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Comfortable with friends sharing your picture on Facebook? - Effects of closeness and ownership on picture sharing preference

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ABSTRACT

Picture sharing activity on social networking sites helps create and maintain social relationships. However, some of these pictures can be undesirable digital traces especially when the person sharing the information (owner) and the person receiving the information (viewer) do not ask the sharing preference of the person who is in the picture (subject). In our exploratory lab study, we asked twenty-nine participants about their picture sharing preference (PSP) towards an owner's act of sharing a photograph containing both the participant (subject) and the owner with a viewer. Our multi-level regression on 5520 data points show that in terms of closeness, a subject feels more comfortable sharing a picture i) as the "closeness between the subject and the owner (SO closeness)" increases and ii) as the "closeness between the subject and the viewer (SV closeness)" increases. In terms of ownership, a subject feels more comfortable with sharing a picture i) when the picture shows a greater number of people as opposed to a smaller number of people, and ii) when the picture is captured at an event held for the viewer or the owner rather than for the subject. In addition, we observed three types of interaction effects on PSP between the following variables: i) SO closeness and SV closeness, ii) SO closeness and num_people, and iii) both types of closeness and event_posessor.

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1. Introduction

People share group photographs to create and maintain social relationships, by constructing and sharing group memory. One medium currently used for sharing pictures is social networking. Social networking services (SNSs) help users broadcast group pictures to their friends instantly (Ahern et al., 2007; Besmer & Lipford, 2010). For example, on Facebook, 25 million pictures are uploaded and shared between Facebook users every day (Ebersman, 2012). However, some of these group pictures may end up creating undesirable digital traces, if the picture sharing preference (PSP) of the owner who shares the picture does not match the PSPs of the other people in the picture. As the result of such a mismatch of PSPs, while many people spend time uploading and tagging group pictures, others spend time untagging themselves from the pictures (Besmer & Lipford, 2010; Lampinen, Lehtinen, Lehmuskallio, & Tamminen, 2011; Lang & Barton, 2015; Stutzman & Kramer-Duffield, 2010). For example, Lang and Barton (2015) found in their survey-based study that 84 percent of their survey participants stated that they had had the experience of having their Facebook friends share pictures they did not want to have distribute.

Our work builds on existing research that focused on understanding the preferences of people who share their own personal information. Unlike existing research, however, we examine how a persons sharing preference differs when another user shares a commonly owned object, namely a group picture that includes both of them. In our study, the one who shares the group picture is the owner, another individual in the group picture is the subject, and the person who sees the group picture that has been shared by the owner is the viewer. Fig. 1 shows the three parties involved in picture sharing activities, and the seven hypotheses that examine various factors that affect a subjects PSP. More specifically, we examine two factors on closeness in hypotheses 1, 2, and 3, two factors on ownership in hypotheses 4 and 5, and the relationship between closeness and ownership in hypotheses 6 and 7.

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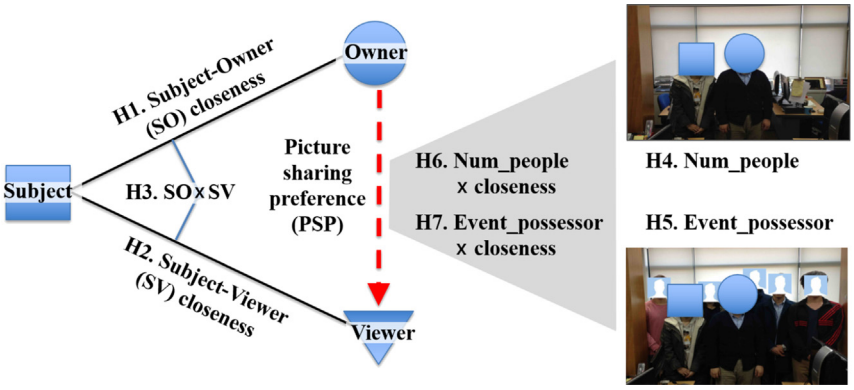

Fig. 1. Summary of the seven hypotheses. The variables include three parties (subject, owner, and viewer), and four factors (SO closeness, SV closeness, number of people, and event_possessor) that affect a subjects picture sharing preference (PSP).

Insights from research on how closeness and ownership affect PSP can be used to inform policies for managing pictures/information on diverse SNS systems. Existing research on information-sharing preferences has mainly examined how the level of closeness between the information sharer (owner) and a receiver (viewer) affects their information-sharing preferences (Greene, Derlega, & Mathews, 2006; Wiese et al., 2011). However, the preference of a party who has an interest in the shared information, but is not directly involved in the sharing process, has not been studied extensively. Therefore, in this paper, we examine the subjects information-sharing preference, a topic that has received little attention thus far.

The remainder of this paper is organized as follows. We begin by reviewing relevant research and seven research hypotheses. Then we present the details of our study. Finally, the studys results are presented, followed by the conclusion.

2. Research questions

Of the seven research hypotheses that we examine in this paper, three relate to how aspects of closeness affect subjects PSPs (H1, H2, H3); the next two explore how ownership affects PSPs (H4, H5); the last two consider how closeness and ownership interact (H6, H7). In the two subsections that follow, we present existing research on closeness and ownership, along with the corresponding hypotheses.

2.1. Research questions on closeness and picture sharing preference (PSP)

Research shows that higher levels of closeness between the parties directly involved in sharing information affects the level of PSP positively (Greene et al., 2006; Joinson, Reips, Buchanan, & Schofield, 2010; Park, Jin, & Jin, 2011; Utz, 2015; Wiese et al., 2011). For example, Wiese et al. (2011) showed that a higher level of closeness between people is associated with a higher degree of willingness to share information. In our context, the parties directly involved in sharing information are the owner and the viewer. We extend such existing research on closeness by examining an additional party who has an interest in the information exchanged, namely the subject who appears in the shared photograph.

The first type of closeness that we are interested in is the relationship between a picture subject and an owner (SO closeness), who shares their personal picture with a viewer. The effect of this relationship on a subjects PSP can be inferred from previous work on social exchange theory and shared acquaintance. Social exchange theory states that the greater the strength of relationship between the parties involved, the greater the degree of willingness there is to help other parties in the relationship (Burt & Knez, 1995; Cropanzano & Mitchell, 2005; Emerson, 1976). According to this theory, when people provide help, they anticipate a norm of reciprocity, and expect others help in return, in the future. As people successfully help each other over time, and build stronger relationships, they build confidence about each others behaviors, and the levels of reciprocity increase. In contrast, the relationships could be lost if help is not successfully exchanged (Burt & Knez, 1995; Emerson, 1976). Therefore, applied to our study, social exchange theory implies that when a subject and an owner have a high degree of closeness, the subject would have a high degree of confidence that the owner would be posting their picture, which in turn would result in a high level of the subjects PSP.

Literature on shared acquaintance suggests a similar prediction regarding a subjects PSP. When a person has a shared acquaintance, he is more trusting of that acquaintance (Yuki, Maddux, Brewer, & Takemura, 2005). In our study, that shared acquaintance is the owner. In addition, literature shows that even without any communication, seeing a person in an online group repeatedly can be a precursor to forming a personal attachment (Milgram, 2010). Since having a common friend (owner) with a high degree of closeness increases the likelihood of seeing that friends friend (viewer) online, for example, on the owners Facebook timeline, a subject is more likely to feel comfortable with the viewer when the owner is close to the subject. Taken together, literature on social exchange theory and shared acquaintance suggests the following hypothesis.

