wish to use social network sites to engage new audiences. Groups that engage as outsider ties may not produce harmful expectancy violations, but they may have trouble connecting with users. Therefore, the creation of interfaces that facilitate conversation without the establishment of ties may be a meaningful middle ground. Although communication in virtual settings is governed by norms of reciprocity [2], the establishment of interfaces that allow for unidirectional connection may facilitate interaction.

Studies of social network site privacy behaviors often highlight the need for better privacy education. In our analysis of interpersonal privacy practices, we identified conversant privacy behaviors as being positively associated with having a friends-only profile. Notably, conversant privacy behaviors do not involve the transmission of technical facts regarding privacy settings, but rather the shared coordination (i.e. *turbulence*) of profile management between two actors. This everyday practice enhances privacy and may produce greater salience for privacy issues among the user population. Rather than focusing on explaining the complexities of a privacy system to users, perhaps we should design ways to facilitate conversations about everyday privacy behaviors. This may result in the development of privacy enhancing norms such as moving to a friends-only profile.

An expectancy violation is defined as an incongruity between a profile's *intended* audience and its *expected* audience. Interestingly, expectancy violations by outsiders were not significantly associated with having friends-only profile. Expectancy violations by weak ties, on the other hand, were associated with having a friends-only profile. This finding highlights the variable saliency of network-based privacy concerns in social network sites. In a network like Facebook, where strong and weak ties are heavily saturated, expectancy violations may arise at the periphery of the saturated network, rather than with outsiders. In this sense, the lived experience of interaction with weak ties may trump violations by hypothetical outsiders. This finding can be modeled in network-based systems to identify the point at which expectancy violations may produce harms. Dynamic and granular privacy controls that adapt to the functional periphery of tie boundaries would be a useful application of this finding.

LIMITATIONS

There are a number of important limitations of this research. The data for this study were self-reported, and are therefore limited in accuracy by respondent comprehension and recall. The sample employed in the study was under-representative of males and non-white individuals. As gender is an important covariate in the study, the potential for nonresponse bias exists. Finally, the cross-sectional nature of this study means the findings reported here are associational and not causal. As a caveat, privacy choices should be viewed as a process as opposed to a one-time decision, which implies ongoing regulation.

CONCLUSION

By modeling the stages of Petronio's communications privacy management (CPM) process with demographic, network and behavioral data, we have identified a range of factors associated with privacy behavior in the social network site Facebook. Particularly, we found that gender, network size, weak tie expectancy violations and increasing levels of interpersonal privacy practices were associated with having a friends-only Facebook profile. Although we did not find support for all of the stages of CPM in our models, we feel that CPM provides researchers a valuable process-oriented approach to privacy that can be supported in HCI.

This analysis also confirms and expands previous research regarding the practice of setting a social network site profile to be friends-only [23,32]. Although privacy in a social network site is managed with a range of methods, the discrete act of having a friends-only profile is particularly notable. Individuals who have a friends-only profile signal a common bond identity to the network, limiting contribution to and resources drawn from the encompassing network. In future research, we plan to elaborate the relationship between privacy attitudes and CPM stages, to provide further insight into the variables identified in this study. This research stands to inform the contextual theorization of privacy in socio-technical systems, contributing to the design of systems that facilitate communication while reducing disclosure-related harms.

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