

# *Narrowcasting in Social Media: Effects and Perceptions*

Jorge Goncalves, Vassilis Kostakos  
Department of Computer Science and Engineering  
University of Oulu  
Penti Kaiteeran katu 1, Oulu, Finland  
{jgoncalv, vassilis}@ee.oulu.fi

Jayant Venkatanathan  
Madeira Interactive Technologies Institute  
University of Madeira  
Campus da Penteada, Funchal, Portugal  
vjayant@m-iti.org

**Abstract**— Narrowcasting refers to the targeted segmentation of media dissemination, and has been proposed as a counterpart to broadcasting. We present an explorative study that evaluates narrowcasting as an approach to sharing in online social media. We test a narrowcasting prototype for Facebook with 54 participants over a four-week period. We outline the various strategies that participants used to appropriate narrowcasting, and report on participants' use and perceptions. We also report on the effects of default sharing options and gender on sharing behavior. Our work provides implications for online sharing, suggesting that narrowcasting is an effective strategy for online social platforms.

**Keywords**—narrowcasting; privacy; security; Facebook.

## I. INTRODUCTION

Narrowcasting refers to the targeted segmentation of media dissemination, and has been proposed as a counterpart to broadcasting. In this paper we present a study of narrowcasting in the context of online social media. Our goal is to collect empirical evidence on how narrowcasting can be used in online social networks and to assess its effect on users' behavior and perception. The study investigates participant's use of a narrowcasting prototype we developed for Facebook. Particularly, it captures the sharing behavior of users in terms of narrowcasting content towards various narrowcasting categories, and provides insights on the design and usefulness of such a mechanism. In addition, we assess the effects of default settings on narrowcasting behavior.

Narrowcasting is both a way of conceptualizing information sharing, as well as the set of mechanisms that implement such sharing. Narrowcasting in social media can be used, as in the case of traditional media, to *disseminate messages to different audiences allowing for higher levels of relevance of content*. This is achieved by tweaking each message to match better the audiences' values, interests and preferences. As such, narrowcasting can also be used as way to *ensure that content is only available to specific groups of people*. This perception shifts the focus from the tailoring of content to an attempt to restrict content so that only specific people can actually see it. In this sense, we consider narrowcasting as less of a marketing technique and more as a mechanism to increase one's privacy and control when using

social networking sites by making unwanted people not able to see a user's potential sensitive information. At the same time narrowcasting has the potential to increase the relevance of posts a user receives.

In the context of social media and online sharing, and particularly where users are the producers of information and content, a narrowcasting approach has not been widely adopted and supported even though the technology is available to do so. The *modus operandi* in many social networking platforms is for users to broadcast content publicly to a large audience of recipients, such as the "wall" posts on Facebook without much consideration. Clearly, a person posting a message on their Facebook wall is not broadcasting in the sense of a television channel, but nevertheless is broadcasting in the sense of reaching one's whole audience with no exceptions. Adopting a narrowcasting approach to sharing would suggest that users think about targeting segments of their audience, regardless of audience size, while also guaranteeing that only those that the user wants to see the content actually see it.

Existing online practices result in sharing that is typically visible to the entire set of friends of a user, and sometimes to the general public both within and outside the platform. While this broadcasting approach has the benefit of reaching wide audiences, it poses privacy concerns and risks of oversharing since the shared information can be of personal nature and reflecting the day-to-day lives of users. In a response to these privacy concerns, social networking sites have gradually sought to develop narrowcasting mechanisms for users to share only with a subset of users in the network. Facebook and Google Plus have attempted to address this issue by allowing users to group their friends and provide the ability to reveal or hide posts from these user-defined groups. However, this has not had a substantial impact on users' sharing behavior so far [39, 40].

While several interfaces have been proposed to help users manage disclosures to different groups of people within their social networks [e.g. 8, 30], there is a lack of empirical evidence on the effects of narrowcasting in social media, as opposed to broadcasting in social media. For example, it is not clear what behaviors users adopt when they attempt to narrowcast a specific post. Also, it is not clear if thinking

---

Research was sponsored by the Academy of Finland, TEKES, the Nokia Foundation, the Walter Åhlstrom Foundation, the Tauno Tönning Foundation and Infotech Oulu.

about whom to hide from, rather than thinking who to show to, may have any effects on narrowcasting.

## II. BACKGROUND

### A. Narrowcasting Concept

Narrowcasting, in a traditional sense, involves targeting media messages at specific segments of an audience defined by values, preferences, or demographic attributes. Narrowcasting is based on the postmodern idea that mass audiences do not exist [9], and such an approach is focused on a specific (narrow) topic, whereas broadcasting has a wider coverage of broad topics. Narrowcasting entails the *dissemination of information* to a *narrow audience* as opposed to the general public. The term narrowcasting can also apply to the spread of information to a geographically limited audience: office employees, military troops, or conference attendees [22].

Narrowcasting has been proposed in response to the increase of information shared through social media in recent years and its associated privacy concerns. Over the years, various techniques for grouping people in a social network have been developed, for instance by considering the role of individuals in an attempt to facilitate sharing of content [19].