Hypothesis 1. *If subject-owner (SO) closeness increases, a subjects PSP for an owners picture sharing activity will also increase.*

The second type of closeness that will be examined is the relationship between a subject and a viewer (SV closeness). Literature on social penetration theory and trust suggests that SV closeness can affect a subjects PSP. Social penetration theory suggests that the strength of the relationship affects the degree of self-disclosure (Altman & Taylor, 1973; Collins & Miller, 1994; Gross & Acquisti, 2005). Self-disclosure is an act of revealing private information about oneself to others (Collins & Miller, 1994; Greene et al., 2006). Sharing ones own picture is, in a broader sense, an act of self-disclosure, because the picture contains information about the people in it. As relationships develop over time, and the strength of these relationships grows, people reveal more of their inner thoughts and feelings, more frequently and deeply, on a wider range of topics (Altman & Taylor, 1973; Collins & Miller, 1994). In

contrast, as relationships deteriorate and the strength of the relationships weaken, people reveal less about themselves (Greene et al., 2006). Therefore, when the closeness between a subject and a viewer is high, the subject will be comfortable with a friend (owner) sharing a picture, because in such a case the owner is just a medium for sharing.

In addition to social penetration theory, research on trust implies a similar story in terms of a subjects PSP. Research shows that the greater the relationship strength, the greater the trust (Granovetter, 1973; Greene et al., 2006; Joinson et al., 2010). Since individuals modify their degree of self-disclosure to ensure their own safety in terms of the leakage of information (Derlega & Chaikin, 1977), when subjects have a higher level of trust, they will disclose more information to a viewer. A more recent study by Beldad & Kusumadewi (2015) supported this finding regarding the level of trust and information-sharing preferences. Specifically, they showed that users are less likely to share personal information, such as locations, when they distrust their friends who are in the same social network. Taken together, from a subjects perspective, these results suggest that if the degree of closeness between the subject and a viewer is high, then the probability of the subjects PSP with regard to the viewer will be greater, due to a higher degree of self-disclosure and trust.

Hypothesis 2. *If subject-viewer (SV) closeness increases, a subjects PSP with regard to an owners picture sharing activity will also increase.*

In addition to the independent effect of SV closeness and SO closeness on a subjects PSP, we are also interested in learning how the two types of closeness interact with each other. We expect that as subject-viewer (SV) closeness increases, relationships with higher subject-owner (SO) closeness will have a stronger impact on a subjects PSP with regard to an owner sharing their personal picture with a viewer, than will occur in relationships with lower SO closeness. Partial support for our reasoning comes from previous research, which shows that people increasingly disclose their inner thoughts and feelings with greater frequency, in greater depth, and on a wider range of topics, as relationships develop over time (Altman & Taylor, 1973; Collins & Miller, 1994; Gross & Acquisti, 2005). Therefore, we expect that if a picture subject feels close to both an owner and a viewer, the two types of closeness can have a synergistic effect, similar to that of the increasing level of self-disclosure that develops over time. The interaction effects between the two types of closeness are summarized in hypothesis 3 below.

Hypothesis 3. *As subject-viewer (SV) closeness increases, relationships with higher subject-owner (SO) closeness will have a stronger impact on a subjects PSP with regard to an owners picture sharing activity than relationships with lower SO closeness.*

2.2. Research questions on ownership and picture sharing preference (PSP)

In psychology, ownership is referred to as a perception or belief that an individual possesses an object (Pierce, Kostova, & Dirks, 2001, 2003). As a strong sense of ownership toward an object anchors in an individuals mind, the individual feels possessiveness and psychologically connected to the object. Furthermore, individuals feel that the object is representative of them and has become a part of their psychological identity (Brown, Crossley, & Robinson, 2014, 2005; Dittmar, 1992; Pierce et al., 2003, 2001; Van Dyne & Pierce, 2004). As a result, the individual wants to retain control of the object, and may refuse to share it further with others. In terms of our study, such a result suggests that a higher sense of ownership toward a picture will result in a subject being more uncomfortable with sharing the picture, that is, a lower level of PSP.

To test our supposition, we explored two variables that affect ownership, based on work by Pierce and his colleagues, namely, the number of people in the picture (num_people) and the possessor of the event at which the picture was taken (event_possessor). The two factors that we examine in our study are based on the three major factors that Pierce and his colleagues have suggested influence the emergence of ownership. The num_people variable is based on the factor of "control", and the event_possessor variable is based on the "investment of self" and "intimacy and knowledge" (Pierce et al., 2001, 2003). Pierce showed that all three factors have a positive and causal effect on ownership.

In terms of control, Pierce showed that when an object is under the control of an individual, the individual feels ownership toward the object. More specifically, the greater the amount of control an individual has over an object, the stronger the sense of ownership. One factor that can affect the extent of control one has over a picture is the number of people in the picture. Marshall and Shipman (2011) showed in their survey-based study that each individual in a picture has the right to share it with others. Therefore, the larger the number of people in a picture, the less control a subject has over the picture, since the number of people who can share the picture with others increases. According to Pierces work, since the subject has less control over an object, the sense of ownership the subject feels toward the picture weakens. We hypothesize that with such a decrease in ownership, the subject would feel more comfortable with others sharing the picture. Thus, our third hypothesis is as follows.

Hypothesis 4. *As the number of people in a picture increases, a subjects PSP with regard to an owners picture sharing activity will also increase.*

Investment of self and intimacy and knowledge are two additional factors that Pierce identified as having a positive effect on ownership. In terms of investment of self, as people invest their effort, time, energy, and attention into an object, they start considering the object as a representation of themselves, and thus develop a sense of ownership toward that object (Pierce et al., 2001, 2003). Not surprisingly, the sense of ownership an individual feels towards an object increases with the extent of the investment. Similarly, for the factor of intimacy and knowledge, the sense of ownership that an individual feels toward an object grows stronger with an increasing sense of intimacy toward, and knowledge of, the object (Beggan & Brown, 1994; Pierce et al., 2001, 2003). One variable that has an effect on both investment of self and intimacy and knowledge in the context of our study is the possessor of an event in which the picture is taken. Pierces work suggests that the sense of ownership for a picture would be different if the level of investment in, and intimacy with, an event differs (2003). For example, if a picture were taken at a birthday party for a friend, the sense of ownership toward the picture would differ for the host of the party, and the friend who was invited to the party. Thus, if the picture sharing activity involves the possessor of an event, the subject who is in the picture, yet not involved in the sharing activity, would have a higher level of PSP, since the event possessor has a higher sense of ownership. On the other hand, if others were sharing a picture that was taken at an event in which the subject is the possessor, the subject would feel uncomfortable, and would be resistant to others sharing the picture for which the subject feels stronger ownership.

Hypothesis 5. *A subjects PSP on an owners picture sharing activity*

will be lower when the event_possessor is the subject, compared to when the event_possessor is an owner or a viewer.

In addition to the independent effect of ownership, we posit that there will be an interaction effect between ownership and closeness, which we examined in hypotheses 1 and 2. More specifically, when the sense of ownership is lower, the impact of closeness on a subjects PSP will also be less. The support for our reasoning is drawn from previous research on trust and ownership. Brown and his colleagues found that when the sense of ownership decreases, territorial behavior also decreases, requiring less trust (Brown et al., 2014). Since the literature supports a positive correlation between trust and closeness (Granovetter, 1973; Greene et al., 2006; Joinson et al., 2010), we suspect that closeness will also correlate with trust. Namely, as the sense of ownership decreases, the effects of closeness on a subjects PSP will become weaker.

