# Influencing Photo Sharing Decisions on Social Media: A Case of Paradoxical Findings

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***Abstract*—We investigate the effects of perspective taking, privacy cues, and portrayal of photo subjects (i.e., photo valence) on decisions to share photos of people via social media. In an online experiment we queried 379 participants about 98 photos (that were previously rated for photo valence) in three conditions: (1) Baseline: participants judged their likelihood of sharing each photo; (2) Perspective-taking: participants judged their likelihood of sharing each photo when cued to imagine they are the person in the photo; and (3) Privacy: participants judged their likelihood to share after being cued to consider the privacy of the person in the photo. While participants across conditions indicated a lower likelihood of sharing photos that portrayed people negatively, they – surprisingly – reported a higher likelihood of sharing photos when primed to consider the privacy of the person in the photo. Frequent photo sharers on real-world social media platforms and people without strong personal privacy preferences were especially likely to want to share photos in the experiment, regardless of how the photo portrayed the subject. A follow-up study with 100 participants explaining their responses revealed that the Privacy condition led to a lack of concern with others' privacy. These findings suggest that developing interventions for reducing photo sharing and protecting the privacy of others is a multivariate problem in which seemingly obvious solutions can sometimes go awry.**

***Index Terms*—privacy, decision-making, perspective-taking, intervention, photo meme**

## I. Introduction

With the rising popularity of digital photography and online social-networking apps and services, people are capturing and sharing photos on social media like Flickr [1], Instagram [2], Snapchat [3], Facebook [4], and Whatsapp [5] at an unprecedented rate. By one estimate, more than 1.8 billion photos are posted to popular social-media services each day [6]. According to Wikipedia, nine of the 25 most popular tweets ever contain images, accumulating more than 14 million retweets [7]. Both the number of photos shared and the number of viewers of such photos will continue to increase as photo-sharing services are now becoming more popular than traditional social networks [8].

Sharing photos online (and the 're-sharing' of photos from social media contacts) can lead to various privacy concerns. A photograph's subject matter can be taken out of context when viewed by unintended audiences (leading to 'context collapse') [9]–[11], and it is often difficult to anticipate the real audience of a photo leading to a disconnect between the 'imagined audience' [12], [13] and the real audience. In fact, the rampant re-sharing of photos, with additional alterations such as text captions and annotations, often gives rise to popular internet 'memes,'[1] where humorous or embarrassing photos (often at somebody else's expense) go 'viral' and reach a large audience. At worst, as in the case with internet memes, people in the photo can be maligned or embarrassed in front of a large population, leading to psychological distress and disruption in their professional and personal lives [14]–[16].

There already exist technical mechanisms, on platforms like Facebook, to limit the sharing of images people are tagged in (e.g., by allowing people to 'untag' themselves, or review images they are tagged in before their own social contacts see the image). While such approaches can offer a first line of protection by at least limiting what one's own social contacts can see, such approaches cannot effectively stop the re-sharing of the content across other users' social contacts. Researchers have also explored the concept of co-ownership of photos [17]. However, a general 'DRM-like' approach (akin to how the sharing of music can be limited through 'digital rights management') is unlikely to succeed because subjects within a photo cannot always assert 'ownership' over photos taken and shared by others; they may not even be a social contact of the person posting the photo, or even use social media to exert such control.

Because of the technical and ownership challenges to controlling photo sharing, of particular interest is whether simple behavioral interventions may be used to help regulate photo sharing. In essence, if users can be motivated to consider whether the effects of their photo sharing may be harmful to others, or may violate privacy norms, perhaps individuals may choose not to share some photos. Thus, in the present work we investigate whether it is possible to influence people in the position to violate – or protect – privacy to reconsider their sharing decisions to improve the privacy of others. Specifically, we investigate the extent to which *perspective taking* for others (i.e., imagine you are the person in the photo) or adopting a *privacy perspective* (i.e., consider the privacy of the person in the photo) may reduce people's willingness to share photos, particularly in the context of highly positive or negative photos of others. Of additional interest in the present

[1]Merriam-Webster defines a 'meme' as "an idea, behavior, style, or usage that spreads from person to person within a culture." https://www.merriam-webster.com/dictionary/meme

work are individual differences in potential photo-sharers. In addition to investigating gender and age differences, we focus on individuals' past photo-sharing behavior. Although this has not been an extensive focus of past research in the photo-sharing literature, as we discuss below, we hypothesize that habitual photo sharing may play a potent role in individuals' future willingness to share photos. Balancing privacy and accessibility is a chronic problem in security, and we believe that behavioral interventions may play an important role in helping people sensibly choose when photo-sharing may be harmful to others. Herein, we report three studies in which we focus on two potential manipulations – taking others' perspective, and considering others' privacy – that may have the potential to reduce problematic photo-sharing behavior.

## II. Background and Related Work

### A. Engaging in Perspective Taking and Photo Sharing

Past research has shown that perspective taking – imagining that the self is in another's position – can powerfully influence how one thinks about and behaves in a situation, often in service of prosocial goals. Thus, of interest is whether having participants take the perspective of the person in the photo may reduce photo sharing, and particularly the sharing of highly negative photos (i.e., those that portray the main subject of the photo in a negative light). Perspective taking can influence photo sharing for two reasons. First, perspective taking can make people self-aware, which is the psychological state of considering the self as the object of others' attention [18]. Self-awareness can be triggered by a variety of situational cues, such as mirrors, cameras, and audiences [19]. However, much like our perspective-taking condition, even considering how one would be viewed by others can generate self-awareness. Importantly, becoming self-aware can cause people to care more about how others view them, generating more socially-desirable responses [20]–[22]. Second, perspective taking also leads to a variety of pro-social responses, such as reduced prejudice and increased sympathy toward others [23], [24]. Thus, for multiple reasons, engaging in perspective taking may have beneficial effects on photo sharing. By imagining being the person in the shared photo, this may trigger both reputational concerns and sympathy for the person in the photo. Both of these may actually increase the sharing of very positive photos but not highly negative photos. Because we'd all prefer our wedding photo to be shared more than a photo of us falling into a puddle, one would expect taking others' perspective when sharing photos of others should cause people to share positive photos of others more than negative photos of others.

### B. Adopting a Privacy Perspective and Photo Sharing

A second interest of this research is whether adopting a privacy perspective – considering the privacy of others – can also influence photo-sharing behavior. Indeed, people often show concern about others' privacy. For example, Jia and Xu have observed collaborative behaviors of people on social media, and found a tendency to collectively protect each other's privacy [25]. Recent work in the context of 'lifelogging' has shown that owners of a photo can be altruistic or show "propriety" behaviors in terms of protecting the privacy of other people. When asked about their decisions to not share certain photos or why they turned their wearable cameras off, participants indicated privacy concerns for the people in the photo as one of the top three reasons to not share a photo (other than objects and the location depicted in the photo) [26], [27]. These findings in the domain of photo sharing map closely onto broader work on the 'Sociology of Privacy,' as discussed by Anthony et al. [28]: across a variety of contexts, people often exhibit 'civil inattention' or what Goffman calls 'tactful inattention' [29] (i.e., purposely ignoring available information about others) and 'pretense awareness' (i.e., pretending not to know information about the other). For example, taxi drivers often pretend to not hear private conversations of their passengers (i.e., civil/tactful inattention), or one may ask questions of a new colleague, such as their dissertation topic, even though one has already closely read their application materials (i.e., pretense awareness). These behaviors highlight how people in society are willing to protect the privacy of others in public settings for the sake of propriety. Yet, thus far technical mechanisms that seek to leverage this sense of 'propriety' have not been adequately explored in the context of photo sharing. Thus, of interest was whether increasing awareness of privacy concerns at the moment of the photo-sharing judgment may make norms about protecting others' privacy more salient. Here again, any potential effects of a privacy-perspective intervention might also be qualified by the valence (i.e., the degree to which photos paint the subject in a 'positive' or 'negative' light) of the to-be-shared photos. If participants were made sensitive to the privacy of others, it is plausible that this would be especially true for more negative photos. Indeed, sharing negative information about others is a greater invasion of privacy than sharing positive information.

