Understanding Motivations for Facebook Use: Usage Metrics, Network Structure, and Privacy

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ABSTRACT

This study explores the links between motives for using a social network service and numerical measures of that activity. Specifically, it identified motives for Facebook use by employing a Uses and Gratifications (U&G) approach and then investigated the extent to which these motives can be predicted through usage and network metrics collected automatically via the Facebook API. In total, 11 Facebook usage metrics and eight personal network metrics served as predictors. Results showed that all three variable types in this expanded U&G frame of analysis (covering social antecedents, usage metrics, and personal network metrics) effectively predicted motives and highlighted interesting behaviors. To further illustrate the power of this framework, the intricate nature of privacy in social media was explored and relationships drawn between privacy attitudes (and acts) and measures of use and network structure.

Author Keywords

Uses and gratifications; social network sites; social networks; Facebook; privacy; computer-mediated communication.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms

Human Factors; Theory.

INTRODUCTION

Social Network Sites (SNSs) exhibit wide popularity, high diffusion and an increasing number of features. Specifically, Facebook, which currently holds a prime position among SNSs, has a continuously evolving feature set and one billion monthly active users, approximately 81% of whom are from outside the U.S. and Canada, and 604 million of whom access the site via mobile devices [22]. Given this diversity, an effective way of understanding Facebook is by exploring motives for using the service via theoretical frameworks such as Uses and Gratifications (U&G) [18, 32]. A good understanding of

these motives can shed light onto the intricate mechanisms behind important aspects of SNSs, such as site adoption, participation [25], information seeking [26], and the privacy of users [18]. Privacy, in particular, is a major concern since it dictates the usage decisions of many SNS users [5] and as Facebook, specifically, has found itself under harsh criticism regarding the enactment of highly contentious privacy policies and privacy-sensitive features [6].

The emergence of social sites also represents a valuable research resource. Indeed, scholars have highlighted the enormous potential of taking advantage of data that are generated electronically when people use online services [27]. Furthermore, compared to the methods and data available to traditional social scientists, online information can be accessed and analyzed computationally in ways that are both efficient and accurate [16, 27]. In particular, in the case of Facebook, a rich, robust Application Programming Interface (API) allows researchers to collect large volumes of data relating to issues such as site feature use and personal network structure with unprecedented accuracy, granularity and reliability.

Leveraging these data, researchers have recently begun to explore how automatically captured information from Facebook relates to key social concepts. For instance, Gilbert and Karahalios [14] demonstrated that tie strength among friends can be predicted with data collected by scraping Facebook pages. Panovich et al. [30] relied on the same tie-strength algorithm to understand the connection between tie strength and information seeking, while Quercia et al. [35] looked at the links between Facebook popularity and personality, and Burke et al. [9] analyzed server logs in order to understand social capital.

In a similar vein to these efforts, researchers have argued that more data-driven methods for the collection of U&G data can enhance the analytical power of the approach [32]. A typical U&G study employs a survey instrument (or occasionally interviews [34] or focus groups [11, 39]) for the collection of all relevant data. In contrast to downloading data directly from Facebook, this is less efficient and subject to well-acknowledged biases [28]. However, as a theoretical framework, U&G does not mandate that any particular empirical methods be used and, therefore, this paper argues for the inclusion of computationally captured data in the U&G framework of analysis.

One way that this can be achieved is by collecting a broader range of Facebook usage data. Typically, one of the main elements of the U&G frame of analysis is the description of the behavioral outcomes from the use of a system, which is typically operationalized as usage patterns [32]. However, U&G studies in social media limit these behavioral outcomes to crude, subjective measures such as self-reported time on site and/or frequency of visits [e.g., 18, 34, 36], even though it has been strongly argued that such data are inadequate [37]. The benefits of a data-centric study that follows a computational approach to measuring Facebook use would include freedom from issues such as recall bias [7], interviewer effects [29], and other sources of measurement error that may accompany survey research (see [28]), and assure the collection of accurate measures of users' activity, broken down by specific Facebook features.

Another untapped resource in U&G studies is the personal network structure of the users. Even though personal network structure has been extensively included in social science studies, network researchers have long observed major discrepancies between self-reports and behavioral measures [24]. Computational modeling of the personal networks with data obtained through the Facebook API can mitigate this concern. Since the relations among users constitute the building blocks and differentiating factors in SNSs, this paper argues that studies on Facebook motivations would benefit greatly by taking into account characteristics of the users' personal networks.