Hypothesis 6. *The effect of closeness on a subjects PSP will be greater when the num_people is low, compared to when the num_people is high.*

When there are fewer people in a picture, relationships with greater levels of closeness will have a weaker impact on a subjects PSP than in relationships with lower levels of closeness.

Hypothesis 7. *The effects of closeness on a subjects PSP will be greater when the event_possessor is the subject, relative to when the event_possessor is the owner or viewer.*

3. The experimental study

In this section, we explain the details of our study to examine a subjects PSP towards his friend (owner) sharing a picture with a friend of the owner (viewer).

3.1. Independent and dependent variables

3.1.1. Independent variables - SO closeness, SV closeness, num_people, event_possessor

To test the hypotheses on closeness and ownership, we measured four independent variables for each of the four hypotheses. Two types of closeness are measured. The first type is closeness between the experiment subject and his Facebook friends (owner), and the second group is Facebook friends of their Facebook friends (viewers). The relationships between subject, owner, and viewer are shown in Fig. 1. To measure closeness, we asked a participant, i.e. a subject, to indicate his closeness towards an owner and a viewer with the following question: "How close do you feel to X?", as used in previous studies (Cummings, Lee, & Kraut, 2006; McCarty, 2002; Wiese et al., 2011). For rating closeness with owners (SO closeness), we used a five point Likert scale (1: very distant, 3: neither distant nor close, 5: very close). For rating closeness with viewers (SV closeness), we used a six point Likert scale ranging from 0 to 5. A rating of "0: do not know" was added because the participant may not know the viewer.

For ownership, two variables that affect ownership are measured, namely the number of people in the picture (num_people) and the possessor of the event at which the picture took place in (event_possessor). Num_people is a binary variable; 0 when there are two people (subject and owner) and 1 when there are seven people (subject, owner, and five additional people) in the picture. We used two binary variables for measuring event_possessor; event4Owner and event4Viewer. Each variable has a value of 1 when the event is held for either the owner or the viewer respectively. When both the event4Owner and event4Viewer variables are 0, the event is held for the subject.

3.1.2. Dependent variable - picture sharing preference (PSP)

PSP measures the degree of comfort level that a subject feels towards a picture owners act of sharing a picture that contains both the subject and the owner. We asked the participant to indicate their PSP using a five point Likert scale (1: definitely not comfortable, 3: no preference, 5: definitely comfortable) with the following question: "How comfortable do you feel about <*owner*> sharing this picture with <*viewer*>?".

3.2. Method

To test our hypotheses, we collected a total of 5520 data points from twenty-nine participants. We recruited the participants by posting advertisements on a campus online bulletin board. Participants were either undergraduate or graduate students at a university in South Korea, which is known to be one of the top-wired countries in the world. To participate in the study, a subject had to have a Facebook account with at least 70 Facebook friends. On average, subjects had 435.1 (SD = 220.8) Facebook friends. Subjects had been Facebook members for an average of 24.3 months (SD = 12.2), and spent an average of 99.3 min (SD = 68.5) on Facebook every day. Fourteen subjects were male, and fifteen subjects were female. The average age of the subjects was 22.8 years (SD = 2.5).

To collect the data, we built a web application using Facebooks Graph API (Facebook, 2015) and HttpComponents library (Apache Software Foundation, 2015) based on JavaServer Pages technology (Oracle, 2015). The Graph API was used to acquire Facebook data, including Facebook Friend lists (owner lists) and Facebook profile photos. Since the Graph API does not allow access to the list of ones Facebook friends Facebook friends (viewer lists), HttpComponents library was used to acquire the viewer list. Fig. 2 shows the relationship between the owner and viewer lists. Using the owner and viewer lists, the web application automatically generated survey questions on a webpage.

The data collection process was as follows. Prior to the main study, a subject was asked to read and sign a consent form for the study. Then the subject logged in to his Facebook account, so that our web application could acquire the list of the subjects Facebook friends. Next, the subject completed a brief questionnaire that consisted of background questions such as gender and age. Finally, subjects answered questions that were generated by the web application. Depending on how quickly they answered these questions, subjects spent about 60–90 min completing the questionnaire. The following three steps detail the three main types of questions presented to the subjects.

Step 1. Rating owners in terms of SO closeness and generating an owner list. In step 1, a subject was asked to rate his randomly selected Facebook friends in terms of SO closeness. The Facebook friend is the owner in our study. To collect at least one owner in each of five SO closeness categories, our system presented a randomly selected owner until the subject identified at least one owner for each of the five SO closeness categories. For example, after rating five friends, if the participant rated owner #1 as SO closeness 2, owner #2 as SO closeness 3, owner #3 as SO closeness 5, owner #4 as SO closeness 1, and owner #5 as SO closeness 4, then this subject satisfied our requirement of identifying at least one owner for each of the five SO closeness categories. At this point, the subject stopped rating owners and completed step 2. However, after rating 5 friends, if the subject rated friends #1, #2, and #3 as closeness 3, and friends #4 and #5 as closeness 1, then the subject had not satisfied the requirement, and had to continue rating owners until he identified one owner for each of the 2, 4, and 5 SO closeness categories. Once the subject satisfied this requirement, our system randomly selected one owner from each of the five SO

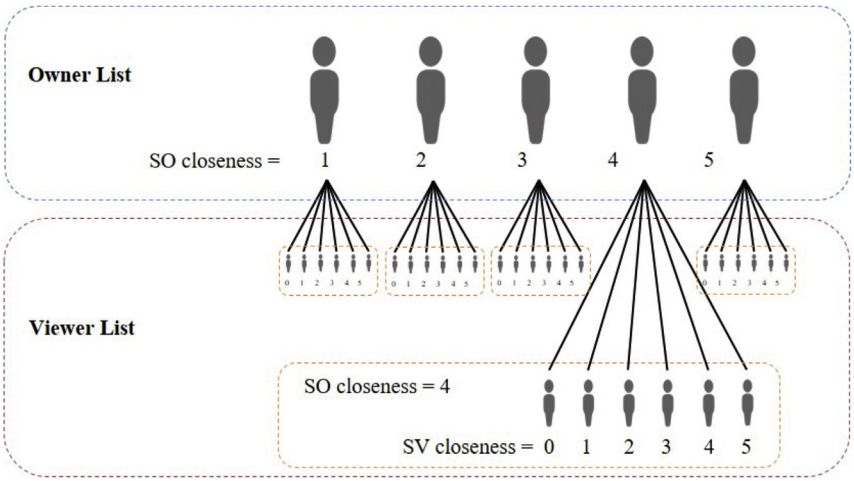

Fig. 2. Illustration of owner and viewer lists.

closeness categories to generate an owner list for each subject. On average, a subject rated forty owners, and spent about 20 min on this task, before satisfying our requirement for identifying at least one owner for each of the five SO closeness categories.

Step 2. Rating viewers in terms of SV closeness and generating a viewer list. Next, the subject was asked to rate the SV closeness between him and a viewer, who had been randomly selected from among the Facebook friends of owners from the owner list. As in step 1, the system presented randomly selected viewers until the subject identified at least one viewer for each of the six closeness categories for each owner in the owners list. Once the subject satisfied our requirement, we randomly selected one viewer from each of the six SV closeness categories to generate a viewers list. This list consists of thirty viewers (five owners * six closeness levels). On average, the subject rated twenty-two viewers before satisfying our requirement for having at least one viewer per closeness category for each owner in the owners list.