### C. Individual Differences in Privacy and Photo Sharing

Although past research on photo sharing has been relatively limited, a number of previous studies have demonstrated that individual differences are important in the context of online privacy, and include users' gender [30], [31] and age [32]. For example, past work suggests that women are more sensitive to privacy concerns than men [30], [31], and are also more risk-averse [33], [34]. These differences may lead to greater privacy protection behaviors amongst women, especially when privacy concerns are salient. Additionally, because women are more concerned with others [35], they may be less willing to share negative photos of others, again especially when privacy concerns are salient. There is also evidence that individuals older than 45 respond differently to privacy concerns that younger individuals, because they are either more or less concerned with privacy than their younger counterparts [32]. Thus, we include in this study an assessment of the effects of gender and age on photo sharing.

We also investigate the extent to which our interventions are influential when considering past behavioral characteris-

tics. For this purpose, we assess whether users' self-reports of photo- sharing behavior may be a meaningful predictor of their photo-sharing behavior. Indeed, past research has reliably shown that established habits are particularly potent predictors of future behavior, especially in domains (such as photo sharing) where behaviors are high in frequency and the situation remains similar [36], [37]. Thus, in the present work we also investigate the extent to which participants are high-, middling-, or low-frequency sharers of photos. Naturally, we hypothesize that people who have been high-frequency photo-sharers in the past will report a higher frequency of sharing photos in our experiment. Of additional interest is whether our *perspective taking* and our *privacy perspective* interventions may be qualified by participants' photo-sharing habits. Past research has shown that very strong habits are harder to change than are moderate habits [38], [39]. Given this, of interest is whether our interventions are stronger for participants who are middling-frequency photo-sharers, relative to participants who almost always or almost never share photos.

### *D. Controlling Dissemination and Limiting Information*

Our eventual interest is in incorporating behavior interventions into technical solutions. Thus we review relevant approaches to control the dissemination of photos. Existing approaches fall into two broad categories: restricting viewers and limiting content. Using access-control mechanisms (such as privacy settings in Facebook), users may choose to limit who can view shared content. Ahern et al. compiled a taxonomy of common privacy and security concerns people express while uploading photographs in the cloud and proposed design considerations to mitigate those risks [40]. Besmer and Lipford proposed a user interface to help Facebook users control dissemination of photos they were tagged in [41]. Klemperer et al. studied how captions and tags of a photo can themselves be used to infer access-control policies [42] and found that tag-based rules can simplify the task of access control for photos. Such et al. studied common problems faced by online social-network users and their conflict resolution mechanisms when there are multiple owners of shared content [43]. Squicciarini et al. proposed automated ways to share images based on an extended notion of content ownership where all owners collectively enforce the privacy policies preferred by each [44], [45]. More recently, Vishwamitra et al. proposed a multiparty access control model based on finer grained information within photos to provide a collaborative control mechanism for photos with multiple owners shared over social networks [46].

Other approaches proposed limiting information in a photo. Two of the most prominent approaches are restricting photographers from capturing certain objects (including people) and redacting certain objects (or people) from the captured photos. In the first category, researchers have proposed using special markers [47], hand gestures [48], and QR codes [49] to signal that certain objects or people should not be photographed. Researchers have also designed systems that can detect if a photo was taken in a certain place [50] or contain certain objects [51], in which case the default sharing of those photos could be restricted by the system. Additionally, there are privacy-preserving sharing platforms that enable users to publish privacy preferences so that nearby photographers can learn and respect their preferences, including I-Pic [52] and COIN [53], which alert registered users whenever another user in the vicinity takes a photo. In general these studies fall under the paradigm of relying on the owner's device to enforce preferences, and they require people to subscribe to such a system and convey privacy preferences. Our approach instead assumes no involvement from people in the photo and attempts to increase people's privacy considerations when they make the decision to share a photo.

In the second category of limiting information in photos, several prior researchers proposed redaction methods that are suitable in social-media settings. Li et al. [54] and Sun et al. [55] proposed several obfuscation methods (such as blurring, pixelating, and head inpainting) to obscure human identity. Hassan et al. [56] proposed cartoon transformations of objects to obscure sensitive elements from a photo. Hasan et al. reported an experiment where they studied the effectiveness of obfuscation methods to obscure photo content as well as the impact of these obfuscations on photo utility [57]. More recently, Hasan et al. studied relationships among several utility variables and how they might be boosted to encourage the use of obfuscation methods [58]. In contrast, our method is designed to alter user decision making and, in turn, photo-sharing behavior. However, behavioral interventions that we study could be applied to decision making related to choosing privacy enhancing redactions and would be interesting to study in future work.

### *E. Pilot study*

Prior to the initiation of the current study, a pilot study was conducted to test the efficacy of our methods and to assess whether we could influence photo sharing responses with a perspective-taking manipulation. We enrolled 166 participants from Amazon's Mechanical Turk and assigned them to one of three conditions: In a baseline condition, participants were asked while viewing each photo whether they liked the photo and how likely they would be to share the photo on social media. More specifically, participants were asked to rate with a slider on the screen the likeability of each photo (0 = strongly dislike to 100 = strongly like), and to rate each photo on how likely they would be to share it on social media (0 = not at all likely to 100 = very likely). In the two additional conditions, participants were asked how likely they would be to share the photo if it was a photo of them (0 = not at all likely to 100 = very likely). This reference to themselves was designed to facilitate perspective taking. In one of these two conditions, the reference to themselves was limited to the first question asked, which was new and designed to address the perceived valence of the photo, "If this was a photo of you, would you view this as negative or positive?" In the second perspective-taking condition, the reference to themselves was included with the new question as well as with the two questions that were used in the baseline condition. It was

unknown prior to this study whether the perspective-taking reference should be included with every question. The results confirmed that the perspective-taking manipulation should be included with every question because it significantly increased the differences between conditions.

The inclusion of the question about the perceived emotional valence of the photos in the two perspective-taking conditions enabled us to classify the photos into four categories: very negative, negative, positive, and very positive. Conceivably, we could have also added photo valence as a covariate, but the nonlinear distribution of the scores suggested that a categorical variable was more appropriate. This classification of the photos proved very informative – the results revealed that the likelihood of sharing photos differed as a function of emotional valence. Participants were significantly more likely to share positive than negative photos, and this result was significantly greater for the second perspective-taking condition than for the baseline condition. In addition, there was no difference among conditions in the likelihood of sharing photos that were very negative.

Overall, these results suggested that the method was promising, but it was premature to draw any firm conclusions because of a few limitations in the design of the study. Most importantly, the ratings of the perceived emotional valence of the photos were not independent of the likelihood to share scores because the same participants responded to both questions. Moreover, it was unknown whether asking multiple questions to each participant could bias their likelihood to share responses. We suspected that these limitations were responsible for not finding any evidence that the perspective-taking manipulation would reduce the likelihood of photo sharing relative to the baseline condition, especially for negative valence photos. In the subsequent research, these problems were eliminated by first conducting a study to independently collect emotional valence ratings on the photos. This study was followed by the main study in which participants were asked only to indicate their likelihood of sharing each photo. Also, some of the photos were removed and replaced by new photos to increase the likelihood of a more balanced distribution of photos ranging from very negative to very positive valences. Lastly, we suspected that the use of a slider constrained the range of responses more than expected, and thus decided to use categorical ratings in future research.

## III. Current Studies

### A. Study 1: Photo Valence Ratings

*1) Participants:* A preliminary study was used to identify photo valence, or the extent to which memes portrayed photo subjects as positive or negative. Four hundred participants were enrolled from Amazon's Mechanical Turk online recruitment system. Participants were eligible to participate in the study if they were 18 years or older, had been living in the United States for a minimum of five years, and used a laptop or desktop computer to complete the experiment. We followed the recommended procedures to minimize the chances that participants were not following our instructions [59]. This included restricting participation in the survey to workers who have at least 95% approval ratings and have completed at least 1,000 HITs.

One hundred and seventy-four (43.5%) and 221 (55.3%) participants identified themselves as female and male respectively. Participants were divided among four age groups: 150 (37.7%) were 18–29 years old, 210 (52.8%) were aged 30–49 years old, 25 were 50–64 years old, and 12 participants were 65 years or older. Sixty-seven percent (267) of the participants identified themselves as Caucasian, followed by Asian (53, 13.3%), Black or African American (31, 7.8%), American Indian or Alaska Native (19, 4.7%), and Hispanic or Latino (13, 3.3%). One hundred and sixty-nine participants (42.04%) had a Bachelor's degree, 99 (24.63%) had some college education, 54 (13.43%) were high school graduates or had a GED, 41 (10.2%) had an Associate's degree, and 38 (9.45%) had a Master's degree. Participants had on average 3.2 ($SD = 1.58$) social media accounts. A majority of the participants (264, 66.3%) reported that they visit social media multiple times a day, and the frequency for sharing photos online had a mode response of 'multiple times a week' (96, 24.1%).