In sum, this paper extends scholarship on SNSs by exploring what aspects of a person's motives for using Facebook can be derived by examining their usage patterns and network structure. Furthermore, it adds to the SNS privacy literature, by utilizing the interpretive power of the U&G framework to understand which user motivations are associated with different dimensions of online privacy. This work also contributes to theory by expanding the analytic framework of U&G theory to include *network* antecedents, as well as a more comprehensive and accurate measure of Facebook *usage*. Finally, this work expands the methodological scope of U&G by combining a typical survey tool with data captured using the Facebook API.

Before embarking on a description of this empirical work, the following section introduces and reviews a range of related work: U&G theory and its application to social media; measures of Facebook usage; the network perspective in SNSs; and online privacy.

USES AND GRATIFICATIONS
Media is consumed for a wide range of purposes and individuals utilize different media channels to achieve very different ends [20,37]. U&G is a theoretical framework for studying these motives and outcomes – fundamentally, the "how" and "why" of media use [18]. A key strength of the approach is its established and broadly applicable frame of analysis (covering media as diverse as tabloids, reality TV and the Internet) that combines *motives* for media use (such as entertainment or social connection) with social and psychological *antecedents* (such as demographics) and cognitive, attitudinal, or behavioral *outcomes* (such as usage patterns) [32].

U&G has recently proven valuable in exploring and explaining a wide variety of social media phenomena including topics as diverse as the motivations for contributing content to an online community [26], explaining why political candidates are befriended [1], and cataloguing the psychosocial well-being of teenage girls [11]. U&G studies have explored behavior on most common forms of social media including content sharing sites (e.g., YouTube [15]), SNSs (e.g., Myspace [1]), media sharing communities [19], and blogs [21].

As the currently dominant SNS, Facebook has been the subject of much U&G research. In early work on this platform, Joinson [18] identified seven unique motives for Facebook use: social connection, shared identities, photographs, content, social investigation, social network surfing and status updating. This study also showed that user demographics, site visit patterns and privacy settings were associated with specific motives. More recent work has continued in this vein and attempted to uncover relationships between motives for Facebook use, antecedents and complex communication outcomes. For instance, Papacharissi and Mendelson [31] found substantial links between Facebook motives, social and psychological predispositions, and the generation of different forms of social capital.

Taken together, this work highlights the importance of eliciting and understanding users' motives in social media, as well as the value of employing data from a natural [28] research instrument, like Facebook, for social studies. Such online services offer the potential to combine traditional U&G survey instruments with data derived from sources such as content analysis [32], behavioral traces captured by site servers [25], and network and usage level data derived from public APIs (e.g., [8, 35]). By integrating such information, the methodological scope of the U&G theory is expanded to offer improved explanatory power. This paper highlights the unexplored potential of capturing and analyzing detailed usage information (representing an accurate, detailed depiction of outcomes) and personal network metrics (serving as new forms of antecedent) for U&G studies. The following sections introduce and review work relating to these two topics.

MEASURING FACEBOOK USAGE
Usage of social network services, and Facebook in particular, has most commonly been captured by self-report methods using surveys. Typical questions include time spent on site and visit frequency [e.g., 18, 34, 36, 39]. Acknowledging the lack of rigor in such ad-hoc methods, the Facebook Intensity Scale [12] was introduced to capture

the extent to which a user is emotionally connected to Facebook and the extent to which Facebook is integrated into their daily activities. The scale has been subsequently adopted in a number of other studies [e.g., 39, 40].

However, evidence points to the inadequacy of such sweeping cross-site measures. Smock et al. [37] strongly argue that Facebook is better conceived as a collection of features that different individuals use in different ways than as a single monolithic site. Indeed, some studies [e.g., 31, 37] have tried to describe Facebook usage in terms of self-reported frequency of use of partial collections of features. Similarly, Yoder and Stutzman [42] conceptualized user activity as where on the user interface Facebook activity took place and were able to link public, person-to-person communication with perceived social capital. Moving away from self-reported usage measures, Burke et al. [9] showed how Facebook affects social capital by analyzing server logs to identify three types of activity: one-to-one directed communication, passive consumption, and broadcasting.

Overall, this body of literature makes a strong case for the development of studies that capture and analyze Facebook usage automatically and with a fine granularity. In essence, the substantial breadth and scope of the site often render overall descriptions of use too high level to be meaningful.

SOCIAL NETWORK METRICS

Studies of the structure of personal networks, i.e., the networks comprised by the social relationships a participant (ego) maintains with other people (alters), have revealed that network structure can provide a very useful perspective for understanding important theoretical constructs. In fact, a basic tenet of the field of social network analysis is that an individual's position in a network can provide a better understanding of "what's going on" or "what's important" than that person's individual attributes, and it has been argued that exclusively focusing on actor attributes leads to the loss of many important explanatory insights provided by network perspectives on social behavior [24].