Step 3. Indicating the picture sharing preference. In this step, we asked the subjects to indicate their PSP ratings for 180 different scenarios. In the scenarios, we varied viewers by SV closeness (closeness 0 ~ closeness 5), owners by SO closeness (closeness 1 ~ closeness 5), num_people in the picture (two, seven), and event_possessor by three different parties (subject, owner, viewer), so that the scenarios fit in the $6 \times 5 * 2 \times 3$ design. The question on PSPs was presented with a picture as shown in Fig. 3. The picture on the left shows a scenario with the subject and the owner, whereas the one on the right shows a scenario with the subject, owner, and five additional people. The subjects and the owners faces shown in the picture were replaced with their Facebook profile images. Note that although our study examines the effect of closeness and different contexts on the picture sharing preferences, other variables, such as the nature of an event (e.g., a drinking event) or the characteristics of the parties involved (e.g., ex-girlfriend) are also important. In our study, we carefully selected images with neutralized content, to minimize the impacts of these other variables. For example, in Fig. 3, the pictures shown in the study were taken in an office environment, and the people in the pictures are standing next to each other, facing the camera.

4. Results and discussion

In this section we discuss the seven hypotheses on picture sharing preference (PSP) that are outlined in section 2. For our analysis, we used R 3.2.3 (Team, 2014) with the lme4 package. The lme4 package allows R to estimate linear and generalized linear mixed-effect models for nested data (Bates, Mächler, Bolker, &

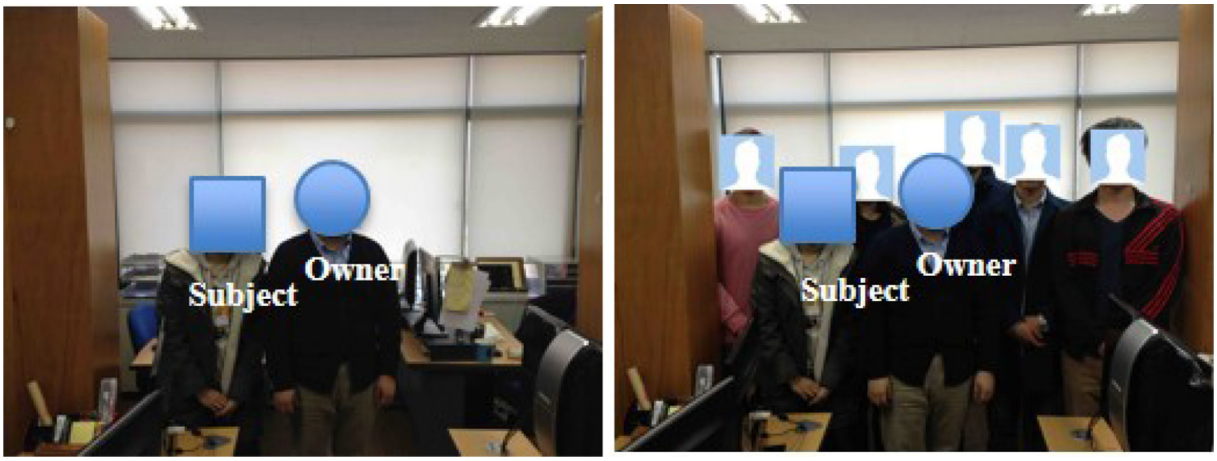

Fig. 3. The picture on the left shows the subject and the owner (num_people = 2), whereas the picture on the right shows the subject, the owner, and five additional people (num_people = 7).

Table 1
Descriptive statistics of PSP according to SO closeness, SV closeness, num_people, and event_possessor. For all cases, minimum and maximum for PSP were 1 and 5, respectively.

Variable	n	Mean	SD	Median	Variable	n	Mean	SD	Median
SO closeness					Num_people				
1	1044	2.04	1.16	2	2 people	2610	2.42	1.23	2
2	1044	2.27	1.18	2	7 people	2610	2.56	1.18	3
3	1044	2.51	1.17	2					
4	1044	2.71	1.15	2	Event_possessor				
5	1044	2.94	1.16	2	Owner	1740	2.5	1.14	2
					Subejct	1740	2.32	1.3	2
SV closeness					Viewer	1740	2.65	1.15	3
0	870	1.58	1.11	2					
1	870	1.95	1.12	2	Overall	5220	2.49	1.21	2
2	870	2.35	1.07	2					
3	870	2.63	1.04	3					
4	870	3.11	0.95	3					
5	870	3.33	0.93	3					

Walker, 2014). Prior to testing the hypotheses, we examined the descriptive statistics of the PSPs according to the two types of closeness and the two types of ownership. As expected, the statistics displayed in Table 1 show an increasing trend on the level of PSP with an increase in the level of closeness and ownership in general.

For our analysis, we conducted two types of mixed model analysis of variance (multilevel model) with PSP as the dependent variable. The first model is built to test the effect of each participants differences, and is presented in Table 2. The second model was built to determine the effects of closeness and ownership as elaborated by the seven hypotheses. The results of the second model are presented in Table 3. For both models, we included the participants in all models as a random effect to control for non-independence of the data, since each participant rated multiple values of PSPs for different scenarios. In addition, we applied maximum likelihood estimations and grand-mean centering, in order to prevent convergence issues by reducing multicollinearity (Kline, 2015; O'Connell & McCoach, 2008). Finally, simple coding schemes for categorical variables were applied to avoid simple effects, such as, "the effect of one variable at one level of the other variables" (UCLA: Statistical Consulting Group, 2011). After building both models, we conducted model assumption checks, which allowed for an unbiased interpretation of the results. We verified that both models used in our analysis satisfied the normality and homoscedasticity assumption, by using the Shapiro-Wilk Test and the Wald test respectively.

Prior to examining the seven hypotheses, we considered the effects of age and gender on PSPs. We first examined a model that only had the effects of the participant, which accounted for individual differences. Results showed that 16% of the variance was due to individual differences (conditional $R^2 = 0.16$). Next, we examined a model that had the participant-level effects of gender and age. As shown in Table 2, only the effect of age was statistically significant, ($p < 0.01$). Participants were less comfortable with an owner sharing pictures as they got a year older, namely they experienced a decrease in PSPs of 1.9% per year ($B = -0.09, p < 0.01$). When considering standardized coefficient values for age ($\beta = -0.191$), a one standard deviation increase in age accounts for a 0.19 standard deviation decrease in PSP.

Given the significant effects of age on this model, we included age as a fixed effect for the multilevel regression model used to examine the seven hypotheses. Table 3 shows the resulting model, with the independent variables shown in the first column.

4.1. The effects of closeness on picture sharing preference (hypotheses 1, 2, and 3)

We examined the effects of two different types of closeness (SO and SV closeness) on PSPs, as well as the interaction effects between them. For hypothesis 1, we examined whether the PSP of a subject increases when SO closeness increases. As hypothesized, standardized coefficient values and significance levels for SO closeness shown in Table 3 indicate that when SO closeness increases, the increase in the PSP of a subject is statistically significant ($\beta = 0.26, p < 0.001$). Namely, subjects felt more comfortable when an owner to whom they felt closer shared their personal pictures. As indicated by the standardized coefficient value β, a one standard deviation increase in SO closeness accounts for a 0.26 standard deviation increase in PSP. The unstandardized coefficient value for SO closeness suggests that a one-point gain in SO closeness accounts for a 4.4% increase in sharing preference ($B = 0.22$).

