A Review of Facebook Research in the Social Sciences

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Abstract

With over 800 million active users, Facebook is changing the way hundreds of millions of people

relate to one another and share information. A rapidly growing body of research has

accompanied the meteoric rise of Facebook as social scientists assess the impact of Facebook on

social life. In addition, researchers have recognized the utility of Facebook as a novel tool to

observe behavior in a naturalistic setting, test hypotheses, and recruit participants. However,

research on Facebook emanates from a wide variety of disciplines with results being published in

a broad range of journals and conference proceedings, making it difficult to keep track of various

findings. And because Facebook is a relatively recent phenomenon, there still exists uncertainty

about the most effective ways to do Facebook research. To address these issues, we conducted a

comprehensive literature search, identifying 410 relevant articles, which we sorted into five

categories: Descriptive analysis of users, motivations for using Facebook, identity presentation,

the role of Facebook in social interactions, and privacy and information disclosure. The literature

review serves as the foundation from which we assess current findings and offer

recommendations to the field for future research on Facebook and online social networks more

broadly.

   Keywords: Facebook, online social network, social networking sites, social network

   analysis, privacy, motivation, identity presentation

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The sheer online ubiquity of Facebook is astounding. As of February 2012, Facebook has over 845 million users (more than the population of Europe) who spend more than 9.7 billion minutes per day on the site (Facebook, 2012; Rusli, 2012; for a description of Facebook, see Appendix A). Users share 4 billion pieces of content *per day*, including uploads of 250 million photos, and Facebook is now integrated with over seven million websites and applications (Facebook, 2012; Tsotsis, 2011). In March of 2010, Facebook passed Google to become the most visited website in the U.S., accounting for 7.07% of all U.S. web traffic (Dougherty, 2010). And Facebook's dominance extends well beyond United States, with over 80% of current users residing outside of the U.S. (Facebook, 2012). Despite having only about 3,000 employees worldwide, Facebook is valued at around $100 billion U.S. dollars (Facebook, 2012; Gertner, 2011; Siegler, 2011, Swartz, 2012). In short, since its creation in February of 2004, Facebook has become a spectacular success by creating a massive new domain in which millions of social interactions are played out every day. This burgeoning new sphere of social behavior is inherently fascinating but it also provides social scientists with an unprecedented opportunity to observe behavior in a naturalistic setting, test hypotheses in a novel domain, and to recruit participants efficiently from many countries and demographic groups.

As researchers scramble to keep up with the rapid evolution of Facebook in terms of size, features, and policies, we assess the degree to which social scientists have been successful in illuminating the psychological and sociological processes associated with this online social network (OSN). Our original goal was to review all articles ever written about Facebook and produce a neat summary of what the findings to date have taught us. However, we soon discovered that despite there being a sizeable body of research on Facebook, the questions,

methods, and perspectives were so diverse and fragmented that it would be impossible to write a coherent summary of the literature. But we also realized that without summarizing the current trends in the literature—fragmented though they are—the situation was unlikely to improve. So we reviewed the literature and used it as the launching point for a broader examination of best-practice methods as well as a consideration of promising directions for future research. The current article is the result.

As this paper will show, there has been major progress towards analyzing behavior on Facebook and effectively utilizing Facebook as a research tool. However, there is much variability in the quality of research. Our comparative analyses identified a number of obstacles impeding research on Facebook and served as the foundation for specifying some robust research methods and best-practice recommendations in this and related domains.

Why study Facebook?

There are three broad reasons why Facebook is of relevance to social scientists. First, activities performed on Facebook (e.g., connecting to others, expressing preferences, status updates) can leave a wealth of concrete, observable data in their wake. Therefore, the domain provides many new opportunities for studying human behavior that previously had to rely on behaviors that were difficult to assess (e.g., making friends, chatting). Social scientists are sometimes accused of failing to examine actual behavior, relying instead on hypothetical or retrospective self-reports of behavior (Baumeister, Vohs, & Funder, 2007; Furr, 2009); behavioral residue left on Facebook provides a compelling source of measurable behavior traces (Graham, Sandy, & Gosling, 2011; Webb, Campbell, Schwartz, Sechrest, & Grove, 1981). It is useful to think of Facebook as an ongoing database of social activity with information being added in real time. As we discuss below, Facebook is popular across a broad swathe of

demographic groups and in many different countries so it offers a unique source of information about human behavior with levels of ecological validity that are hard to match in most common research settings. Thus, topics that have long been of interest to social scientists, such as how people become acquainted, how social networks spread, and how people communicate their identities, can be examined in this new context.

Second, the tremendous popularity of Facebook makes it a topic worthy of study in its own right. Facebook and other OSNs are interesting to social scientists because in addition to reflecting existing social processes they are also spawning new ones by changing the way hundreds of millions of people relate to one another and share information. Some commentators describe OSNs as a medium that is disconnected from the "real world," but this stance creates a false distinction; for vast numbers of people living in industrialized societies, OSNs have become a core feature of daily life such that their online and offline worlds have become at least partially integrated (Lampe, Ellison, & Steinfield, 2006). Therefore, if social scientists hope to fully understand social life in contemporary contexts, they must examine OSNs. Facebook is by far the most popular OSN (Kreutz, 2009) making it the logical place to begin investigating the patterns, causes, and consequences of the social processes associated with OSN usage.

Third, the rise of OSNs brings both new benefits and dangers to society, which warrants careful consideration. The benefits associated with Facebook, such as the strengthening of social ties, are tempered by concerns about privacy and information disclosure. As Facebook becomes increasingly integrated into everyday life, it becomes necessary to monitor and examine the platform's positive and negative impacts on society.

Who Studies Facebook?

Scholars from a wide variety of disciplines—ranging from law, economics, sociology,

and psychology, to information technology, management, marketing, and computer-mediated communication—have recognized the importance of Facebook. As a consequence of their distinct disciplinary affiliations and research goals, these efforts at understanding Facebook have followed largely independent paths and have been published in a broad range of journals and conference proceedings. The result is an impressive collection of research, but the fragmented literature makes it difficult to keep track of the various findings. Each of the discipline-bound studies is interesting and valuable in its own right, but provides only narrow windows into what is known about Facebook. In addition, articles are being published in a wide range of international journals and conference proceedings, many of which are not found in the databases traditionally monitored by social scientists. In fact, in the course of preparing this review, even after scouring several databases (e.g., PsycInfo, Google Scholar, and Web of Science) for relevant reports, we had not discovered the many pertinent reports listed only in the computer-science oriented IEEE Xplore database.

Articles on OSNs vary dramatically in the breadth of their focus. Some articles focus exclusively on Facebook whereas others include other OSNs, too. A broad focus can be useful in identifying general patterns but there are dangers in treating OSNs as a single general category without drawing distinctions among them. For example, in one article participants needed only to be a member of any OSN to qualify for inclusion in a study that explored what motivated older adolescents to use OSNs (Barker, 2009). In this study, only 54% of participants used Facebook, while the rest qualified for the study because they were members of MySpace, Friendster, or another OSN. Results were framed in terms of OSNs generally and provided valuable insight into the motivations of older adolescent OSN use. However, the findings blurred potentially consequential distinctions across OSNs in terms of OSN-specific demographics, functionality,

and network development. Therefore, in our review we omitted articles that broadened their

scope to OSNs in general without reporting results specific to Facebook (see boyd & Ellison,

2007 for an excellent review of all OSNs).

So just as political scientists or economists may sometimes find it useful to study Asia as

a whole (e.g., lumping China together with Taiwan, Singapore, etc.), for many questions it

makes sense to study the individual countries separately, especially when one of them (e.g.,

China) dominates a space. This approach allows researchers to document and understand the

diverse processes that operate within that country; of course, those country-specific findings can

later be linked to findings from other countries and the region as a whole. Based on this

reasoning, we narrowed our scope to Facebook, the currently dominant OSN, with the hope that

our detailed summary of research will both illuminate Facebook-specific phenomena and enrich

knowledge about OSNs more generally. We encourage researchers to include multiple OSNs in

their studies but we recommend reporting the results separated by each OSN to clarify the effects

that are OSN-specific and those that generalize across OSNs.

The aims of the present paper are to summarize what has been found in regards to

Facebook, pinpoint the major gaps in knowledge in this domain, provide recommendations for

research practice, and identify promising directions for future research on Facebook and OSNs

more broadly.