*2) Stimuli:* Ninety-eight publicly-available photos were selected from popular social media sites, including Reddit and Pinterest, based on the following criteria: First, all photos included people, hereon referred to as "photo subjects." Second, photos were also accompanied by text with 50 words or less, which provided context for photos. For example, one photo portrayed a woman and a man sitting together in a field surrounded by flowers, with text that read "Husband spends 2 years planting thousands of scented flowers for his blind wife to smell & get her out of depression." Another photo included derogatory text directed toward a smiling subject with bad teeth, saying "9/10 dentists would recommend suicide." The text provided a common reference point for interpreting and evaluating the photos and their subjects. Third, photos varied in terms of how the photo subjects were portrayed: Some photo subjects were shown in ways that highlighted their accomplishments (e.g., completing a degree) or positive personal traits (e.g., performing an act of care). Other photo subjects were shown in ways that violated social norms (e.g., excessive alcohol intake) or highlighted negative personal traits (e.g., clumsiness). Fourth, we excluded photos that appeared to include children, as well as photos that presented sexist, racist, or otherwise bigoted messages. Each participant was presented with all of the photos (in random order).

*3) Procedure:* All procedures were carried out in accordance with a protocol approved by our institution's review board for the conduct of human research. After completing the informed consent form, participants viewed a sequence of 98 photos at the top center of their Amazon Mechanical Turk survey. One question was displayed below each photo, which asked participants "Does this portray the subject of the photo negatively or positively?" Participants provided ratings for each photo using a seven-point Likert scale (-3 = Extremely negative, -2 = Negative, -1 = Somewhat negative,

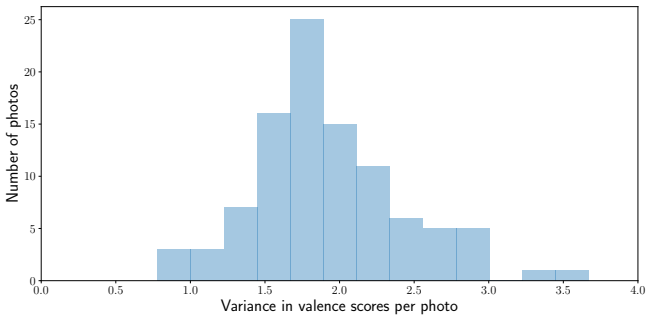


Fig. 1. Histogram of variances for valence scores per photo.

0 = Neither negative nor positive, 1 = Somewhat positive, 2 = Positive, 3 = Extremely positive). By rating the photo as positive or negative, participants were providing ratings of photo "valence," or the degree to which participants were portrayed in an aversive or bad way, versus an attractive or good way. Each participant was paid $3 and the average time to complete the survey was approximately 36 minutes.

*4) Results:* Each photo was assigned a valence score by averaging ratings across participants. The means range from $-1.74$ to $2.45$ for the 98 photos. The standard deviations ranged from 0.88 to 1.93 (Figure 1). Notably, the distributions of responses for each photo revealed that the means were not a function of a bimodal distribution of scores, but rather were a function of one or two consecutive Likert ratings constituting the most frequent response.

Photos were then ordered from most negative to most positive and divided into four quartiles with regard to how they portrayed subjects in the photos: very negative ($M = -1.15$, $SD = 0.34$, $N = 25$), negative ($M = -0.29$, $SD = 0.17$, $N = 24$), positive ($M = 0.38$, $SD = 0.23$, $N = 24$), or very positive ($M = 1.47$, $SD = 0.49$, $N = 25$). Perceived valence ratings obtained from this study were used in the second study to differentiate photos into four valence categories to assess whether valence moderates likelihood of sharing responses.

### *B. Study 2: Behavioral Interventions for Decreasing the Likelihood of Photo Sharing*

*1) Participants:* Participants were enrolled from Amazon's Mechanical Turk online recruitment system using the same eligibility criteria described in the previous study. In addition, participants were excluded if they answered incorrectly on one or both attention checks, which instructed participants to provide a specific Likert-scale response (e.g., "Select the third option for this question."). Of the 444 respondents, 379 responded correctly to both attention checks and were retained for the final sample. A majority of participants were between the ages of 30–49 years (209, 55%), followed by 18–29 years (124, 32.7%), 50–64 years (36, 9.5%), and 65 years or older (10, 2.6%). One hundred and fifty-seven participants (41.4%) identified as female and 221 (58.3%) identified as male. Two hundred and fifty-one participants (66.2%) identified themselves as Caucasian, 61 (16.1%) as Asian, 27 (7.1%) as Black or African American, 16 (4.2%) as Hispanic or Latino, 18 (4.7%) as biracial or multiracial or "other," and six (1.6%) as American Indian. Participants ranged in education from having some high school education (0.53%) to having doctoral (0.26%) or professional degrees (1.1%). The mode for education level was a bachelor's degree (44.1%), followed by having completed some college (21.6%), and then high school graduate or GED (15.31%). Participants reported having an average of 3.26 ($SD = 1.36$) social media accounts. They modally reported visiting those accounts 'multiple times per week' (n=267, 61.1%) and sharing photos through those accounts 'multiple times per week' ($n = 90$, 21.84%).

TABLE I
QUESTIONS PRESENTED FOR EACH CONDITION

| **Condition** | **Photo questions** |
|---|---|
| Baseline | How likely are you to share this photo on social media? |
| Perspective-taking condition (PT) | If this was a photo of you, how likely are you to share this photo on social media? |
| Privacy-perspective condition (PP) | Taking into account the privacy of the person in the photo, how likely are you to share this photo on social media? |

*2) Stimuli and Experimental Manipulation:* The 98 photos from the previous study (including their text captions) were shown one-at-a-time in random order on Amazon's Mechanical Turk. Participants were randomly assigned to one of three conditions (see Table I). In the Baseline condition ($n = 126$), participants were asked to respond to the following question appearing below each photo using a seven-point Likert scale: "How likely are you to share this photo on social media?" (-3 = Extremely unlikely to 3 = Extremely likely). In the Perspective-Taking (PT) condition ($n = 126$), participants were asked to put themselves in the position of the photo subject, "If this was a photo of you, how likely are you to share this photo on social media?" (-3 = Extremely unlikely to 3 = Extremely likely). In the Privacy-Perspective (PP) condition ($n = 127$), participants were cued to consider the privacy of the photo subject before rating the likelihood they would share the photo. They were asked, "Taking into account the privacy of the person in the photo, how likely are you to share this photo on social media?" (-3 = Extremely unlikely to 3 = Extremely likely). A power analysis demonstrated that a sample size of 48 participants per condition was required to attain power of .95 using a one-way ANOVA with three conditions and a projected effect size, ${\eta_p}^2 = 0.10$.

*3) Questionnaires:* The *Social Media Usage Questionnaire* was designed to assess online social-media behavior. Questions asked participants to indicate the social media platforms for which they had an account, the extent to which they use the accounts and post photos, and the content that they and their friends post on social media websites. For example, one multiple-choice question asked participants, "How often do you share photos on social media?" (see Appendix B for the complete questionnaire).

The *Social Media Privacy Questionnaire* was designed to measure a social-media user's privacy-related experiences. Five questions were designed to assess users' experiences having embarrassing photos of them posted online (Personal Photo Subscale; e.g., "Has anyone ever shared a photo of you online that you did not want them to share?"). Three questions assessed the extent to which social media users posted online embarrassing photos of people they know, and then regretted posting them (Familiar Photo Subscale; e.g., "Have you ever shared an embarrassing photo of someone else you know?"). The Stranger Photo Subscale included three questions and was directed toward understanding users' experiences posting photos of strangers and experiencing regret (e.g., "Have you ever shared an embarrassing photo online of a stranger (someone that you do not personally know)?"). Lastly, four questions were used in the Familiar Posting Subscale to determine the extent to which people in users' networks posted embarrassing photos of others (e.g., "Do people you know post photos that might be embarrassing to other people?"). Answers were recorded on a three-point scale, either "no," "maybe," or "yes." An additional Privacy Preference Question was administered, which asked participants, "Are you a private person who keeps to yourself or an open person who enjoys sharing with others (1 = very private, 7 = very open)?" [60].