For hypothesis 2, we wanted to examine whether the PSP of a subject increases when SV closeness increases. Table 3 shows that when SV closeness increases, the increase in PSP of subjects is statistically significant ($\beta = 0.51, p < 0.001$). Namely, subjects felt more comfortable when their personal pictures were shared with a viewer to whom they were closer. A one standard deviation increase in SV closeness accounts for a 0.51 standard deviation increase in PSP. When considering unstandardized coefficient values for SV closeness, a one-point gain in SV closeness accounts for a 7.2% increase in sharing preference ($B = 0.36$).

Table 2
Multilevel regression model on PSP, controlling for each participant. Conditional $R^2 = 0.16$.

Independent variables	Unstandardized coefficients		Standardized coefficients	t	Sig.	95% C.I. for B	
	B	Std. error	β			Lower	Upper
Constant	2.49	0.08	n/a	32.00	0.000	2.34	2.65
Age	−0.09	0.03	−0.19	−2.91	0.007	−0.16	−0.03
Gender(=Male)	−0.14	0.16	−0.06	−0.88	0.386	−0.47	0.19

Table 3
Multilevel regression model on PSP, controlling for each participant. Intra-class correlation is 0.20; Conditional R^2 is 0.52; Proportion reduction in variance (PRV) is the local effect size of each independent variable.

Independent variables	Unstandardized coefficients		Standardized coefficients	t	Sig.	95% C.I. for *B*		PRV
	B	Std. error	*β*			Lower	Upper	
Constant	2.49	0.08	n/a	31.54	0.000	2.34	2.65	n/a
Age	−0.10	0.03	−0.20	−3.12	0.004	−0.17	−0.03	0.02
SO closeness (H1)	0.22	0.01	0.26	27.29	0.000	0.21	0.24	0.08
SV closeness (H2)	0.36	0.01	0.51	52.87	0.000	0.34	0.37	0.34
SO * SV (H3)	0.03	0.00	0.06	6.01	0.000	0.02	0.04	0.01
Num_people(=7) (H4)	0.14	0.02	0.06	5.91	0.000	0.09	0.18	0.03
Event4Owner (H5)	0.17	0.03	0.07	6.02	0.000	0.12	0.23	0.05
Event4Viewer (H5)	0.32	0.03	0.13	11.32	0.000	0.27	0.38	
Num_people * SO (H6)	−0.06	0.02	−0.04	−3.75	0.000	−0.09	−0.03	0.02
Num_people * SV (H6)	0.01	0.01	0.01	0.53	0.597	−0.02	0.03	
SO * Event4Owner (H7)	0.05	0.02	0.03	2.31	0.021	0.01	0.09	0.02
SO * Event4Viewer (H7)	−0.02	0.02	−0.01	−0.82	0.414	−0.06	0.02	
SV * Event4Owner (H7)	−0.16	0.02	−0.10	−9.35	0.000	−0.19	−0.12	0.02
SV * Event4Viewer (H7)	−0.13	0.02	−0.09	−7.99	0.000	−0.17	−0.10	

For hypothesis 3, we examined the interaction effects between SO closeness and SV closeness in a subjects PSP. Standardized coefficient values and significance levels for the interaction effects between SO closeness and SV closeness (SO * SV) shown in Table 3 indicate that in addition to SV closeness and SO closeness, the interaction effects between the two are also significant. Namely, the effect of SV closeness on the PSP of a subject is greater for relationships that have higher SO closeness than for relationships with lower SO closeness ($\beta = 0.06, p < 0.001$).

Our statistical analysis reveals that SO and SV closeness are both important for subjects PSPs. When comparing the standardized coefficient values of SO and SV closeness, one can see that SV closeness has a stronger impact, with a standardized coefficient value of $\beta = 0.51$, than SO closeness with a $\beta = 0.26$ on a subjects PSP. This result is not surprising, because SV closeness is a direct measure of relationship strength between a subject and a viewer, and the owner acts as a medium for sharing a picture. However, although SO closeness is a more indirect measure compared to SV closeness, it still impacts a subjects PSP. Furthermore, a significant interaction effect between the two types of closeness variables implies that the impact of one type of closeness becomes stronger as the other type of closeness increases. For example, when an owner to whom a subject feels closer shares a picture, relative to an owner who is less familiar, the subject feels more comfortable in terms of PSP, as the closeness level of the picture viewer increases.

4.2. The effects of ownership on picture sharing preferences (hypothesis 4, 5)

For hypotheses 4 and 5, we examined the effects of ownership on a subjects PSP using num_people and event_possessor variables. For hypothesis 4, we examined whether a subjects PSP increases when the num_people in a picture shared by an owner increases from two to seven. We used a binary variable for num_people; −1/2 when there are two people (subject and owner), and 1/2 when there are seven people (subject, owner, and five additional people) in the picture. Table 3 shows the resulting multi-regression model. As hypothesized, standardized coefficient values and significance levels for Num_people shown in Table 3 reveal that subjects feel more comfortable when an owner shares a picture of seven people, compared to showing a picture with two people, ($\beta = 0.06, p < 0.001$). Five additional people in a picture shared by an owner account for a 2.8% increase in PSP. This result indicates that with a lower level of ownership, the level of PSP increases ($B = 0.14$).

For hypothesis 5, we wanted to examine whether the PSP of a subject decreases when the picture is taken at an event held for a subject, compared to an event held for an owner or a viewer. We used two binary variables for measuring event types: “event4Owner” and “event4Viewer”. Each variable has a value of 2/3 when the event is held for either the owner or the viewer respectively. When both the event4Owner and event4Viewer variables are −1/3, the event is held for the subject. Table 3 shows the results of this analysis. As hypothesized, standardized coefficient values and significance levels for event4Owner and event4Viewer reported in Table 3 show that subjects felt less comfortable when the picture was taken at an event held for them, rather than the owner ($\beta = 0.07, p < 0.001$), or the viewer ($\beta = 0.13, p < 0.001$). In addition, subjects were most comfortable when the picture was taken at an event held for the viewer, as indicated by the higher coefficient value of Event4Viewer ($\beta = 0.13, p < 0.001$), compared to Event4Owner ($\beta = 0.07, p < 0.001$). This result suggests that when a picture is taken at an event held for a subject, compared to an event held for a viewer or an owner, the subject feels a stronger sense of ownership toward the picture.