Furthermore, narrowcasting presents itself as a potential solution to the vastly recognized issue of context collapse in social media by separating one's friends depending on the tie instead of being grouped together under a generic term such as "Friends" [3]. Without the proper controls for selective sharing, context collapse can lead to oversharing [14]. Narrowcasting can therefore be used to maintain boundaries between different aspects of one's life in online social media as well as help them engage with differentiated self-presentations based on their audience [38].

In this paper we study the effects of a demographics-driven narrowcasting solution in response to the concerns associated with broadcasting on social media.

### B. Narrowcasting and Privacy Concerns

Communication technologies are fundamentally changing the way we behave, interact, socialize, and share on a daily basis [16]. This sharing behavior has been shown to depend on [23]:

- *norms of appropriateness* (what information about persons is appropriate to reveal in a context), and
- *norms of distribution* (movement of information from one party to another).

As such, privacy problems arise when information appropriate for one context is inappropriately shared in another. However, judging context in online settings is challenging because users are limited to perceived information flows [23], and therefore our daily sharing behavior ultimately can lead to privacy concerns.

Interestingly, online sharing and posting has become popular in part due to human beings' inherent need to publicize their thoughts [25]. Most commonly users post about current activity and location [26]. In the early days social networking platforms users primarily used them to stay in touch with existing friends rather than to engage in new relationships [18]. However, more recently it has been shown that users adopt arbitrary and evolving criteria for accepting friends that they will not directly engage with, and have limited awareness of the amount and detail of personal data provided in their profiles [5, 29]. Many Facebook users befriend other users even if they are weak acquaintances or absolute strangers, something that they would not do in an "offline" environment. While many users attempt to restrict their profiles, they do not appear to fully appreciate that their level of privacy protection is relative to the number of friends. Users are often unaware or unconcerned about temporal boundary intrusions, or threats to privacy due to data persistence [36].

In addition, social networking sites such as Facebook can have confusing privacy settings mechanisms and default settings which often allow friends of friends of a user to be able to see their content. It is possible that thousands of users may be able to access shared personal information. The combination of human nature, appropriation of online tools, and poor privacy controls leads to situations where users may *overshare*, or share information that they may regret at some point in the future. In summary, it can be argued that privacy issues can arise due to:

- the difficulty of judging context online.
- users' tendency to overshare.
- use of arbitrary and evolving criteria for sharing.

We argue that these three obstacles can effectively be addressed by a narrowcasting approach to online sharing. Narrowcasting requires that users consider context before sharing, inherently tackles oversharing by limiting the number of recipients, and can offer a consistent way to establish and maintain sharing criteria. In Table 1 we summarize the existing sharing practices of "broadcasting" in social media and how narrowcasting can address these issues.

TABLE I. SUMMARY OF THE CHARACTERISTICS OF BROADCASTING AND NARROWCASTING IN THE CONTEXT OF ONLINE SOCIAL MEDIA

	Broadcast in Social Media	Narrowcasting in Social Media
Context	Difficulty in judging context [23, 39]	Requires considering context [36, 39]
Sharing Practices	Users tend to overshare [29, 34]	Inherently limits audience [33]
Criteria for Sharing	Arbitrary and evolving [5, 29]	Well-defined segmentation [34]

### C. Requirements for a Narrowcasting Prototype

We are interested in identifying the effect of narrowcasting on users' online social sharing behavior. While Facebook has built-in narrowcasting mechanisms, research has found that users often experience difficulties when trying to divide their Facebook friends into groups [33], totally oblivious to the fact that such a feature already exists in the form of Friends Lists. To minimize bias and increase control during the study, we opted to develop a standalone narrowcasting prototype that integrates with Facebook to enable narrowcasting. We rely on previous findings on online sharing in general to ground our work, since relatively little work has focused on narrowcasting in social media. In fact, only 5% of users have actively adopted Friend Lists on Facebook [32], suggesting that existing attempts to support narrowcasting are not yet successful.

The prototype for our study was designed as a category-driven filter drawing on previous work [20], and allows users to narrowcast based on demographic information. It automatically groups one's friends by demographic attributes: Age, Home Country, Relationship (family and significant other), Current Location, Relationship Status and Gender. Previous work shows that users tend to make decisions on how to share information based on the identity of the recipient rather than on the situation [20]. This behavior was also confirmed in a separate study [4] showing that people decide with whom to share information based on the type of relationship (e.g. significant other, friend, colleague, etc.). Furthermore we draw on work that shows people want to be able to specify groups and basic categories centered on relationships for which they could assign specific privacy settings [13, 24]. This highlights the importance of providing a relationships category (family and significant other separate from rest of friends) in our prototype.

Managing groups of contacts can be a significant burden that worsens with the expansion of one's network (more friends) and the popularity of the social networking website [21]. This is similar to the effect that increased number of applications have on computer systems leading to users relying on shortcuts [11, 15]. Therefore we designed our prototype to automatically categorize participants' friends, using information in their profile, in order to minimize the workload. Also, although privacy is highly valued, it should not be the users' primary task since making it an explicit and tenuous task could lead to the disregard of the solution [1]. Therefore, the prototype dynamically updates the narrowcasting groups when a change occurs in the user's network (e.g. a friend leaves Facebook, a new friend is added, a friend changes their profile, etc.).