Literature Review

This is the first major review devoted to academic articles written about Facebook, so we

cast a broad net. The focus of the review was on empirical articles published in academic

journals or conference proceedings that explicitly studied Facebook. To be included as relevant

in our final review, a source must have: (1) specifically investigated Facebook (but not

necessarily only Facebook) and, if other OSNs were included, reported data separately for Facebook, (2) been published in a peer-reviewed academic journal or peer-reviewed conference proceedings, and (3) reported empirical findings.

Limitations of the Search Criteria

By including only those reports that specifically investigated Facebook, it is likely that we omitted some articles that discussed online social networking in general. Our rationale for excluding broader articles on OSNs was based on conceptual and practical considerations. Other OSNs, such as MySpace, Xt3 (a Catholic OSN site), LinkedIn, and FourSquare, have varied histories and are associated with different patterns of use, user characteristics, and social functions compared with Facebook. Therefore, it would have been conceptually unwarranted to apply conclusions derived from OSN research in general to the specific case of Facebook. In addition, we chose to exclude non-Facebook articles because they would have distended our bibliography to an unmanageable number of articles, making a concise and informative review of articles impractical.

In choosing to include only peer-reviewed academic articles, sources such as unpublished manuscripts, dissertations, position papers, and popular press articles were omitted. Many of these sources offered thoughtful insights as well as ideas for future research. However, many other such sources report research with sub-optimal designs, inappropriate analyses, and unwarranted conclusions. The main goal of our review was to gather high-quality research about Facebook. Without setting the standard to include only peer-reviewed research, it would have required making arbitrary decisions about which non-peer-reviewed articles were of sufficient quality to be included in our review.

Our third criterion required each article to be empirically based, which resulted in the

exclusion of commentaries, reviews, proposals, and popular press articles that did not use empirical data to support their reasoning. This final criterion was a safeguard against unsubstantiated conjecture.

Despite their drawbacks, we believe the three criteria provide a sensible and effective system for gathering relevant research. We hope that the bibliography produced using these criteria (see Appendix B) will function as a valuable resource to those conducting research on Facebook in the future. The set of articles reported in Appendix B formed the empirical basis for our analyses of the Facebook literature but, of course, in the text below we do draw on articles beyond that set when relevant (e.g., articles published in 2012, articles on OSNs that do not report separate Facebook results). And not every article identified in the literature search (and listed in Appendix B) is referenced individually in the text of the paper. Thus, the references section and Appendix B overlap only partially.

Literature Search procedures

Our literature search procedures (described in detail in the online supplementary materials) used two basic steps: Generating a large pool of potentially relevant articles and then selecting a smaller subset of articles deemed relevant based on the three inclusion criteria described above. The search was completed on January 1st, 2011. As shown in Figure 1, 223 articles meeting our criteria were published by this date.

<p align="center">**Survey of Facebook Research**</p>

In this section, we summarize the themes and findings of research that emerged from our review of the literature. To identify the major topic areas by which to organize our review, we undertook a systematic series of theme-extraction procedures commonly used in qualitative research (Braun & Clarke, 2006). Specifically, to ensure the themes extracted were not overly

biased by the idiosyncratic perspective of any single researcher, a team of nine researchers conducted independent literature reviews and then together generated a list of the major themes that emerged from the literature. This process resulted in the identification of five general categories that captured the major themes found throughout the literature: Descriptive analysis of users, motivations for using Facebook, identity presentation, the role of Facebook in social interactions, and privacy and information disclosure. The five categories correspond to five broad questions: (1) Who is using Facebook and what are users doing while on Facebook? (2) Why do people use Facebook? (3) How are people presenting themselves on Facebook? (4) How is Facebook affecting relationships among groups and individuals? And (5) why are people disclosing personal information on Facebook despite potential risks?

For the sake of clarity, articles were assigned to only a single category; if the content of articles fell into more than one category it was placed into the one that was most relevant (see Table 1). Thus, the category sizes should be seen as indicative of each article's primary topic, not necessarily as its only one. Moreover, despite the care we took in deriving the categories, we do not view them as definitive. They were chosen to serve as a useful organizational framework that seemed to reflect the trends that could be discerned in the Facebook research literature at that time.

As noted above, the five categories were derived from an analysis of the articles identified by January 1st, 2011. However, it was another whole year before this paper was written and accepted for publication. To provide the most up-to-date summary of articles and also to test the applicability of our categorization system, we repeated our review procedures for 2011 to include all articles (meeting our criteria) published up until January 1st, 2012. The review of 2011 yielded 187 more articles and conference papers, bringing the new total to 410.

Reassuringly, our five-category system effectively accommodated all the new reports. The review below and the bibliography in the online supplement incorporate the full dataset, including the reports from 2011.

Who is Using Facebook?

To appreciate the form and functions of Facebook, it is helpful to understand its rapid expansion. So before reviewing the findings to emerge from the descriptive analyses of Facebook users, we start with a short summary of Facebook's history and growth.

In February of 2004, Mark Zuckerberg created Facebook (then called "thefacebook") in his dorm room at Harvard University (Markoff, 2007). Within one month of its creation, half of the Harvard student population had signed up (Phillips, 2007). Facebook quickly expanded the list of approved networks, allowing it to reach a wider range of users. By 2005, Facebook allowed access to over 800 college and university networks as well as high-school networks (Arrington, 2005). In 2006, Facebook continued to expand its network base, allowing access to over 22,000 commercial organization networks (Zywica & Danowski, 2008). The last major network expansion occurred in 2006, which allowed access to anyone over the age of thirteen with a valid email address (Brown, 2008). As shown in Figure 1, the rapid expansion of approved networks was followed by a dramatic rise in user growth.

Even with such incredible success, the growth of Facebook shows little sign of abating. By expanding globally as well as attracting a wider range of age groups, Facebook has been able to continue its rapid growth. Facebook originated in the United States but more than 80% of current Facebook users now live outside the United States and the majority of new growth is occurring internationally, with Facebook available in over 70 languages (Facebook, 2012; Schonfeld, 2010). In addition to the growing global diversity of users, the typical age of

Facebook users has also shifted over the course of the network's growth. For example, Facebook originally targeted college-aged students but in 2010 the fastest growing demographic group was users over the age of 34, representing 28% of users (Fletcher, 2010).

Descriptive analyses of users. When users register for Facebook, they must agree to the terms of service, which includes the provision that Facebook Inc. has the right to collect users' demographic information (Hodge, 2007). Therefore, Facebook Inc. has access to the exact population parameters of Facebook users and can precisely monitor patterns in user behavior, which it discloses at its discretion. Some basic statistics reported by Facebook Inc. include the findings that the average user has 130 friends, contributes 90 pieces of content per month, and is connected on average with 80 community pages, groups, and events (Facebook, 2012). The information revealed by Facebook Inc. is helpful but meager—all the available demographic and usage information is presented on a one-page document posted on Facebook's website (see Facebook, 2012).

In addition to this one-page document, Facebook Inc. also has a team of in-house researchers (e.g., Lars Backstrom, Moira Burke, Jonathan Chang, Adam Kramer, Thomas Lento, Cameron Marlow, Itamar Rosenn, Eric Sun; See Facebook, 2011a) who have access to the anonymized web logs of the full Facebook dataset, and consequently have produced some of the most informative studies regarding demographics and behavior on Facebook. For instance, in collaboration with researchers at the Università degli Studi di Milano, the Facebook research team produced two studies that examined 721 million Facebook users with a combined 69 billion friendships (Backstrom, Boldi, Rosa, Ugander, & Vigna, 2011; Ugander, Karrer, Backstrom, & Marlow, 2011). To date, these are the largest social network studies ever released (Backstrom, 2011), and it is likely that these sample sizes are the largest in history. Some major findings

included: (1) 92% of users were connected by only four degrees of separation, meaning any two

people were on average separated by no more than four intermediate connections; further, the

degrees of freedom separating users is shrinking as Facebook grows; (2) after measuring how

many friends people had, researchers found a curvilinear, highly skewed distribution such that

20% of users had less than 25 friends, 50% of users had over 100 friends, and a small percentage

of people had close to 5,000 friends, which is the maximum number of friends allowed by

Facebook; (3) users' friends were most likely to be of a similar age and from the same country;

(4) the average number of Facebook friends in the U.S. was 214 (Backstrom, 2011; Backstrom

et al., 2011; Ugander et al., 2011), somewhat higher than the Worldwide average of 130 reported

by Facebook (2012). Researchers who do not work or collaborate with Facebook Inc. have

devised alternate methods for data collection: Recruitment of participants in offline contexts,

recruitment of participants via Facebook applications, and data crawling (see Appendix C for a

description of each).