4.3. The interaction effects of ownership and closeness on picture sharing preference (hypotheses 6 and 7)

For hypotheses 6 and 7, we examined the interaction effects between ownership and closeness on a subjects PSP. For hypothesis 6, we examined interaction effects between num_people and two different types of closeness on PSP. Hypothesis 6 only holds true for SO closeness, but not SV closeness. As shown in Table 3, although the interaction between num_people and SO closeness is significant ($\beta = -0.04, p < 0.001$), the interaction between num_people and SV closeness is not statistically significant. Namely, when the level of ownership is lower, with more people in a picture, only the impact of SO closeness on a subjects PSP is lower, as indicated by negative standardized coefficient values of SO closeness ($\beta = -0.04$). To examine why only SO closeness, but not SV closeness, impacts PSP negatively as a subjects level of ownership toward a picture increases, we also conducted multi-regression analysis of only the SO closeness, SV closeness, num_people, and their interactions in the model. The results of this analysis are shown in Fig. 4, and reveal that when the level of ownership is lower, with more people in a picture, the impact of closeness on a subjects PSP is also lower, as indicated by a lower rate of increase when num_people = 7 ($B = 0.21$), as opposed to when

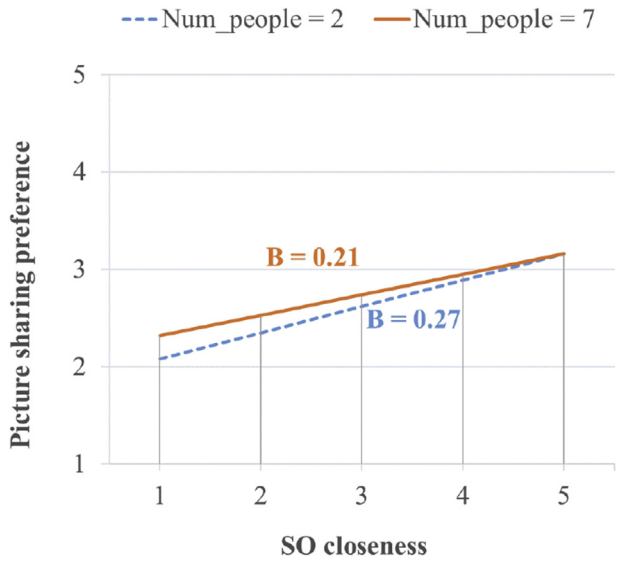

Fig. 4. Interaction effects between SO closeness and num_people on PSP when SV closeness is 3.

num_people = 2 (B = 0.27). This result indicates that when a subject feels a strong level of ownership toward a picture, he considers the level of closeness to be a more important factor for his PSP. In addition, in the new model that examines closeness and num_people interactions, the data shows that the impact of SV closeness on PSP ($\beta = 0.39$) is stronger than SO closeness ($\beta = 0.14$). Therefore, one possible explanation for the non-significance of interactions between num_people and SV closeness is that the impact of the num_people variable, which indicates the level of ownership ($\beta = 0.13$), is not strong enough to impact the level of SV closeness ($\beta = 0.39$).

For hypothesis 7, we examined interaction effects between the event_possessor and two types of closeness on PSP. We hypothesized that the effects of closeness on a subjects PSP will be greater when the event_possessor is the subject, compared to when the event_posessor is the owner or a viewer. As hypothesized, we observe interaction effects between levels of ownership and both types of closeness. The regression model in Table 3 shows a significant interaction effect between SO closeness and event_posessor (p = 0.02), and between SV closeness and event_posessor ($p < 0.001$). More specifically, when the event is for an owner, the level of ownership an owner has is higher than for either the viewer or the subject. Therefore, as shown in Fig. 5, the impact of SO closeness on the subjects PSP is also higher, as indicated by a higher rate of increase when the event_possessor is the owner (B = 0.19), compared to when the event_possessor is the subject (B = 0.14), or the viewer (B = 0.12). On the other hand, when the event is for a subject, the level of ownership of a subject is higher than for both the viewer and owner. Fig. 6 also shows that the impact of SV closeness on the subjects PSP is also higher, as indicated by a higher rate of increase when the event_possessor is the subject (B = 0.37) himself, compared to when the event_possessor is the owner (B = 0.21) or the viewer (B = 0.23).

5. Conclusion

This paper presents the findings of a preliminary study on a subjects picture sharing preference (PSP), when a picture containing the subject is shared between an owner and a viewer. The study results show that the subject feels more comfortable sharing a picture when i) the "closeness between the subject and the owner (SO closeness)" is higher, ii) the "closeness between the subject and the viewer (SV closeness)" is higher, iii) the "number of people in the picture (num_people)" is greater, and iv) the "event_possessor" is the viewer or the owner, rather than the subject. In addition, we observed three types of interaction effects on PSP between the following variables: i) SO closeness and SV closeness, ii) SO closeness and num_people, and iii) both types of closeness and event_posessor.

Although this paper presents a first step toward the investigation of a subjects PSP when that individual is not directly involved in the picture sharing activity, the results should be carefully interpreted, given the limitations of the study. First, the study results may not be generalizable, since our user population is limited in terms of demographics, such as age and background diversity. In particular, the average age of our subjects was 22.8, ranging from 19 to 32. Second, for the variable of num_people, we only compared two scenarios in which the shared picture contained two versus seven people. Although we assumed a positive linear relationship

Fig. 5. Interaction effects between SO closeness and the event_possessor on PSP when SV closeness is 3.

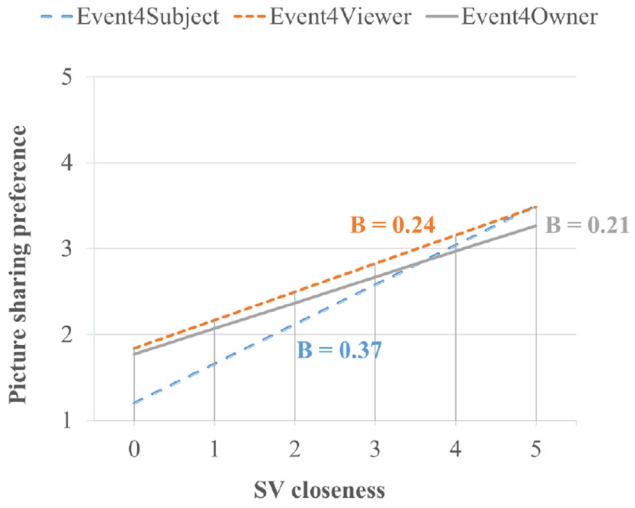

Fig. 6. Interaction effects between SV closeness and the event_possessor on PSP when SO closeness is 3.

between two and seven people in a picture for the num_people variable, a curvilinear relationship may exist in reality. Third, we measured the factors that affect ownership rather than directly measuring the strength of ownership in our study. A direct measure of ownership would offer additional support for our study. Finally, additional factors that can impact the level of closeness or ownership affect the results of the study. Although we tried to examine a subjects sharing preference in a neutral setting, such as using a picture in an office environment with everyone facing the camera, our results may not be generalizable to different scenarios. For example, if a picture were taken at a drinking party, a subject may not have a high level of PSP with a family member whose level of closeness is high.

Nevertheless, our study presents a first step toward improving the experience of sharing pictures on SNS. At a specific application level, these findings on the effects of closeness and ownership can be used to support current practices on picture sharing activities on SNS. Currently, most SNS systems entrust owners with picture disclosure levels (Besmer & Lipford, 2010), which can be different from the preferred disclosure levels of the people in the picture (Besmer & Lipford, 2010; Johnson, Egelman, & Bellovin, 2012; Madejski et al., 2011). Given that our data show that the average of subjects PSP is slightly lower at 2.49/5 than no preference at 3/5, subjects would feel uncomfortable toward owners picture sharing if the uploaded pictures are automatically shared with all of the owners friends, as occurs with most SNS systems. In fact, considering that the average PSP value of 2.49 was calculated with equal numbers of users for each of the five closeness levels, the actual average PSP may be lower, since our data show that most users have more friends with lower levels of closeness. Similar findings on the distribution of users are supported by literature that shows most users on SNS have a smaller number of strong ties, and a greater number of weak ties (Easley & Kleinberg, 2010).