The prototype was designed to facilitate the process of creating a new wall post and choosing to whom to make it visible or invisible based on demographic criteria of the recipients. Previous work has suggested that the default interaction pattern of an application, i.e. to share by default vs. to hide by default (referred to as "optimistic" vs. "pessimistic") has an effect on online sharing [10]. Therefore, rather than pick

one pattern over the other, we decided to also investigate the effects of the default interaction pattern on users' narrowcasting behavior.

### III. METHOD

Our goal was to understand how our narrowcasting prototype affects behavior and perceptions in social media, and to draw lessons that can be used to improve privacy and security on these platforms. Particularly, we are interested in studying whether the use of our narrowcasting tool would:

- 1) Change users' perceptions and practice regarding online sharing.
- 2) Effect sharing behaviors that ultimately impact privacy.
- 3) Be adopted differently by different groups of users.

We conducted an exploratory study where participants were initially observed using Facebook for two weeks, and then were asked to use our prototype system for narrowcasting their posts for another two weeks. All participants also completed a survey, and interviews were conducted with a subset of participants.

#### A. User Study

A total of 54 participants took part in our study for 4 weeks. Participants were recruited via University message boards and Facebook to help provide a more diverse sample. During the last two weeks participants were asked to use our prototype to narrowcast messages to their Facebook accounts and were instructed to avoid posting directly via Facebook. We also informed participants that the content of their posts would not be recorded for privacy reasons. We collected data via Facebook's API and with users' consent regarding the number of posts made by each user during the first 14 days of the study. We then deployed two versions of our prototype for another 14 days. One version adopted an optimistic interaction pattern (forces the user to choose from whom to hide) and the other adopted a pessimistic interaction pattern (forces the user to choose with whom to share). Participants with odd Facebook ID numbers were assigned the pessimistic interaction pattern, while users with even Facebook ID numbers were assigned the optimistic interaction pattern in order to totally randomize and automatize this process.

#### B. Surveys

At the end of the study all participants completed an online survey. The survey was designed to collect feedback and insights on the usage patterns observed during the study. In addition to demographic information, the survey asked participants to report on how they believed they had used the system. We decided against a survey at the beginning of the study for two reasons. First, we did not want participants to feel over-burdened and drop out of the study. Second, we did not want to influence their subsequent behavior by asking them questions about how they used Facebook, especially given that had already collected rich data about their actual usage of Facebook.

### C. Interviews

We invited all participants to a follow-up interview, and 15 of them (9 male and 6 female) agreed to it. During these 1-hour sessions participants came to our lab and we asked them to log into the prototype using our own desktop computer. Participants were asked to complete a small set of sample tasks using the prototype, and we then held an open-ended interview discussing their experience of using the system, any difficulties they had, and any further suggestions they had.

## IV. SYSTEM USE

To use the prototype, participants could navigate to our custom website and click the “Facebook Login” button, or just access the application directly from Facebook’s application directory. During registration participants had to provide their Facebook credentials and allow access to our software. During subsequent use, every time participants logged in the system fetched their contacts from Facebook. Participants were then shown six categories to use for controlling how they share their message: Age, Home Country, Current Location, Gender, Relationship Status, Relationships (family/significant other).

Fig. 1 shows an annotated screenshot of the prototype with the “Age” category activated. Here, the user has the option to select various groups within that category, choosing to hide or show for each. The default sharing setting for each category (show/hide) was one of our experimental manipulations. In our prototype only one category can be active at any given time, and this was an explicit design choice for two reasons. We wanted to understand how each narrowcasting category is used, but also we were concerned that logic group operands and combinations may be challenging for some users.

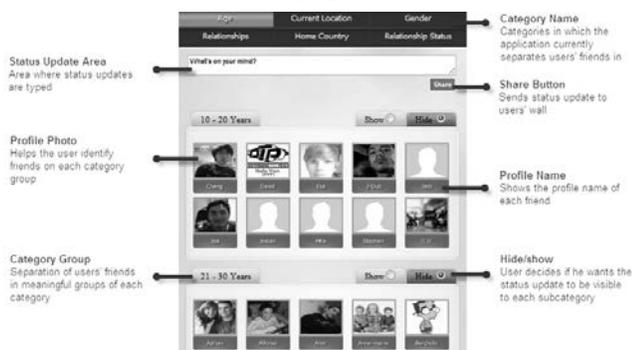


Fig. 1. The interface of our prototype. Running as a Facebook application, it dynamically groups one’s friends into demographic categories and allows the participant to share or hide their posts with each category.