Ninety-seven (24%) of the 410 articles in the review focused on descriptive analysis of

Facebook, providing baseline information on demographic patterns and time-use trends that can

inform future studies of Facebook activity. The articles in this section tended to be descriptive,

with an emphasis on exploring who is on Facebook (e.g., by comparing users with non-users)

and on how sub-populations within Facebook (e.g., based on race, sex, age, country, membership

in user groups) behave differently. For example, one research team analyzed 77,954 U.S.

Facebook profiles and found that the breakdown of ethnicities on Facebook has grown more

diverse over time and currently mirrors the proportions represented in the U.S. population

(Chang, Rosenn, Backstrom, & Marlow, 2010). To better understand the global distribution of

Facebook users, another study found that the top five countries with users on Facebook were the

U.S. (155 million users), Indonesia (36.6), the U.K. (29.8), Turkey (28.4), and India (25.5;

Carmichael, 2011; for a breakdown of users by continent, see

http://www.internetworldstats.com/facebook.htm).

       Potential for research comparing demographic groups. As the above studies show,

the broad composition of Facebook users provides an exceptionally useful opportunity to

examine trends both within and across countries in an ecologically compelling manner. Our

review revealed that many articles explored trends within countries, but even basic direct

comparisons of samples across countries were rare. The lack of cross-cultural research is

unfortunate because behavioral data gathered from Facebook is well-suited to explore cultural

differences. Past research has demonstrated that self-reports can be poor indicators of how

people vary across cultures because social norms may shape responses, leading to a shifting

baseline of comparison (Heine, Lehman, Peng, & Greenholtz, 2002; Hong, Morris, Chiu, &

Benet-Martinez, 2000; Ramírez-Esparza, Gosling, & Pennebaker, 2008). For example, one study

(unrelated to Facebook) found that Mexican participants rated themselves as less sociable than

American participants on self-reports but an independent analysis of behavior showed that the

Mexican participants actually behaved more socially in their everyday lives (Ramírez-Esparza,

Mehl, Álvarez-Bermúdez, & Pennebaker, 2009. This discrepancy illustrates the problems of

cultural framing and shifting norms associated with comparing self-reports across cultures, and

cultural psychologists have strongly recommended using behavior as a comparative metric;

Facebook provides a convenient context to assess a wide range of socially important behaviors

across cultures.

       In addition to exploring differences between countries, future research should continue to

compare trends across demographic groups. Such findings would provide valuable contextual

information about Facebook users in general and may also help explain some specific research findings. For example, it is reasonable to suppose that many of the basic Facebook findings now reported could differ across high-school students, college students, middle-age users, and older users. Such possibilities are quite plausible given studies showing substantially different usage patterns across age groups. For example, a study by researchers at Microsoft found that employees' Facebook use was inversely correlated with age (Archambault & Grudin, 2012). Other research has found that younger users (15-30 year olds) had eleven times more friends than older users (50+ year olds; Quinn, Chen, & Mulvenna, 2011). Such evidence indicates that as Facebook continues to grow internationally and infiltrate broader demographic groups, exploring basic differences in how these groups use Facebook will become increasingly important.

The rapid growth of Facebook, along with network expansions (as documented in Figure 1) and changes to the layout of the Facebook site, highlight an important issue when interpreting Facebook studies. Readers and researchers must take into account that there were over 140 times more users in 2011than in 2005 and many features of the site have been added over this period (see Figure 1). So comparing studies from 2005 with those from 2011 is potentially misleading.

However, there are a few reasons to suppose that findings from Facebook studies do not become obsolete every time Facebook changes its features or as new kinds of users sign up. First, the site's network organizational structure, in which users are grouped in networks of friends, buffers the users from most changes to the overall demographics of the broader Facebook population. For example, a college student Facebook user in Oklahoma will be largely unaffected by user growth in Indonesia because Indonesians are unlikely to be added into his network. To help readers understand the reach of reported findings, we urge researchers to pay

close attention to and report demographic variables as they interpret their data.

Second, while Facebook Inc. is constantly updating the features of the site, the changes are largely additive, with drastic changes becoming less common as the site matures. The core Facebook experience has remained largely unchanged from the beginning, always focusing on the users' ability to: (a) post self-relevant information on an individualized profile page; (b) link to other members and create a 'friends' list, and (c) interact with other members (Buffardi & Cambell, 2008; Tufekci, 2008).

Finally, studying Facebook is conceptually similar to studying any culture over time, where fluidity is to be expected and measured, not interpreted as a fatal design flaw (Lopez & Guarnaccia, 2000). As with culture, an expectation that Facebook should consist of static demographic patterns and unchanging social processes would neglect the element of change that is a core feature of the OSN. Culture shifts with time. Populations grow, laws are amended, and people's perceptions living in a culture change. Such change is also inherent in Facebook use, and it is incumbent on researchers in the social sciences to account for these changes and recognize both the importance of measured change and the limitations intrinsic to the study of Facebook over time.

Why Do People Use Facebook?

Seventy-nine (19%) articles examined what motivates people to use Facebook. Articles on user motivation varied in their focus and methodology, but in general these studies can be split into one of two subcategories regarding the researchers' perspectives on the motivations underlying Facebook use. One subcategory emphasized the external press that encouraged users to engage in Facebook-related behaviors, such as the features on the site like the birthday reminder or automatic emails sent by Facebook to users (Viswanath et al., 2009). However, the

majority of articles fell into another subcategory, which focused on internal motivations for

Facebook use, such as the need for social engagement. Of course, these two subcategories

represent two sides of the same coin because motivations are both prompted by the pressures and

opportunities afforded by the external world and driven by internal motives (Murray, 1938).

The most common internal motivation discussed in the literature was users' desire to

keep in touch with friends (Ellison, Steinfield, & Lampe, 2006; Joinson, 2008; Lampe, Ellison,

& Steinfield, 2006; Saleh, Jani, Marzouqi, Khajeh, & Rajan, 2011; Sheldon, 2008). Expanding

on these findings, researchers have explored the underlying influence of "social capital," which

refers to the benefits received from relationships with other people (Steinfield, Ellison, & Lampe,

2008). To understand the connections between social capital and Facebook relationships,

researchers have distinguished between strong and weak ties among Facebook friends

(Granovetter, 1973). A typical Facebook user will directly communicate with a small core group

of friends by posting comments or messages, indicating strong ties, and then follow the majority

of friends through passive means such as viewing the News Feed and browsing, indicating weak

ties (Burke, Marlow, & Lento, 2010). Research has shown that users are able to cultivate weak

ties in an informal manner, and Facebook use may help maintain previous relationships and

crystallize otherwise ephemeral relationships (Ellison, Steinfield, & Lampe, 2007; Lewis &

West, 2009).

In addition to increasing social capital, Facebook use may help fulfill social-grooming

needs (Dunbar, 1998; Gosling, 2009). In many non-human primate species, physical grooming

plays a significant role in maintaining social bonds and promoting group stability (Dunbar,

1998). In humans, Dunbar has suggested that seemingly superfluous acts like gossip and small

talk serve a similar social grooming role. Certainly, users of online networking sites engage in

activities that can be conceptualized as social grooming (Tufekci, 2008). Consequently, Gosling

(2009) speculated that Facebook's popularity may be due, in part, to the ease with which it

allows individuals to satisfy a similar basic desire to monitor other network members and

maintain social bonds, even in networks that are geographically dispersed. Facebook provides an

excellent medium for studying the processes that comprise social grooming because actions that

cannot be easily captured in face-to-face interactions (e.g., commenting on another's appearance)

often leave a measurable trace in Facebook interactions.

Minimizing loneliness may motivate some Facebook activity, but the research reviewed

here suggests that the association between Facebook use and loneliness is complex. A 2010

survey of 1,193 participants found correlational evidence that users who engaged in directed

interaction with others, such as leaving wall posts or messaging friends, reported lowered

feelings of loneliness and increased feelings of social capital (Burke, Marlow, & Lento, 2010).

