How Taking Photos Increases Enjoyment of Experiences

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Experiences are vital to the lives and well-being of people; hence, understanding the factors that amplify or dampen enjoyment of experiences is important. One such factor is photo-taking, which has gone unexamined by prior research even as it has become ubiquitous. We identify engagement as a relevant process that influences whether photo-taking will increase or decrease enjoyment. Across 3 field and 6 lab experiments, we find that taking photos enhances enjoyment of positive experiences across a range of contexts and methodologies. This occurs when photo-taking increases engagement with the experience, which is less likely when the experience itself is already highly engaging, or when photo-taking interferes with the experience. As further evidence of an engagement-based process, we show that photo-taking directs greater visual attention to aspects of the experience one may want to photograph. Lastly, we also find that this greater engagement due to photo-taking results in worse evaluations of negative experiences.

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Experiences play a vital role in people's lives and well-being. In particular, experiences shape people's identities and contribute to their life satisfaction (Singer & Salovey, 1993; Van Boven & Gilovich, 2003). Hence, learning more about the factors that make those experiences more or less enjoyable is important.

One critical factor that has been shown to affect enjoyment is the extent to which people are engaged with the experience (Csikszentmihalyi, 1997; Higgins, 2006). While many individual and situational forces could potentially influence engagement, in this paper we are interested in one highly prevalent behavior that may affect engagement and thus enjoyment of experiences: whether or not people take pictures during an experience. Certainly, photo-taking may have multiple important downstream effects (e.g., on memory), yet our interest in this paper is to specifically understand whether enjoyment of the experience itself is affected by whether or not people take photos during that experience.

With recent technological innovations and the widespread availability of camera phones, photo-taking has become a daily and ubiquitous activity for millions of people. While it is difficult to assess precisely how many photos people actually take, the *New York Times* estimates that in 2010, people took 0.3 trillion photos worldwide, and this number will reach 1.3 trillion by 2017 (Heyman, 2015). In addition, the number of photos being uploaded on different social media sites every day can provide a lower-bound estimate of the number of photos taken. For example, Facebook reports that their worldwide users upload two billion pictures daily (Bandaru & Patiejunas, 2015), and Instagram (2015) users upload 80 million photos per day.

With the explosion in the number of photos taken, the breadth of experiences being documented has also expanded. Traditional tourist spots such as Disneyland or New York City, usually part of special experiences, are still photographed heavily (Gigaom Blog, 2014; Wong, 2014). However, beyond these special trips and

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events, people are also increasingly taking photos of almost any type of experience, including the more mundane details of their daily lives, such as their food (Murphy, 2010).

Surprisingly, despite the prevalence of photo-taking today, prior research has not studied how taking photos affects the experiences being photographed. In this paper, we are interested in this very question: how does photo-taking affect people's enjoyment of their experiences? Lay beliefs regarding this question vary widely. For example, some business owners and performers have banned cameras from restaurants and concerts, arguing that taking photos will ruin individuals' experiences (Stapinski, 2013; Wright, 2012). However, the prevalence of photo-taking across countless situations suggests that many individuals do not share this opinion. In order to more systematically assess people's lay beliefs on this topic, we asked 203 online respondents (65% male, 18 to 60 years, average age: 30.3 years) for their intuition about the effect of photo-taking on their experiences. Approximately 41% thought that taking photos during an experience would *increase* enjoyment of the experience, while 31% thought it would *decrease* enjoyment, and 28% thought it would *not affect* enjoyment at all.

Clearly, people do not share a single intuition as to how taking photos will affect their evaluation of experiences. To answer this question, we systematically examine how taking photos during an experience affects enjoyment of that experience, even without examining the pictures taken.

Photo-Taking and Enjoyment of Experiences

Given the significance of experiences to people's identities and life, it is important to understand what factors render positive experiences more or less enjoyable. In particular, we are interested in how taking photos during experiences affects the enjoyment of those experiences for two main reasons. First, due to the prevalence of photo-taking, any effect that photo-taking may have on the enjoyment of experiences would be pervasive and far-reaching. Second, as we will discuss in greater length below, prior research makes no clear a priori prediction about whether photo-taking would enhance or diminish enjoyment of an experience. Two different perspectives point to the same underlying process, namely that photo-taking will affect enjoyment through its impact on engagement with the focal experience, but whether photo taking will enhance or decrease engagement, is an open question.

In line with prior work, we define engagement as the extent to which one attends to and is immersed in the experience itself (e.g., Csikszentmihalyi, 1997; Higgins, 2006; Killingsworth & Gilbert, 2010). For many positive experiences, greater engagement with and attention to the experience may increase enjoyment (Csikszentmihalyi, 1997; Killingsworth & Gilbert, 2010). Indeed, prior work has shown that carefully attending to an experience can heighten enjoyment, even when the experience is enjoyable to begin with (e.g., eating chocolate cake; LeBel & Dubé, 2001). Similarly, being more actively engaged in an experience can also lead to greater enjoyment (Larsson, Västfjäll, & Kleiner, 2001). Such active engagement may cause people to become immersed in an experience, which has been shown to boost feelings of joy (Csikszentmihalyi, 1997). Hence, to the extent that taking photos increases engagement during the experience, it may enhance enjoyment.

Importantly, however, based on prior literature, it is unclear whether photo-taking will in fact increase or decrease engagement. Next, we outline two different perspectives on how photo-taking may affect engagement and thus enjoyment.

On the one hand, taking photos can be seen as a secondary task that reduces engagement and enjoyment by forcing attentional shifts. Much prior work has examined how performing two distinct tasks concurrently affects cognitive functions, focusing particularly on response latencies and accuracy as outcome measures (for a review, see Pashler, 1994). While a number of different processes are triggered when performing two tasks concurrently (e.g., task switching, response selection, etc.), one important process involves attention. When multiple tasks tap into the same attentional resources, they divide attention, which can then impede performance. In addition to affecting performance, prior research has shown that task *enjoyment* may also be affected by concurrent tasks. For example, engaging in a focal enjoyable experience (e.g., watching a TV show) in parallel with another enjoyable experience (e.g., using Facebook) can reduce enjoyment with the focal experience (Oviedo, Tornquist, Cameron, & Chiappe, 2015). To the extent that taking photos reduces engagement by creating a distraction, thus dividing and shifting attention, photo-taking may lower enjoyment of the experience.

On the other hand, one may also argue that photo-taking could increase engagement and thus heighten enjoyment. In traditional dual-task situations, people divide and shift their attention between two or more unrelated tasks. However, taking photos during an experience differs from such situations, because taking photos generally requires attention being directed *toward* the experience one wants to capture. As such, photo-taking may not direct attention away from the experience but may instead focus attention onto the experience. This potential effect of photo-taking may parallel findings from the domain of driving, where prior research has found that being a driver (compared to being a passenger), concentrates attention, particularly toward areas that provide information relevant to the task at hand (e.g., center of the road; Mackenzie & Harris, 2015). Where attention will be directed likely depends on the nature of the task. For photo-taking, attention should be directed toward aspects of the experience one may want to photograph. To the extent that taking photos increases engagement by focusing attention on positive experiences, taking photos may increase enjoyment of the experience.

Given these contradictory perspectives, in order to answer our key question regarding the effect of photo-taking on *enjoyment*, we need to examine empirically whether, and under what conditions, capturing an experience in photos will increase or decrease *engagement* in that experience.

Overview of the Current Research

In this paper, we examine the effect of photo-taking on enjoyment across a broad range of experiences (e.g., bus tours, meals, museum visits), focusing on experiences where active photo-taking is socially acceptable and consistent with current behavioral norms (e.g., not at a funeral). Across nine studies, we directly manipulate whether people can or cannot take photos during an experience, and then examine the impact of photo-taking on enjoyment and the underlying role of engagement. Overall, the focus of our investigation is on contrasting photo-taking during an ex-

perience to not doing so. When taking photos in our studies, participants endogenously decide how many photos to take. Empirically, the number of photos taken does not account for, or alter the results in any one of our studies. We will, however, discuss the role of number of photos taken in the General Discussion.

The first four studies examine the basic effect of photo-taking on engagement and enjoyment, both in the field and in the lab. Studies 1 and 2 test the effect of photo-taking in the field during a more special experience (i.e., a city bus tour; Study 1) and a more mundane experience (i.e., eating lunch; Study 2). Studies 3 and 4 utilize a computerized lab paradigm we developed to mimic key features of a first-person experience, such as the bus tour used in Study 1. This paradigm provides us with greater control over the environment, allowing us to more precisely isolate the effect of photo-taking, as well as the engagement mechanism.

In the next two studies, we more closely examine the engagement process. By manipulating whether participants actually take photos or merely plan to take photos, we show that it is not the mechanics of taking photos but rather the mental process of taking photos that leads to greater engagement (Study 5). We also examine behavioral manifestations of the engagement process using an eye-tracking methodology during a real-life museum visit. Results reveal that taking photos heightens attention, that is, photo-taking leads to longer and more frequent fixations on objects likely to be photographed (Study 6).

The last set of studies tests implications and boundaries of the photo-taking effect and the role of engagement. We examine how the act of photo-taking may interfere with the experience and thus may reduce its positive effect on enjoyment (Study 7). We also show that when the experience is already sufficiently engaging to begin with, photo-taking does not have any additional effect on engagement or enjoyment (Study 8). Finally, we show that when photo-taking increases engagement with negative experiences, enjoyment during the experience actually worsens (Study 9).

Study 1: The Effect of Photo-Taking on Enjoyment of a Real-Life Bus Tour

This field study examines the effect of photo-taking in a natural context where people commonly take photos: a double-decker city bus tour. We contracted with an actual tour bus company and tour guide to offer university students a real bus tour of Philadelphia. This natural setting, where taking photos is common, provides an externally valid test for the presence of the basic effect of photo-taking on enjoyment.

Method

One hundred eighty-eight people (56% female, mean age = 22.3) participated in this study.[1] This study was conducted on a single day, with 21 to 24 participants signed up each hour between 9 a.m. and 4 p.m. At their scheduled time-slot, participants checked in with research assistants at a central campus location at the University of Pennsylvania where they received written instructions about the study. Because photo-taking is visible to other participants, each hourly tour was assigned to either a photo or no-photo condition. The two conditions were alternated every hour, with the first hour determined by a coin flip.

After receiving their instructions, participants proceeded to the double-decker bus, where they were randomly assigned a specific seat on the upper level. Every participant sat in their own row on the outside edge of the bus, so as to ensure optimal viewing and photo-taking opportunities and to avoid social interactions with others on the tour. Participants in both conditions left their belongings (including cell phones) on the bottom level of the bus with a research assistant. Hence, none of the participants had access to their own photo-taking devices during the tour.

Participants in the photo condition ($n = 95$) were then provided with a digital camera and a new memory card, which they returned at the end of the tour. These participants were told, "People often take photos of their experiences. During your tour, please use the camera provided to take photos as you normally would in this context. Please take at least 10 photos during your experience." Participants in the no-photo condition ($n = 93$) were told, "Please experience the tour as you normally would when going on a sightseeing tour." On average, participants in the photo condition took 35 photos ($SD = 18.64$, Min = 10, Max = 116). The number of photos taken was not significantly correlated with enjoyment, $r = .01$, $p = .887$.

The tour bus followed a predetermined route that included over 10 sights frequented by Philadelphia tourists and residents alike (e.g., famous statues, buildings, public squares, museums). During the tour, a professional tour guide working for the bus company provided verbal information about the sights based on a previously written script to ensure that each group received as close to the same experience as possible. Participants were told not to ask questions during the tour, again to hold the experience as constant as possible across hours.