Results from network studies have found striking similarities between the social structures in offline and online personal social networks [2], and it has been argued that Facebook networks represent complete and unbiased proxies for hard-to-establish real world friendship networks [16]. Reflecting this perspective, Facebook personal network structure has been associated with many important social constructs and phenomena, such as social capital [8], personality [35], and diffusion of information [3]. The advent of SNSs has greatly facilitated the capture of personal social network data and a wide range of useful metrics can now be calculated automatically and in real time [16]. Commonly used metrics include:

- *Network Size*: The number of nodes in a participant's egocentric network, i.e., the number of friends that an individual has. Correlations have been shown between network size and personality [35] and social capital [8].

- *Network Density*: The extent that nodes in an egocentric network are interconnected – essentially, how many of an individuals' friends know each other. This is calculated as the ratio of the number of ties to the number of possible ties.

- *Average Degree*: Mean number of mutual friends in an egocentric network. Higher values on this statistic have previously been associated with bonding social capital and higher socioeconomic status [8].

- *Average Path Length*: The average geodesic distance between all pairs of nodes in a network.

- *Diameter*: The longest geodesic distance within the network, i.e., maximum distance between two nodes.

- *Network Modularity*: A scalar value between −1 and 1 that measures the density of links inside communities as compared to links between communities [4].

- *Number of Connected Components*: The number of distinct clusters within a network. This has been interpreted as the number of an individual's social contexts [38] and associated with bridging social capital [8] and social contagion [38].

- *Average Clustering Coefficient*: The clustering coefficient is a measure of the embeddedness of a node in its neighborhood. The average gives an overall indication of the clustering in the network, and high values are associated with a "small-world" effect [41].

This paper highlights the explanatory power of these measures and aims to deploy them in a U&G study in order to explore their value as antecedents capable of predicting (or being predicted by) individual motives for media use.

PRIVACY IN SOCIAL MEDIA

Users often make decisions about whether and how they use a SNS based on the perceived privacy implications of their actions. However, privacy is a complex concept that has presented challenges to the social media ecosystem. One key issue is the tradeoff between providing users with advanced new features that mine their data to provide relevant content but lead to negative effects in terms of how users perceive their privacy [6]. Attempting to understand this topic further, boyd [5] argues that in the context of the social web, privacy violations are common because mediated publics exhibit certain properties that are not present in unmediated publics, namely persistence, searchability, replicability, and invisible audiences. Researchers studying the social implications of privacy have concluded that the right to privacy can be considered a social stratifier that divides users into classes of haves and have-nots, thus creating a privacy divide [33].

Finally, the privacy of SNS information is a particularly pertinent topic of study because of research reporting that users find it challenging to understand the privacy

	Median	Mean	SD
Age	20	23.5	8.35
Time spent on site (mins/day)	42.5	71.5	88.3
Facebook usage metrics			
Activities mentioned	3	11.8	28.3
"Likes" given	136.5	306.9	460.9
Photo albums uploaded	12	13.63	7.95
Photos uploaded	153	309.8	388.7
Check-ins posted	0	2.63	6.1
Events currently attending	0	1.22	2.01
Groups joined	11	19.7	23.1
Photos tagged in[1]	33	85.3	265.1
Links posted[2]	8	45.7	127.5
Questions posted	0	0.38	1.38
Status updates posted[2]	21	56.6	96.9
Network metrics[3]			
Size (nodes)	362.5	427	295.3
Average degree	30.6	55.5	59.2
Diameter	7	7.1	2.2
Density	0.111	0.132	0.092
Modularity	0.41	0.4	0.17
Connected components	9	14.7	32.1
Average clustering coefficient	0.56	0.56	0.089
Average path length	2.45	2.6	0.66

[1] in the past 12 months, [2] in the past 6 months
[3] based on the personal networks with ego and their ties removed

Table 1. Demographics, usage, and network metrics collected

implications of SNSs. For instance, recent research has shown that the current Facebook privacy controls allow users to effectively manage threats from outsiders, but are poor at mitigating concerns related to members of a user's existing friend network [17]. Similarly, a study on Facebook apps found abundant misunderstandings and confusion about how apps function and how they manage, use, and share profile data [23].