However, users who predominantly spent time on Facebook passively viewing friends' content,

such as status updates and photos, without actively engaging in interaction reported feelings of

increased loneliness and reduced social capital (Burke et al., 2010). Complimenting these

findings, a separate study measured the physiological indicators of emotion by observing

participants who browsed Facebook in an undirected manner for five minutes while in a lab

setting. The researchers found that users who engaged in extractive social searching (e.g.,

directed clicking on a friends' profiles) showed greater physiological evidence of pleasure than

users who browsed passively (e.g., undirected viewing of the newsfeed; Wise, Alhabash, & Park,

2010). Together, these studies demonstrate that a complex relationship exists between differing

types of user engagement and the consequent benefits gained from Facebook use. Future studies

are needed to map the intricacies of this relationship and to unpack the psychological processes

that drive them.

A more mundane internal motivation for engaging in Facebook activities may be to relieve boredom (Lampe, Ellison, & Steinfield, 2008). Participants have reported using Facebook simply to pass time, and boredom was stated as a reason for Facebook use (Lampe et al., 2008). However, students used Facebook regardless of how busy they were, suggesting that boredom is unlikely to be the only factor influencing Facebook use (Pempek, Yermolayeva, & Calvert, 2009).

In the domain of Facebook activities, research has investigated the motives for engaging in specific behaviors, such as adding content or joining groups. For example, one study investigating content contributions found that 54% of interactions between pairs of users who interact infrequently were directly attributable to Facebook's birthday reminder feature (Viswanath, Mislove, Cha, & Gummadi, 2009). This finding points to the importance of features built into the Facebook site in motivating user interaction. The success of Facebook makes it clear that powerful motivations are driving people to join and use this OSN. It is equally clear that researchers do not know exactly why Facebook has become so popular, and research that builds on the current findings about motivation promises to be an important area for future investigations.

How Are People Presenting Themselves on Facebook?

Fifty (12%) of the articles in our review investigated identity presentation, which can be defined as the process by which individuals share part of the self with others (Altheide, 2000; see Friedlander, 2011 for a review of the history of identity presentation prior to Facebook). Identity presentation on Facebook centers on the user profile, which serves as a stage upon which users can make public or semi-public presentations of themselves. New users are presented with blank

profiles, which they personalize by entering information about themselves into a series of

standard fields. Of course, Facebook profiles are not created in a social vacuum, and interactions

with other users plays an important role in shaping identity presentation. Studying how users

choose to portray themselves in their profile presents an excellent opportunity for social

scientists to study identity presentation in a naturalistic, socially consequential setting.

Unlike other kinds of online profiles (e.g., dating profiles), Facebook profiles afford

opportunities for others to contribute content (e.g., via wall posts, comments, and photo tags).

However, most of the information on a profile is furnished by the user, providing opportunities

for users to present themselves authentically, or to cast themselves in a positive (or negative)

light, or even to fabricate some other image. The potential for profile authors to manipulate their

profile raises a critical question: Do Facebook profiles convey accurate impressions of the profile

owners? A number of papers have attempted to answer this question. In one study of 133

Facebook users, researchers tested whether profiles represented idealized virtual identities or

accurate portrayals of the users' personalities (Gosling, Gaddis, & Vazire, 2007). A more robust

set of analyses combined this Facebook dataset with an equivalent dataset from the German OSN

StudiVZ (Back et al., 2010). In both datasets, strangers' ratings of participants based solely on

the participants' user profiles were compared with an accuracy criterion (consisting of the

participants' self-ratings and ratings of the participant by multiple informants who knew the

participants offline) and with participants' ideal-self ratings. The findings, which did not differ

across samples, showed that observer ratings correlated strongly with the criterion measure but

weakly with the ideal-self ratings, suggesting that OSN profiles convey fairly accurate

personality impressions of profile owners (Back et al., 2010). Other research has supported this

finding, concluding that although some self-enhancement may occur, profile owners are

generally portraying a fairly accurate representation of their offline identity (Waggoner, Smith,

& Collins, 2009; Weisbuch, Icevic, & Ambady, 2009).

The veracity of information given by profile owners on Facebook might be explained, in

part, by the prevalent sequence of friendship formation, in which individuals typically become

online Facebook friends after being offline friends. Unlike many other social networking sites

(e.g., Badoo, Habbo), offline relationships tend to lead to Facebook relationships, rather than the

other way around (Lampe et al., 2006; Ross et al., 2009). Therefore, if an owner presented

inaccurate or enhanced information on their Facebook profile, their online friends, who also

know the user from offline contexts, would realize that the user was not telling the truth (Pempek

et al., 2009). As a consequence of this offline-to-online sequence, statements about interests and

values are likely to be authentic (Lampe et al., 2006; Lampe, Ellison, & Steinfield, 2007;

Pempek et al., 2009; Ross et al., 2009).

Another reason why Facebook profiles elicit accurate impressions may be that

individuals generally want others to see them as they see themselves. Research on self-

verification theory suggests that people are not as motivated to self-enhance when they are

certain about the strength of a relationship or when the relevant self-views are firmly held

(Swann, 1999). Therefore, one might expect more self-enhancement when people are new to

Facebook or uncertain about the specific bonds they have with their Facebook friends.

Despite the obstacles to portraying oneself in an overly positive light, it is possible that

some positive spin occurs on Facebook profiles. In what circumstances might profile information

be enhanced or inaccurate, and why? Narcissists are one group that engages in self-promotion on

their Facebook profiles (Buffardi & Cambell, 2008). However, although narcissists presented an

idealized online profile, independent raters saw through the deception and accurately judged the

profile authors as narcissistic (Buffardi & Cambell, 2008). One study found that introverted users

with low self-esteem and low offline popularity admitted to doing things on Facebook to make

themselves look more popular, such as editing their profile in certain ways or un-tagging

unflattering photos; however there was no evidence that the self-promotion strategies were

effective (Zywica & Danowski, 2008).

Assumptions about the perceived audience as well as cultural norms may also influence

how users portray themselves on Facebook. One study showed that students in the United States

were more inclined to post inappropriate content than German students on Facebook (Karl et al,

2010b), which parallels previous research on differing conventions between the two countries

(Hofstede, 1991) and points to the influence of cultural norms on Facebook identity construction.

The study highlights the potential role of cultural influences and perceived audience on self-

presentation strategies, mirroring the concerns that affect self-presentation strategies in offline

contexts (Goffman, 1959).

Most information about identity is furnished by the profile owner, but observers'

impressions of Facebook users are also affected by the user's number of friends and the

characteristics of friends, especially those who write on the wall of the user (Walther, Van Der

Heide, Hamel, & Shulman, 2009). A curvilinear relationship exists between a user's number of

friends and observers' ratings of the user's attractiveness and extraversion; one study showed

that the correlation remains positive up until about 300 friends and then declines, perhaps

because an overabundance of friends created less credibility (Tong, Van Der Heide, Langwell, &

Walther, 2008). Other research showed that the attractiveness of the people leaving posts on a

user's wall affected impressions of the user; users with walls where the posts were left by

attractive people were judged to be more attractive than those very same users when the same

posts were left by unattractive users (Walther et al., 2008). Perhaps because of this phenomenon, both males and females are more willing to become friends with users that have attractive (vs. unattractive) photos (Wang, Moon, Kwon, Evans, & Stefanone, 2010) and less likely to hide attractive (vs. unattractive) friends, even when they posted negative messages (Peña, & Brody, 2011). Taken together, these studies demonstrate that friend characteristics provide indirect yet meaningful contributions to perceived profile identity (Tong et al., 2008).

How is Facebook Affecting Relationships Among Groups and Individuals?

Research on social interactions was studied frequently, in 111 (27%) articles. These articles examined the positive and negative effects of Facebook on relationships between groups and among individuals (e.g., students/faculty, employees/management, businesses/customers, doctors/patients, romantic partners). In addition, articles in this category discussed how the benefits of strengthened relationships on Facebook may be tempered by tensions that arise as a result of overlapping social spheres, such as those between work and non-work contexts (Binder, Howes, & Sutcliffe, 2009).

Relationships between groups of users on Facebook. Some researchers have looked at how Facebook is changing relationships between companies and customers (e.g., Cvijikj, Spiegler, & Michahelles, 2011). To gauge the usefulness of Facebook as a business tool, one team of researchers conducted a case study of a bakery in Houston to examine the usefulness of Facebook as a marketing and customer-service tool (Dholakia & Durham, 2010). A survey of 689 customers provided baseline opinions towards the bakery and participants were subsequently invited to join the bakery's Facebook fan page. Participants reported an increase in store visits per month after joining the fan page, suggesting that Facebook can act as an effective niche marketing tool. In addition to increasing interaction with customers, company pages also give

businesses a continuous source of consumer feedback, which can act as an important source of

information when it comes to adapting and improving products (Pantano, Tavernise, & Viassone,

2010). Of course, these few studies only begin to touch on ways in which Facebook can be used

to connect with customers. A few articles attempted to assess the ultimate financial value of

using Facebook as a business tool (e.g., Syncapse, 2010), but much research in this area remains

to be done.