After participants completed the tour, they returned to the location where they had checked in to complete a short survey. The exact wording for all questions asked in this and all subsequent studies can be found in the supplementary online materials; we will focus our reporting on the focal measures relevant to our research question. The survey first asked participants to rate how much they enjoyed the bus tour experience, our primary dependent measure that will be used across all studies. As a measure of engagement we asked participants to rate how immersed they felt in the bus tour experience. Both questions were measured on a 15-point Likert scale from 1 (*not at all*) to 15 (*extremely*). After the study was completed, one research assistant downloaded the photos from each participant's memory card and counted the number of photos taken.

[1] Sample sizes in the field studies (Studies 1, 2, 6) were determined by the number of participants we could recruit over the time frame available to us (e.g., one day in the case of Study 1). For studies conducted in the behavioral lab, sample size was determined by number of attendants over a standard week-long lab session, which typically attracts 200 to 240 participants. For studies recruiting participants from Amazon's Mechanical Turk (MTurk), we aimed for at least 70 participants per cell. The sample size for the eye tracking study was in line with studies using this particular methodology and the labor-intensive nature of running participants through the study individually in an actual museum exhibit.

Results

We estimated an analysis of variance (ANOVA) with condition as the between-subjects manipulated factor.[2] Importantly, those who took photos enjoyed the experience significantly more (M = 11.13, SD = 2.35, 95% CI [10.54, 11.71]) than those who were not able to take photos (M = 10.23, SD = 3.32, 95% CI [9.64, 10.81]), $F(1, 186) = 4.62$, $p = .033$, partial $\omega^2 = 0.02$.

Our manipulation also had a small but nonsignificant effect on engagement, $F(1, 186) = 2.28$, $p = .133$, partial $\omega^2 = 0.01$, with those who took photos reporting they were slightly more engaged (M = 10.07, SD = 3.04, 95% CI [9.39, 10.75]) than those who did not take photos (M = 9.33, SD = 3.67, 95% CI [8.65, 10.02]).

Discussion

The main goal of Study 1 was to examine the effect of photo-taking on enjoyment in an extended, real-life experience during which people often take photos. We find that individuals who took photos during the bus tour enjoyed their experience more than individuals who did not take photos. In this complex, real-life experience, we find only suggestive evidence for the role of engagement. Given the noisy environment, the logistical constraints, and the maximum sample size possible, our manipulation only had a small effect on engagement. Subsequent studies will attempt to heighten the power to detect the engagement process by strengthening the manipulation relative to the environment, and by using multi-item as well as behavioral attention measures to capture the effect on engagement.

Study 2: The Effect of Photo-Taking on Enjoyment of an Eating Experience

In the first study, participants signed up for a study involving a tourist experience. In Study 2, we recruited diners at the seating area of a historic farmers' market food court during two Thursday afternoons. This field setting was selected because taking photos of one's dining experience is an increasingly common phenomenon (Murphy, 2010), and we were interested in exploring how taking photos during a mundane, self-chosen experience such as a mid-week meal would affect enjoyment. This setting also presented a natural social activity. Most participants (88%) dined with somebody else, yet the number of people dining together had no effect on the results.

Method

One hundred forty-nine visitors (56% female, mean age = 32.8) to the food court of Reading Terminal Market, a historic farmers market in Philadelphia, participated in a study for a candy bar. Visitors were approached by a research assistant and asked to participate in a quick study that would involve their eating experience. Then, they were then randomly assigned to one of two conditions and given a sheet of paper with written instructions. In the photo condition, participants read, "While you eat your meal, please take at least three photos of your eating experience." Everybody who took photos did so on their own device (camera or cell phone), giving them potential usage of these photos in the future. In the control condition, participants read, "Eat your meal as you normally would." Participants agreed to participate before being assigned to condition, and no one opted out of the study or refused to continue after reading their instructions.

Overall, participants in the photo condition took significantly more photos (M = 4.48, SD = 7.54, 95% CI [3.16, 5.80]) than participants in the control condition (M = 0.83, SD = 3.09, 95% CI [−0.47, 2.13]), $F(1, 147) = 15.16$, $p < .0001$, partial $\omega^2 = 0.09$. One participant in the photo condition (1.4%) did not take pictures, and 15 participants in the control condition (19.7%) did take photos. The analyses we report include all participants as they were assigned to conditions, but results hold when restricting respondents to actual photo and nonphoto takers.

When participants showed signs of completing their meal, they were given a short survey by the research assistant with the same enjoyment and immersion questions from the previous study. As a manipulation check, participants were asked how many photos they took during their eating experience.

Results

Enjoyment and engagement. Consistent with Study 1, we found that taking photos had a significant effect on enjoyment, $F(1, 147) = 9.74$, $p = .002$, partial $\omega^2 = 0.06$, such that individuals in the photo condition enjoyed the experience more (M = 13.33, SD = 1.96, 95% CI [12.81, 13.85]) than individuals in the control condition (M = 12.17, SD = 2.52, 95% CI [11.66, 12.68]). A similar pattern emerged for engagement, $F(1, 146) = 6.52$, $p = .012$, partial $\omega^2 = 0.04$,[3] such that individuals in the photo condition were significantly more immersed in the experience (M = 12.44, SD = 2.54, 95% CI [11.85, 13.03]) than individuals in the control condition (M = 11.37, SD = 2.53, 95% CI [10.79, 11.95]).

Mediation analysis. To test whether engagement mediates the effect of photo taking on enjoyment, we conducted a bootstrap analysis with 10,000 samples (Hayes, Preacher, & Myers, 2011; MacKinnon, Fairchild, & Fritz, 2007) using photo-taking condition as the independent variable (control = 0; photo = 1), engagement as the mediator, and enjoyment as the dependent variable. The 95% CIs did not include zero, indicating that engagement mediates the effect of photo-taking on enjoyment (indirect effect = 0.55, SE = 0.21, 95% CI [0.15, 0.99]). Controlling for engagement, the direct effect of photo-taking on enjoyment was also significant (direct effect = 0.62, SE = 0.31, 95% CI [0.003, 1.24]), suggesting partial mediation.

Discussion

Study 2 provides evidence in a day-to-day setting that taking photos causes individuals to enjoy a mundane experience more than when they do not take photos. We also find evidence that photo-taking heightens engagement and that this engagement in the experience in turn heightens enjoyment.

[2] We also estimated a model that included time slot nested within condition, as a control to capture differences between each hour. Time slot did not have a significant effect on enjoyment, $F(6, 180) = 1.28$, $p = .270$, or engagement $F(6, 180) = 1.40$, $p = .218$, and hence was not included in the model reported in the main text.

[3] One individual did not respond to the question about how immersed they were in the experience. In our analyses, we use all available data for each measure.

In the following studies, we will test the effect of photo-taking in a more controlled environment. To do so, we developed a lab paradigm that mimics key features of a first-person experience, such as a bus tour or a concert. This experimental set-up allows us not only to examine the effect of photo-taking, but also to manipulate different aspects of the photo-taking process in order to better understand the underlying mechanism.

Study 3: The Effect of Photo-Taking Under Controlled Conditions

Study 3 tests the effect of photo-taking that we observed in the field in a controlled lab environment. Like Study 1, this first lab study contrasts the effect of photo-taking to not having the option to take photos. We use a unique computer interface that presents participants with first-person videos of real-life experiences and asks them to imagine actually experiencing the events as if they were there themselves. This allows us to simulate key features of an actual experience in the lab, while maintaining control over what participants see and ensuring that the experience is identical across conditions. For those in the photo-taking condition, the interface mimics a camera screen, and they can take pictures of the experience by clicking a camera icon with their mouse. Participants do not have access to their photos following the experience, allowing us to isolate the effect of photo-taking on enjoyment, separate from the effect of revisiting one's photos.

Method

Two hundred thirty-four students (70% female, mean age = 21.2) at a northeastern university participated in a multistudy session for which they were paid $10. Participants experienced two first-person videos (3–4 min each) of guided bus tours of London, England, and Hollywood, California, and were asked to imagine they were actually experiencing these events themselves. Participants could choose which city to visit first, which did not affect any of the results.

Participants were randomly assigned to either a no-photo or a photo condition. In the no-photo condition, participants simply experienced the bus tours. In the photo condition, participants could take as many photos of the experience as they wanted by clicking a camera icon with their mouse. Each photo taken immediately appeared as a thumbnail at the bottom of the screen. See Figure 1 for a screenshot of the photo-taking interface. Over the course of both focal bus tours, participants in the photo condition took on average 36 photos (SD = 24.66, Min = 6, Max = 136).

Figure 1. Screenshot of the photo-taking interface in Studies 3–5, 7, and 9. See the online article for the color version of this figure.

We first introduced a short (38-s) first-person video of a safari to familiarize participants with their respective conditions. In particular, this allowed participants in the photo condition to practice taking photos and to overcome any initial curiosity with the interface. Following the bus tours, participants reported how much they enjoyed this experience (1 = *not at all* to 7 = *very much*), how immersed they felt in the experience (1 = *not at all* to 7 = *extremely*), and to what extent they felt really part of the experience (0 = *I felt I was not at all part of the experience* to 100 = *I felt I was entirely part of the experience*). The factor score of the latter two measures served as our measure of engagement, $r = .76$, $p < .0001$.

Participants also rated how much they enjoyed the experience two additional times: 30 min later after completing two unrelated studies (94% of participants completed Time 2) and online after 1 week (71% of the original participants provided Time 3 responses in exchange for a $3 gift card). This was done to explore the robustness of the effect of photo-taking *during* the experience on enjoyment over time. Response rate for Time 3 did not differ significantly between conditions (no photo: N = 73, 66%, photo: N = 92, 75%, $\chi^2 = 2.29$, $p = .130$) and Time 1 enjoyment did not affect whether or not respondents returned at Time 3 ($\chi^2 = .03$, $p = .873$). Importantly, neither at Time 2 nor Time 3 did participants revisit any of the photos they had taken, thus allowing us to examine purely the effect of photo-taking on remembered enjoyment, without any influence of memory cues after the experience had ended.

Results

Enjoyment and engagement (Time 1). Replicating the finding from the two field studies, participants who took photos during the bus tour enjoyed the experience more (M = 4.06, SD = 1.46, 95% CI [3.79, 4.32]) than participants who did not take photos (M = 3.62, SD = 1.53; 95% CI [3.34, 3.90]), $F(1, 232) = 4.96$, $p = .027$, partial $\omega^2 = 0.02$. As before, participants who took photos during the bus tour were also more engaged (M = .28, SD = 1.01, 95% CI [0.11, 0.45]) than individuals who did not take photos (M = −0.31, SD = .89; 95% CI [−0.49, −0.14], $F(1, 232) = 22.87$, $p < .0001$, partial $\omega^2 = 0.09$.

Mediation analysis (Time 1). We conducted a bootstrap analysis with the same specifications as in Study 2, using photo-taking condition as the independent variable (no photo = 0; photo = 1), engagement as the mediator, and enjoyment as the dependent variable. The 95% confidence intervals did not include zero, indicating that engagement mediates the effect of photo-taking on enjoyment (indirect effect = 0.52, SE = 0.12, 95% CI [0.31, 0.78]), and lending further support for the proposed mechanism. Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = −.09, SE = 0.17, 95% CI [−0.42, 0.24]), suggesting full mediation.