*4) Procedure:* All procedures were carried out in accordance with a protocol approved by our institution's ethics review board for the protection of human subjects. After providing informed consent, participants completed the Social Media Usage Questionnaire. They then completed the experimental task, which required them to view all 98 photos one-at-a-time followed by a question that differed depending on the condition (see Table I). In the case of the baseline condition, there was no modification to the question, "How likely are you to share this photo on social media?", but the question in the PT and PP conditions was preceded by a phrase designed to cue participants to think about their decision differently. In the case of the PT condition, participants were cued to think about how they would feel as the subject of each photo. In the case of the PP condition, participants were cued to consider the privacy of the photo subjects.

After answering questions for all photos, participants completed the Social Media Privacy Questionnaire, Privacy Preference Question, and demographic questions. These questions were included at the end of the experiment to avoid privacy-related cuing, other than those included in the experimental manipulation. Participants were thanked for their time and compensated for completing the online experiment. Each participant was paid $3 and the average time to complete the survey was approximately 24 minutes.

## IV. Results

In addition to experimental condition (Baseline, Perspective Taking, Privacy Perspective), there were three additional independent variables assessed in this study. Perceived valence of the photos was derived from Study 1 and included very negative, negative, positive, and very positive valences. History of photo sharing was based on how often participants reported posting photos on social media: Participants were assigned to 'low' ($N = 110$), 'medium' ($N = 111$), or 'high' ($N = 158$) photo-sharing groups. The final variable was the gender of the participants.

A 2 (gender) $\times$ 3 (condition) $\times$ 3 (photo-sharing frequency) $\times$ 4 (photo valence) mixed-design ANOVA was conducted with the first three factors as between-subjects variables and the last factor as a within-subjects variable. The likelihood of sharing photos was the dependent measure. Age was added as a covariate because of its association with photo-sharing frequency ($r(379) = -.15$, $p = 0.005$); older participants demonstrated less likelihood to share photos than younger participants. The inclusion of age as a covariate controlled for the possibility that age rather than sharing frequency moderated the likelihood of sharing in the experiment.

We report all findings in Appendix A, however, the key findings are outlined below. First, the main effects of condition and photo-sharing frequency were significantly related to sharing scores. Age was also a significant covariate of likelihood to share (as reported above) and significantly interacted with photo valence to predict sharing likelihood. There were additional two-way interactions between condition and valence, photo-sharing frequency and valence, as well as gender and valence. All other main effects and interactions were non-significant, $p$s$> 0.05$.

### A. Condition Effect on Likelihood to Share

Given that the effect of condition is central to our research question, we examine the main effect of condition before outlining more complex, higher-order interactions between the independent variables. Figure 2 shows the average share scores across photos for each condition. Post-hoc tests (a Bonferroni correction was used to adjust $p$-values for multiple comparisons here and in all subsequent comparisons) revealed that participants in the Privacy-Perspective (PP) condition demonstrated a *greater* likelihood to share photos than those in the Baseline condition ($M_{PP} = -.42$, $SD_{PP} = 1.32$; $M_{Baseline} = -.88$, $SD_{Baseline} = 1.49$, $p = 0.03$), but there was no significant difference between the Perspective-Taking (PT) and Baseline groups, $p = 0.34$, or between the PP and PT conditions, $p = 0.48$.

These results were contrary to our hypothesis in that we expected privacy reminders would decrease the likelihood to share photos. To better understand the effects of the two experimental interventions on sharing decisions, we next examine whether the likelihood to share was modulated by the previously rated valence of the photos as well as participants' photo-sharing history.

*1) Effects of photo valence:* Figure 3 illustrates a significant interaction effect on sharing likelihood between the experimental condition and photo valence ($F(4.02, 721.66) = 8.38$, $p < 0.001$, ${\eta_p}^2 = 0.05$); sharing scores tend to increase with photo valence, but the increase differs as a function of condition.

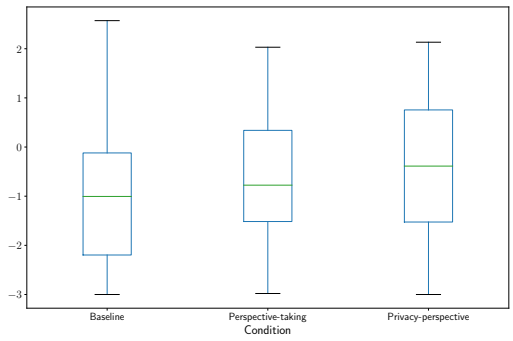


Fig. 2. Mean photo-sharing likelihood scores by condition.

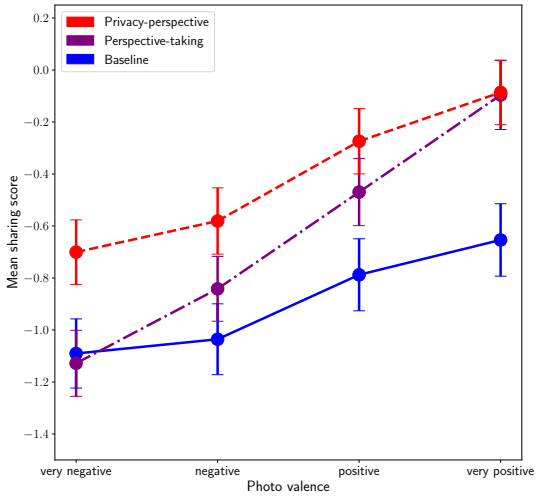


Fig. 3. Mean photo-sharing likelihood by condition and photo valence, or the degree to which photo subjects were portrayed negatively or positively.

Simple-effects analyses were used to understand how the experimental manipulation was associated with photo-sharing likelihood for photos of different valences, and detailed results are presented in Appendix A (also see Figure 3). There was a non-significant effect of condition on likelihood to share very negative photos. However, there was a condition effect on photo-sharing likelihood for negative, positive, and very positive photos. Bonferroni post-hoc tests revealed that participants in the baseline condition were significantly less likely to share negative and positive photos than participants in the PP condition (Fig 3; see Appendix A for means and standard deviations). Baseline condition participants were also significantly less likely to share very positive photos, as compared to PT and PP conditions. All other comparisons were non-significant.

In short, participants in the PP condition were more likely to share negative, positive, and very positive photos than

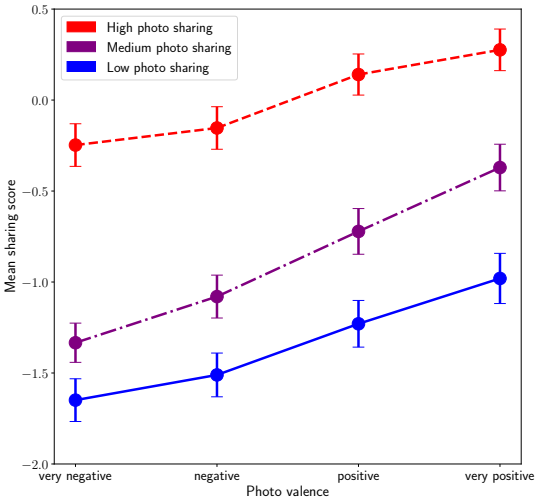


Fig. 4. Mean sharing likelihood by photo valence and photo-sharing frequency in social media.

those in the baseline condition. Thus, it is not only the case that positive valence photos were shared more often after a privacy manipulation – even negative valence photos were shared more often after a privacy manipulation. Participants in the PT condition were no more likely to share very negative photos than participants in the Baseline condition, but they were significantly more likely to share very positive photos than participants in the Baseline condition.

*2) Effects of photo-sharing frequency:* As can be seen in Figure 4, there was also a significant interaction between photo-sharing frequency and photo valence ($F(4.02, 721.66) = 3.97, p = 0.003, {\eta_p}^2 = 0.02$). Simple-effects tests also revealed that individual differences in past photo-sharing predicted current likelihood to share ratings (see Appendix A for detailed results). Bonferroni post-hoc tests indicated that the high photo-sharing frequency group demonstrated a greater likelihood to share photos than medium- or low-frequency sharers, regardless of photo valence, $p < 0.05$. In addition, medium-frequency photo sharers were more likely to share both positive and very positive photos than low sharers, $p < 0.05$. By contrast, medium- and low- frequency sharers did not differ in their likelihood to share negative and very negative photos. All other interactions and comparisons were non-significant, $p > 0.05$.

In sum, high self-reported photo sharers were more likely to share photos during the experiment, including those that risk violating the privacy of others. These findings indicate that high-frequency photo sharers are especially appropriate targets of privacy-related interventions.