As business and marketing researchers strive to help companies engage with customers

through Facebook, other research offers a more cautious outlook on the benefits of Facebook

contact. For example, a large number of articles examined the role of Facebook on

student/faculty relationships. Interestingly, the studies focus largely on students' perceptions of

faculty, not faculty perceptions of students. One study found that students predicted a positive

classroom environment and high motivation when a teacher shared more personal information on

their Facebook profile page (Mazer, Murphy, & Simonds, 2009). Other research warned of the

dangers that arise when a teacher becomes friends with students on Facebook, including being

charged with sexual harassment, breaking political correctness, and being seen as "creepy"

(Lipka, 2007; Madge, Meek, Wellens, & Hooley, 2009). However, a study in this area found that

only 4% of users' wall postings refer to education and the vast majority of students report not

contacting university staff on Facebook for any reason, suggesting that concern over the

appropriateness of student/faculty Facebook interaction may be unfounded because these

interactions are not prevalent (Madge et al., 2009; Selwyn, 2009). Readers interested in learning

more about students' and teachers' Facebook use are referred to Hew's (2011) thorough review

of the topic.

Similarly, the benefits accruing from Facebook interactions between businesses and

employees may be mixed (Stopfer & Gosling, in press). Specifically, employers have begun

using Facebook to evaluate job candidates in hiring decisions (Karl, Peluchette, & Schlaegel,

2010b; Kluemper & Rosen, 2009). Given the findings reported in the identity presentation

section of this paper, which suggest that impressions based on Facebook profiles are generally

accurate, it may make good sense from the employer's perspective to evaluate the information

found on Facebook profiles (Back et al. 2010; Waggoner et al., 2009; Weisbuch et al., 2009).

However, by using Facebook to screen applicants, employers can inadvertently learn about a

candidate's marital status, age, and other topics that are not legal bases for hiring decisions

according to equal opportunity laws in the U.S. (Kluemper & Rosen, 2009). As a result of these

concerns, researchers have warned that employers may be open to discrimination lawsuits

(Kluemper & Rosen, 2009).

As might be expected, information presented on Facebook can both help and hurt job

candidates. One study showed that, if a job candidate's Facebook profile emphasized family

values or professionalism, the chances of the applicant being offered a job increased (Bohnert &

Ross, 2010). Conversely, if a profile contained inappropriate material, such as alcohol and drugs,

then a candidate's prospects decreased (Bohnert & Ross, 2010). Some applicants are judged with

disproportionate harshness when they post inappropriate material. For example, female job

candidates suffered more than their male counterparts when their Facebook profiles were judged

by potential employers (Karl & Peluchette, 2008). Such unequal judgment highlights the dangers

that exist when users decide to post improper content on their profiles as well as the potential for

discrimination when using Facebook as a hiring tool (see Brown & Vaughn, 2011 for further

review of this topic).

Tension across social spheres. The above findings raise the basic question of why any

user would post inappropriate information on their Facebook profile. Users' 'friends' on Facebook often include overlapping social groups (e.g., family, friends, employers) and this overlap could create tension (Binder et al., 2009). These different spheres are traditionally partitioned into different contexts, but on Facebook they are sometimes combined into a single context. A user whose Facebook friends encompass family members, employers, and college friends may have difficulty presenting information that is appropriate across all social spheres simultaneously (Lampinen, Tamminen, & Oulasvirta, 2009). For example, a photo of the user drinking heavily may be acceptable in the context of college friends but not in the context of work or family.

Despite these potential concerns, one study found that the co-presence of multiple groups did not cause tension for users (Lampinen et al., 2009). Users seemed to mitigate any uncomfortable overlap among their social spheres by implementing a number of strategies including the use of detailed privacy controls to limit the access of certain friends, choosing more private communication channels for certain information (e.g., messaging rather than posting on others' walls), and self-censoring potentially problematic content (Lampinen et al., 2009). The overlap of social spheres on OSNs presents a new domain in which to study self-verification processes and, more broadly, how individuals negotiate the task of selective self-presentation.

Why Are People Disclosing Personal Information on Facebook Despite Potential Risks?

Research on privacy and personal information disclosure was the focus of 73 articles (18%) in our review. These articles discussed the risks associated with revealing information on Facebook and assessed the motivations that impelled users to share personal information despite these risks. (For readers wanting greater context, a brief history of recent Facebook privacy policy shifts is provided in Appendix D.)

The information disclosure-privacy dilemma. As with any social networking site,

Facebook is only as good as the content that users share. Therefore a design that encourages

content contribution improves the overall user experience (Burke et al., 2009). But the sharing of

content and personal information on Facebook comes with certain potential privacy risks,

including unintentional disclosure of personal information, damaged reputation due to rumors

and gossip, unwanted contact and harassment, vulnerability to stalkers or pedophiles, use of

private data by a third party, hacking, and identity theft (boyd, 2008; Debatin, et al., 2009;

Taraszow, Arsoy, Shitta, & Laoris, 2008). The tradeoff between potential benefits and risks that

accompany privacy settings presents a dilemma, both for Facebook administrators and Facebook

users. Facebook administrators have the incentive to keep security and access controls weak by

design in order to encourage information exchange and increase their company's value to

advertisers. Yet at the same time the administrators want to avoid a privacy scare similar to the

MySpace pedophile panic, a sensationalist scare that drove people away from using MySpace

(Raynes-Goldie, 2010). Paradoxically, Facebook has both a comprehensive privacy-protection

architecture and significant privacy problems (Anthonysamy, Rashid, & Greenwood, 2011). In

an attempt to explain this incongruity and better understand privacy issues on Facebook,

researchers have explored information disclosure and attitudes towards privacy.

A review of the privacy literature. One of the first comprehensive studies to investigate

privacy on Facebook surveyed more than 4,000 Carnegie Mellon University student users and

found that participants were willing to provide large amounts of personal data on Facebook

(Gross & Acquisti, 2005). The participants were largely unconcerned about or oblivious to

personal privacy risks on Facebook. Over 50% of participants provided their current address and

40% of participants provided their phone number but only a handful of individuals changed the

highly permissive privacy settings (Gross & Acquisti, 2005). In contrast to these findings, a 2007

study with 205 student participants found that only 10% of participants provided their home

address (Fogel & Nehmad, 2009). Additionally, a 2008 study with 1,740 students found that an

entire third of student participants had changed their privacy default setting to a more restrictive

setting, suggesting that awareness of privacy and security issues had increased (Dey, Jelveh, &

Ross, 2012; Lewis, Kaufman, Gonzalez, Wimmer, & Christakis, 2008a).

        Supporting the premise that users' attitudes shifted towards greater privacy concern over

time, a 2009 study confirmed that participants were generally concerned with personal privacy

on Facebook (Christofides, Muise, & Desmarias, 2009). Such a shift may be partly explained by

increased threats to unwanted information disclosure, such as data crawling by third parties.

However, research has revealed a disparity between reported privacy concerns and observed

privacy behaviors (Acquisti & Gross, 2006; Stutzman & Kramer-Duffield, 2010; Tufekci, 2008).

For instance, 16% of respondents who reported being "very worried" about the possibility that a

stranger knew where they lived and the location of their classes still revealed both pieces of

information on their Facebook profile (Acquisti & Gross, 2006). Attempting to understand this

discrepancy, a study found that privacy concerns were primarily determined by the perceived

likelihood of a privacy violation and much less by the expected damage (Krasnova, Kolesnikova,

& Gunther, 2009); specifically, the perceived likelihood of a privacy violation had a medium

effect on privacy concerns but perceived damage had a negligible effect on privacy concern

(Krasnova et al., 2009). Additional research has revealed another potential reason for the

inconsistency between reported concerns and behavior—privacy concerns and disclosure were

not negatively correlated, suggesting that they may not be two ends of the same spectrum, but

independent behaviors influenced by different aspects of personality (Christofides et al., 2009;

McKnight, Lankton, Tripp, 2011).