Enjoyment over time (Time 1, 2, and 3). In order to test for robustness and examine whether the effect of photo-taking on

enjoyment persists over time, we estimated a mixed ANOVA with photo-taking as a between-subjects factor and time of response as a within-subjects factor. This analysis is based on 156 participants who provided responses at Times 1, 2, and 3. Notably, even over time, those taking photos enjoyed the experience more (M = 3.95, SD = 1.41, 95% CI [3.65, 4.24]) than those who did not take photos (M = 3.39, SD = 1.38, 95% CI [3.06, 3.72]), $F(1, 154) = 6.09$, $p = .015$. We also found a main effect of time, $F(2, 308) = 5.25$, $p = .006$, and a time by condition interaction, $F(2, 308) = 3.12$, $p = .046$. For those who did not take photos, remembered enjoyment decreased over time, $F(1, 68) = 4.50$, $p = .038$; however, for those who did take photos, enjoyment did not change over time, $F(1, 86) = 0.49$, $p = .485$. These results are depicted in Figure 2.

Discussion

Holding constant the underlying experience in a setting that mimics our initial bus tour field study, we replicate our main finding that photo-taking heightens felt engagement and enjoyment. Interestingly, this effect on enjoyment persists over time even though participants were unable to revisit their pictures. Moreover, while remembered enjoyment for those who did not take photos decreased over time, for those who did take photos, enjoyment remained higher and more stable over time. We will further test the robustness of our findings in the next study by examining a different context during which people often take photos.

Study 4: How Taking More or Less Visually Homogeneous Photos Affects Experiences

One may wonder whether taking photos has a bigger effect when the photos one takes during the experience are more visually diverse, but may have less of an effect when photos are more visually homogenous. To test the robustness of our results to the visual characteristics of the photos taken, in this study we manipulate the focal experience: participants experienced either the bus tours used in Study 3, or concerts where the singers were standing in front of a plain background for the entire performance. Photos taken during the bus tours were more visually heterogeneous, while photos taken during the concerts were more visually homogenous. This allows us to examine whether photo-taking has a similar effect regardless of the visual diversity of the photos taken.

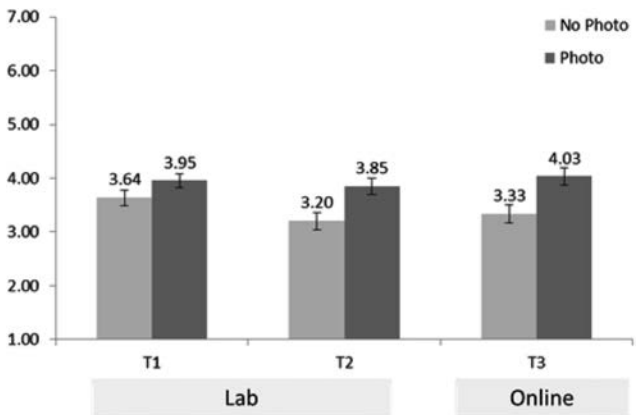

Figure 2. Enjoyment over time in Study 3. Error bars represent ±1 *SE*.

Method

Two hundred twenty-eight students (64% female, mean age = 23.5) at a northeastern university participated in a multistudy session for which they were paid $10. Participants were randomly assigned to one of four conditions in a 2 (Photo-Taking: yes vs. no) × 2 (Experience Type: bus tours vs. concerts). Like in Study 3, those in the no-photo condition simply experienced the event, while those in the photo condition could take pictures of the event as they experienced it. We also manipulated the nature of the event: participants either experienced two bus tours (London and Hollywood, a visually heterogeneous experience) or two concerts (Rihanna and Of Monsters and Men). Both concerts involved the musicians performing a single song on a stage with a plain and nonchanging background, a visually homogenous experience. To give participants some sense of control over their experience, we allowed them to choose which bus tour or concert they experienced first. There were no significant differences in the number of photos taken between the two experiences (M_{bus} = 23.86, SD_{bus} = 13.09, 95% CI [19.95, 27.77]; $M_{concert}$ = 23.51, $SD_{concert}$ = 16.64, 95% CI [19.75, 27.26]), $F(1, 119) = .02$, $p = .897$.

Similar to Study 3, participants responded to the same enjoyment item, and two engagement items ($r = .69$, $p < .001$) right after the experience ended, as well as their enjoyment 30 min later, after completing two unrelated studies (N = 223, 98% of participants completed Time 2) and online after 1 week (N = 164, 72% of the original participants provided Time 3 responses in exchange for an additional $3 gift card). Note that participants never saw the photos they had taken after the focal experience had concluded. Response rate for Time 3 did not differ significantly between photo-taking conditions for either experience (bus: no photo: N = 35, 73%, photo: N = 41, 71%, $\chi^2 = .06$, $p = .800$; concert: no photo: N = 40, 68%, photo: N = 48, 76%, $\chi^2 = 1.06$, $p = .301$) and Time 1 enjoyment did not affect whether or not respondents returned at Time 3 ($\chi^2 = .01$, $p = .937$).

Results

Enjoyment and engagement (Time 1). As before, we find a main effect of photo-taking on enjoyment, $F(1, 224) = 8.98$, $p = .003$, partial $\omega^2 = 0.03$. Individuals in the photo condition enjoyed the experience more (M = 4.06, SD = 1.58, 95% CI [3.77, 4.34]) than individuals in the no-photo condition (M = 3.44, SD = 1.64, 95% CI [3.11, 3.72]). There was also a marginal effect of experience type, $F(1, 224) = 2.99$, $p = .085$, partial $\omega^2 = 0.01$; participants enjoyed the concerts slightly more (M = 3.93, SD = 1.65, 95% CI [3.63, 4.20]) than the bus tours (M = 3.58, SD = 1.60, 95% CI [3.24, 3.86]). Importantly, though, the interaction of experience type and photo-taking was not significant, $F(1, 224) = 0.35$, $p = .557$, suggesting that photo-taking increases enjoyment similarly across these types of experiences. These results are depicted in Figure 3.

We also found a main effect of photo-taking on engagement, $F(1, 224) = 11.47$, $p < .001$, partial $\omega^2 = 0.04$. Individuals in the photo condition were more engaged in the experience (M = 0.20,

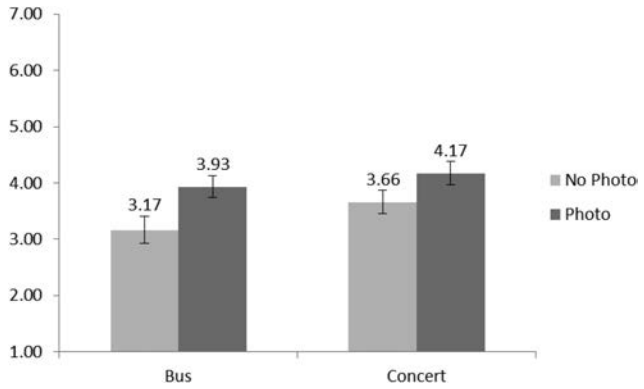

Figure 3. Enjoyment as a function of photo-taking and experience type in Study 4. Error bars represent ±1 *SE*.

SD = 1.01, 95% CI [0.04, 0.38]) than individuals in the no-photo condition (*M* = −0.23, *SD* = .95, 95% CI [−0.42, −0.04]). There was no significant main effect of experience type, $F(1, 224) = 1.73$, $p = .190$, nor was there a significant interaction, $F(1, 224) = 1.73$, $p = .190$.

Mediation analysis (Time 1). We again conducted a bootstrap analysis with 10,000 samples, using photo-taking condition as the independent variable (no photo = 0; photo = 1), engagement as the mediator, experience type as a control variable, and enjoyment as the dependent variable. The 95% confidence intervals did not include zero, indicating that engagement mediates the effect of photo-taking on enjoyment (indirect effect = 0.44, *SE* = 0.14, 95% CI [0.18, 0.74]), and lending further support for the proposed mechanism. Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = .19, *SE* = 0.17, 95% CI [−0.15, 0.52]), suggesting full mediation.

Enjoyment over time (Time 1, 2, and 3). In order to test for robustness and to examine the effect of photo-taking on enjoyment over time, we estimated a mixed ANOVA with photo-taking and experience type as between-subjects factors and time of response as a within-subjects factor. This analysis is based on 161 participants who provided responses at Times 1, 2, and 3. Importantly, even over time, those taking photos enjoyed the experience more (*M* = 4.05, *SD* = 1.44, 95% CI [3.72, 4.34]) than those who did not take photos (*M* = 3.40, *SD* = 1.53, 95% CI [3.04, 3.72]), $F(1, 157) = 7.68$, $p = .006$, partial $\omega^2 = 0.04$. We also found a main effect of experience type, $F(1, 157) = 4.09$, $p = .045$, partial $\omega^2 = 0.02$, indicating that participants enjoyed the concert experience (*M* = 3.97, *SD* = 1.46, 95% CI [3.63, 4.26]) more than the bus tours (*M* = 3.50, *SD* = 1.54, 95% CI [3.13, 3.81]). Finally, the three-way interaction of time by photo-taking condition by experience type was significant, $F(2, 314) = 3.36$, $p = .036$; however, none of the underlying two-way interactions were significant (time by photo-taking interaction: for bus conditions, $F(2, 144) = 1.82$, p .166; for concert conditions, $F(2, 170) = 1.69$, p .188; time by experience type interaction: for no-photo condition, $F(2, 142) = 1.91$, p .152; for photo condition, $F(2, 172) = 1.95$, p .146; photo-taking by experience type interaction: Time 1, $F(1, 157) = 1.72$, p .191; Time 2, $F(1, 157) = 0.02$, p .895; Time 3, $F(1, 157) = 0.07$, p .793. As such, we do not think the three-way interaction provides any interpretable insight. All two-way interactions are graphically depicted in the supplementary online materials.

Discussion

This study replicates the findings from earlier studies with experiences where the photos taken during the experiences are more or less visually homogenous. Our results show that taking photos increases enjoyment and engagement regardless of whether the actual photos taken were more or less similar to each other. Further, consistent with Studies 2 and 3, we find support for the proposed engagement-based mechanism via mediation. Moreover, this study allows us to further examine the effect of photo-taking on engagement and enjoyment of the experience, even in situations where a crucial aspect of the situation (i.e., the music from the concert) cannot be documented via photos. Note, though, that while the effect of photo-taking persists over time, the interaction of photo-taking by time we observed in Study 3, did not replicate.

In the following studies, we further examine the relationship between photo-taking and engagement. One aspect of taking a photo is the physical act of pushing a button. This aspect is particularly salient in our lab paradigm where photos are taken via mouse-click. In Study 5, we separate the mechanics of taking photos from the mental process of taking photos to examine their effect on engagement.

Study 5: The Effect of Taking Photos Versus Planning to Take Photos

In this study, we compare taking photos not just to our standard control of not taking photos, but importantly, also to planning to take photos. To the extent that the process of planning which photos to take engages people in a similar way as actually taking photos does, planning should lead to similar results as photo-taking. Such a pattern of results would also provide additional support for the validity of our lab paradigm by showing that it is not the mechanical aspect of the task, such as clicking a camera button, that heightens enjoyment.

Method

Two hundred twenty-three MTurk workers (46% female, mean age = 33.2) participated in this study. Participants were randomly assigned to one of three conditions: photo, no photo, and planned photo. All participants experienced the first-hand London bus tour used in previous studies. As before, in the no-photo condition participants were asked to simply experience the bus tour, while those in the photo condition were asked to take photos as they normally would on such a tour. Participants took on average 21 photos (*SD* = 12.06, Min = 2, Max = 58). In the planned photo condition participants read, "As people often take pictures during events that they are experiencing, we also will ask you to plan out the photos you would take on the experience, as you would if you were actually there taking photos." Thus, the experience itself was the same for this condition as the no-photo condition (i.e., no photo-taking capability). However, the objective with which participants approached the situation was more similar to the photo condition. As such, this study lets us disentangle the mechanical

act of taking photos from the mental process that photo-taking activates. Following the experience, participants reported how much they enjoyed the experience, and responded to the same two measures of engagement used in the previous lab studies, $r = .87$, $p < .0001$.