### *B. Gender and Photo Sharing*

Though the main effect of gender was non-significant, there was a significant interaction between photo valence and

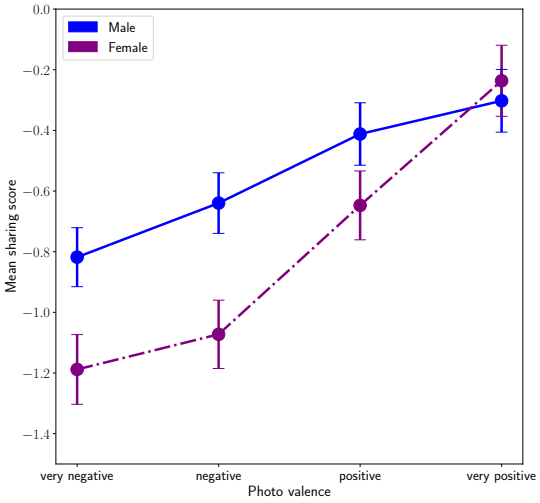


Fig. 5. Mean sharing likelihood based on photo valence and gender.

gender ($F(4.02, 721.66) = 8.57$, $p < 0.001$, $\eta_p{}^2 = 0.05$) as illustrated in Figure 5. Simple-effects analyses with Bonferroni adjustment showed that female participants were significantly less likely to share negative photos than male participants. In contrast, female and male participants were not significantly different in their likelihood to share very negative, positive and very positive photos. All other interactions and pairwise comparisons were non-significant. Overall, these results suggest that female participants were less likely to share photos that portray others in a negative light, and thus less likely to violate other people's privacy.

### *C. Online Activity, Privacy Preferences, and Photo Sharing Likelihood*

A hierarchical multiple regression analysis was used to examine the extent to which individual differences, including social media usage and privacy measures, predicted photo-sharing likelihood across conditions. For each participant, sharing likelihood was calculated as the mean likelihood of sharing the photos displayed during the experiment ($min = -3.00$, $max = 2.57$, $M = -.64$, $SD = 1.40$).

The hierarchical multiple regression analysis included three types of predictors. First, factors related to *social media usage*, including self-reported number of social media accounts (i.e., total number of social media platforms used from a list of five options), frequency of visits to social media websites (0 = Never, 7 = Multiple times a day), and frequency of real-world photo-sharing online (0 = Never, 7 = Multiple times a day) were entered into the model. Second, *measures of privacy*, including the privacy preference question and familiar posting subscale total score from the social media privacy questionnaire were included in the model. The privacy preference question asked participants to rate the extent to which they considered themselves a private person who keeps to themselves, versus an open person who enjoys sharing with others (1 = very private, 7 = very open). The familiar posting subscale assessed the extent to which participants had posted embarrassing photos of people they know and regretted posting photos of people they know online. The familiar posting subscale was selected due to its high correlation with average likelihood to share ($r(379) = 0.53$, $p < 0.001$), while other subscales were excluded due to their correlation with one another ($r(379) = 0.43 - 0.71$, $p < 0.001$). Finally, *condition* was entered into the model to examine its effect in relation to individual differences.

TABLE II
REGRESSION COEFFICIENTS PREDICTING PHOTO-SHARING LIKELIHOOD

| **Predictors** | *B* | *SE* | $\beta$ | $p$ |
|---|---|---|---|---|
| **Social media usage** | | | | |
| Number of accounts | -0.01 | 0.05 | -0.01 | 0.78 |
| Website visit frequency | -0.12 | 0.04 | -0.12 | $0.008^{**}$ |
| Share photo frequency | 0.19 | 0.03 | 0.30 | $< 0.001^{***}$ |
| **Privacy** | | | | |
| Personal privacy rating | 0.24 | 0.04 | 0.30 | $< 0.001^{***}$ |
| Posting experiences scale | 0.08 | 0.02 | 0.16 | $< 0.001^{***}$ |
| **Photo perception** | | | | |
| Condition | 0.23 | 0.07 | 0.14 | $0.001^{***}$ |

$^{*} = p < 0.05$, $^{**} = p < 0.01$, $^{***} = p < 0.001$.

As shown in Table II,[2] the results of this analysis indicated that social media usage accounted for a significant amount of the photo-sharing likelihood variability ($R^2$ change $= .21, F(3, 375) = 33.51$, $p < 0.001$). The privacy measures predicted sharing likelihood significantly over-and-above measures of social media usage ($R^2$ change $= .10$, $F(2, 373) = 27.52$, $p < 0.001$). In addition, condition contributed significantly to the predictive validity of the model ($R^2$ change $= .02$, $F(1, 372) = 10.28$, $p = 0.001$). Despite correlations between predictors, tolerance values for all independent variables were greater than .20 and variance inflation factors less than four, indicating that the model was not significantly compromised by multicollinearity.

Table II outlines the extent to which social media usage, measures of privacy, and condition relate to photo-sharing likelihood. Of the measures entered into the full model, all variables except number of social media accounts were significantly correlated with average likelihood of sharing. Frequency of photo sharing on real social media platforms and personal privacy rating were most strongly related to sharing likelihood. Supporting this conclusion is the strength of the bivariate correlation between self-reported frequency of photo sharing on real social media platforms and sharing likelihood across conditions, ($r(379) = 0.43$, $p < 0.001$), as well as the correlation partialling out the effects of all other predictors in the full model ($r(372) = 0.29$, $p < 0.001$). In addition, there was a significant correlation between personal privacy rating and sharing likelihood across conditions ($r(379) = 0.47$,

[2] 'B' refers to unstandardized coefficients in units of the original measure, while $\beta$ is standardized to allow for easier comparison across measures and refers to the degree of standard deviation change we would expect in the outcome variable for a one standard deviation change in the predictor variable.

$p < 0.001$), even when controlling for other measures in the full model ($r(372) = 0.30$, $p < 0.001$), indicating that participants who rated themselves as being less private and more open were more likely to share photos.

### D. Photo order effects on sharing likelihood

Lastly, though the order of photos was randomized for each participant, we examined whether fatigue throughout the experiment influenced photo sharing likelihood. Of potential interest is whether participants' photo-sharing decisions change over the relatively large number of decisions they made in the study. To investigate this, we split the ratings into four quartiles based on the order that the photos were presented to each participant. We then used a repeated-measures ANOVA comparing average share score of the four quartiles of photos, applying a Greenhouse-Geisser adjustment as needed, which revealed that photo order was not significantly associated with likelihood to share ($F(2.80, 1056.64) = 2.26$, $p = 0.08$, $\eta_p^2 = .006$). This was also the case when comparing average likelihood to share for the first ten and last ten photos using a paired-samples t-test ($t(378) = 1.49$, $p = .14$). Thus we conclude that there were no significant order effects due to fatigue.

### E. Summary of Results

These findings demonstrate a counter-intuitive effect of the experimental manipulation, where participants in the privacy condition reported a *greater* likelihood of sharing photos of others than participants in the baseline condition. Given our predictions for this study, these findings are clearly paradoxical. Privacy reminders may have the unintended effect of *increasing* privacy violations.

In addition, there were a number of individual difference factors that were associated with likelihood of photo sharing. First, participants who were high photo sharers on real-world social media platforms were more likely to want to share photos in the experiment than low or medium photo sharers, regardless of how the photo portrayed the subject. Second, male participants were more likely to share negatively valenced photos than female participants, though female and male participants were equally likely to share positively valenced photos. These findings contribute to our understanding of online privacy by identifying social media users who, generally speaking, are most likely to violate the privacy of others and who may be particularly important target groups for privacy-related interventions.

Of the measures entered into the regression model, social media usage, privacy experiences and preferences, and experimental condition were significant predictors of overall likelihood to share. Specifically, frequency of photo sharing on real social media platforms and personal privacy rating were most strongly related to sharing likelihood. The correlation between real-world photo sharing and likelihood of sharing during the experiment suggest that the present study design is a valid way of understanding decisions to share online. The correlation might be even higher if photos were more representative of real-world photos shared by participants, for example, more self-relevant images like those of friends and family. The results also indicate that past photo sharing is the best predictor of future decisions to share. Personal privacy preference was also significantly related to decisions to share photos of other people, suggesting that people who value their own privacy more, in turn, also value the privacy of others.