One study from the 'Motivations' literature provides a perspective that might help explain potential influences on information disclosure other than privacy concerns. To test the extent to which social learning motivates content sharing by new members, researchers analyzed data from 140,292 Facebook profiles, using information from their first 3 months of Facebook membership (Burke, Marlow, & Lento, 2009). Findings revealed that new members were closely monitoring and adapting to what their friends were doing, and that the experiences in the first two weeks predicted long-term sharing. For example, relatively inactive newcomers are more likely to upload photos to their profile if they observe a comment about a friend's photo uploads (Burke et al., 2009). This research demonstrated that social learning and social comparison are important influences on new users, and that people closely follow the actions of their friends on Facebook and adapt their content contributions accordingly (Burke et al., 2009). (This study also illustrates how some studies in our review were relevant to multiple categories).

Conclusions and Recommendations

The studies to date have demonstrated the value of Facebook as a domain in which to conduct social science research. However, the overarching conclusion emanating from the literature as a whole is that much remains to be done. By providing the first comprehensive collection of Facebook research reports (see Appendix B), we hope to help bring some clarity to research in this new domain and provide a foundation on which subsequent research can build. We attempted to identify every published empirical report on Facebook, subject to our review criteria (e.g., reporting data specific to Facebook in cases where multiple OSNs were included). Inevitably, some reports will have slipped through our net, but we believe our search strategy captured the vast majority of relevant sources. Facebook literature continues to be published at

an escalating rate so to help investigators keep up with the most current Facebook research, we

have created a website (www.facebookinthesocialsciences.org) that maintains an updated

bibliography of Facebook articles. Researchers interested in a broader bibliography of OSN

research are directed to danah boyd's website, http://www.danah.org/researchBibs/sns.php.

To ensure future research is effective in addressing the issues encountered by previous

studies, we offer the following recommendations. First, researchers should carefully decide on

the method they use to gather data from Facebook. As noted in an earlier section, there are three

principle methods to collect Facebook data: Recruitment of participants in offline contexts,

recruitment of participants via Facebook applications, and data crawling (see Appendix C for a

more detailed description of the methods). Each method has pros and cons in regards to the

quality of data gathered, and the choice of method depends largely on the type of research

question that is being asked. In addition, some methods, such as data crawling, are becoming less

informative over time as privacy restrictions are strengthened, while other methods (e.g., use of

Facebook applications) are continuing to be used successfully. Naturally, researchers must

explain to users what information is being collected and how the information will be used and

then design protocols that protect the information.

Second, certain disciplines in the social sciences (e.g., developmental psychology,

cultural psychology) seem to have underappreciated Facebook as a source of relevant data. The

Facebook profile page amounts to a blank canvass upon which each user has free reign to

construct a public or semi-public image of him or herself. Studying the process by which this

image is created provides a valuable new perspective on identity formation, and examining the

interpersonal interactions on Facebook provides an unprecedented opportunity to study a wide

variety of social phenomenon in a naturalistic setting.

In an effort to overcome the problems inherent in comparative studies of OSNs, we offer the following framework as a way to bring order to this nascent research domain. In our literature review of Facebook, we identified five broad categories of research that correspond to five broad questions: (1) Who is using Facebook and what are users doing while on Facebook? (2) Why do people use Facebook? (3) How are people presenting themselves on Facebook? (4) How is Facebook affecting the relationships among groups and individuals? And (5) why are people disclosing personal information on Facebook despite potential risks? For the purposes of comparison, we anticipate that it would profitable to conceptualize research on other OSNs in terms of these five key questions. By replacing "Facebook" in the above questions with other OSNs (e.g., MySpace, LinkedIn) researchers can effectively analyze core differences and similarities among OSNs. Such comparative analyses will allow researchers to reach conclusions that are applicable across OSNs while recognizing the attributes that are unique to each. If in-depth reviews of specific OSNs (such as the present report) are conducted on other OSNs, then together these findings can be combined with broader surveys of OSNs in general (e.g., boyd & Ellison, 2007) and with domain-specific comparisons of OSN usage (e.g., Stopfer & Gosling, in press).

As Facebook and other OSNs continue to grow in worldwide influence and online ubiquity, people are now engaging with the Internet in a more socially interactive manner. These developments represent a fundamental shift in the role of the Internet in daily life, and researchers are only beginning to understand the impact of these changes. A dramatic example of the emerging importance of OSNs in shaping modern society was displayed in the 2011 Egyptian overthrow of longtime president Hosni Mubarak. With over five million users in Egypt, Facebook seemed to play a particularly pivotal role as protesters used the site to organize and

energize the grassroots uprising. The protests began on January 25, 2011, and during the

following two weeks over 32,000 new groups and 14,000 new pages were created on Facebook

in Egypt ("Egyptian Couple," 2011).

　　　　After Mubarak relented to public pressure and resigned as president, an Egyptian couple

named their newborn girl Facebook Jamal Ibrahim in an expression of gratitude to honor the role

Facebook played in the historic event ("Egyptian Couple," 2011). Such a striking incident

underscores the importance of Facebook and other OSNs in modern society. Social scientists

must continue to conduct research in order to better understand this growing new domain, and

we hope that our efforts at drawing together the pioneering studies on Facebook will provide a

foundation on which subsequent research can be built.

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networks. *Journal of Computer-Mediated Communication, 14*, 1-34.

APPENDICES

Appendix A: Overview of Facebook Online Social Network

Facebook consists of a series of interrelated profile pages in which members post a broad range of information about themselves and link their own profile to others' profiles. The core of the Facebook experience centers on users' ability to: (a) post self-relevant information on an individualized profile page; (b) link to other members and create a 'friends' list, and (c) interact with other members (Buffardi & Cambell, 2008; Tufekci, 2008). Major features that promote communication include a "messages" system that allows for private communication and a "wall" system that allows for a more public form of communication (Grimmelmann, 2009). In addition, a 'Home' page provides a central hub where up-to-date information pertaining specifically to each user is displayed, including a personalized 'Events' calendar and a 'News Feed' where recent content contributions by friends are shown in chronological order. Users can post photographs and "tag" other users in photos, a feature so popular that, as of the time of writing, Facebook is the number one photo-sharing site in the world with 48 billion unique images (Fletcher, 2010; Lewis, Kaufman, & Christakis, 2008b). With the click of a button, users can "poke" a friend (e.g., send a content-free notification of positive communication, rather like saying "Hi") or "like" a comment or picture (to indicate approval), presenting users with a quick and easy form of social interaction. Users can buy and sell items in the Marketplace and find entertainment on the Games page, and there are over 900 million objects that users can interact with in the form of pages, groups, events, and community pages (Facebook, 2011c).

A key organizational component of Facebook is the emphasis on networks, which define the users' levels of profile accessibility. The four broad categories of networks are colleges, high schools, workplaces, and regions, and users can access up to five networks (Lewis et al., 2008b).

For many networks, Facebook allows access only to users with a valid email address that corresponds to a network. For example, only people with an @state.edu address could gain access to the (hypothetical) State College network (Grimmelmann, 2008). Non-friend users within the same network are typically able to see more profile information than non-friend users outside of the network. Each network differs in the default level of access given to users within the network, and each user may personalize their privacy levels to restrict or open their profile. Thus, the network structure affects the ability of users to view the profile information of others.

Perhaps the feature that most differentiates Facebook from other OSNs is the Facebook Platform, which allows third parties to develop Applications and permits other websites to integrate with Facebook through Open Graph (Gjoka, Sirivianos, Markopoulou, & Yang, 2008). Applications are small programs designed specifically for Facebook that encompass a wide variety of forms including games, polls, quizzes, and fan pages. As of August 2011, there were over 550,000 applications with users installing an average of 20 million applications per day (Facebook, 2010; Facebook, 2011c).

Another key feature of the Facebook Platform is Open Graph, a utility that allows outside websites to seamlessly integrate with Facebook by placing a variety of Facebook features directly on any web page. For example, websites can choose to place a 'like' or 'recommend' button on a webpage, which allows Facebook users to express their approval of web content directly to their Facebook friends. This feature helps websites promote their content, and over 2.5 million websites have chosen to integrate with Facebook through Open Graph (Facebook, 2011c). With more than 250 million people engaging with Facebook on external websites every month, Open Graph has successfully positioned Facebook as a central hub for information sharing on the Internet (Facebook, 2011c).

Appendix B: Bibliography of Reports Included in the Review

See page 57 to view the online supplementary materials, which includes the full

bibliography of 410 articles.

