

Posters: Transitive Privacy Concern in Social Networks

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1. INTRODUCTION

On Facebook, users can share information with others by creating posts and specifying audiences that are permitted to see each post. Every Facebook post has a producer (the person who created the post) and a consumer (the person who reads the post). Once a producer has shared a post, consumers of that post have the ability to copy or re-share the information. This gives the consumer some power to control the producer's information. The ability to control access to personal information is an important aspect of privacy management [4]. However, the consumer may have a different understanding of the post than the producer intended, and use the information in ways that are contrary to the intentions of the original producer. If the level of privacy concern is different between the producer and consumer for the same post, this might result in a privacy violation.

For example, in one highly publicized incident from December 2012, Mark Zuckerberg's sister Randi posted a photo of a family gathering to Facebook. She had not intended for the photo to be shared publicly, but it was subsequently posted to Twitter by a stranger. The stranger had gained access to the photo via someone who had been tagged in the photo, who was Facebook friends both with the stranger and also with Randi¹. The stranger apologized for the privacy violation, and explained that since the photo had appeared in her feed, she had assumed that Randi had intentionally allowed it to be public.

This highlights a problem we call *transitive privacy concern* in social networks, which is based on the concept of transitive trust. Transitive trust is a mechanism of trust extension from a relationship between two people who know each other, to a relationship between two people who do not know each other directly, but have a trusted mutual contact through whom they are connected [3, 2].

We wondered whether privacy concern, like trust, might be transitive. Do friends-of-friends of a post producer have the same level of privacy concern about posts as the producer does? In other words, if Bob is Facebook friends with Alice and Charlie, but Alice and Charlie are not connected with each other (Figure 1), does Charlie feel the same level of privacy concern regarding Alice's posts as she does? In addition, would Alice be more concerned if she knew Charlie could see her post, than if she believed only Bob could see it? Using an online survey, we measured the privacy concern of information producers and consumers at different network distances, and compared producer and consumer responses for the same post. We asked the following research questions:

1. Do information producers and consumers have different privacy concern about the same post?

¹<http://www.forbes.com/sites/kashmirhill/2012/12/26/oops-mark-zuckerbergs-sister-has-a-private-facebook-photo-go-public/>

2. Does the privacy concern of information producers and consumers vary based on the network distance separating the producer from the consumer?

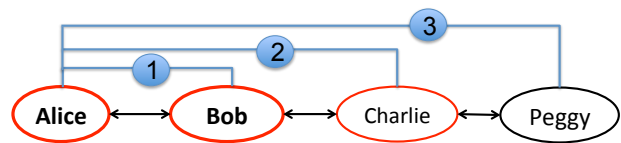


Figure 1: A part of Alice's Facebook network by distance

2. DATA COLLECTION

We recruited forty-two pairs of Facebook friends via snowball sampling on Facebook. Participants were required to have at least two recent posts that they produced and their partner in the study either commented on or liked. This ensured that partners had seen each others' posts around the time they were originally created. Both partners completed an online survey that asked about their perceptions of four Facebook posts, two produced by each partner. Both partners answered questions as the information producer for his or her own posts, and as a consumer for the partner's posts.

Producers and consumers were asked to rate their agreement with statements about privacy concern at different network distances on a 7-point Likert scale that ranged from Strongly Disagree (1) to Strongly Agree (7). The overall mean for agreement with all privacy concern statements was 3.92 (SD=1.75). At distance 1, direct Facebook connections, producers rated the statement "I was concerned about my privacy when I created my post," and consumers rated "[Name of producer] would be concerned about his or her privacy when he or she created the post."

We manipulated network distance from the post producer by presenting variations of the above statements about privacy concern. For example, the producer's privacy concern about his or her post being seen by friends-of-friends (distance 2) was measured by agreement with the statement, "I am concerned about my privacy when my post is shown to [name of consumer]'s Facebook friends." Similarly, privacy concern about disclosures to other people connected to friends-of-friends (distance 3) was measured with, "I would be concerned about my privacy if a friend-of-a-friend shared my post with others."

We measured general Facebook privacy concern by asking all participants to rate the statement, "I am concerned about my privacy on Facebook" using a 7-point Likert agreement scale (M=5.54, SD=1.24). Finally, we measured how private the producer considered the post to be (M=3.86, SD=1.80), with the statement "How personal is the information in your post?" (1=not personal at all – 7=very personal).