### F. Follow-up study

The central findings of Study 2 were opposite of our hypothesis, revealing that the privacy prime *increased* rather than decreased photo sharing. To better understand this paradoxical effect, we conducted a follow-up study asking participants to explain their sharing decisions for a subsample of photos from our original study. Past work has shown that drawing attention to privacy concerns can sometimes backfire. For example, Trudeau and colleagues found that when participants were primed to think about privacy they made 'worse' decisions in sharing private information on social media, indicating they were willing to engage in riskier decisions and less concerned about privacy after being explicitly reminded of it [61]. Thus, perhaps our privacy prime condition actually made perceivers *less* concerned about others' privacy. To test this, we randomly assigned a new sample of participants to our Baseline or Privacy condition but had them view only six photos selected from the previous study. Their task was to describe in two to three sentences why they would or would not share them. Of interest was whether participants in the privacy condition would express less concern about others' privacy. If true, reminding participants of a value they do not actually hold (i.e., protecting others privacy) could ironically lead them to act against it, which would explain our previously observed results.

*1) Stimuli and Procedure:* One hundred participants were recruited via Amazons Mechanical Turk. Half of them were randomly assigned to the baseline condition and other half to the PP condition. After providing informed consent, participants viewed six photos in random order. The stimuli consisted of the six photos from Study 2 for which participants showed the largest difference in sharing scores between the control and PP conditions. These photos also included both negatively and positively valenced photos. The procedure was the same as Study 2, except that participants were also asked to explain their likelihood to share using at least 200 characters in a text box at the bottom of the screen.

*2) Coding Measures:* Four coders, unaware of the participants' condition, read their responses and created a coding scheme to capture the main themes present in the participants' written responses (Table III). Codes included: concern for privacy; no concern for privacy; mentioning the person/people in the photo; understanding the meme; personally relating to the photo; not personally relating to the photo; viewing the photo as funny; viewing the photo as not funny; considering the photo inappropriate; and whether sharing the photo reflects positively or negatively on the self. We also coded for nonsensical responses, and found 13% of the responses had

this code. Those responses were removed from subsequent analyses. Participant responses to each photo were coded for the presence or absence of each code. One hundred responses were coded independently by all four coders, after which the four coders refined the coding scheme and reached agreement on all responses by discussion. Two coders then coded each of the remaining responses independently. Inter-rater reliability was measured with Gwet's AC1 [62], which is reported to be less affected by prevalence and marginal probabilities than Cohen's Kappa [63]. The mean coding reliability across all seven categories was 0.83, and ranged from 0.72 to 0.95. All coding disagreements were resolved by discussion.

*3) Results:* Of primary interest was whether privacy concerns were higher or lower in the privacy condition relative to the baseline condition. We examined the extent to which condition (baseline or PP condition) predicted each of the coded categories outlined in Table III using mixed-effects logistic regression models with participant number as a random intercept. We included photo number (1-6) and likelihood to share over-and-above these factors.

The results are shown in Table IV. Notably, participants in the PP condition were more likely to state that they were *not* concerned with the privacy of photo subjects compared to the baseline condition, $Oddsratio = 15.91$, $B = 2.77$, $p = .01$. Thus, PP condition participants were over 15 times more likely to note that they were unconcerned with photo subject privacy than baseline participants. This effect was not qualified by photo; participants demonstrated a lack of concern about privacy regardless of the photo. In addition, the extent to which participants reported that they personally related to the photo was significantly lower in the PP condition compared to the baseline condition, $OR = 0.32$, $B = -1.13$, $p = .003$. For all other models, the effect of condition was nonsignificant, $p$s $> .05$.

In sum, these findings indicate that participants instructed to attend to the privacy of photo subjects were more likely to mention *not* being concerned with others' privacy when sharing images via social media, while also reporting less often that they thought the photos personally related to their lives. This finding offers some preliminary insight into why the privacy condition in Study 2 led to more photo sharing, as compared to the baseline. In particular, it appears that when participants are reminded of others' privacy, they become less concerned with risking others' privacy, perhaps because they feel less personally related to those whose privacy is at risk.

## V. Discussion

The principal goal of this research was to assess whether either of two behavioral interventions would influence the likelihood of sharing photos online. Our perspective-taking intervention was designed to make participants consider what it would be like to be the target of the shared photo. Our privacy perspective intervention involved increasing the likelihood of the participant considering the privacy of others. Both of these interventions were operationalized by leading participants to explicitly think about one or the other of these perspectives prior to rating the likelihood of sharing each photo. Based on the results, it is apparent that these manipulations were successful in affecting behavior, but they did not modulate response in the manner expected. Instead of decreasing the likelihood of sharing photos, both interventions *increased* the likelihood of sharing photos (although this difference was only significant at the very positive level for the PT condition).

Although these results were surprising and unexpected, they were conceptually consistent across multiple studies. The perspective taking condition in both the pilot and main studies revealed that participants were more likely rather than less likely to share images. Similarly, in both the main study and the follow-up study, the privacy prime resulted in more photo-sharing and less concern for others' privacy. Thus, although seemingly paradoxical, the consistency of the findings suggests that they are not easily attributable to sampling error or to minor variations in experimental design.

### A. First-order interpretations for paradoxical findings

How should we interpret these paradoxical results? One possibility is suggested by research revealing that individuals' concerns about privacy are lessened when their perceived control over personal information is increased [64], [65] or when they underestimate the risks of sharing [65]. This result is similar to previous research revealing that people are more willing to take risks and judge risks as less severe when they feel in control [65]–[68]. For example, people feel safer driving than flying presumably because they are more in control when driving a car. In reality, driving is much more dangerous then flying because there are risks that cannot be controlled, such as the behavior of other drivers. The proximal effects of controlling the car appear to obscure the many risks that cannot be controlled. Extending this past work to the present findings, perhaps adopting a self- or privacy-perspective increased the sense of control that participants perceived they had over the privacy of the people appearing in the photos. This increased perception of control may have lessened concerns about violating the privacy of others.

As noted above, past research has also shown that drawing attention to privacy concerns can sometimes backfire, causing more online sharing rather than less [61]. This may occur because people explicitly reject the values of the primes. For example, if participants do not value others' privacy, but are reminded of others' privacy, this could cause them to share more rather than less. Alternatvely, prior work in psychology by Wilson and Schooler [69] suggests that introspection about one's judgments can inhibit performance. In the present context, asking people to consider the privacy of others may result in poorer judgments of privacy, and increase the likelihood of photo sharing with a privacy reminder. Another possibility for these seemingly paradoxical effects of a privacy mindset is reactance, or the tendency for seemingly unnecessary rules or prompts to elicit the opposite effect as intended [70]. Just as a forbidden fruit becomes sweeter, so too might being constantly reminded about privacy concerns make violating others' privacy more attractive.

TABLE III

CODING SCHEME FOR PARTICIPANTS' EXPLANATIONS OF THEIR LIKELIHOOD TO SHARE A PHOTO. PARTICIPANT RESPONSES TO EACH PHOTO WERE CODED FOR THE PRESENCE (1) OR ABSENCE (0) OF EACH CATEGORY. PERCENT OF PHOTOS THAT EXHIBIT THE PRESENCE OF EACH CODE ARE PROVIDED FOR BASELINE AND PP CONDITIONS.

| Code | Description and demonstrative quote | Baseline condition | PP condition |
|---|---|---|---|
| Not concerned with privacy | Participant noted that they were not concerned with the photo subjects privacy when considering posting to social media. "I would post it. If that grandma is willing to wear that shirt in public, I imagine she wants her photo taken, so I would not worry about the privacy." | 1% | 11.7% |
| Concerned with privacy | Participant noted that they were concerned with the photo subjects privacy when considering posting to social media. "I would not share it because this lady may not even know her photo is within this meme. I will guess and say the t-shirt quote is photoshopped. It would not feel right to me to share this with her face being so open." | 1.3% | 4.3% |
| Personally related | Participant noted that they personally related to the photo subject or content. "It's the perfect picture to convey how most people feel their lives are going. It's a picture almost anyone could relate to." | 17.6% | 8% |
| Did not personally relate | Participant stated that they did not personally relate to the content of the photo or it did not apply to them. "I just don't see why I would have a motivation to share it. It's cute, but it's not relevant to me, or anyone I know. It would be more random than anything if I did share it, and no one would understand why I did." | 12% | 12.3% |
| Funny | Participant indicated that they found the photo funny. "This seems pretty humorous [sic] to me. I wouldn't not [sic] mind sharing this with others since most of my friends, family and followers enjoy humorous content as well. I think others would get a good laugh from this photo." | 38% | 31% |
| Not funny | Participant noted that the photo was not funny or was not funny enough to post. "It's a lame joke. I don't like sharing stupid memes. I don't know why people think these dumb images with dumb text in ugly fonts are funny. It's as funny as a home video which is to say not funny." | 33% | 29.7% |
| Mentions subject | Participant directly references the person in the photo. "I feel like it is also a little mean to post this guy on my social media and to have lots of people see him in an embarrassing situation." | 19.3% | 25% |
| Did not understand | Participant noted that they did not understand the meaning of the photo or text paired with the photo. "To me, the image does not make sense at all." | 5.5% | 5.3% |

An important task for the future will be to begin testing these interpretations so that we can better understand what psychological processes are responsible for lessening concerns about privacy and the boundary conditions within which they operate. Possibly, more extensive interventions involving, for example, a cover story about the harmful effects of photo sharing on the mental health of an individual would result in greater rather than lesser concerns for the privacy of others.