Results

Enjoyment and engagement. The pattern of results for enjoyment showed the predicted differences between conditions, $F(2, 220) = 5.05$, $p = .007$, partial $\omega^2 = 0.04$. Planned contrasts replicated our previous findings that taking photos increased enjoyment ($M = 5.36$, $SD = 1.40$, 95% CI [5.03, 5.69]) compared to simply experiencing the tour ($M = 4.76$, $SD = 1.49$, 95% CI [4.42, 5.10]), $F(1, 220) = 6.14$, $p = .014$, partial $\omega^2 = 0.02$. Further, planning to take photos ($M = 5.46$, $SD = 1.40$, 95% CI [5.16, 5.77]) also increased enjoyment compared to simply experiencing the tour, $F(1, 220) = 9.05$, $p = .003$, partial $\omega^2 = 0.03$, and led to similar levels of enjoyment as actually taking photos, $F(1, 220) = 0.20$, $p = .653$.

A one-way ANOVA indicated that photo condition had a significant effect on engagement, $F(2, 220) = 12.28$, $p < .0001$. Planned contrasts showed that, similar to the previous studies, taking photos ($M = 0.21$, $SD = 0.84$, 95% CI [−0.01, 0.43]) increased engagement compared to simply experiencing the tour ($M = -0.48$, $SD = 1.11$, 95% CI [−0.71, −0.25]), $F(1, 220) = 18.43$, $p < .0001$. Importantly, planning to take photos ($M = 0.20$, $SD = 0.91$, 95% CI [−0.002, 0.41]) also heightened engagement compared to simply experiencing the tour, $F(1, 220) = 19.31$, $p < .0001$, and further, led to similar levels of engagement as actually taking photos, $F(1, 220) = 0.003$, $p = .955$.

Mediation analysis. We conducted two separate mediation analyses using bootstrap analyses with 10,000 samples. In the first mediation analysis, we compare the photo condition to the no-photo condition (no photo = 0; photo = 1), using engagement as the mediator and enjoyment as the dependent variable. The 95% confidence intervals did not include zero, indicating that engagement mediates the effect of photo-taking on enjoyment (indirect effect = 0.72, $SE = 0.21$, 95% CI [0.34, 1.16]). Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = −.13, $SE = 0.18$, 95% CI [−0.49, 0.24]), suggesting full mediation.

We also estimated a second mediation analysis comparing the planned photo condition to the no-photo condition (no photo = 0; planned photo = 1), again using engagement as the mediator and enjoyment as the dependent variable. The 95% confidence intervals did not include zero, indicating that engagement also mediates the effect of planning to take photos on enjoyment (indirect effect = 0.73, $SE = 0.19$, 95% CI [0.38, 1.11]). Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = −.03, $SE = 0.17$, 95% CI [−0.36, 0.31]), suggesting full mediation.

Discussion

In this study we examined whether it is the psychological process underlying photo-taking that alters engagement and enjoyment, or whether it is the mechanical aspect of taking pictures. We find that thinking about what photos to take has similar effect to actually taking photos, suggesting that is the *mental* process of photo-taking rather than merely the photo-taking mechanics that triggers greater engagement and thus increases enjoyment. This not only provides conceptual insight, but also addresses concerns that the previous lab results were due to the no-photo condition being akin to TV watching, while the photo condition requires a mechanical response. The current findings, therefore, provide further validation of the lab paradigm showing that it is not the specific procedure of the interface that leads to the effect of photo-taking, but a change in the underlying psychology.

Still, it is unclear whether photo-taking influences engagement with *every* aspect of the experience, or whether photo-taking heightens engagement only with certain aspects of the experience, in particular, with those aspects that are more likely to be photographed. In order to gain greater insight into the mechanism, in the next study, we track participants' eye fixations during a real-life museum visit as a behavioral measure of engagement.

Study 6: The Effect of Photo-Taking on Visual Attention in a Natural Setting

So far, we have provided evidence that photo-taking increases engagement with an experience using self-report measures. In this study, we use a behavioral measure of engagement: visual attention as measured by eye fixations. Participants visited an exhibit in a northeastern archaeology museum at their own pace, and were randomly assigned to either take photos during their visit, or to simply experience the exhibit. While in the exhibit, participants across both conditions wore eye-tracking glasses that captured which aspects of the exhibit they fixated on and for how long, allowing us to assess how photo-taking affects visual attention.

Method

Fifty-one students (49% female, mean age = 21.6) participated in this study one at a time. Only participants who did not wear contact lenses or glasses were eligible to participate, due to the constraints of the eye-tracking technology. After checking in with a research assistant outside the exhibit, each participant received written instructions about the study (see supplementary online materials). In particular, participants were told they would go on a self-guided tour of the museum's Japan exhibit and were provided with directions to the entrance. Participants received a map of the exhibit that depicted the location of the exhibit's 14 individual displays, featuring a total of 40 different artifacts, which were the focus of the exhibit. Each display was numbered clockwise, from 1 to 14. Participants were asked to view the exhibit in a clockwise pattern following the map provided, starting with display number one. Thus, while each person visited the exhibit at their own pace, the general sequence of artifacts was the same across participants.

Participants were randomly assigned to either a photo or a no-photo condition. Similar to Study 1, participants in the photo condition were provided with a digital point and shoot camera with an individual memory card and were asked to take at least 10 pictures during their visit. On average, participants in the photo condition took 14 photos ($SD = 3.67$, Min = 3, Max = 21). Participants in the no-photo condition were instructed to experience the exhibit as they normally would.

Next, the research assistant fitted and calibrated the eye-tracking glasses on each participant. After calibration, participants pro-

ceeded to the exhibit, where they spent as much time as they liked. Once participants completed their visit, they returned the equipment and answered several survey questions. In particular, similar to previous studies, participants rated how much they enjoyed the exhibit (1 = *not at all* to 7 = *a lot*) and how immersed they felt in the exhibit (1 = *not at all* to 7 = *extremely*), similar to Studies 1 and 2.

For each participant, the eye tracking-glasses created a video recording of everything the participant saw during his or her time in the exhibit. The software subsequently provided data on eye fixations throughout the experience. We a priori classified different areas of the exhibit into categories, consisting of all 40 focal individual artifacts, as well as all other aspects of the exhibit (e.g., placards, wall; for a listing of all areas see Appendix A). Each video was reviewed by one of three research assistants, blind to the hypothesis, who coded each fixation for which category a given participant was fixated on. Research assistants received a detailed coding guide, attended a training session with one of the authors, and coded a practice video (that was not part of the study), on which they received feedback. After this training, each research assistant coded approximately 17 videos.

Results

Enjoyment and engagement. Replicating our previous findings, participants enjoyed the experience more when they were taking photos ($M = 5.12$, $SD = 1.11$, 95% CI [4.69, 5.54]) compared to when they were not taking photos ($M = 4.36$, $SD = 1.04$, 95% CI [3.93, 4.79]), $F(1, 49) = 6.32$, $p = .015$, partial $\omega^2 = 0.09$. Further, those taking photos also felt they were marginally more engaged in the experience ($M = 4.73$, $SD = 1.15$, 95% CI [4.24, 5.22]) than those not taking photos ($M = 4.08$, $SD = 1.32$, 95% CI [3.58, 4.58]), $F(1, 49) = 3.53$, $p = .066$, partial $\omega^2 = 0.05$.

Mediation analysis. We again conducted a bootstrap analysis with 10,000 samples, with photo-taking condition as the independent variable (no photo = 0; photo = 1), engagement as the mediator, and enjoyment as the dependent variable. The 95% CIs did not include zero, indicating that measured engagement mediates the effect of photo-taking on enjoyment (indirect effect = 0.34, $SE = 0.19$, 95% CI [0.008, 0.77]), lending further support for the proposed mechanism. Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = 0.42, $SE = 0.25$, 95% CI [−0.09, 0.92]), suggesting full mediation.

Analysis of eye tracking. With the eye tracking data, we are particularly interested in examining how taking photos (vs. not) affects the amount of visual attention devoted to different aspects of the exhibit. We examine two different measures of visual attention: total duration participants spent fixating on different aspects of the exhibit, and the frequency with which participants fixated on different aspects of the experience. Both duration and frequency of fixations have been shown to be positively related to the informativeness of and interest in a region (see Henderson & Hollingworth, 1999, for a review). In our main analysis, we compare the amount of visual attention devoted to the artifacts (i.e., the main focus of the exhibit) to the amount of visual attention devoted to all other (nonfocal) aspects of the experience. To assure comparability between conditions, analyses include only fixation types that could have occurred in either condition. That is, we did not include fixations that could only occur in the photo condition (fixations on the camera or while the participant took a picture). We also excluded one extreme response from the analyses.[4]

Duration of fixations. We summed the durations of participants' fixations on any of the 40 artifacts as a measure of visual attention directed toward focal aspects of the exhibit. We further summed the durations of participants' fixations on any of the other, nonfocal aspects of the exhibit. Based on these measures we calculated the proportion of time spent fixating on artifacts relative to the time spent fixating on artifacts and all other areas. Due to the nature of the proportion data, we analyzed these data using PROC GLIMMIX specifying a beta distribution. The results show that participants who took photos spent a larger proportion of their total fixation duration looking at artifacts ($M = 33.77\%$, $SD = 0.12$, 95% CI [0.29, 0.38]) compared to those not taking photos (23.10%, $SD = 0.09$, 95% CI [0.20, 0.27]), $F(1, 48) = 12.60$, $p = .001$.

An alternative way to examine this data is by estimating a mixed ANOVA with duration of fixations on the artifacts and duration of fixations on all other, nonfocal aspects as within-subjects measures, and condition (photo, no photo) as a between-subjects factor. We find a main effect of fixation target (i.e., artifacts vs. all other areas) such that, not surprisingly, participants spent less time looking at artifacts ($M = 65.79$ s, $SD = 45.04$) compared to all other areas combined ($M = 166.37$ s, $SD = 74.64$), $F(1, 48) = 99.39$, $p < .0001$. More importantly, the interaction of condition (photo, no photo) and fixation target is significant, $F(1, 48) = 6.31$, $p = .015$. Specifically, while taking photos does not affect how long participants fixate on other, nonfocal aspects of the experience ($M_{\text{Photo}} = 154.39$, $SD_{\text{Photo}} = 77.66$, 95% CI [124.46, 184.31], $M_{\text{No Photo}} = 178.34$, $SD_{\text{No Photo}} = 71.02$, 95% CI [148.42, 208.27]), $F(1, 48) = 1.30$, $p = .261$, taking photos leads to significantly longer fixations on exhibit artifacts ($M = 79.16$ s, $SD = 55.44$, 95% CI [61.70, 96.62]) compared to not taking photos ($M = 52.43$, $SD = 26.37$, 95% CI [34.97, 69.88]), $F(1, 48) = 4.74$, $p = .034$, partial $\omega^2 = 0.07$. This analysis also allows us to examine the effect of photo-taking for each of the nonfocal areas (e.g., placards, wall) separately. Photo-taking had a significant effect only on the focal aspect of the exhibit (i.e., the artifacts), but not on any of the other nonfocal categories. The results are depicted in Figure 4.