Once a participant configures their sharing preferences for a particular post, i.e. select for which groups to show/hide the shared information, they click on the share button. The application then posts a message on the participant’s wall such that it is only visible to the people chosen by the participant, and hidden from the rest. To achieve this behavior, the system hardcodes a large set of privacy settings for each individual post, specifying explicitly for each of the participant’s friends whether they should be able to see the post or not. This behavior has the benefit that if participant’s friends

subsequently change their profile settings (e.g. change their location or age), the privacy settings at the time of posting remain hardcoded with the post itself and are not affected. For instance, as seen on Fig. 2, only one person will be able to see this particular post.



Fig. 2. Sample post made with our prototype. Posts are attributed to the participant, and only s/he can inspect the privacy settings of each button.

## V. RESULTS

Of the 54 participants 30 (56%) were male and 24 (44%) female. Most participants were in the age brackets 18-25 ( $n=29$ , 54%) and 26-34 ( $n=18$ , 33%) while the rest were divided between the 35-44 ( $n=5$ , 9%) and the 45-54 ( $n=2$ , 4%) age brackets. The majority of our participants were either college students or had already completed their college degrees ( $n=34$ , 63%) with the rest of our participants being spread across numerous occupations (e.g. staff at the university, waiter, military, unemployed, etc.). During the study a total of 595 posts were made using the prototype, distributed across categories in the following manner: Age - 98 (16%), Home Country - 64 (11%), Current Location - 82 (14%), Gender - 122 (21%), Relationship Status - 42 (7%), Relationships - 187 (31%).

### A. How did our Prototype affect Sharing?

We analyzed both self-reported and actual usage data. Participants were asked in the online survey: “Did you post more or less frequently than before since you started using the [narrowcasting] application?” Out of the 54 participants, 6 claimed they posted more often (11%), 16 claimed they posted less often (30%) and 32 answered that they posted about the same amount (59%). Analysis of the usage data showed that during the first 14 days of the study (i.e. prior to the deployment of the prototype) the participants made a total of 488 posts in which there was no use of friends’ lists to hide or show posts ( $M=9.04$ ,  $SD=2.75$ ). During the last 14 days of the study, participants made a total of 595 posts ( $M=11.02$ ,  $SD=2.24$ ).

### B. What is the effect of Interaction Pattern?

Participants were assigned to either the optimistic or pessimistic interaction pattern, resulting in 29 participants (17 male, 12 female) in the optimistic condition 25 (13 male, 12 female) in the pessimistic. Since interaction pattern became a factor only after the deployment of the prototype, and therefore could have no effect during the first part of our study, we performed two separate tests. A one-way ANOVA was conducted to assess the impact of the interaction pattern on sharing frequency. There was such a significant effect ( $F(1,52)=7.21$ ,  $p=.01$ ), with the optimistic group sharing more posts than the pessimistic group. Analysis also showed no significant change in sharing between the first two weeks and last two weeks of the study ( $F(11,42)=1.49$ ,  $p=.17$ ).

These results suggest that people in the pessimistic group did not change their sharing activity with the introduction of our prototype, but there was a significant increase in sharing activity of the participants in the optimistic group. Specifically, the optimistic group made 255 posts ( $M=8.79$ ,  $SD=2.74$ ) before the deployment of the prototype and 349 posts ( $M=12.03$ ,  $SD=3.42$ ) after the deployment. In contrast, people assigned to the pessimistic group did not have significant changes in sharing activity with 233 posts ( $M=9.32$ ,  $SD=2.79$ ) before the deployment of our prototype and 246 posts ( $M=9.84$ ,  $SD=2.41$ ) after deployment.

We also compared the average number of posts for each interaction pattern in each narrowcasting category (Fig. 3). This analysis showed that there was no significant difference between the average number of posts per category when comparing both interaction patterns ( $F(9,15)=1.41$ ,  $p=.27$ ). In other words, the interaction pattern did not influence participants to favor any of the categories.

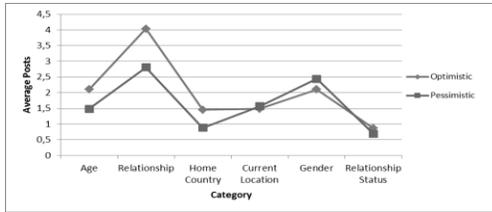


Fig. 3. Breakdown by interaction pattern of average number of posts done on each category

### C. Does Gender affect Narrowcasting?

Previous research has highlighted strong effects of gender on sharing [6, 7, 12], and therefore we investigated whether these effects are carried over to narrowcasting. We analyzed data from both the qualitative and the quantitative datasets in order to first check the difference between the self-reported and actual behavior of the participants. For the qualitative data we cross tabulated against gender the answers to the questions regarding how they preferred using each category: “Please indicate how you preferred using the “.....” category – to hide information or to show information – on a 1 to 5 scale” (1: only hide, 2: mostly hide, 3: neutral, 4: mostly show, 5: only show).

A chi-squared analysis showed that there was only a significant relationship between gender and self-reported sharing behavior regarding the Relationships category (family and/or significant other) ( $\chi^2=20.53$ ,  $df=4$ ,  $p<.01$ ) and the Gender category ( $\chi^2=10.71$ ,  $df=3$ ,  $p=.01$ ). The findings suggest that the self-perceived behavior of males is that of hiding their posts more often than females when using the Relationships category (avg. 1.87 vs. avg. 3.42 in the Likert scale) and the Gender category (avg. 3.17 vs. avg. 3.92 in the Likert scale) but not when using the other categories in our prototype.