### *B. Effects of photo valence, history of photo sharing, and gender*

In spite of these counter-intuitive findings related to the behavioral interventions, most of the other findings from this study were consistent with our expectations. First, the emotional valence associated with the subjects of the photos modulated the likelihood of sharing photos in the expected direction. Very negative photos were much less likely to be shared than very positive photos, and the difference between baseline and PP groups remained significant across three of the four valence levels. By contrast, the mean responses of the PT group were more variable such that they were very similar to the baseline group for the very negative photos and very similar to the PP group for very positive photos. Recall from the Introduction that adopting a self-perspective can make one more self-aware and concerned about the opinions of others [18]. It also facilitates perspective taking through which participants are more likely to put themselves in another's place. As such, these participants may be more inclined to lessen sharing of negative photos and increase sharing of positive photos in service of pro-social responding. Alternatively, this response could be viewed as a form of reputation management which is related to trusting ones' partners [71]. Knowledge of others' reputation permits the choice of better partners and provides incentives to be more cooperative. Individuals who have gained a reputation for cooperative behavior are more likely to be chosen as partners and to receive rewards. The type of responses displayed by self-perspective participants are consistent with reciprocal and cooperative behaviors and are thus likely to improve their reputation.

TABLE IV
ESTIMATES (B), STANDARD ERRORS, AND ODDS RATIOS FOR MIXED-EFFECTS LOGISTIC REGRESSION MODELS EXAMINING THE RELATIONSHIP BETWEEN CONDITION AND PARTICIPANTS EXPLANATIONS OF SHARING DECISIONS FOR SELECT MODELS.

| | **Not concerned with privacy** | | **Did relate** | |
|---|---|---|---|---|
| | *B (SE)* | *OR* | *B (SE)* | *OR* |
| Condition (PP condition) | 2.77 (1.08)*** | 15.91 | -1.13 (0.39)** | 0.32 |
| **Covariates:** | | | | |
| Photo 2 | −0.31(0.79) | 0.73 | −2.95(0.68)*** | 0.05 |
| Photo 3 | 0.31(0.75) | 1.36 | −2.61(0.61)*** | 0.07 |
| Photo 4 | 0.06(0.77) | 1.06 | −0.85(0.41) | 0.43 |
| Photo 5 | −0.63(0.82) | 0.54 | −0.40(0.38) | 0.67 |
| Photo 6 | −0.64(0.82) | 0.53 | −2.39(0.56)*** | 0.09 |
| **Random effects:** | | | | |
| $\sigma^2$ | 3.29 | | 3.29 | |
| $\tau_{00}$ | $10.88_{Participant}$ | | $1.06_{Participant}$ | |
| ICC | $0.77_{Participant}$ | | $0.24_{Participant}$ | |
| Marginal $R^2$ / Conditional $R^2$ | 0.13 / 0.80 | | 0.28/ 0.45 | |

$* = p < 0.05$, $** = p < 0.01$, teams $*** = p < 0.001$

Second, the effects of photo valence on photo sharing were modulated by participants' self-reported history of photo sharing. As we reported, the likelihood of sharing photos was significantly greater for those participants who had established a high-frequency habit of photo sharing [36], [37] through their everyday interactions with social media. The finding that there was a significant relationship between self-reported photo-sharing frequency and photo sharing responses is consistent with the evidence that established habits predict future performance in similar situations. Although photo sharing frequency was modestly correlated with age, the obtained pattern of results was maintained even after age was covaried from the analyses. We are thus confident in concluding that the previous history of photo sharing and not age, per se, modulated participants' likelihood of sharing photos in our study. One possible reason that high-frequency photo sharers responded with less concern for the privacy of others is that they were more likely to respond automatically or at least with less reflection regarding their decisions than those who were less experienced with sharing photos. The logic here is somewhat akin to the difference between experts and novices. Those who are experts have a great deal of experience and are often capable of bypassing working memory and responding reflexively or automatically [72]. As such, they are less likely to think about their choices before making a decision and responding. If high-frequency photo sharers were forced to slow down their decisions during our study, it is conceivable that they would decrease their likelihood of sharing photos.

Lastly, male participants were more likely to share very negative and negative photos than were female participants. If greater sharing is considered consistent with less concern about privacy or higher levels of risk taking, then our results follow empirical evidence on gender differences in decision making [33], [34]. Similarly, these findings are consistent with empathy or communal concern differences between men and women shown in previous research. Women tend to care more than do men about others' inner states and experiences (i.e., empathy) [35], which could explain our finding that women are less willing to share negative photos of others.

### C. Future directions

The lessons of our findings can serve as guidelines in designing psychological interventions in the specific context of photo-sharing online as well as the broader context of online privacy. First, it is important to consider other background variables that might influence a specific behavior, and how the intervention to be used might interact with those variables. More specifically, instead of providing a sense of control over sharing decisions, an intervention might try to portray the loss of actual control over information after sharing it. An example might be informing the user that the service providers own the shared content, they can reuse it for other purposes, and the action cannot be undone and might result in a large cascade of re-shares. If there is a possibility of an undesired reaction as a result of a seemingly unnecessary intervention, or habituated ignoring of frequent (and same) interventions, a better approach might be to craft interventions based on the severity of the consequence, such as using different colors and fonts to cue the levels of danger. In the specific context of photo sharing, 'face in-painting' [55] seems promising since we found that negative photos were much less shared when participants imagined themselves in the photos. Another approach would be to explore interventions that influence the way in which photos are shared. Prior work has shown that it is possible to apply privacy-enhancing redactions that are visually appealing as well [54], [56], [57]. Inducing people to apply such redactions may be effective for people who are prone to share the images anyway (as we observed with high photo sharers), since these images can be shared 'safely'. Finally, our findings reinforce the idea that interventions should take account of the individual differences of the recipient [73], [74], and interventions should be customized based on the sharing history and demographics of the users.

## VI. LIMITATIONS

There were some limitations to these studies that should be mentioned. First, the data were collected using Amazon's Mechanical Turk, and this platform introduces some noise into the data [75], [76]. To reduce noise, we included two attention check questions and removed participants' responses with one or more wrong answers to maintain data quality. Similarly, recruiting participants from this platform involves a limited test population as well. Although participants reported robust variability in individual differences such as age and photo-sharing frequency, it will be important for future research to replicate the present findings across additional participant populations. Finally, an oversight in our recruiting method led to a small amount of overlap in participants between Studies 1 and 2 (23 of 778 completed both studies). This overlap,

however, was quite small and reanalyzing the data without these participants did not change our results.

Second, it is difficult to know for certain how much the task demands of the study influenced the results. Our task could only approximate the online activity of participants. Photos were neither self-selected nor sent to participants by known friends. Moreover, it is artificial to make decisions about sharing 98 photos in succession. In spite of these circumstances, there was a significant concordance between self-reported photo-sharing behaviors and photo-sharing responses in the study. Furthermore, the behavioral manipulations did make a difference with regard to participants' performance. If their responses were simply a function of the task demands, then there was no reason to expect response differences as a function of condition.

Third, we did not have independent measures to validate that our two behavioral interventions increased the likelihood of adopting either a self-perspective or a privacy-perspective. It is possible that our manipulations were responsible for creating some network of activation that was not centered on either a self- or privacy-perspective, per se, but nevertheless was responsible for increasing the likelihood of photo-sharing responses. For our purposes, the finding that the behavioral interventions differentially changed photo-sharing responses was most important, and confirms that the responses were not simply an artifact of some other unspecified process.