Frequency of fixations. We also analyzed the *frequency* with which participants fixated on artifacts as a function of whether they did or did not take photos. We summed the total number of

[4] As common in eye tracking analysis (Holmqvist et al., 2011), we eliminated data from one participant who took more than three standard deviations longer than the average participant to complete the study. Results reported are based on the remaining sample ($N = 50$). Including this outlier in the analyses does not affect the analyses using proportions. It does affect the mixed ANOVA analyses: when analyzing total duration of fixations, the key interaction or fixation target and photo-taking condition becomes statistically weaker, $F(1, 49) = 2.98$, $p = .091$, but the critical simple effect of photo-taking on artifact fixation remains significant, $F(1, 49) = 5.08$, $p = .029$, partial $\omega^2 = 0.074$. When analyzing the frequency of fixations without this participant, again the interaction becomes statistically weaker, $F(1, 49) = 1.97$, $p = .167$, but again the critical simple effect of photo-taking on artifact fixation remains significant, $F(1, 49) = 5.78$, $p = .02$, partial $\omega^2 = 0.09$.

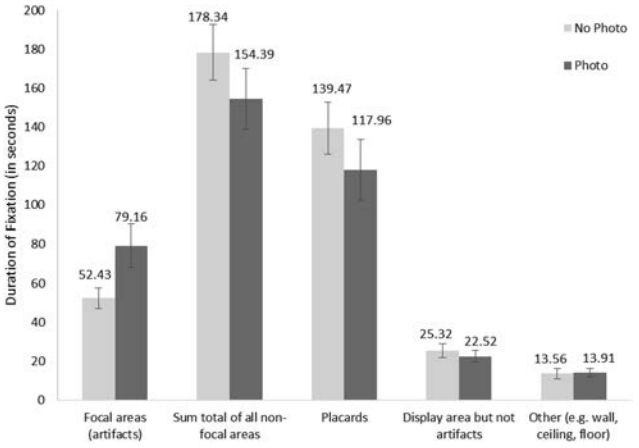

Figure 4. The effect of photo-taking on duration of fixations in Study 6. Error bars represent ±1 *SE*.

fixations on any of the 40 artifacts, as well as the total number of fixations on all other, nonfocal areas of the exhibit. Based on these measures we calculated the proportion of frequencies with which participants fixated on artifacts relative to the frequencies spent fixating on artifacts and all other areas. We analyzed these proportions using PROC GLIMMIX and specifying a beta distribution. This analysis shows that for those taking photos the proportion of their fixations on artifacts is larger (M = 33.01%, SD = 0.12, 95% CI [0.28, 0.37]) compared to those not taking photos (M = 23.41%, SD = 0.09, 95% CI [0.20, 0.28]), $F(1, 48) = 10.39$, $p = .002$.

In order to parallel the approach used for duration of fixations, we again estimated a mixed ANOVA. We again find a main effect of fixation target (artifacts vs. all other, nonfocal areas) such that participants fixated less on the artifacts (M = 373.84, SD = 237.92) than on all other areas combined (M = 971.58, SD = 423.49), $F(1, 48) = 105.67$, $p < .0001$. Importantly, the interaction of condition (photo, no photo) and fixation target is also significant, $F(1, 48) = 4.41$, $p = .041$. While taking photos does not affect how frequently participants fixate on other, nonfocal aspects of the experience (M_{Photo} = 924.36, SD_{Photo} = 440.30, 95% CI [753.39, 1,095.33], $M_{\text{No Photo}}$ = 1,018.80, $SD_{\text{No Photo}}$ = 409.45, 95% CI [847.83, 1,189.77]), $F(1, 48) = 0.62$, $p = .436$, taking photos significantly increases the number of fixations on exhibit artifacts (M = 448.80, SD = 290.35, 95% CI [357.16, 540.44]) compared to not taking photos (M = 298.88, SD = 139.87, 95% CI [207.24, 390.52]), $F(1, 48) = 5.41$, $p = .024$, partial $\omega^2 = 0.08$.

One may wonder whether, similar to self-reported engagement, these visual-based engagement measures would also mediate the effect of photo-taking on enjoyment. Enjoyment is indeed positively and significantly correlated both with the proportion of time participants spent fixating on the artifacts, $r = .30$, $p = .03$ and the proportion of instances of fixation, $r = .29$, $p = .04$. However, while the confidence intervals suggest a close to significant indirect effect, neither proportion of time (indirect effect $b = 0.20$, $SE = 0.17$, 95% CI [−0.05, 0.65]) nor proportion of instances (indirect effect $b = 0.18$, $SE = 0.16$, 95% CI [−0.05, 0.58]) significantly mediates the effect of photo-taking on enjoyment. It appears that the relatively large standard errors for these goggle-based eye tracking measures introduced a level of noise that made detecting such a relationship difficult given the limited sample size.

Discussion

In this study, we replicated our findings that photo-taking increases enjoyment of an experience in a different natural, self-paced setting: a real-life museum exhibit. We also used an eye-tacking technology that provided a behavioral measure of engagement. Specifically, examining participants' eye fixations, and found that photo-taking increases how long and how often participants examine the focal artifacts in a museum exhibit, but not to other, nonfocal aspects of the exhibit. This behavioral evidence for differential attention mirrors and supports the self-reported measures of engagements. As expected, visual attention is positively correlated with the one-item engagement measure (for proportion of duration spent fixating on artifacts: $r = .25$, $p = .08$, for proportion of frequency: $r = .24$, $p = .09$). Notably, focal artifacts are more likely to be photographed compared to other, nonfocal aspects of the exhibit (e.g., placards). In fact, overall 95% of photos taken depicted artifacts, and for all individual participants artifacts make up the majority of photos taken (M = 95%, Min = 65%, Max = 100%).

Across the studies we reported so far, we have examined the engagement mechanism by manipulating whether photos are actually taken (or are taken mentally), through visual attention data (e.g., eye tracking), and via self-reported engagement measures. In the next two studies, we further explore the causal mechanism by examining boundary conditions and downstream consequences. We argue that the effect of capturing experiences via photos on enjoyment should depend on the extent to which the act of photo-taking engages or interferes with the experience. Hence, in this next study we manipulate the nature of the photo-taking interface.

Study 7: The Effect of Photo-Taking When Photo-Taking Gets in the Way

In order to manipulate the extent to which photo-taking may reduce engagement and interfere with the experience, in this study we add two new photo-taking conditions to the two conditions used in the previous studies (photo, no photo). Both additional photo-taking conditions involve participants dragging a virtual camera onto the video frame in order to take a picture, imitating some real-life camera interfaces where the photographer must hold a bulky camera between themselves and the experience (e.g., a digital single-lens reflex). In one of these conditions, participants also have the ability to delete photos as the experience unfolds, which could shift attention away from the experience and decrease engagement. To the extent that these aspects of the photo interface interfere with engagement in the experience, these additional photo conditions should dampen the positive effect of photo-taking on enjoyment.

Method

We recruited 432 MTurk workers (35% female, mean age = 33.1). In addition to the two bus tours used in Study 3, participants also experienced a tour of Paris, France, for a total experience of

Figure 5. Screenshots of intrusive photo-taking interface in Study 7. (a) Medium- and high-interference photo conditions. (b) High-interference photo condition with "deleteable" thumbnail. See the online article for the color version of this figure.

about 11 min. Participants chose whether to visit Hollywood or London first and always experienced Paris third.

Participants were randomly assigned to one of four conditions. Two conditions (no photo, photo) were identical to those in Studies 3 and 4. Instead of taking a picture simply by clicking the mouse, both new photo conditions (photo medium interference and photo high interference) involved dragging a camera onto the video and aligning the camera's viewfinder with the center of the video in order to "take a picture" (see Figure 5). The high-interference condition also allowed participants to "delete" photos during the experience. Both conditions were designed to mimic certain real-life situations where the act of taking photos itself could potentially interfere with the experience (e.g., using an unwieldy camera, deleting photos on the fly).

As before, participants were first given the opportunity to familiarize themselves with their particular condition, during which they did not face any photo-taking limits. In the main task, all photo conditions faced a budget of 50 photos that was tracked by an on-screen counter. This budget was chosen to encourage some deleting in the high-interference condition without being too limiting overall.

After experiencing the three bus tours, participants reported how much they enjoyed the experience immediately following the experience (Time 1), after completing an unrelated 5-min study (Time 2), and 1 week later (Time 3). At Time 1 and 3, they also indicated how immersed they felt and how much they felt like they were part of the experience (Time 1: $r = .85$, $p < .0001$; Time 3: $r = .86$, $p < .0001$; factor scores again used as measures of engagement). In addition, at Time 1, two manipulation check items were taken in the photo conditions to assess the extent to which participants felt that taking pictures had disrupted their experience and caused them to miss out on the tour experience ($r = .84$, $p < .001$; factor scores were used as a measure of interference).

Results

Manipulation check of interference. As intended, the three photo-taking conditions varied in the extent to which they interfered with the experience, $F(2, 321) = 46.72$, $p < .0001$. Planned contrasts revealed that, compared to the original photo interface ($M = -0.65$, $SD = 0.83$, 95% CI [−0.81, −0.48]), the medium-interference ($M = 0.42$, $SD = 0.91$, 95% CI [0.25, 0.60]), $F(1, 321) = 76.99$, $p < .0001$, partial $\omega^2 = 0.19$, and high-interference ($M = 0.27$, $SD = 0.91$, 95% CI [0.11, 0.43]), $F(1, 321) = 60.90$, $p < .0001$, partial $\omega^2 = 0.16$, conditions disrupted participants' experiences significantly more. There was not a significant difference between the medium- and high-interference conditions on this measure, $F(1, 321) = 1.62$, $p = .204$. Further, consistent with greater interference, the more cumbersome photo-taking was, the fewer photos participants took ($M_P = 32.36$, $SD_P = 19.51$, 95% CI [29.52, 35.20]; $M_{MI} = 27.58$, $SD_{MI} = 11.04$, 95% CI [24.54, 30.62]; $M_{HI} = 22.81$, $SD_{HI} = 8.77$, 95% CI [19.91, 25.72]; all different at $p < .02$).[5]

Enjoyment and engagement (Time 1). Replicating the findings from the previous studies, Time 1 results show that individuals in the photo condition enjoyed the experience more ($M = 5.45$, $SD = 1.58$, 95% CI [5.15, 5.74]) than individuals in the no-photo condition ($M = 4.93$, $SD = 1.60$, 95% CI [4.63, 5.22]), $F(1, 428) = 5.98$, $p = .015$, partial $\omega^2 = 0.01$. Individuals in the medium-interference condition ($M = 5.18$, $SD = 1.47$, 95% CI [4.87, 5.50]) rated their enjoyment similar to both the no-photo

[5] For the high interference condition, this number represents all photos taken, whether or not they were deleted later. Note that for 55 participants in the different photo-taking conditions ($N_P = 17$, $N_{MI} = 15$, $N_{HI} = 23$), the program failed to record the number of photos taken. Hence, this analysis is based on $N = 269$.

condition, $F(1, 428) = 1.37$, $p = .243$, and the photo condition, $F(1, 428) = 1.45$, $p = .230$. Further, individuals in the high-interference condition ($M = 5.06$, $SD = 1.65$, 95% CI [4.77, 5.35]), the most intrusive photo-taking interface, rated their enjoyment similar to the no-photo condition, $F(1, 428) = 0.41$, $p = .523$, and marginally lower than the photo condition, $F(1, 428) = 3.36$, $p = .067$, partial $\omega^2 = 0.005$. These results are depicted in Figure 6.