METHOD

Data Collection and Participants
Participants were recruited with a request to complete an online survey. Approximately 1/3 of participants were recruited through posts on social network sites, 1/3 through posts to online forums, mailing lists and online study repositories, and 1/3 through a Facebook ad campaign. The ad campaign consisted of two ads with similar wording targeted at self-reported English-speaking Facebook users from 12 countries and the experiment was framed clearly as an academic study. Facebook automatically manages the visibility of ads in an auction-like way. Thus, the Facebook ads resulted in the recruitment of a relatively large number of Indian users, possibly due to the lower cost (and therefore higher frequency) of ads distributed to this group. The ads linked to the study description page and participants then had to explicitly click a link to login with their Facebook credentials and access the survey, which is an equivalent action to installing a Facebook application.

During this process the Facebook API ensured the application displayed all data-access permissions granted to it. Thus participants had a good understanding of the data captured by the study. The whole data collection procedure was in compliance with the Facebook terms of service. The app required access to the users' basic profile information and one extended permission: friendlists. 25.5% of participants refused this extended permission, and so this single variable was excluded from the analysis. 67.1% of the people that clicked the link to go to the app accepted the "basic info" permission dialog. The Facebook ads themselves had a 0.059% click-through rate. Participants whose responses exhibited discrepancy between the demographic variables (e.g., gender, age) that were collected through the API and those reported by them in the survey were considered unreliable and removed. This resulted in an 8% discard rate and a total of 208 usable responses. There was no compensation, but participants were given the option to be contacted about the results of the study and to receive information on the structure of their Facebook network.

Participants were 116 males (55.8%) and 92 females (44.2%), with a mean age of 23.5 years old (SD = 8.35, range = 14 – 62 years old). Participants came from 30 different countries, with 85 (40.9%) from the USA and 64 (30.8%) from India. The majority of the sample were full time students (n = 159, 76.4%), 21.2% (n = 44) were employed and 2.4% (n = 5) unemployed. 96 participants (46.2%) reported to have been using Facebook for between 3 and 5 years, 53 (25.5%) between 2 and 3 years, 28 (13.5%) for more than 5 years, and 25 (12%) between 1 and 2 years. 43.3% of the sample (n = 90) reported using Facebook every day and 38% (n = 79) many times per day.

Survey Content
After logging in, participants were directed to an online survey capturing demographics and presenting 28 questions regarding their gratifications from Facebook, corresponding to the items identified by Joinson [18]. More specifically, the participants were asked to answer "How important are the following uses of Facebook to you personally?" on a 7-point Likert scale from "very unimportant" to "very important". Five more questions followed that measured participants' use of Facebook, including frequency and length of visits, and attitudes towards privacy.

Facebook Usage Data and Network Measures
The Facebook API was used to access a range of usage information for each participant (see Table 1). In addition, the participant's Facebook friendship network was also collected via the application. This is essentially a 1.5-degree egocentric network (i.e., the friends and all the mutual friendships among them) with ego (i.e., the participant) removed. Table 1 presents descriptive statistics from the network data, as well as demographics and usage data.

RESULTS

Exploratory factor analysis based on the items used in previous literature [18] led to the identification of the uses and gratifications. The scores for each factor were calculated for each participant, and then a series of multiple regressions was carried out, in order to investigate the effect of Facebook usage metrics and network metrics on the motives for Facebook use. Further analysis examined the effect of the motives to Facebook users' attitudes and actions about privacy.

Identifying Motives of Facebook Use

An exploratory factor analysis was conducted on the 28 items with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .850. Seven factors were found with eigenvalues over Kaiser's criterion of 1 and in combination explained 69.01% of the variance. Examination of the scree plot and unique loadings supported the retention of these seven factors. A cut-off value of 0.6 for the factor loadings led to five items being discarded. Table 2 shows the factor loadings after rotation.

Predicting Facebook Motives

A series of multiple regressions were run with the seven motives (i.e., factor scores) of Facebook use as outcome variables. The Facebook usage metrics and network metrics were used as predictor variables with age, reported time spent on site, gender (male = 1), occupation (recoded as a dichotomous variable, student = 1), and nationality (recoded as a dichotomous variable, USA = 1) as controls. The correlation matrix revealed a number of strong relationships among the predictor variables, however none exceeded the 0.8 benchmark which would indicate potential multicollinearity. The highest correlation was found between network diameter and average path length at 0.789 ($p < 0.001$), which is to be expected as both metrics rely on path length, but indicate a different distribution of path lengths in a network. Furthermore, examination of the Variance Inflation Factor (VIF) for every predictor variable found a highest value of VIF = 6.551, which is well below the benchmark value of 10 that indicates multicollinearity. Therefore, we are confident that the regressions carried out were free from multicollinearity concerns. Table 3 shows the results of the regressions.