Fig. 4 shows participants’ actual sharing behavior for each of the narrowcasting categories. A one-way ANOVA showed there was only a significant relationship between gender and

sharing in the relationships category ( $F(5,95)=4.27$ ,  $p<.01$ ). Males posted a total of 103 times using the Relationships category of which 78 of those posts were with the Hide option selected (75.73%) while 25 of those posts were with the Show option selected (24.27%). On the other hand, females used the category a total of 84 times of which 48 was with the Show option selected (57.14%) while 36 of those posts were with the Hide option selected (42.86%).

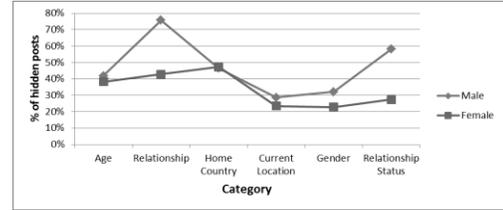


Fig. 4. Breakdown by gender of the percentage of posts that were partially hidden in each category.

## VI. DISCUSSION

The recent automation enhancements of Friends Lists by Facebook and the existence of Circles from the launch of Google Plus suggest that popular social media networks are concerned with privacy issues and are gradually turning to narrowcasting. In our survey and interviews, participants claimed to become more engaged and have an easier time posting on Facebook and in general they would welcome a category-driven approach that relies on tie strength and relationships. For instance one participant claimed: “It really helped me quickly send posts to the people I want”, and “It was easy to use and I like how it sorts my friends into groups I can relate to”.

### A. How Narrowcasting was appropriated

While our tool was designed with demographic-driven narrowcasting in mind, we found that some participants adopted, in certain occasions, a rather different strategy in choosing how to narrowcast. Despite no participant using friend lists before, we found that some became very conscious about a small set of friends which had an effect on their narrowcasting strategy while also improving their social capital [37]. We note, however, that the behaviors reported next constitute a very low portion of the total usage of our prototype and therefore did not have an impact on the results reported previously.

One strategy that some participants adopted for selecting in which category to narrowcast was driven by the presence of *important individuals* in the groups. Based on which individuals they did *not* want to see their posts they would then choose the category that would more easily allow them to hide that post from those friends. As one participant stated: “Helped me post effectively to the people I wanted to in one occasion. There was a group of girlfriends I did not want to see something, so I just used gender and hide it from all girls”. Another strategy we observed was one participant using the most *semantically relevant* category to narrowcast, as explained by the participant: “Since there was no school

*category, I just choose the current location; while not being perfect still is better than broadcasting especially since I have many friends in other locations”.*

Our data also showed that there were a couple cases where people shared a post with just 1 person. We also verified that all instances of this behavior were associated with the relationships category. The existence of such targeted messages begged the question why did not the participants just send a private message. We raised this issue in one of the interviews, where the participant replied: *“I did it because I think it is more visible in the Wall and it could take the person much longer to realize they had a message from me”.*

In contrast, on a couple of occasions participants used the prototype to post to everyone. This is possibly because our instructions to participants were to avoid using Facebook directly to post anything during the study. Thus, when participants wanted to post a message to be viewed by everyone they simply chose the category that appeared in the initial screen of the application (which in this case was age): *“I wanted to send something to everyone, so I just used the initial screen and selected show for every subcategory”.*

Finally, in some cases participants sent a series of messages in succession, but because we did not record the content of the messages we could not verify if this was the same message being tailored to different groups. During the interviews one participant indeed verified this was the case: *“I had a post with a link to a picture that I only wanted to share with my girlfriend and male friends, so I had to do it twice.”*

This was a case where the participant effectively wanted to merge multiple narrowcasting categories by sending multiple messages. However, the need for repeating the sharing process a handful of times did not seem burdensome but rather gave participants a sense of control.

#### *B. Effects of Narrowcasting on Sharing Behavior*

Our log analysis showed that while using our prototype participants shared with less people overall, but actually posted a similar amount when compared to the baseline data of two weeks before the use of the prototype. This suggests that the additional effort required to narrowcast a post (e.g. for tweaking the recipients) does not outweigh the apparent benefits or satisfaction that participants get from this process. The relevant questionnaire and interview feedback we obtained supports this interpretation. For instance, many respondents claimed to find narrowcasting useful, and at the same time offered quite creative ways that the system could be redesigned and improved: *“The tool opened my eyes to narrowcasting and how I can use it to help me”*, and *“The option to attach pictures/videos to the posts would be great. Add/remove people from each category. More categories organized in a better way. Some configuration options like colors and default settings”.*

This feedback suggests that participants successfully engaged with narrowcasting, and did not find it laborious. However, we cannot be fully confident about this finding

because another possible explanation for our results may be the Hawthorne effect [2]. It can be argued that the participants adapted their behavior in order to “please” the researchers, or because they knew they were being observed. However, the evidence we have is not in complete accordance with this explanation. First, we observed participants for 14 days prior to deployment, and therefore it is possible that if there had been any such effect it would also manifest in the first part of the study. Hence, the differences in behavior between the first 14 days and the last 14 days may be over and beyond any such effect. In addition, participants did not self-report a change in terms of posting volume. In fact, only 11% of participants claimed they posted more often while most of them (59%) believed their posting behavior remained the same. However, the introduction of a new user interface obviously led to adaptive behavior by the participants as demonstrated in the previous section.