	Coef.	S.E.
(Intercept)	0.05	0.57
Role (Producer)		
Consumer	0.54***	0.14
Distance (1)		
Distance 2	0.28	0.30
Distance 3	1.24***	0.30
Distance 2 * Consumer	-0.07	0.19
Distance 3 * Consumer	-0.36	0.19
Types of Audience (Public)		
Friends-of-friends	0.64*	0.29
Friends	0.47**	0.15
Specific Group	0.40	0.20
General FB privacy concern	0.21**	0.03
Privateness	0.21***	0.03
Random effects		(SD)
Level 2 (Individuals)		0.94
Level 3 (Pairs)		0.30

p<0.001, ***; p<0.01, **; p<0.05, *; p<0.10, .

Table 1: Multilevel regression model.

3. RESULTS

We used a multilevel regression model to explain variation in privacy concern about Facebook posts as a function of *post-level* variables, such as network distance, “privateness”, and Facebook audience specified when the producer created the post; *individual level* variables, such as role (producer vs. consumer); and general privacy concern on Facebook. We included an interaction effect of distance and role to investigate how privacy concern might vary from one level of distance to the next, depending on role. The data have a three level structure: pairs (level 3, n=41), individuals (level 2, n=82), and Facebook posts (level 1, n=164). We included the individual and pair level as a random effects in the model.

Table 1 shows the regression results. On average, consumers’ privacy concern was 0.54 points higher than the concern of producers who were their Facebook friends (distance 1). In other words, consumers felt more strongly that producers would be concerned about the privacy of their posts than the producers themselves did.

As the network distance increased to two steps away from the producer, privacy concern also increased for both producers (0.33) and consumers (0.80). However, the difference between the coefficients for producers and consumers at distance 2 (0.47 points) was smaller than the than the difference at distance 1 (0.54 points). This pattern was repeated at distance 3, where concern was yet again stronger, and the difference between the producer (1.57) and consumer (1.75) was smaller still at 0.18 points. In other words, as network distance increased, privacy concern increased for both producers and consumers, but the ratings of producers and consumers about the same post became more similar.

Compared with posts that producers made publicly available, posts where the Facebook audience was specified as “Friends-of-friends” were associated with greater concern by 0.64 points on average. While the coefficients were positive for all levels of audience type, the effect was smaller for “Friends” (0.47 points) and “Specific Group” (0.40 points). This indicates that for posts with more restrictive audiences, participants were more concerned about privacy. Finally, both general Facebook privacy concern and the producer’s assessment of the “privateness” of the post had a positive association with participants’ privacy concern. This means that participants with higher levels of concern about privacy on Facebook overall agreed more strongly with statements about privacy concern related to the post, and also for posts that were shared with more restricted Facebook audiences.

4. DISCUSSION

This study examined two research questions: whether producers and consumers have different privacy concern about the same post, and how privacy concern varies based on the network distance separating the producer from the consumer. Consumers expressed more privacy concern overall than producers did about the same posts. This might mean that when a Facebook user creates a post, the people who read the post could be more protective of producers’ privacy than the producers are themselves.

In addition, both producers and consumers reported greater privacy concern when they considered that their Facebook posts might be consumed by users with indirect relationships (distance 2 and 3) than with direct relationships (distance 1). This is problematic for specification of audiences for posts on social networks. While Facebook’s privacy control mechanisms are conceptually similar to access control policies, they offer no easy way to find out who one’s friends-of-friends might be. Gilbert [1] wrote about this problem as one of “triadic awareness”—Alice is not necessarily aware that Charlie exists, nor whether conditions might occur where Charlie could see her posts. One consequence of this is that it is very hard to imagine transitive relationships from the perspectives of different consumers, when each producer has an incomplete picture of the network relationships at various distances.

Increasing privacy concern when considering consumers at greater distances may mean that privacy concern in the context of relationships on social networks is not transitive. If it were transitive, increasing distance would not be a source of greater concern. Instead, the greater agreement may reflect increased uncertainty about who might be able to see the post at these different distances. It is hard to entrust one’s privacy to those whom you are not aware of.

One limitation of this research is that we asked about privacy concern, but we did not ask about potential or actual re-sharing or disclosure of the information. So, we cannot tell from this project whether consumers are willing to share producers’ posts anyway, despite feeling like producers should be concerned. In the Randi Zuckerberg example, the stranger who shared her photo stated that she felt her actions were not a violation (after removing the post from her Twitter feed) because she had seen the photo as part of her Facebook news feed. She took this to mean that the post was not protected. In the face of evidence from the system that a post has been shared widely, consumers may be more willing to take those cues at face value rather than try to speculate about producers’ intentions. Future work will investigate how privacy concern really matters on sharing decisions.

5. REFERENCES

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