Predicting Attitudes Towards Privacy

With the intention of investigating more closely the intricate and important topic of privacy in SNSs, further analysis was conducted in order to understand the attitudes and actions towards privacy among different types of Facebook users, i.e., the users with different motives. Two additional multiple regressions were run with the factor scores of the users as predictor variables and the answers to two questions regarding privacy as outcomes. Age, time spent on site, gender and occupation were used as control variables. The question Q1: "Generally, how concerned are

Item	Mean	SD	Factor Loading
Factor 1: Social Connection (α = .775)			
Connecting with people you otherwise would have lost contact with	5.13	1.57	.770
Reconnecting with people you`ve lost contact with	4.81	1.74	.739
Finding people you haven't seen for a while	4.74	1.58	.706
Finding out what old friends are doing now	4.51	1.61	.651
Factor 2: Shared identities (α = .736)			
Organizing or joining events	3.69	1.92	.815
Joining groups	3.09	1.78	.799
Communication with likeminded people	3.80	1.96	.660
Factor 3: Photographs (α = .878)			
Being tagged in photos	3.58	1.98	.843
Tagging photos	3.25	1.85	.823
Sharing / posting photos	4.28	1.85	.778
Viewing photos	4.85	1.60	.694
Factor 4: Content (α = .862)			
Applications within Facebook	2.54	1.78	.848
Discovering apps because you see friends have added them	2.19	1.61	.797
Playing games	2.02	1.71	.796
Quizzes	2.14	1.61	.779
Using advanced search to look for specific types of people	2.65	1.99	.610
Factor 5: Social Investigation (α = .713)			
Virtual people-watching	2.98	1.97	.817
Stalking other people	2.60	1.96	.688
Factor 6: Social network surfing (α = .894)			
Looking at the profiles of people you don`t know	2.67	1.89	.833
Viewing other people`s friends	2.91	1.81	.823
Browsing your friends` friends	2.88	1.80	.787
Factor 7: Newsfeed (α = .819)			
Seeing what people have put as their status	4.41	1.78	.766
The news feed	4.95	1.74	.683

Note: All items shared a common prompt: "How important are the following uses of Facebook to you personally?" and were measured with a 7-point Likert-type scale ranging from "very unimportant" to "very important".

Table 2. Summary of factors and individual items

you about your privacy on Facebook?" (mean = 4.83, SD = 1.96) was intended to measure participants' attitudes towards privacy and the question Q2: "How often do you change your Facebook privacy settings?" (mean = 2.95, SD = 1.68) was intended to measure participants' actions. Both items were rated on a 7-point Likert scale from "Not at all" to "A lot", and from "Not at all" to "Very often" respectively. Due to the fact that these outcome variables were measured at the ordinal level, only correlations of significance $p < 0.01$ were interpreted as statistically significant. Table 4 shows the results of this analysis.

DISCUSSION

Motives for Facebook Use

The exploratory factor analysis yielded seven factors, corresponding to motives for Facebook use, which are similar to those identified by Joinson [18]. This was expected, since the same set of items were used. The differences between the factors identified in the two studies

	Social Connection	Shared Identities	Photographs	Content	Social Investigation	Social Network Surfing	Newsfeed
Age	-.014	.351***	.106	.030	-.088	-.083	-.106
Time spent on site	.018	-.049	-.064	.041	.199*	.138	.055
Gender (male)	-.213**	.103	.084	.033	.002	.187*	.108
Occupation (student)	.041	.107	.170	.117	-.071	-.085	-.097
Nationality (USA)	-.042	-.209*	.199*	-.161	.122	-.172	.012
Activities mentioned	-.008	-.079	-.010	.018	-.007	.127	-.049
"Likes" given	-.020	.085	.067	.131	.020	-.119	-.234*
Photo albums uploaded	.011	.057	.222*	.140	.039	-.156	.039
Photos uploaded	-.003	.057	.168	-.332***	.106	.084	.006
Check-ins posted	-.039	-.141	-.033	-.035	-.016	.010	.068
Events currently attending	.125	.152	.061	-.011	.007	.013	-.035
Groups joined	.034	.090	-.050	-.113	.036	-.022	-.068
Photos tagged in	.013	-.056	.049	.013	.075	.015	.047
Links posted	.002	.153*	-.049	.015	-.088	.078	.059
Questions posted	.008	.006	-.114	.088	.045	-.105	-.012
Status updates posted	.040	-.138	.009	-.146	-.185*	-.194*	.324***
Network size	.298*	.014	-.122	.026	-.135	-.033	.017
Average degree	-.299	.059	.169	-.108	.163	.129	-.151
Diameter	.074	.036	-.142	-.076	.206	-.045	.013
Density	.162	-.195	-.050	.031	-.016	.048	.044
Modularity	.197	-.105	.120	-.111	.099	.087	-.160
Connected components	-.104	.171*	.063	.004	.137	-.034	-.171*
Average clustering coefficient	-.048	.209*	.037	-.196	.127	-.177	-.117
Average path length	.011	-.184	-.011	.139	-.259	-.046	.127
Intercept	-0.687	-1.644*	-1.269	1.078	-0.655	1.659	0.935
R^2	.150	.261	.233	.303	.143	.186	.190