Finally, participants highlighted that through narrowcasting they became more aware regarding which friends they were posting to at any given time. *“It was really helpful to be able to see which friends were going to see my post. Gave me a sense of control over what I was posting”.*

In addition to increased user awareness at the time of posting, this categorization mechanism could be used for building and maintaining friend lists with relative ease inside of Facebook itself.

#### *C. Effects of Default Settings on Narrowcasting*

In the usage data we observed a statistically significant difference between the number of posts made in the optimistic and pessimistic conditions, with participants in the optimistic condition posting more often once our prototype was deployed. An inherent difference between these two conditions is that participants who wanted to hide from a small subset of friends required more clicks when using the pessimistic model. Conversely, those who wanted to share with a small subset of friends required more clicks in the optimistic model. Given our results we argue that making it easy to hide from a small subgroup of friends is more comfortable narrowcasting approach, since in our case it resulted in more frequent posting.

Some participants noted that effectively having everyone in a category set to show and then deciding to whom to hide a post would lead to fewer mistakes, and therefore minimize the risk of someone they did not intend to see their post having access to that information.

Previous work suggests that the optimistic approach is useful in cases where openness and availability are more important than complete protection [10] and specifically in the context of Facebook the benefits outweigh the risks of disclosing personal information [5]. Interestingly, previous findings [3] claim that because within a hyper-public each person is not simply able to choose what they wish to expose, they have to choose what they wish to hide. Hence, previous work suggested that people would be more comfortable

posting with a pessimistic interaction pattern, but this was not the case in the context of narrowcasting.

#### D. Gender Effects on Narrowcasting

The effects of gender on posting behavior have been highlighted by previous research [6, 7, 12], suggesting that males have a tendency to disclose less information about themselves than females. The questionnaire results suggested there was a statistically significant difference in the self-reported number of hidden posts between males and females, particularly in the Relationships and Gender categories: the self-reported behavior of males (avg. 1.87 & 3.17 on the Likert scale) was that of hiding their posts more often than the females (avg. 3.42 & 3.92 on the Likert scale). This was partially confirmed by the usage data, as the actual behavior of males is that of hiding their posts more often than females when using the Relationships category in our application (75.7% vs. 42.9%), but not so for any other category. The self-reported behavior and the actual behavior of our participants were in concordance for all categories except the Gender category.

During our interviews both genders expressed concern regarding sharing information with co-workers, their boss and strangers. A male participant noted: *“I sometimes find myself wanting to post something but do not want my boss and colleagues to read but it is such a hassle to do it in Facebook”* and a female participant said: *“There is definitely a concern with strangers knowing my location when I want to post something but also my boss especially if it is at night and before a working day”*.

However, males appeared more concerned about what their family, significant other and people they considered as potential romantic partners could see; further confirming that males are generally more sensitive towards narrowcasting in specific contexts: *“Well, to be honest, I rather my mom and girlfriend not know about what I did in a party last time or see a picture I might want to upload”*, and *“I sometimes worry that my Facebook profile gives a wrong image of myself that might turn away new people”*.

Our findings regarding gender effects of narrowcasting are in agreement with previous studies that claim that males have a greater need to control their privacy [28, 31]. Men also report expecting greater negative ramifications when disclosing about life expectations [27]. Framed within the theory of privacy management, there has been substantial research that has shown that men and women use different criteria for deciding to open or close their boundaries. Consequently, they tend to depend on different rules to reveal or conceal. The outcome of these rules is that women more than men tend to disclose overall, though there are situations where the reverse is true [12, 34]. Women, more than men, also tend to talk about intimate or personal topics with each other, with their families and with their partner [6, 7]. This can explain why in the analysis of actual behavior we only observed a significant difference in the Relationships category. However, it is also true that the interface itself may

have influenced how each gender approached our prototype [17].

#### E. Limitations

This study has a number of limitations. Firstly, most participants are college students or have college degrees, which could introduce response bias; also this is not an accurate representation of the current Facebook population that now comprises of many different demographics hence the potential problems that can influence the study. However, our sample’s popular age brackets were roughly the same as that of Facebook [35].

Additionally, it is not entirely clear the role internet self-efficacy played as a user’s confidence in his/her ability to navigate and accomplish tasks online is relevant to narrowcasting. However, we expect all users to benefit from tools that simplify narrowcasting. These benefits may be intensified among those with lower efficacy: these users might be less aware or willing to invest effort to use the limited narrowcasting tools currently available, such as lists. While we can expect the insights from our findings to largely hold across demographics, clearly the magnitude of these findings may vary across different levels of self-efficacy.