Thus, the findings from our study can help improve the PSP on SNS by offering guidelines for disclosure levels, when an owner posts a picture that contains his friends. For example, since the level of closeness affects the level of PSP, the system can provide an option for the owner to disclose pictures depending on different closeness levels. Furthermore, since the effect of SO closeness ($\beta = 0.14$) and SV closeness ($\beta = 0.39$) differed, the system can offer different disclosure levels, depending on the levels of the two types of closeness. Note that researchers have proposed an approach that will automatically predict the level of closeness with 70% accuracy, using information that can be collected in current SNS systems (Wiese et al., 2011). Therefore, such automatic prediction technology can be used in conjunction with our results. In addition to the level of closeness, hypotheses 4 and 5 suggest that variables that affect ownership can also be used to inform an owner of different disclosure levels when that owner shares a picture on SNS. For example, the system would offer a different disclosure level for a group picture versus a picture with two or three people. Furthermore, when there are only a few people in the picture, the system could automatically evaluate the closeness of the owner with the others in the picture, when suggesting the disclosure level.

In addition to closeness, an examination of the variables that impact ownership also adds insights to the current debate on the ownership of shared pictures. A comparison of the results from the two types of variables that impact ownership shows that although both num_people and event_possessor variables affect ownership, they differ in terms of the degree to which they impact the level of ownership, and consequently the level of PSP. More specifically, compared to num_people, our data shows that the event_posessor variable more strongly represents who has ownership of a given picture taken at an event. Therefore, our study implies that variables that impact ownership to a different degree will affect a subjects level of PSP differently, and the possible existence of interaction effects between variables should be considered. Therefore, as part of future work, studies should be conducted on how different types of variables that impact ownership can extend and support the current findings from our study. For example, ownership of the device that was used to take a picture would impact PSP.

At a higher level, our findings on ownership can also add insights to the current debate on the ownership of shared pictures. Two main claims on the ownership of uploaded pictures are that the ownership belongs to the uploader, rather than everyone in the picture (Besmer & Lipford, 2010). Results from the current study suggest that ownership of a picture is not such a clear-cut issue. For example, our results show a decrease in the PSP of subjects when the event at the time of capture is held for a subject, compared to when it is held for an owner or a viewer. Thus, subjects felt a stronger level of ownership toward pictures taken at an event held for them. Therefore, ownership of uploaded pictures may not simply be assigned to the people involved, but according to the context at the time of capture, such as the number of people in the picture or the event possessor.

In addition to the discussion on the number of people that hold ownership, the research questions studied in this paper can also be discussed in terms of authorship. Namely, depending on who authored the content of information, that is, took the picture, the levels of ownership that different stakeholders in the picture have may differ. For example, if the viewer took a picture and the owner shared the picture with the viewer on SNS, a subject may feel more comfortable, compared to if the subject had taken the picture himself.

As part of future work, studies that address issues on PSP would complement the results of our study. For example, instead of using a neutral background, as was used in our study, using a background with social implications, such as social gatherings or unusual experiences, could yield different, yet interesting stories on PSP. In addition, examining the PSP of an owner rather than the subject in our scenario would also add knowledge to research on PSP.

In conclusion, our studys findings on the effects of closeness and ownership are meaningful, in that they can be used to support current practices on picture sharing activities on SNS, which is becoming increasingly popular, with the introduction of various types of life-logging devices such as Narrarive Clip (Narrative, 2016), GoPro Hero4 (GoPro, 2016), SenseCam (Microsoft, 2005). However, the studys findings are not limited to picture sharing activities. They can be extended to information sharing practices in general. In addition to pictures, other types of mediums that contain personal information are shared on SNS systems with increasing popularity (Cheng, Li, & Liu, 2013; Lin & Lu, 2011). For example, personal videos or recordings of audios are now more commonly shared on SNS, due to the ease of recording such mediums using life logging devices (Facebook, 2014). Other information sharing practices outside of SNS are becoming more prevalent as well (Lo, McKercher, Lo, Cheung, & Law, 2011). For example, online file sharing systems such as Dropbox have similar sharing issues, since users share files that may have co-ownership. Another type of information sharing practice that is becoming more popular, and is applicable to our research question, includes online collaborative tools such as Google Docs. Finally, in addition to their relevance for online information sharing practices, our results have important implications for offline information sharing activities, where offline information that is being shared has co-ownership issues (Durrant, Frohlich, Sellen, & Lyons, 2009).

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References

Ahern, S., Eckles, D., Good, N. S., King, S., Naaman, M., & Nair, R. (2007). Over-exposed?: Privacy patterns and considerations in online and mobile photo sharing. In *Proceedings of the SIGCHI conference on human factors in computing systems CHI '07* (pp. 357–366). New York, NY, USA: ACM. http://dx.doi.org/10.1145/1240624.1240683.

Altman, I., & Taylor, D. A. (1973). *Social penetration: The development of interpersonal relationships*. Holt: Rinehart and Winston.

Apache Software Foundation. (2015). *Apache httpcomponents*. https://hc.apache.org.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4. *arXiv preprint arXiv:1406.5823*.

Beggan, J. K., & Brown, E. M. (1994). Association as a psychological justification for ownership. *The Journal of Psychology, 128*, 365–380. http://dx.doi.org/10.1080/00223980.1994.9712741.

Beldad, A., & Kusumadewi, M. C. (2015). Heres my location, for your information: the impact of trust, benefits, and social influence on location sharing application use among Indonesian university students. *Computers in Human Behavior, 49*, 102–110, 10.j.chb.2015.02.047.

Besmer, A., & Lipford, H. R. (2010). Moving beyond untagging: photo privacy in a tagged world. In *Proceedings of the SIGCHI conference on human factors in computing systems CHI '10* (pp. 1563–1572). New York, NY, USA: ACM. http://dx.doi.org/10.1145/1753326.1753560.

Brown, G., Crossley, C., & Robinson, S. L. (2014). Psychological ownership, territorial behavior, and being perceived as a team contributor: the critical role of trust in the work environment. *Personnel Psychology, 67*, 463–485. http://dx.doi.org/10.1111/peps.12048.

Brown, G., Lawrence, T. B., & Robinson, S. L. (2005). Territoriality in organizations. *The Academy of Management Review, 30*, 577–594. http://dx.doi.org/10.5465/AMR.2005.17293710.

Burt, R. S., & Knez, M. (1995). Kinds of third-party effects on trust. *Rationality and Society, 7*, 255–292. http://dx.doi.org/10.1177/1043463195007003003.

Cheng, X., Li, H., & Liu, J. (2013). Video sharing propagation in social networks: measurement, modeling, and analysis. In *INFOCOM, 2013 proceedings IEEE* (pp. 45–49). http://dx.doi.org/10.1109/INFCOM.2013.6566732.

Collins, N. L., & Miller, L. C. (1994). Self-disclosure and liking: a meta-analytic review. *Psychological Bulletin, 116*, 457–475. http://dx.doi.org/10.1037/0033-2909.116.3.457.

Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: an interdisciplinary review. *Journal of Management, 31*, 874–900. http://dx.doi.org/10.1177/0149206305279602.

Cummings, J. N., Lee, J. B., & Kraut, R. (2006). Communication technology and friendship during the transition from high school to college. In R. Kraut, M. Brynin, & S. Kiesler (Eds.), *Computers, phones, and the internet: Domesticating information technology* (pp. 265–278). Oxford University Press.