* p < .05, **p < .01, *** p < .001, all beta coefficients are standardized

Table 3. Multiple regression models comparing the effects of demographics, Facebook usage measures and network measures

are in the five items that did not load clearly, and the reinterpretation of factor 7 from "Status updates" to "Newsfeed" to better reflect its constituent questions. In addition, the item "Using advanced search to look for specific types of people" was moved from the "Social Investigation" factor to the "Content" factor.

Effects of Facebook Usage, Social and Network Antecedents on Motives for Facebook Use

Gender emerged as a significant predictor of both the *Social Connection* and the *Social Network Surfing* motives, albeit in opposite directions. Females were associated with the *Social Connection* motive (as in [18]), the items of which indicate connections and links to past relationships. On the other hand, males were associated with the factor whose items indicate a tendency for acquiring more information about acquaintances or strangers. Network size, i.e., the number of friends, was also positively correlated with the *Social Connection* motive; users interested in connecting with others tend to have larger networks.

Older participants and those from outside the USA were more motivated by the opportunity to be associated with like-minded individuals, as described by the *Shared Identities* factor. Surprisingly, neither the number of events nor groups that an individual is associated with proved a good predictor for this motive. The number of links posted was positively correlated with this factor, illustrating that

(re)sharing information can be a way of connecting with like-minded people. Interestingly, two network measures were found to have a significant positive effect on this motive: the number of connected components and the average clustering coefficient. The former has been interpreted as the number of an individual's social contexts [8, 38], and in this sense explains the motivation of these

	Q1	Q2
Age	-.033	-.086
Time spent on site	.141*	.046
Gender (male)	-.136	-.055
Occupation (student)	.011	.000
Nationality (USA)	-.233**	-.110
F1: Social Connection	.078	.100
F2: Shared Identities	.149*	.281***
F3: Photos	.033	.000
F4: Content	.068	.231***
F5: Social Investigation	.019	.053
F6: Social Network Surfing	-.015	.048
F7: Newsfeed	.045	.090
Intercept	5.426***	3.549***
R^2	.132	.193

Q1: "Generally, how concerned are you about your privacy on Facebook?"

Q2: "How often do you change your Facebook privacy settings?"

* p < .05, **p < .01, *** p < .001, all beta coefficients are standardized

Table 4. Multiple regression models comparing the effects of motives of Facebook use on two privacy questions

people to belong to distinct groups. A high average clustering coefficient is an indication of networks with modular structure and, at the same time, small distance among the different nodes; in other words, like-minded people will tend to form groups and attend events (based on their similar interests) and will tend not to engage in isolated friendships. In all, the model for the *Shared Identities* motive has five significant predictors from all three variable types, accounting for 26.1% of the variation.

Participants from the USA were positively correlated with the *Photographs* motive, pointing perhaps to the high diffusion of camera-equipped smartphones in that market. Interestingly, the number of photo albums uploaded emerged as a significant predictor, whereas the number of photos uploaded was (marginally) not significant. In a follow-up analysis (not presented), when the number of albums was removed from the model, the number of photos emerged as a very significant predictor. This indicates that, while the two variables share a lot of variation, the number of albums is a better predictor for this motive, possibly demonstrating that people who are really interested in photographs organize them carefully in albums.

The *Content* motive, which includes items for Facebook applications and games, was strongly and negatively associated with only one predictor variable: uploaded photographs. This highlights the possibility of a user population on Facebook that is focused on highly interactive content and disinclined to use and share more traditional media. This finding also reinforces the notion that Facebook uses can be very distinct and that there is a need to differentiate among particular uses when examining the site [37].

Time on site was positively associated with the *Social Investigation* motive, possibly suggesting that this kind of activity can be "addictive" and occupy large amounts of time. On the other hand, the number of status updates posted was negatively associated with this motive, as well as with *Social Network Surfing*. This reinforces the notion of a distinction between users who are interested in contributing content to the site and those that are not [26].