Finally, we acknowledge the possible existence of the novelty effect particularly during the first days of deployment. However, participation during the study did level off during the second week, so it is hard to conclude whether a novelty effect was at play. A much longer study is required to assess this, which can be challenging to conduct in a controlled manner.

## VII. CONCLUSION

Our results suggest that narrowcasting can be an effective approach to online social sharing, and in fact it does not seem to affect sharing levels. Therefore, to the extent that it offers benefits in relation to privacy, yet does not hinder sharing, narrowcasting can be a successful approach to online sharing. Our empirical evidence suggests that users find narrowcasting an interesting and engaging way of thinking about sharing.

Interestingly, however, while we recorded a positive reaction from most participants, we found that participants greatly varied in their narrowcasting behavior. For example, males were more restrictive of their posts and participants preferred different categories over others. These sharp distinctions in how participants adopted narrowcasting are a reminder that when developing narrowcasting or other sharing mechanisms, demographics are an important source of inspiration as well as variation in how people adopt a service.

In addition to the sharp effects of demographics we found that default settings have an impact on narrowcasting behavior, particularly frequency. Our finding that users of an optimistic interaction model narrowcast more frequently can be thought of as a way to *nudge* users toward more or less sharing. Even though Facebook uses a pessimistic model, and therefore our participants were likely more familiar with this

approach, in our study we found that this model resulted in a relative reduction in sharing frequency. This further suggests that the effect we have observed is quite robust.

In summary, narrowcasting in social media has the potential to not only improve the privacy of users, but can also improve the relevance of content to anyone who receives posts. This is a fundamental shift in contrast to how narrowcasting is perceived in traditional media. Hence narrowcasting does no longer need to be just about making sure receivers of content care about it, but also about protecting the senders by minimizing their digital footprint. Orthogonally to this phenomenon, it can also raise awareness among users and make them think that a certain post might not be appropriate for a certain group of people. This gives inherent value to a narrowcasting platform since it can prevent problems caused by social media over-exposure.