Also as before, individuals in the photo condition were more engaged with the focal experience ($M = 0.45$, $SD = 0.96$, 95% CI [0.27, 0.62]) than individuals in the no-photo condition ($M = 0.13$, $SD = 0.89$, 95% CI [−0.05, 0.30]), $F(1, 428) = 6.43$, $p = .012$, partial $\omega^2 = 0.01$. Individuals in the medium-interference condition ($M = 0.13$, $SD = 0.95$, 95% CI [−0.06, 0.31]) were similarly engaged as those in the no-photo condition, $F(1, 428) = 0.00$, $p = .997$, and less engaged than those in the photo condition, $F(1, 428) = 6.13$, $p = .014$, partial $\omega^2 = 0.01$. Further, those in the high-interference condition ($M = 0.08$, $SD = 0.97$, 95% CI [−0.09, 0.26]) were similarly engaged as those in the no-photo condition, $F(1, 428) = 0.12$, $p = .726$, and less engaged than the photo condition, $F(1, 428) = 8.54$, $p = .004$, partial $\omega^2 = 0.02$.[6]

Mediation analysis. As in prior studies we conducted a mediation analysis using bootstrap analyses with 10,000 samples contrasting the photo condition to the no-photo condition (no photo = 0; photo = 1) and using engagement as the mediator and enjoyment as the dependent variable. The 95% CIs did not include zero, indicating that engagement mediates the effect of photo-taking on enjoyment (indirect effect = 0.35, $SE = 0.14$, 95% CI [0.09, 0.65]). Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = 0.17, $SE = 0.17$, 95% CI [−0.16, 0.50]), suggesting full mediation. Note that we do not conduct any mediation analyses for the other photo-taking conditions because they did not differ from the no-photo condition on engagement.

Discussion

In this study, we introduced multiple photo-taking interfaces that were designed to moderate the effect of picture-taking on enjoyment by increasing the level of interference and thus decreasing engagement with the experience. We again found that nonintrusive photo-taking increased engagement and enjoyment in an experience. However, increasing the extent to which the act of taking photos interferes with the experience eliminated the positive effect of photo-taking on engagement and enjoyment.

Note that these additional photo-taking interfaces also provide further evidence that our previous findings are not merely driven by the nature of the photo-taking task in the lab (i.e., that photo-taking via mouse-click is more fun or novel than merely watching a video). If that explanation were true, the two new interface conditions should be even more fun and novel (i.e., moving a camera around to a specific location is more fun than simply clicking the mouse), thus increasing enjoyment. However, that was not the case.

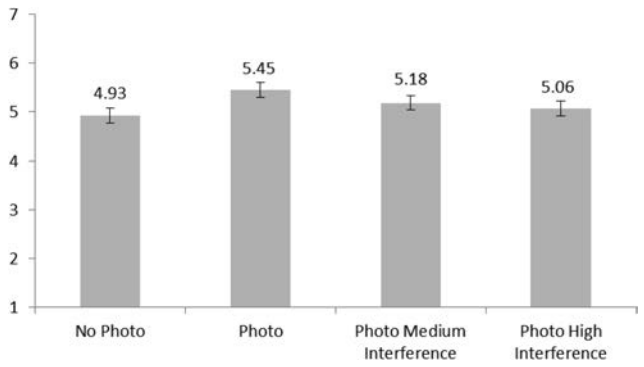

Figure 6. The effect of different photo-taking interfaces on enjoyment in Study 7. Error bars represent ±1 *SE*.

Study 8: The Effect of Photo-Taking When the Activity Is Actively Engaging

The previous lab studies used a computer mediated photo-taking experience that mimics real-life first-person experiences. However, it did not involve active participation in the event. In this study, we use a different paradigm where participants partake in an actual arts-and-crafts activity in the lab. In addition to testing robustness using a different paradigm, this study allows us to manipulate the extent to which the focal experience itself is actively engaging in a new way. Different activities allow for different levels of active engagement. For example, a museum may only allow for passive observation of its exhibits, or it may encourage some form of active interaction (e.g., hands-on science museums); seeing a show may involve passively watching the actors, or it may require active participation from the audience (e.g., improv comedy). Activities that require active participation are generally more engaging to begin with, and hence should not benefit as much from photo-taking. Further, it is also possible that taking photos during an active, participatory experience could interfere with the experience, similar to the intrusive photo-interface in the previous study. We will examine one such activity that allows us to test whether photo-taking during a highly active experience does not heighten, or possibly even reduces, enjoyment in this context.

Method

Two hundred two participants (67% female, mean age = 21.6) at a northeastern university participated in a multistudy session. Participants were randomly assigned to one of four conditions in a 2 (Photo-Taking: yes vs. no) × 2 (Activity: builder vs. observer) between-subjects design. Conditions were randomized by behavioral lab session; that is, during each of the four 1-hr sessions scheduled in the behavioral lab each day, one of the four condi-

[6] Time 2 measures, taken after a 5-min delay, follow the same pattern as enjoyment at Time 1. However, due to self-selection, analyzing Time 3 measures is not meaningful. Time 1 enjoyment had a positive and significant effect on whether or not respondents returned at Time 3 ($b = 0.17$, $SE = .06$, $\chi^2 = 6.76$, $p = .009$). Those who completed the follow-up survey 1 week later, enjoyed the initial experience significantly more ($M = 5.39$, $SD = 1.38$, 95% CI [5.16, 5.62]) than those who did not complete the follow-up survey ($M = 4.98$, $SD = 1.70$, 95% CI [4.79, 5.18]), $F(1, 430) = 6.95$, $p = .009$. Consequently, among those who did complete the final survey, enjoyment at Time 1 was no longer different across conditions, $F(3, 179) = 0.18$, $p = .911$ (all comparison ps $> .5$).

tions was run. The total length of the study was 4 days, for a total of 16 sessions (four sessions for each condition). Given the elaborate nature of implementing a real-life arts-and-crafts study in the lab, this was necessary to ensure that participants were never exposed to the other conditions.

First, all participants were told that they would experience an actual arts-and-crafts project of their choice. Two craft projects were available for participants to choose between, both involving the use of food materials to create a tower from scratch. One project was to create an Eiffel Tower from wafers and icing; the other project was to create a tower created from spaghetti and marshmallows.

Half the participants were assigned to be "observers" of the arts-and-crafts project, mimicking real-life artisanal demonstrations. These individuals were told that they would be watching someone build one of those two towers from scratch. The other half of participants were assigned to be "builders" of the project. These individuals were told that they would be building one of those two towers. As a way to give participants autonomy in the craft project, both observers and builders were asked to select which of the two arts-and-crafts projects they wanted to participate in. Overall, 77.2% of participants chose the wafer tower, and this did not differ by activity condition ($\chi^2 = 1.35$, $p = .246$). See supplementary online materials for the descriptions and photos used to explain the task to the participants.

Observers were split up into two groups depending on which tower they had chosen. In separate rooms, each group then observed a research assistant build their selected craft project. The research assistants were instructed and trained to build the tower similarly each time, thus holding the experience as constant as possible across hours. The research assistant sat at a table with the observers standing around him/her to watch.

Builders were provided with the supplies and instructions for the tower that they had chosen. Builders were told, "The picture of the tower you see below is just meant as general guidance. Please feel free to create your own vision of the tower." Each builder was given more than enough materials (wafers and icing or spaghetti and marshmallows) to complete the tower but were also told to help themselves to more if necessary. Builders completed the craft project they had chosen at their individual cubicle.

Based on pretests, both builder and observer conditions were given 12 min to participate in the arts-and-crafts activity. This time allowed participants to complete the tower without being too rushed, but did not give them too much idle time. Across both conditions, participants were told that we were interested in their own individual experience with the craft project, and that they should not to talk to anyone else in the session.

As in previous studies, half the participants were assigned to a photo condition, while the other half were assigned to a no-photo condition. Those in the photo condition were told that they should take photos of the arts-and-crafts project using their own cell phones throughout the experience (i.e., not just at the end of the experience, but while it was unfolding). Participants were given a general guideline to take at least five photos. Those in the no-photo conditions were told to go through the experience as they normally would.

Participants in the photo condition took significantly more photos when assigned to the observer condition ($M = 10.16$, $SD = 5.40$, 95% CI [9.03, 11.29]) compared to the builder condition ($M = 5.45$, $SD = 1.63$, 95% CI [4.32, 6.58]), $F(1, 96) = 34.19$, $p < .0001$, partial $\omega^2 = 0.25$. A few individuals in the no-photo condition ended up taking photos of the craft experience as well, even though they had not been instructed to do so (observer: $N = 1$, $M = 3.00$; builder: $N = 4$, $M = 1.25$). We analyze our results for all participants who completed the study based on their assigned conditions, but results hold when restricting the sample to participants in the no-photo condition who did not take any photos.

After the 12-min craft experience was over, the experimenters collected all the leftover materials, and observers were asked to go back to their desk. Then, participants completed a survey that asked them the same enjoyment question and two engagement questions, $r = .86$, $p < .0001$, as in the previous studies. In addition, we collected four ancillary measures to test potential alternative explanations: how crowded the experience was, how frustrated they felt during the craft experience, how unusual the craft experience was, and how novel the craft experience was, all on 7-point Likert scales (1 = *not at all* to 7 = *extremely*).

Next, across conditions those participants who indicated that they had taken photos during the craft project were asked several questions about their photo-taking experience. First, they were asked how many photos they took during the experience (by looking back at their photo-taking device to determine the exact count). Then, they were asked three questions to assess how much taking photos had interfered with the experience. All items were on 7-point Likert scales. Two of those items were the same as in Study 7 (how much they felt like they were missing out on the experience while taking photos, and how disruptive photo-taking was), with one additional measure asking participants how distracting it was to take photos during the experience ($\alpha = .89$; factor scores were used as a measure of interference). As intended, those in the photo condition who built the craft project themselves reported that photo-taking interfered more with their experience ($M = 0.38$, $SD = 0.99$, 95% CI [0.12, .64]) compared to those who simply observed ($M = -0.27$, $SD = 0.89$, 95% CI [−0.53, −.006]), $F(1, 96) = 11.72$, $p = .001$, partial $\omega^2 = 0.10$.

At the end of the session, participants in the Builder condition were told that they could take their craft home if they would like. Twenty-five individuals did so (23 who built the wafer tower and two who built the spaghetti tower; 25.3% of all builders), and this did not differ by photo condition ($\chi^2 = 0.4$, $p = .525$).

Results

Enjoyment and engagement. A two-way ANOVA revealed a significant main effect of activity, $F(1, 198) = 12.97$, $p < .001$, partial $\omega^2 = 0.06$. Consistent with prior literature (Larsson et al., 2001), participants enjoyed the experience more as builders ($M = 5.30$, $SD = 1.44$, 95% CI [5.0, 5.61]) than they did as observers ($M = 4.50$, $SD = 1.70$, 95% CI [4.22, 4.82]). There was also a marginally significant main effect of photo-taking, such that participants who took photos ($M = 5.09$, $SD = 1.59$, 95% CI [4.78, 5.40]) enjoyed the experience more than those who did not take photos ($M = 4.70$, $SD = 1.65$, 95% CI [4.43, 5.03]), $F(1, 198) = 2.79$, $p = .097$, partial $\omega^2 = 0.01$. Importantly, these effects were qualified by a photo-taking by activity interaction, $F(1, 198) = 8.66$, $p = .004$, partial $\omega^2 = 0.04$. When participants were observing the craft project, individuals in the photo condition enjoyed the experience significantly more ($M = 5.02$, $SD = 1.66$, 95% CI

[4.59, 5.45]) than individuals in the no-photo condition ($M = 4.02$, $SD = 1.61$, 95% CI [3.60, 4.43]), $F(1, 198) = 10.84$, $p = .001$, partial $\omega^2 = 0.05$. However, when participants were building the craft themselves, individuals in the photo condition enjoyed the experience no differently ($M = 5.16$, $SD = 1.52$, 95% CI [4.73, 5.60]) than individuals in the no-photo condition ($M = 5.44$, $SD = 1.36$, *CI* 5.01, 5.87]), $F(1, 198) = 0.80$, $p = .373$. These results are depicted in Figure 7.