The last motive examined, *Newsfeed*, has two significant usage predictors, "likes" given and status updates posted. It is worth noting that these two major and popular Facebook features predict this motive in opposite direction, again reinforcing the idea that it is important to unbundle Facebook usage to its respective features [37]. For example, the use of likes may indicate someone who tends to respond more to media clips rather than status updates, which, in turn, may seem more appealing to users interested in conversation. Furthermore, the number of connected components in a user's personal network was negatively correlated with this motive. As component count has been viewed as a measure of structural diversity [38], with each component hinting at a distinct social context, this correlation may indicate that Facebook users with a very large number of diverse social groups get less value from their newsfeed - it may be overloaded, or the content too wide-ranging and tertiary to be of substantial interest.

Looking at the overall picture of the analysis, it stands out that the number of status updates emerged as a significant predictor for 3 out of the 7 motives for Facebook use. This suggests that this feature remains one of the most important aspects on the site, despite the continuous inclusion of new functionality, the shift in the demographics of users and the general evolving ecosystem of Facebook.

The size of a Facebook user's personal network emerged as a significant predictor for one of the seven factors, even though it has traditionally been the most common, and usually the only, network measure in SNS studies. Two more sophisticated network measures, the number of connected components and the average clustering coefficient, also show a significant effect on motives for use. Thus, the impact of the network size appears to have been lessened with the introduction of more complex network measures, suggesting they capture aspects of the structure that are more important and meaningful for understanding motives.

Finally, recent research has suggested that appropriate use of network analysis depends on choosing the right network representation for the problem at hand [10]. Indeed, a previous study of the different "connection strategies" among Facebook users has found that they differentiate between all Facebook friends and "actual" friends at approximately 25% of that total [13]. Since the underlying relations (i.e., Facebook friendships) of networks can vary substantially, it may be that standard network metrics are not directly comparable across Facebook users. Taking the idea of systematically introducing personal network measures in studies of SNS motives a step further, it may be valuable to study alternative network representations, such as those whose links are weighted based on tie strength (see [14]). Such networks may result in metrics and analyses with greater explanatory power.

Understanding Privacy
Nationality showed a significant effect on the regression model for the first privacy question, with participants from the USA being less concerned about their privacy on Facebook, possibly due to the fact that they are more tech savvy and comfortable with this online media. On the other hand, nationality did not have a significant effect on the second privacy question, but two of the motives for use did. Specifically, users that were motivated by communication opportunities with like-minded people were found to be more likely to report tweaking their privacy settings. From the factor's description we know that these people tend to be more enthusiastic about organizing or joining events and groups. This may be because they feel more comfortable in familiar settings and therefore have increased suspicion of strangers or companies on Facebook. Furthermore, since

events predominantly take place offline and a popular use of groups is to organize offline meetings, it may be that these people have greater experience of the implications of Facebook privacy settings to offline social interaction. The fact that the *Content* motive was positively associated with frequently changing privacy settings may be due to the fact that people who frequently use applications and interactive content on Facebook have taken the time to understand the privacy implications of installing such dynamic features.

Interestingly, the newsfeed feature, which caused a large backlash with regards to privacy when it was first introduced [6], does not show a significant effect on users' perceived privacy. Furthermore, a substantial discrepancy was observed in the motives of people that report to be concerned about their privacy on Facebook and those that engage in changing their privacy settings.

Theoretical and Methodological Contributions to U&G
Although the U&G framework has been used extensively in the communications sciences, one of its main criticisms is that it relies heavily on self-reported data [20, 32]. This study addressed this limitation by eliciting extensive data about the patterns of use and several social and network antecedents programmatically through the Facebook API. These data should be more accurate than self-reported data about usage or network structure, as well as free from possible cognitive and recall biases.

In fact, previous research [37] revealed that users' motivations for using Facebook predict their use of different features, such as status updates and wall posts, but features that share similar capabilities do not necessarily share underlying motivations for use. When these results are contrasted against models employing unidimensional measures of Facebook use, differences were found between motivations for both general Facebook use and that of specific site features. This suggests that unidimensional measures of SNS use obfuscate motivations for using specific features. The current study took this analytic approach further by looking not only at the reported use of specific Facebook features, but by examining a broad range of Facebook usage data. In particular, a comprehensive set of data corresponding to Facebook usage was gathered computationally, comprising 11 distinct variables as opposed to the one or two variables (time on site, frequency of visits) that are typically gathered through self-reports in similar studies.

Furthermore, this study expanded the methodological arsenal of U&G studies by leveraging the Facebook API to gather a set of data that is by far larger and more diverse than that in a typical U&G study. Furthermore, the network structure was gathered and eight representative network metrics were computed for each participant. This introduced the network antecedent as a possible consideration in the U&G frame of analysis, next to the social and psychological antecedents usually employed.