Derlega, V. J., & Chaikin, A. L. (1977). Privacy and self-disclosure in social relationships. *Journal of Social Issues, 33*, 102–115. http://dx.doi.org/10.1111/j.1540-4560.1977.tb01885.x.

Dittmar, H. (1992). *The social psychology of material possessions: To have is to be*. Harvester Wheatsheaf.

Durrant, A., Frohlich, D., Sellen, A., & Lyons, E. (2009). Home curation versus teenage photography: photo displays in the family home. *International Journal of Human-Computer Studies, 67*, 1005–1023. http://dx.doi.org/10.1016/j.ijhcs.2009.09.005.

Easley, D., & Kleinberg, J. (2010). *Social penetration: The development of interpersonal relationships*. Cambridge University Press.

Ebersman, D. A. (2012). *Facebook, Inc. Registration statement on form S-1*. https://www.sec.gov/Archives/edgar/data/1326801/000119312512034517/d287954ds1.htm.

Emerson, R. M. (1976). Social exchange theory. *Annual Review of Sociology, 2*, 335–362. http://dx.doi.org/10.1146/annurev.so.02.080176.002003.

Faacebook. (2014). *The latest on Facebook video*. http://newsroom.fb.com/news/2014/09/the-latest-on-facebook-video/.

Facebook. (2015). *The graph api*. https://developers.facebook.com/docs/graph-api.

GoPro. (2016). *Gopro hero4*. http://gopro.com/.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*, 1360–1380.

Greene, K., Derlega, V. J., & Mathews, A. (2006). Self-disclosure in personal relationships. In A. L. Vangelisti, & D. Perlman (Eds.), *The Cambridge handbook of personal relationships* (pp. 409–428). Cambridge University Press. http://dx.doi.org/10.1017/CBO9780511606632.023.

Gross, R., & Acquisti, A. (2005). Information revelation and privacy in online social networks. In *Proceedings of the 2005 ACM workshop on privacy in the electronic society WPES '05* (pp. 71–80). New York, NY, USA: ACM. http://dx.doi.org/10.1145/1102199.1102214.

Johnson, M., Egelman, S., & Bellovin, S. M. (2012). Facebook and privacy: it's complicated. In *Proceedings of the eighth symposium on usable privacy and security SOUPS '12 (pp. 9:1–9:15)*. New York, NY, USA: ACM. http://dx.doi.org/10.1145/2335356.2335369.

Joinson, A. N., Reips, U.-D., Buchanan, T., & Schofield, C. B. P. (2010). Privacy, trust, and self-disclosure online. *Human Computer Interaction, 25*, 1–24. http://dx.doi.org/10.1080/07370020903586662.

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford Publications.

Lampinen, A., Lehtinen, V., Lehmuskallio, A., & Tamminen, S. (2011). We're in it together: interpersonal management of disclosure in social network services. In *Proceedings of the SIGCHI conference on human factors in computing systems CHI '11* (pp. 3217–3226). New York, NY, USA: ACM. http://dx.doi.org/10.1145/1978942.1979420.

Lang, C., & Barton, H. (2015). Just untag it: exploring the management of undesirable Facebook photos. *Computers in Human Behavior, 43*, 147–155. http://dx.doi.org/10.1016/j.chb.2014.10.051.

Lin, K.-Y., & Lu, H.-P. (2011). Why people use social networking sites: an empirical study integrating network externalities and motivation theory. *Computers in Human Behavior, 27*, 1152–1161. http://dx.doi.org/10.1016/j.chb.2010.12.009.

Lo, I. S., McKercher, B., Lo, A., Cheung, C., & Law, R. (2011). Tourism and online photography. *Tourism Management, 32*, 725–731. http://dx.doi.org/10.1016/j.tourman.2010.06.001.

Madejski, M., Johnson, M. L., & Bellovin, S. M. (2011). *The failure of online social network privacy settings*. Columbia University Academic Commons.

Marshall, C. C., & Shipman, F. M. (2011). Social media ownership: using twitter as a window onto current attitudes and beliefs. In *Proceedings of the SIGCHI conference on human factors in computing systems CHI '11* (pp. 1081–1090). New York, NY, USA: ACM. http://dx.doi.org/10.1145/1978942.1979103.

McCarty, C. (2002). Structure in personal networks. *Journal of Social Structure, 3*. https://www.cmu.edu/joss/content/articles/volume3/McCarty.html.

Microsoft. (2005). *Sensecam*. http://research.microsoft.com/en-us/um/cambridge/projects/sensecam/.

Milgram, S. (2010). The familiar stranger: an aspect of urban anonymity. In T. Blass (Ed.), *The individual in a social world: essays and experiments*. Pinter & Martin Ltd.

Narrative. (2016). *Narrative clip 2*. http://getnarrative.com/.

Oracle. (2015). *Jabasever pages technology*. http://www.oracle.com/technetwork/java/jsp-138432.html.

O'Connell, A. A., & McCoach, D. B. (2008). *Multilevel modeling of educational data*. IAP.

Park, N., Jin, B., & Jin, S.-A. A. (2011). Effects of self-disclosure on relational intimacy in Facebook. *Computers in Human Behavior, 27*, 1974–1983. http://dx.doi.org/10.1016/j.chb.2011.05.004.

Pierce, J. L., Kostova, T., & Dirks, K. T. (2001). Toward a theory of psychological ownership in organizations. *Academy of Management Review, 26*, 298–310. http://dx.doi.org/10.5465/AMR.2001.4378028.

Pierce, J. L., Kostova, T., & Dirks, K. T. (2003). The state of psychological ownership: integrating and extending a century of research. *Review of General Psychology, 7*, 84–107. http://dx.doi.org/10.1037/1089-2680.7.1.84.

Stutzman, F., & Kramer-Duffield, J. (2010). Friends only: examining a privacy-enhancing behavior in Facebook. In *Proceedings of the SIGCHI conference on human factors in computing systems CHI '10* (pp. 1553–1562). New York, NY, USA: ACM. http://dx.doi.org/10.1145/1753326.1753559.

UCLA Statistical Consulting Group. (2011). *R library: Contrast coding systems for categorical variables*. http://www.ats.ucla.edu/stat/r/library/contrast/_coding.htm.

Utz, S. (2015). The function of self-disclosure on social network sites: not only intimate, but also positive and entertaining self-disclosures increase the feeling of connection. *Computers in Human Behavior, 45*, 1–10. http://dx.doi.org/10.1016/j.chb.2014.11.076.

Van Dyne, L., & Pierce, J. L. (2004). Psychological ownership and feelings of possession: three field studies predicting employee attitudes and organizational citizenship behavior. *Journal of Organizational Behavior, 25*, 439–459. http://dx.doi.org/10.1002/job.249.

Wiese, J., Kelley, P. G., Cranor, L. F., Dabbish, L., Hong, J. I., & Zimmerman, J. (2011). Are you close with me? Are you nearby?: Investigating social groups, closeness, and willingness to share. In *Proceedings of the 13th international conference on ubiquitous computing UbiComp '11* (pp. 197–206). New York, NY, USA: ACM. http://dx.doi.org/10.1145/2030112.2030140.

Yuki, M., Maddux, W. W., Brewer, M. B., & Takemura, K. (2005). Cross-cultural differences in relationship- and group-based trust. *Personality and Social Psychology Bulletin, 31*, 48–62. http://dx.doi.org/10.1177/0146167204271305.