A similar pattern emerged for engagement. Participants were more engaged as builders ($M = 0.59$, $SD = .64$, 95% CI [0.44, 0.75]) than as observers ($M = -.57$, $SD = .95$, 95% CI [−0.71, −0.40]), $F(1, 198) = 105.45$, $p < .0001$, partial $\omega^2 = 0.34$. There was also a significant main effect of photo-taking, such that participants who took photos ($M = 0.14$, $SD = .94$, 95% CI [−0.02, 0.29]) were more engaged than those who did not take photos ($M = -0.13$, $SD = 1.04$, 95% CI [−0.25, 0.05]), $F(1, 198) = 4.42$, $p = .037$, partial $\omega^2 = 0.02$. These effects were qualified by a photo-taking by activity interaction, $F(1, 198) = 7.46$, $p = .007$, partial $\omega^2 = 0.03$. When participants were observing the craft project, individuals in the photo condition were more engaged ($M = -0.29$, $SD = 0.98$, 95% CI [−0.51, −0.06]) than individuals in the no-photo condition ($M = -0.83$, $SD = 0.86$, 95% CI [−1.04, −0.61]), $F(1, 198) = 11.90$, $p < .001$. However, when participants were building the craft themselves, individuals in the photo condition were just as engaged ($M = .56$, $SD = .69$, 95% CI [0.33, 0.78]) as individuals in the no-photo condition ($M = .63$, $SD = .59$; 95% CI [0.41, 0.85]), $F(1, 198) = 0.20$, $p = .660$.

Mediation analysis. In order to test whether engagement acts as a mediator in this study, we used the Hayes macro with 10,000 bootstrap samples to estimate a mediation model (Model 8) with photo-taking condition (no photo = 0; photo = 1) as the independent variable, engagement as the mediator, enjoyment as the dependent variable, and task (observer = 0, builder = 1) moderating the effect of photo-taking on engagement as well as enjoyment. Replicating our prior findings, for observers, engagement mediated the effect of photo-taking on enjoyment (indirect effect = 0.69, $SE = 0.24$, 95% CI [0.24, 1.18]). Controlling for engagement, the direct effect of photo-taking on enjoyment was no longer significant (direct effect = 0.31, $SE = 0.24$, 95% CI [−0.15, 0.78]), suggesting full mediation. However, for builders, engagement did not act as a mediator (indirect effect = −0.09, $SE = 0.17$, 95% CI [−0.42, 0.23]).

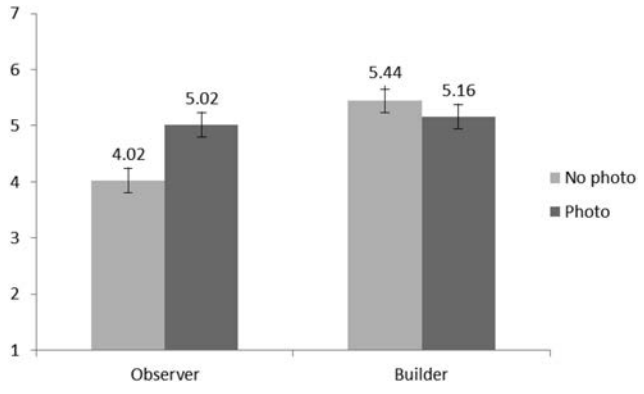

Figure 7. Effect of photo-taking for observers versus builders in Study 8. Error bars represent ±1 *SE*.

Discussion

In this study, we examined how the effect of photo-taking during an experience depends on the extent to which the experience involves active participation and naturally trigger different levels of involvement. When participants were taking part in a less active experience (i.e., watching a real arts-and-crafts activity), taking photos boosted enjoyment by increasing engagement, replicating our previous studies. We show that this is the case even though individuals were experiencing the event in a group setting; thus, the benefits of photo-taking appear to hold above and beyond the intensification of emotions that might occur in group contexts (e.g., Shteynberg, Hirsh, Galinsky, & Knight, 2014).

In situations where active participation in the task was required, taking photos of the experience did not increase enjoyment, though we did not find any evidence that photo-taking actually decreased enjoyment in this context. Importantly, this study demonstrates a boundary condition of our effect: Photo-taking does not increase enjoyment for experiences that are already actively engaging. Note that regardless of the level of activity, participants across conditions had some autonomy over the specific activity they participated in. Further, even for nonphoto takers, the experience was still relatively involved and enjoyable (i.e., at least at the midpoint of the scale).

We also examined several additional aspects that could be affected by the photo-taking experience. In particular, we measured the extent to which participants felt the experience was novel or unusual, and the extent to which participants felt crowded or frustrated. Photo-taking did not interact with participant activity (i.e., builder vs. observer) on any of these measures, suggesting that these factors cannot explain the observed effects on enjoyment.

In our final study, we explore the valance of the experience as another boundary condition for the positive effect of photo-taking, a direct implication of our engagement mechanism. Prior research has shown that for negative experiences, greater attention increases the negative affect involved in the experience (e.g., Higgins, 2006). By the same logic, if taking photos heightens engagement and attention, as we have found, then taking photos of negative experiences should actually *decrease* enjoyment.

Study 9: Taking Photos of Positive Versus Negative Experiences

In this study, all participants experienced an African safari as their focal experience. In order to study how photo-taking affects enjoyment of positive versus negative experiences, we pretested two videos to trigger either more positive or more negative emotions (see Appendix B). Both videos depicted animals killing or eating other animals in their natural environment. In the more positive video, a group of four warthogs are eating from the remains of a dead antelope while a jackal is trying to get a bite as well. In the more negative video, a pride of lions is attacking a water buffalo, biting and clawing the animal that is still alive. To provide a better sense of the experience, we include in the supplementary online materials several screenshots for each video, taken 15 s apart. Note however, that screenshots only provide a static, visual approximation of the experience, missing important dynamic and auditory aspects. While the different valences of the

two videos were selected to create differential enjoyment, our main prediction is that photo-taking will amplify differences in enjoyment between positive and negative videos by increasing engagement with the experience.

Method

We recruited 298 participants from MTurk (43% female; average age = 32.2). Participants were randomly assigned to one of four conditions in a 2 (Photo-Taking: yes vs. no) × 2 (Experience Valence: positive vs. negative) between-subjects design. Participants experienced one of two 3-min safari videos of animals feeding on other animals in their natural habitats, which were pretested to vary on the extent to which they induced more positive or more negative emotions.

As in previous studies, those in the no-photo conditions simply watched the safari experience, while those in the photo conditions were able to take pictures via mouse click. Participants took significantly more photos in the positive-experience condition ($M = 15.74$, $SD = 11.44$, 95% CI [13.21, 18.27]) than in the negative-experience condition ($M = 10.67$, $SD = 9.94$, 95% CI [8.35, 13.00]), $F(1, 149) = 8.48$, $p = .004$, partial $\omega^2 = 0.05$. We will further elaborate on this finding in the discussion of the study.

As before, participants familiarized themselves with the interface for their condition, this time by watching a 1-min excerpt of the previously used London bus tour. Following the focal safari experience, participants responded to the same enjoyment question and two engagement items, $r = .83$, $p < .001$, as in previous studies.

Results

Enjoyment and engagement. In line with the valence evaluations elicited in the pretest, participants indicated greater enjoyment in the more positive experience ($M = 4.39$, $SD = 2.06$, 95% CI [4.12, 4.70]) than the more negative experience ($M = 1.95$, $SD = 1.53$, 95% CI [1.69, 2.24]), $F(1, 294) = 143.96$, $p < .0001$, partial $\omega^2 = 0.32$. Importantly, this effect was qualified by the predicted photo-taking by valence interaction, $F(1, 294) = 17.09$, $p < .001$. When the experience was more positive, individuals in the photo condition enjoyed the experience more ($M = 4.99$, $SD = 1.87$, 95% CI [4.57, 5.40]) than individuals in the no-photo condition ($M = 3.84$, $SD = 2.08$, 95% CI [3.44, 4.24]), $F(1, 294) = 15.28$, $p < .0001$, partial $\omega^2 = 0.05$. However, when the experience was more negative, individuals in the photo condition enjoyed the experience less ($M = 1.70$, $SD = 1.03$, 95% CI [1.31, 2.08]) than individuals in the no-photo condition ($M = 2.24$, $SD = 1.92$, 95% CI [1.83, 2.64]), $F(1, 294) = 3.64$, $p = .058$. These results are depicted in Figure 8.

As before, we also find a main effect of photo taking on engagement, $F(1, 294) = 4.21$, $p = .041$, partial $\omega^2 = 0.01$. Individuals in the photo condition were more engaged ($M = 0.11$, $SD = .92$, 95% CI [−0.04, 0.28]) than individuals in the no-photo condition ($M = -0.12$, $SD = 1.06$, 95% CI [−0.28, 0.04]). Neither the effect of valence, $F(1, 294) = 0.16$, $p = .692$, nor the interaction, $F(1, 294) = 0.39$, $p = .535$, was significant, suggesting that photo-taking increases engagement similarly across valance conditions.

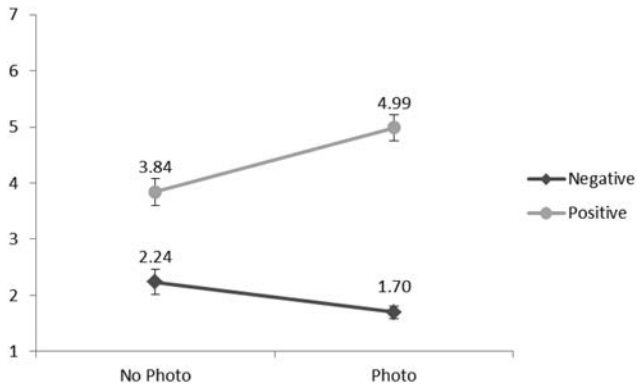

Figure 8. The effect of photo-taking on enjoyment of positive and negative experiences in Study 9. Error bars represent ±1 *SE*.

Mediation analysis. In order to further examine the engagement mechanism in the context of the photo-taking by valence interaction, we estimated a moderated mediation model. We predicted that engagement should mediate the effect of photo-taking on enjoyment for both positive and negative experiences. However, for positive experiences, greater engagement should increase enjoyment, whereas for negative experiences, greater engagement should decrease enjoyment. In order to test this, we used the Hayes macro with 10,000 bootstrap samples to estimate a mediation model (Model 15) with photo-taking condition (no photo = 0; photo = 1) as the independent variable, engagement as the mediator, enjoyment as the dependent variable, and valence of the experience (negative = 0; positive = 1) as a moderator of both the direct effect of photo-taking, as estimated before, as well as of the engagement to enjoyment path. As expected, valence moderates the relationship between engagement and enjoyment ($b = 0.56$, $t = 2.88$, $p = .004$). Further, we find support for the idea that the effect of photo-taking on enjoyment is mediated by engagement for both positive (indirect effect = 0.21, $SE = 0.12$, 95% CI [0.016, 0.450]) and negative (indirect effect = 0.08, $SE = 0.05$, 95% CI [0.006, 0.21]) experiences.