Appendix C: Data Collection Methods on Facebook

The researchers cited in our literature review used three principle methods to collect

Facebook data: Recruitment of participants in offline contexts, recruitment of participants via

Facebook applications, and data crawling.

Recruitment of participants in offline contexts. Several studies recruited volunteers

(often college students) in offline contexts. For example, to determine the percentage of users

verses non-users, one early Facebook study used an offline survey, which was a necessary

approach to capture a representative sample (Acquisti & Gross, 2006). This method was

especially effective when comparing offline and online behavior or when evaluating users verses

non-users.

Recruitment of participants via Facebook applications. Facebook Inc. makes it simple

for third party developers to create applications and surveys (see http://developers.facebook.com)

and many researchers have taken advantage of this resource (e.g., Vajda, Ivanov, Goldmann, &

Ebrahimi, 2011). For example, one research team created three popular applications (Fighter's

Club, Got Love, and Hugged) where users consented to sharing information when they download

one of the applications (Nazir, Raza, & Chuah, 2008). Combined, these three applications have

over 8 million users, providing researchers with a huge dataset. MyPersonality, another example

of a successful application used to collect data, is an online personality survey designed by

psychologists. It provides an excellent model of how to construct a useful survey using a

Facebook application (Stillwell & Kosinski, 2011). Over 4.5 million users have taken the

personality survey on this application, and the researchers have been able to gather a complex

and detailed dataset. For example, the researchers released a database of triads where all three

friends in the group are described with information on demographics, personality, self-

monitoring, IQ, workplace, education, and more (Stillwell & Kosinski, 2011). MyPersonality

demonstrates the vast potential of applications as a tool for recruiting participants on Facebook

and studying interpersonal interactions. However, the success of applications is far from

guaranteed. Some applications designed to collect data (e.g., youjustgetme) have been much less

successful at recruiting participants than others (e.g., MyPersonality, MyType, Stumbl).

Data crawling. Data crawling, which involves gleaning information about users from

their profiles without their active participation, provides another effective approach to gathering

data from a wide range of users (Gjoka, Kurant, Butts, & Markopoulou, 2011; Kurant,

Markopoulou, & Thiran, 2011). Data crawling is possible because researchers can implement

algorithms to gather publicly available information from Facebook users (see Gjoka et al., 2011

for an excellent review of data crawling techniques). Note, however, that data crawling has

become less informative over time as Facebook Inc. has implemented stricter privacy policies.

As of March 2011, Facebook Inc. states that data cannot be collected using automated means

(e.g., harvesting bots, robots, spiders, scrapers) without the explicit approval of Facebook Inc.

(Facebook, 2011b).

The combination of recruiting participants (offline and through applications) and data

crawling gives researchers some effective methods for gathering data on Facebook. In addition,

investigators can take advantage of data already collected because several Facebook researchers

have made their datasets available to the research community (Ginger, 2008; Nazir, Raza, Gupta, Chuah, & Krishnamurthy, 2009; Stillwell & Kosinski, 2011).

   Ethical considerations. Before social scientists collect and examine Facebook data, it is imperative to consider the many ethical obligations inherent in Facebook research and OSN research more generally. One important debate has emerged regarding the appropriate methodological standards for research on Facebook. The heart of this discussion focuses on whether research on Facebook constitutes research with human subjects. Some ethics scholars contend that data mining projects harvest publically available data so they do not meet the regulatory definition of human subjects research, and therefore researchers should not have to gain approval from Institutional Review Boards (IRBs; Schrag, 2010; Solberg, 2010). However, this argument applies only to information that is publically available. Some users do set their privacy settings to allow access to everyone but many users opt for more restrictive privacy settings. If researchers are collecting private information or interacting with Facebook users, then there is an ethical obligation to adequately inform users about the research, gain their consent, and protect their information (Solberg, 2010).

   Facebook and other OSNs constitute a new domain for research so it is understandable that protocols for research ethics have yet to be fully formalized. In the U.S., the Department of Health and Human Services is the federal agency charged with protecting the rights of human subjects in experiments and overseeing IRBs, but this agency has yet to issue formal guidance for research on Facebook (Solberg, 2010). In the absence of top-down direction, some IRBs have enacted institution-specific guidelines that apply to Facebook research (Solberg, 2010). In addition, because every user must register and accept the Facebook terms of use, certain user rights are explicitly protected by Facebook. For example, Facebook requires that any developer

or operator of a Facebook application must obtain consent from users and explain what

information is being collected and how the information will be used (Facebook, 2011b).

We urge caution and due diligence when conducting research on Facebook. The website

Internet Research Ethics (internetresearchethics.org) provides an excellent resource for learning

about current IRB standards and how they are being implemented in regards to Facebook. In

addition, several articles examine ethical and methodological issues associated with gathering

information on Facebook (see Buchanan & Ess, 2011; Mazur, 2010; Solberg, 2010; Zimmer,

2010).

Appendix D: Background on Facebook's privacy policies

In December of 2009, Facebook unveiled a new 5,830-word Privacy Policy (Bilton,

2010). In addition to new granular privacy controls, Facebook changed the privacy default

setting to allow everyone, including non-Facebook members, the ability to view profile

information such as status updates, interests, and friends (Fletcher, 2010). The comprehensive

change was lambasted by privacy advocates. Critics complained that the Privacy Policy was

bewilderingly complicated, noting that a user must click through 50 privacy buttons and choose

from 170 options in order to opt out of personal information disclosure (Bilton, 2010). In

response to the growing public uproar, Facebook rolled out new, simplified privacy setting

options in May of 2010 (Richmond, 2010). With the new settings, users could choose one of four

overarching options regarding the people with which they wanted to share information – friends,

friends of friends, everyone on the internet, or a 'recommended' option that combines settings

from the three previous options. In addition, users could still change specific privacy options or

micromanage their privacy settings if they did not wish to choose one of the overarching options.

As this brief six-month snapshot demonstrates, the nature of Facebook's privacy policy frequently changes. Consequently, research results regarding privacy and information disclosure may be particularly dependent upon the time period in which the study was conducted. Facebook's privacy policy shifts have been well documented and a detailed summary and critique of events pre-2010 is available elsewhere (See Debatin, Lovejoy, Horn, & Hughes, 2009).

Privacy risks on Facebook

To manage risk, a user must first understand the probability of a privacy breach occurring on Facebook. One notorious risk to Facebook users are botnets, which are false profiles that leverage social networks in order to spread malware, spam, and phish for user information. The most infamous botnet on Facebook is Koobface, which invites users to be their 'friend' and then attempts to trick users into installing malware by masquerading as a Flash update or other web link on a spoofed Facebook page (Thomas & Nichol, 2010). Victims who fall for the ruse then automatically spam their own Facebook friends, perpetuating the cycle. In an attempt to assess the dangers posed by botnets, researchers created a Koobface botnet emulator to quantify the risk to Facebook users (Thomas & Nichol, 2010). The study found that current defenses on Facebook recognize and block only 27% of threats and take on average 4 days to respond, which leaves Facebook users largely vulnerable to attacks. Obviously, botnets pose a major concern for Facebook users, and further research in this area is critical to mitigating the evolving threat of botnets.