## REFERENCES

- [1] Ackerman, M., Mainwaring, S. Privacy Issues in Human-Computer Interaction. *Computer* 27, 5 (2005), 19-26.
- [2] Adair, J. The Hawthorne effect: A reconsideration of the methodological artifact. *Journal of Applied Psychology* 69, 2 (1984), 334-345.
- [3] boyd, d. Facebook's Privacy Trainwreck: Exposure, Invasion, and Social Convergence. *The International Journal of Research into New Media Technologies* 14, 1 (2008), 13-20.
- [4] Davis, M., Van House, N., Towle, J., King, S., Ahern, S., Burgener, C., Perkel, D., Finn, M., Viswanathan, V., Rothenber, M. MMM2: mobile media metadata for media sharing. *Ext. Abstracts CHI' 05*, ACM Press (2005), 1335-1338.
- [5] Debatin, B., Lovejoy, J.P., Horn, A., Hughes, B.N. Facebook and Online Privacy: Attitudes, Behaviors, and Unintended Consequences. *Journal of Computer-mediated Communication* 15, 1 (2009), 83-108.
- [6] Derlega, V.J., Chaikin, A.L. Norms affecting self-disclosure in men and women. *Journal of Consulting and Clinical Psychology* 44, 3 (1976), 376-380.
- [7] Dindia, K., Allen, M. (1992). Sex differences in self-disclosure: A meta-analysis. *Psychological Bulletin* 112, 1 (1992), 106-124.
- [8] Egelman, S., Oates, A., Krishnamurthi, S. Oops, I did it again: Mitigating repeated access control errors on Facebook. In *Proc. of CHI' 11*, ACM Press (2011), 2295-2304.
- [9] Flera, A. Mass Media Communication in Canada. Thompson Nelson (2003), 379.
- [10] Hong, J., Landay, J. An architecture for privacy-sensitive ubiquitous computing. In *Proc. of MobiSys' 04*, ACM Press (2004), 177-189.
- [11] Hosio, S., Goncalves, J., Kostakos, V. Application Discoverability on Multipurpose Public Displays: Popularity comes at a Price. In *Proc. of PerDis' 13*, ACM Press (2013), Mountain View, California.
- [12] Joinson, A.N. Looking at, looking up or keeping up with people?: Motives and use of Facebook. In *Proc. of CHI' 08*, ACM Press (2008), 1027-1036.
- [13] Jones, Q., Gandhi, S.A., Whittaker, S., Chivakula, K., Terveen, L. Putting Systems into Place: A Qualitative Study of Design Requirements for Location-Aware Community Systems. In *Proc. of CSCW' 04*, ACM Press (2004), 202-211.
- [14] Kairam, S., Brzozowski, M.J., Huffaker, D., Chi, E.H. Talking in Circles: Selective Sharing in Google+. In *Proc. of CHI' 12*, ACM Press (2012), 1065-1074.
- [15] Kostakos, V., Kukka, H., Goncalves, J., Tselios, N., Ojala, T. Multipurpose public displays: How shortcut menus affect usage. *IEEE Computer Graphics and Applications* 33, 2 (2013), 56-63.
- [16] Kostakos, V., O'Neill, E., Little, L., Sillence, E. The Social Implications of Emerging Technologies. *Interacting with Computers* 17, 5 (2005), 475-483.
- [17] Kukka, H., Oja, H., Kostakos, V., Goncalves, J., Ojala, T. What Makes You Click: Exploring Visual Signals to Entice Interaction on Public Displays. In *Proc. of CHI' 13*, ACM Press (2013), 1699-1708.
- [18] Lampe, C., Ellison, N.B., Steinfield, C. A Face(book) in the crowd: Social searching vs. social browsing. In *Proc. of CSCW' 06*, ACM Press (2006), 167-170.
- [19] Lampinen, A., Tamminen, S., Oulasvirta, A. All My People Right Here, Right Now: Management of group co-presence on a social networking site. In *Proc. of GROUP' 09*, ACM Press (2009), 281-290.
- [20] Lederer, S. Dey, A., Mankoff, J. A conceptual model and a metaphor of everyday privacy in ubiquitous computing. *Intel Research Berkeley*, Tech. Rep. IRB-TR-02-017 (2002).
- [21] Lederer, S., Hong, J., Dey, A., Landay, J. Personal privacy through understanding and action: five pitfalls for designers. *Personal and Ubiquitous Computing* 8, 6 (2004), 440-454.
- [22] Legendre, F., Lenders, V., May, M., Karlsson, G. Narrowcasting: An Empirical Performance Evaluation Study. In *Proc. of CHANTS' 08*, ACM Press (2008), 11-18.
- [23] Nissenbaum, H. Privacy as Contextual Integrity. *Washington Law Review* 79, 1 (2004), 101-139.
- [24] Olson, J., Grudin, J., Horvitz, E. A study of preferences for sharing and privacy. *Ext. Abstracts CHI' 05*, ACM Press (2005), 1985-1988.
- [25] Palen, L., Dourish, P. Unpacking Privacy for a Networked World. In *Proc. of CHI' 03*, ACM Press (2003), 129-136.
- [26] Patterson, D.J., Baker, C., Ding, X., Kaufman, S.J., Liu, K., Zaldivar, A. Online everywhere: evolving mobile instant messaging practices. In *Proc. of UbiComp' 08*, ACM Press (2008), 64-73.
- [27] Petronio, S., Martin, J. Ramifications of Revealing Private Information: A Gender Gap. *Journal of Clinical Psychology* 42, 3 (1986), 499-506.
- [28] Petronio, S., Martin, J., Littlefield, R. Prerequisite Conditions for Self-Disclosing: A Gender Issue. *Communication Monographs* 51, 3 (1984), 268-273.
- [29] Reynolds, B., Venkatanathan, J., Goncalves, J., Kostakos, V. Sharing ephemeral information in online social networks: privacy perceptions and behaviors. In *Proc. of INTERACT' 11*, Springer (2011), 204-215.
- [30] Richter, H., Besmer, A., Watson, J. Understanding privacy settings in Facebook with an audience view. In *Proc. of UPSEC' 08*, Article 2 (2008), 1-8.
- [31] Rosenfeld, L.B. (1979). Self-disclosure avoidance: Why am I afraid to tell you who I am? *Communication Monographs* 46, 1 (1979), 63-74.
- [32] Shiels, M. Facebook unveils 'groups' feature and user controls. BBC (2010), Retrieved from <http://www.bbc.co.uk/news/technology-11486427> on 15 May 2012.
- [33] Skeels, M.M., Grudin, J. When social networks cross boundaries: A case study of workplace use of Facebook and LinkedIn. In *Proc. of GROUP' 09*, ACM Press (2009), 95-104.
- [34] Stutzman, F., Kramer-Duffield, J. Friends only: examining a privacy-enhancing behavior in Facebook. In *Proc. of CHI' 10*, ACM Press (2010), 1553-1562.
- [35] The Royal Pingdom (2012). Retrieved from <http://royal.pingdom.com/2012/08/21/report-social-network-demographics-in-2012/>
- [36] Tufekci, Z. Can you see me now? Audience and disclosure regulation in online social network sites. *Bulletin of Science, Technology & Society* 28, 1 (2008), 20-36.
- [37] Venkatanathan, J., Karapanos, E., Kostakos, V., Goncalves, J. Network, Personality and Social Capital. In *Proc. of Web Science' 12*, ACM (2012), 326-329.
- [38] Vitak, J., Lampe, C., Gray, R., Ellison, N. Why won't you be my Facebook friend? Strategies for managing context collapse in the workplace. In *Proc. of iConference' 12*, ACM Press (2012), 555-557.
- [39] Watson, J., Besmer, A., Lipford, H. +Your circles: sharing behavior on Google+. In *Proc. of SOUPS' 12*, ACM Press (2012), Article 12.
- [40] Wisniewski, P., Lipford, H., Wilson, D. Fighting for my space: Coping mechanisms for SNS boundary regulation. In *Proc. of CHI' 12*, ACM Press (2012), 609-618.