As a result, none of the regression models for predicting motives for Facebook use were rejected, since at least one predictor variable for every motive was found to have a significant effect. Overall, all three types of predictor variables - social antecedents, usage metrics, and personal network measures - were useful in predicting motives, supporting the validity of this broad data-centric approach.

Advantages and Limitations of the Sampling Procedure
The sampling procedure that was employed resulted in a participant sample that exhibited certain particularities. The combination of recruitment methods led to a sample that was diverse in terms of demographic and geographic distribution, compared to similar studies that typically take place within universities and study students. Since motives for Facebook use will likely vary substantially across cultures, ages, and educational backgrounds, the diversity of the sample used in this work may better match the traditionally exploratory nature of U&G studies.

However, as with other web-based survey studies, the current work was subject to a self-selection bias. Basically, the group of people who opted to participate in the study may not adequately represent typical users. This bias may have been strengthened by the study's requirement that participants install a Facebook application that openly admitted it would access personal details; many users may have been frightened off. On the other hand, these same processes may have discouraged spurious participants (e.g., careless, dishonest, or mischievous web surfers). These advantages and limitations, common to similar studies [35], pose interesting implications for future work using the Facebook API or comparable data-intensive techniques.

Practical Implications
Typically, in a U&G study, after the gratifications are gathered, the analysis examines the effect of the social/psychological antecedents and gratifications on the uses. However, since this analysis is purely correlational, it is methodologically sound to reverse the directionality of analysis and attempt to predict the gratifications from the variables describing antecedents and uses, which is the approach adopted in the current work.

In this study, a number of predictor variables that can be collected and measured automatically by an API were used to establish potentially predictive links to valuable subjective data that can only be collected via a survey instrument. In particular, the motives for Facebook use that were the outcome of this analysis can be very useful information for marketers who want to promote their products or services to the users who visit Facebook with a particular goal in mind. For example, advertisements of digital cameras can be shown to users who score highly on the *Photographs* motive, or applications, games and online services can be suggested to users interested in *Content*. In addition, opportunities for social connection can be shown more prominently to users interested in connecting and

interest- or event-based recommendations may more effectively target people scoring highly on the *Shared Identities* factor.

The study found users with large numbers of connected components (i.e., separate social contexts) to be less motivated to use their feeds, independently of overall network size. This hints at information overload – a problem that needs to be addressed in future versions of this feature. Furthermore, status updates were also negatively associated with two motives, *Social Investigation* and *Social Network Surfing*. This suggests that individuals who post few status updates are not necessarily inactive on this site, but may be enthusiastic and regular users aiming to achieve specific, largely observational, goals.

Motives of use can also provide useful insights for features to incorporate into future system designs. For instance, motives can be directly incorporated into user personas in the requirements analysis and design phase of systems, leading to richer creative artifacts. On the interface level, adaptive systems can use the identified motives of use as part of the user modeling process that is employed to personalize and adapt the system interfaces and the user experience. In addition, the relationships identified between specific Facebook motives of use and the way users perceive their privacy, and act on privacy-sensitive issues, can aid the association of specific types of users with the level of privacy or publicity that makes them feel more comfortable and, thus, enable an improved user experience.

CONCLUSION
Investigating the uses and gratifications of a social network site can provide powerful descriptive and explanatory insights into the mechanisms that drive users' behaviors. In this study we identified seven distinct uses and gratifications for Facebook users and investigated the extent to which they can be predicted through a range of data that can be collected automatically via the Facebook API.

In addition, an expansion of the current methodological scope of the U&G framework was suggested. This combines a survey instrument with the wealth of data that can be collected in an automatic way from a social network site, thus enabling the inclusion of a more comprehensive and reliable set of usage data, as well as a number of metrics derived from the personal networks of users. The theoretical implications of this are that network antecedents are useful additions to the U&G frame of analysis, complementing the social and psychological antecedents that are typically employed. In fact, the inclusion of more complex network measures lessened the effect of network size, the single and most common network metric used in prior work.

Finally, this paper highlights practical mechanisms by which the usage of a social network site can be unpacked to its many dimensions with high accuracy and reliability, adding to the descriptive and explanatory power of the

U&G framework. This technique applies to unearthed general findings and for exploring specific factors and issues, such as the important topic of privacy.

In sum, this paper has shown the benefits of combining the established framework of U&G theory with detailed data captured from an online social network service. Precise usage data helps unbundle and untangle the links between features and motives, while network antecedents serve as novel forms of predictor. We believe that work that further explores and investigates these topics will continue to shed light on the complex and evolving ways in which users interact on social network services.

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