Together, the research on privacy and disclosure on Facebook suggests three broad strategies for managing the risks found in this domain: (1) change the level of privacy from the permeable default setting to a more private setting, such as friends-only status, (2) limit the
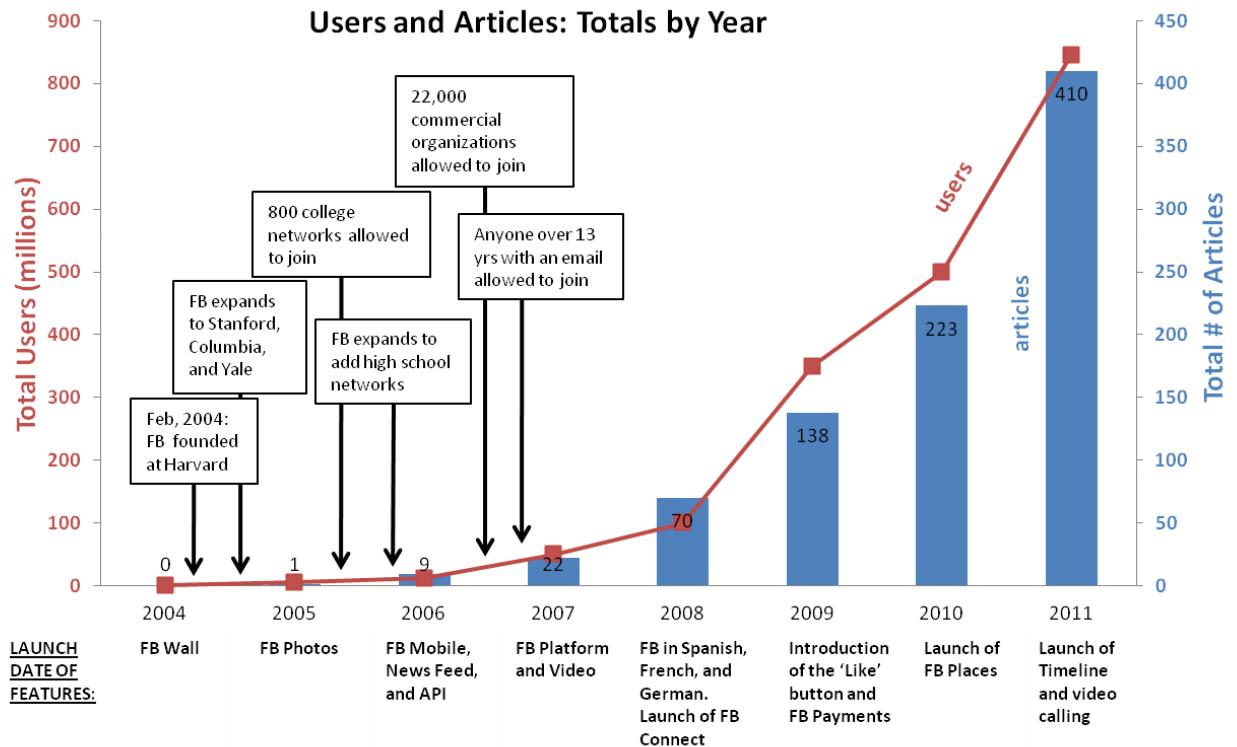
amount of personal information shared on Facebook, or (3) not acquire a Facebook account. The

first step towards improving privacy management on Facebook is to further analyze the risks

associated with using Facebook, and researchers must continue to pursue this goal. By better

understanding the threats to privacy, researchers and developers can construct counter measures

to mitigate the risks, and individual users can take informed steps toward protecting their

personal information.

Table 1

Areas of Facebook Research Identified in the Literature Review

Categories of research	# of articles	% of total	Associated research question
Descriptive analyses of users	97	24%	Who is using Facebook and what are users doing while on Facebook?
Motivations for using Facebook	79	19%	Why do people use Facebook?
Identity presentation	50	12%	How are people presenting themselves on Facebook?
The role Facebook in social interactions	111	27%	How is Facebook affecting relationships among groups and individuals?
Privacy and information disclosure	73	18%	Why are people disclosing personal information on Facebook despite potential risks?
Total:	410	100%	

Figure 1

Users and Articles: Totals by Year

Online Supplemental Materials to accompany article:

Appendix B: Bibliography of Reports Included in the Review

Total articles: 410

Literature Review completed 01/01/12

Literature Search procedures

Our literature search used two basic steps: We first generated a large pool of potentially relevant articles and then selected a smaller subset of articles deemed relevant based on the three inclusion criteria described in the published manuscript. In the initial search cycle, we conducted searches in the PsycInfo, Google Scholar, Web of Science, and IEEE Xplore databases.

Our goal was to be as inclusive as possible, so we used the term "Facebook" as well as search terms such as "online social network" and "social network analysis" to identify other articles relating to Facebook that may not have explicitly used the term "Facebook" in the fields searched by keyword searches (e.g., the title, abstract, and list of keywords). This method yielded articles published primarily in peer-reviewed academic journals and conference proceedings, which was the focus of the review. After the initial search was completed, we reviewed the references cited by each relevant article and identified any new reports that were then included in a second round of articles to examine. This two-step approach yielded a wide range of articles relevant to Facebook. With each new relevant article, we browsed the references, searching for additional relevant articles, and continued this iterative process until no new relevant articles were found. The first exhaustive literature search was completed on January 1st, 2011, and this review served as the basis for the creation of our five theme-based categories. To provide the most thorough review for our readers and increase the usefulness of the bibliography, shortly

before publication we updated our bibliography through January 1st, 2012. The follow-up literature search also served as a useful test for our 5-category structure. Given the magnitude and diversity of the article from 2011 (187 articles), the five categories proved to be a remarkably effective organizational framework. See Table S2 for a summary of articles published by category and year.

Note, we did not restrict our search to the social sciences and any articles that met the three inclusion criteria were included regardless of their disciplinary affiliation. So it is quite possible that our review captures every report written on Facebook, not just those in the social sciences. However, we did not specifically search databases focused on other disciplines such as Law and Management, so we restrict our claims to the social sciences.

The following bibliography is organized by category: Descriptive analyses of users (97 articles), motivations for using Facebook (79), identity presentation on Facebook (50), the role of Facebook on social interactions (111), and privacy and information disclosure (73).

Descriptive Analyses of Users (97 articles)

Ackland, R. (2009). Social network services as data sources and platforms for e-Researching social networks. *Social Science Computer Review*, *27*, 481-492.   doi: 10.1177/0894439309332291

Akcora, C., Carminati, B., & Ferrari, E. (2011). Network and profile based measures for user similarities on social networks. *2011 IEEE International Conference on Information Reuse and Integration,* 292-298. doi: 10.1109/IRI.2011.6009562

Aral, S., & Walker, D. (2011). Identifying social influence in networks using randomized experiments. *IEEE Intelligent Systems, 26*, 91-96. doi: 10.1109/MIS.2011.89

Archibald, R., Liu, Y., Corbett, C., & Ghosal, D. (2011). Disambiguating HTTP: Classifying

  web applications. *2011 7th International Wireless Communications and Mobile*

  Computing Conference (IWCMC), 1808-1813.   doi:

  10.1109/IWCMC.2011.5982809

Backstrom, L., & Kleinberg, J. (2011). Network bucket testing. *Proceedings from* WWW '11:

  The 20th international conference on World wide web. New York, NY, USA. doi:

  10.1145/1963405.1963492

Ballantine, P., & Stephenson, R. (2011). Help me, I'm fat! Social support in online weight loss

  networks. *Journal Of Consumer Behaviour*, *10*, 332-337. doi:10.1002/cb.374

Banhawi, F., & Ali, N. (2011). Measuring user engagement attributes in social networking

  application. *2011 International Conference on Semantic Technology and Information*

  Retrieval (STAIR), 297-301. doi: 10.1109/STAIR.2011.599580

Barkhuus, L., & Tashiro, J. (2010). Student socialization in the age of facebook. *Proceedings*

  from the 28th international conference on Human factors in computing systems (CHI

  '10), 133-142. New York, NY, USA.   doi:

  10.1145/1753326.1753347

Bender, J., Jimenez-Marroquin, M., & Jadad, A. (2011). Seeking support on facebook: A

  content analysis of breast cancer groups. *Journal of medical Internet research, 13*.

  doi:10.2196/jmir.1560

Bhattacharyya, P., Rowe, J., Wu, S., Haigh, K., Lavesson, N., & Johnson, H. (2011). Your best

  might not be good enough: Ranking in collaborative social search engines. *2011 7th*

  International Conference on Collaborative Computing: Networking, Applications and

  Worksharing (CollaborateCom), 87-94.

Caci, B., Cardaci, M., & Tabacchi, M. (2010). Come è piccolo il mondo in rete: un'ipotesi small-world sulla topologia di Facebook. *Sistemi Intelligenti*, *22*, 451-457.

Castiglione, A., Cattaneo, G., & De Santis, A. (2011). A forensic analysis of images on online social networks. *2011 Third International Conference on Intelligent Networking and Collaborative Systems*, 679-684. doi: 10.1109/INCoS.2011.17

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Table S2

Number of Articles Published by Category and Year

Year	Descriptive Analysis	Motivations	Identity Presentation	Social Interactions	Privacy and Disclosure	TOTALS:
2005	0	0	0	0	1	**1**
2006	0	3	1	2	2	**8**
2007	2	4	3	3	1	**13**
2008	5	13	11	10	9	**48**
2009	6	13	6	24	19	**68**
2010	18	15	11	25	16	**85**
2011	66	31	18	47	25	**187**
TOTALS:	**97**	**79**	**50**	**111**	**73**	**410**