Finally, the present research focused exclusively on meme-like photos. Whereas these photos are consistently shared using traditional social media platforms such as Facebook, it is unclear whether the present results would generalize to more ephemeral photo-sharing platforms such as Snapchat. The more ephemeral nature of these media may encourage additional risk-taking (i.e., sharing very personal or embarrassing photos), which may make the paradoxical effects of our interventions even more potent in such contexts. However, more research is certainly needed to understand how the ephemeral nature of such social media may interact with behavioral interventions to influence photo-sharing decisions.

## VII. Conclusions

In sum, we set out to test two behavioral interventions for reducing photo sharing and improving concerns about privacy. Contrary to our predictions, adopting a self-perspective or a privacy-perspective increased, as opposed to decreased, the likelihood of participants sharing photos. This paradoxical result does not appear to be a function of the task demands of the study nor does it appear to be specific to only one type of behavioral intervention. Instead, it appears to represent a robust phenomenon that is in need of further research and a more complete explanation. Not surprisingly, photo sharing was also modulated by other factors including the emotional valence of the photos as well as the participants' history of photo sharing. Furthermore, individual differences, such as gender, concerns for personal privacy, and previous experience posting embarrassing photos of someone else online or having regrets about posting these photos online were associated with participants' likelihood of photo sharing. The goal of developing new interventions for reducing photo sharing, especially of embarrassing or unflattering photos, is clearly a multivariate problem that will require a great deal more research.

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## APPENDIX

### A. Tables

TABLE V
MEANS AND STANDARD DEVIATION OF CONDITION, PHOTO SHARING FREQUENCY, AND GENDER BY PHOTO VALENCE.

| Condition | Very Negative $M(SD)$ | Negative $M(SD)$ | Positive $M(SD)$ | Very Positive $M(SD)$ |
|---|---|---|---|---|
| Baseline | -1.09 (1.49) | -.98 (1.54) | -.81 (1.53) | -.62 (1.58) |
| PT | -1.11 (1.41) | -.80 (1.41) | -.51 (1.42) | -.10 (1.48) |
| PP | -.73 (1.39) | -.53 (1.43) | -.30 (1.37) | -.08 (1.38) |
| Low photo sharers | -1.63 (1.22) | -1.44 (1.30) | -1.24 (1.29) | -.95 (1.43) |
| Medium photo sharers | -1.35 (1.10) | -1.05 (1.24) | -.76 (1.30) | -.39 (1.34) |
| High photo sharers | -.26 (1.47) | -.10 (1.45) | -.11 (1.38) | .30 (1.44) |
| Female participants | -1.18 (1.41) | -1.03 (1.40) | -.66 (1.39) | -.21 (1.45) |
| Male participants | -.83 (1.44) | -.58 (1.49) | -.46 (1.49) | -.30 (1.54) |

TABLE VI
2 (GENDER) × 3 (CONDITION) × 3 (PHOTO- SHARING FREQUENCY) × 4 (PHOTO VALENCE) MIXED-DESIGN ANOVA AND SIMPLE EFFECTS F-TESTS. PAIRWISE COMPARISONS ARE REPORTED IN TEXT.

| Source | $df$ | $F$ | $\eta_p^2$ | $p$ |
|---|---|---|---|---|
| Gender | 2, 359 | 0.51 | .003 | 0.60 |
| Condition | 2, 359 | 7.01 | .04 | .001 |
| Sharing frequency | 2, 359 | 29.84 | .14 | $< .001$ |
| Valence* | 2.01, 721.66 | 2.80 | .01 | .06 |
| Age (covariate) | 1, 359 | 15.25 | .04 | $< .001$ |
| Condition × Valence* | 4.02, 721.66 | 8.38 | .05 | $< .001$ |
| Simple effects: | | | | |
| Condition: Negative photos | 2,376 | 3.03 | .02 | .05 |
| Condition: Positive photos | 2, 376 | 4.01 | .02 | .02 |
| Condition: Very positive photos | 2, 376 | 5.27 | .03 | .006 |
| Photo-sharing frequency × Valence* | 4.02, 721.66 | 3.97 | .02 | .003 |
| Simple effects: | | | | |
| Sharing frequency: Very negative photos | 2, 376 | 42.86 | .19 | $< .001$ |
| Sharing frequency: Negative photos | 2, 376 | 35.67 | .16 | $< .001$ |
| Sharing frequency: Positive photos | 2, 376 | 35.43 | .16 | $< .001$ |
| Sharing frequency: Very positive photos | 2, 376 | 25.99 | .12 | $< .001$ |
| Gender × Valence* | 4.02, 721.66 | 8.57 | .05 | $< .001$ |
| Age × Valence* | 2.01, 721.66 | 6.95 | .02 | .001 |

*Greenhouse-Geisser adjustment applied.

### *B. Questionnaires*

**Social Media Usage Questionnaire**

- Which social media platforms do you have an account for? (Select all that apply.)
  1. Facebook, 2. Instagram 3. Pinterest 4. Snapchat 5. Twitter 6. Myspace 7. Flicker 8. Other (Please describe)
- How often you visit social media?
  1. Never, 2. Less than once in a month, 3. Once in a month, 4. Multiple times in a month, 5. Once in a week, 6. Multiple times in a week, 7. Once in a day, 8. Multiple times in a day
- What social media platform do you use to share photos online the most? (Select all that apply.)
  1. Facebook, 2. Instagram 3. Pinterest 4. Snapchat 5. Twitter 6. Myspace 7. Flicker 8. Other (Please describe)
- When you share photos online, who do you typically share them with?
  1. Friends/connections, 2. General viewers/public, 3. Both
- How often do you share photos on social media?
  1. Never, 2. Less than once in a month, 3. Once in a month, 4. Multiple times in a month, 5. Once in a week, 6. Multiple times in a week, 7. Once in a day, 8. Multiple times in a day
- How often do you share pictures taken by you, your friends, or your family on social media?
  1. Never, 2. Less than once in a month, 3. Once in a month, 4. Multiple times in a month, 5. Once in a week, 6. Multiple times in a week, 7. Once in a day, 8. Multiple times in a day
- How often do you share pictures on social media that you found on the internet or that other people took (not including your friends, family or other people you personally know.)? 1. Never, 2. Less than once in a month, 3. Once in a month, 4. Multiple times in a month, 5. Once in a week, 6. Multiple times in a week, 7. Once in a day, 8. Multiple times in a day

**Experimental Manipulation**

- (Baseline condition) How likely are you to share this photo on social media?
  1.Extremely unlikely, 2. Moderately unlikely, 3. Slightly unlikely, 4. Neither unlikely nor likely, 5. Slightly likely, 6. Moderately likely, 7. Extremely likely
- (Perspective taking condition) If this was a photo of you, how likely are you to share this photo on social media?
  1.Extremely unlikely, 2. Moderately unlikely, 3. Slightly unlikely, 4. Neither unlikely nor likely, 5. Slightly likely, 6. Moderately likely, 7. Extremely likely
- (Privacy perspective condition) Taking into account the privacy of the person in the photo, how likely are you to share this photo on social media?
  1.Extremely unlikely, 2. Moderately unlikely, 3. Slightly unlikely, 4. Neither unlikely nor likely, 5. Slightly likely, 6. Moderately likely, 7. Extremely likely

**Social Media Privacy Questionnaire**: Answer each of the questions below with options: i) Yes ii) Maybe iii) No

1) Has anyone ever shared a picture of you online that you did not want them to share?
2) Has anyone ever shared a picture of you online that you felt violated your privacy?
3) Have you ever been embarrassed by a picture of yourself that has been posted online?
4) Have you ever regretted posting a picture of yourself online?
5) Have you ever accidentally posted a picture of yourself online that you did not want to share?
6) Have you ever shared an embarrassing picture online of someone else you know?
7) Have you ever regretted posting a picture online of someone else you know?
8) Have you ever posted a picture online of someone else you know, which may have violated his or her privacy?
9) Have you ever shared an embarrassing picture online of

a stranger (someone that you do not personally know)?
10) Have you ever regretted posting a picture online of a stranger (i.e., someone you do not personally know)?
11) Have you ever posted a picture of a stranger (i.e., someone you do not personally know), which may have violated his or her privacy?
12) Do people you know post pictures that might be embarrassing to other people?
13) Has anyone you know regretted posting a picture of another person?
14) Has anyone you know regretted posting a picture of themselves?
15) Has anyone you know posted a picture that may have violated someone's privacy?

**Privacy Preference Question**

Are you a private person who keeps to yourself or an open person who enjoys sharing with others?

1) Very private . . . 7) Very open