Note that we would expect a negative coefficient for the indirect effect of engagement in the negative video condition (i.e., greater engagement should reduce enjoyment). The fact that the coefficient is close to zero and positive appears to be due to a floor effect in our data: The majority of participants ($N = 96$, 62%) rated the negative video at the lowest scale point (1). At the same time, some participants did like the video (i.e., $N = 25$, 16% rated it a 4 or higher). Because those who did not like the movie could not move any further down the scale, those who actually liked the stimulus exerted a relatively stronger effect on the relationship between engagement and enjoyment, leading to the small positive coefficient. Eliminating those who rated their enjoyment of the negative video as a four or higher ($N = 25$) reduces the indirect effect (indirect effect = 0.02, $SE = 0.02$, 95% CI [−0.002, 0.08]), but due to the floor effect for those who hated the video, the coefficient does not become negative. It appears that a restricted scale (1 to 7 Likert scale) in combination with substantial heterogeneity in taste seem to have jointly affected the sign of the indirect effect in the negative experience condition. A more powerful investigation

of the effect should personalize which experiences a participant encounters, allowing for more positive and more negative experiences that are matched to the individual not just the group as a whole.

Discussion

This study shows that photo-taking can amplify differences in enjoyment between positive and negative experiences by increasing engagement with the experience. While we replicate our previous findings that taking pictures heightens enjoyment when the experience is positive, photo-taking has the opposite effect when the experience is negative.

Note that participants took significantly fewer pictures during negative experiences. This may reflect a lower desire to capture negative experiences. Yet, to the extent that taking *fewer* pictures was an attempt by participants to *engage less* with such experiences, it was unsuccessful: participants in both valence conditions felt more engaged when they took photos of the experience. This is consistent with the findings in Study 5, which showed that it is not the mechanical process of taking photos that increases enjoyment, but the mental process associated with capturing the experience in photos (e.g., planning which photos to take). These results further underscore the fact that engagement is the key factor that shifts enjoyment—increasing enjoyment for positive experiences and decreasing enjoyment for negative experiences, regardless of number of photos taken.

General Discussion

Experiences, and the enjoyment of these experiences, are important to people's lives. To the best of our knowledge, this research is the first extensive investigation examining how the ubiquitous contemporary activity of capturing experiences by taking photos impacts people's enjoyment of their experiences. Across nine studies with different paradigms, we investigate how photo-taking influences evaluations of experiences. We show that, relative to not taking photos, photo-taking can heighten enjoyment of positive experiences, and does so because photo-taking increases engagement.

While taking photos during an experience adds another activity, unlike traditional dual-task situations that divide attention, capturing experiences with photos actually focuses attention onto the experience, particularly on aspects of the experience worth capturing. As a result, photo-taking leads people to become more engaged with the experience. We examine the effect of photo-taking on enjoyment and engagement across a wide range of field and lab settings where we randomly assign participants to take photos or not take photos. The experimental approach allows us to examine the causal effect of photo-taking independent of people's self-selected behaviors and preferences. Further, the convergent results across diverse empirical settings, as well as various moderators, should alleviate any concerns about demand characteristics or selected methodologies, and demonstrate the generalizability of the findings. We also present direct evidence for the proposed engagement-driven process using multiple manipulation and measurement approaches.

Across studies, we find consistent evidence that photo-taking heightens enjoyment of positive experiences in a variety of real-life situations, such as taking part in an actual city bus tour (Study 1), eating a midweek lunch (Study 2), and visiting a museum (Study 6). We also replicate these findings in more controlled laboratory settings, both with virtual photo-taking experiences that simulate the real world (Studies 3, 4, 5, 7, and 9), and with a hands-on arts-and-craft experience (Study 8). Virtual experiences in the lab include more visually diverse experiences, such as bus tours (Studies 1, 3, 4, 5, and 7), museum visits (Study 6), and safaris (Study 9), and more visually homogenous experiences, such as certain concerts (Study 4). Further, we observe a positive effect of photo-taking whether the experience is relatively uncommon (e.g., a city bus tour), relatively common and self-selected (e.g., midweek lunch), or relatively inconsequential (e.g., as part of a lab study). Finally, we show that the effect of photo-taking is robust to delayed evaluations and does not only occur immediately after the experience (Studies 3 and 4). Note that because participants did not have access to their photos following the experience, we are able to isolate the unique effect of photo-taking on enjoyment of the experience, separate from any effects of revisiting the photos taken. We will return to this point below.

In addition to establishing the effect of photo-taking on enjoyment, we also examine *how* photo-taking causes this effect on enjoyment, identifying engagement as one important underlying process. We find support for photo-taking heightening engagement with both self-reported measures (Studies 2–5, and 7–9) and behavioral evidence (i.e., visual attention, Study 6). Using eye-tracking in a natural setting, we find that photo-taking directs attention to visual aspects that are most relevant to the experience (e.g., artifacts in a museum exhibit) rather than increasing attention to *every* aspect of the experience (Study 6). Further, we show that it is the *mental* process people adopt while taking photos, rather than the photo-taking mechanics, that triggers greater engagement and thus increases enjoyment (Study 5). We also identify several relevant moderators that shed further light on this underlying engagement process (Studies 7, 8, and 9). First, we show that when the focal experience is already engaging, there is no additional benefit from taking photos, though we do not find any evidence for a detrimental effect of photo-taking (Study 8). Second, we show that the act of taking photos itself can interfere with engagement and enjoyment, thus moderating the benefits of capturing experiences with photos. For example, when photo-taking becomes overly intrusive, the hedonic benefits of taking photos are reduced (Study 7). Third, because taking photos amplifies engagement with the experience, it boosts positive experiences, but worsens negative ones (Study 9).

Robustness and Generalizability

We examined the effect of photo-taking across a range of contexts in the lab and the field, using multiple methods and approaches. Overall, 2,005 individuals participated in the nine studies reported here. This diverse set of studies allows us to conduct a meta-analysis to estimate the overall effect size of photo-taking across many settings. In this meta-analysis, we focused on conditions that were intended to test our primary hypothesis: the comparison between actually taking photos and not taking photos (i.e., not including the planning condition in Study 5). Hence, we also did not include conditions that were intended to further examine the process or to show where the positive effect of

photo-taking would not hold. That is, for the three studies that test moderators, we included the primary two conditions comparable across studies, and we excluded the interference conditions in Study 7, the builder conditions in Study 8, and the negative conditions in Study 9.

For each study, we first used the means and standard deviations of each condition to compute Hedges *g*, the bias-adjusted estimate of the standardized mean difference (Hedges & Olkin, 2014). We then calculated a weighted mean, using inverse variance weights to assign more weight to studies with larger samples (Lipsey & Wilson, 2001). Overall, we find that participants enjoy the experience more when they take photos compared to when they do not take photos. The mean effect size across studies is 0.411 (95% CI [0.307, 0.515]).

We supplemented this analysis by examining whether different operationalizations across our studies contributed to variation in our results. Specifically, we separately evaluated the mean effect size for studies that used our computer-mediated paradigm and studies where people had to physically operate a camera or cell phone. One may think that by holding the experience constant, a computer-mediated experience gives greater weight to whether people take photos or not. However, there is no evidence that the computer-mediated paradigm exaggerated the effect of photo-taking: the mean effect size for that paradigm is 0.381 (95% CI [0.254, 0.509]), whereas for the other approaches it is 0.471 (95% CI [0.291, 0.650]). While these effect sizes are not significantly different from each other, this suggests that, at least directionally, our computer-mediated paradigm understates the effect of photo-taking relative to physical experiences.

The above analysis speaks to the robustness of the effect across various experimental settings. However, one could wonder whether it possible that the effect of photography found in our studies is due to some form of a demand effect, where the fact that we instruct participants to take photos signals that the experience will be more enjoyable. At first glance, some of the studies presented might indeed trigger such concerns; hence, we will briefly present evidence that is inconsistent with such arguments.

Bias due to demand characteristics is expected to arise when participants believe they have *correctly identified* the hypothesis and behave accordingly in order to *cooperate* with the experimenter (Aronson, Ellsworth, Carlsmith, & Gonzales, 1990). If participants had indeed guessed that the experimenters' interest was in the effect of photo-taking on enjoyment, one would expect participants would base the *direction* of that expected effect, and their responses, on their own intuitions (e.g., Stang, 1974). In our initial survey, for which respondents were drawn from the same pool as participants in several studies (Studies 5, 7, and 9), we find that people hold a range of beliefs about how photo-taking affects enjoyment. While 41% thought that taking photos during an experience would increase enjoyment of the experience, 59% of participants did not hold that belief. Hence, assuming that all beliefs are held with the same conviction, it is unlikely that respondents acting in accordance with their intuitions would produce the results we found, as most respondents in the survey did not hold the belief that photo-taking would heighten enjoyment.

Another version of this criticism is that asking people to take photographs may heighten expectations that the experience will be engaging and enjoyable. Prior research has shown that retrospective evaluations can assimilate to affective expectations (e.g., Klaaren, Hodges, & Wilson, 1994), and thus one could argue that respondents enjoy the experience more in the photo-taking conditions because of heightened expectations. This explanation could potentially account for the main effects presented in our studies, if the instructions to take photos did indeed shift expectations. However, several results are inconsistent with this argument. The bus tour in Study 1 represents a situation that typically involves photo-taking in real-life; hence providing participants with cameras was unlikely to signal that this bus tour would be more enjoyable than other bus tours they had taken.

More importantly, the expectation-based explanation cannot account for several other key findings, particularly the observed interactions. If asking participants to take photos suggests that the experience will be more enjoyable, that should affect all conditions in which photos are taken. However, those in the medium and high-interference photo conditions in Study 7 reported enjoying the experience no differently than in the no-photo condition. Further, those taking photos while building a tower in Study 8 did not report greater enjoyment than those not taking photos. Lastly, taking photos when the experience was negative did not increase, and in fact marginally deceased, enjoyment in Study 9. As such, we strongly believe that neither strict demand explanations nor affective expectations, can account for our findings.

Theoretical Contributions and Implications

This paper makes a number of substantive and theoretical contributions. Despite the prevalence of photo-taking in our lives, empirical research on how taking photos affects experiences is conspicuously missing. Because experiences are of great importance to people's happiness (Bhattacharjee & Mogilner, 2014; Carter & Gilovich, 2010; Van Boven, 2005; Van Boven & Gilovich, 2003), what amplifies or dampens enjoyment of those experiences is of deep interest to a large number of researchers. Further, individuals presumably take photos in part because they expect that reviewing those photos in the future will provide them with additional enjoyment (e.g., utility from memory; Loewenstein, 1987). While our research has not examined those benefits directly, we have shown that as a consequence of such forward-looking behavior, people may in fact enhance their immediate enjoyment of the experience itself. Interestingly, this effect is not anticipated by many people in our initial survey who believe that photo-taking either reduces or does not affect enjoyment. This result is also unanticipated by many marketers of experiences (e.g., restaurants, bands) who believe that taking photos ruins individuals' experiences, leading them to forbid photography in their venues (Stapinski, 2013; Wright, 2012). Our findings, however, show that on average photo-taking can actually improve experiences, as long as it does not interfere too much.

We also contribute to the understanding of the factors that influence enjoyment of experiences by examining the role of engagement not just for positive but also for negative experiences. Higgins (2006) discussed engagement as a crucial component for *both* pleasure and pain, yet the role of engagement has been virtually unexplored for negative experiences, as acknowledged by Higgins and Scholer (2009). Only recently in one article, Sehnert and colleagues (2014) show that negative experiences (i.e., eating bitter yogurt) are worsened when the experience is perceived as scarce, presumably because scarcity heightens engagement with

the experience. In a similar vein, we demonstrate that photo-taking worsens negative experiences by increasing engagement.

In addition, we examine photography as a novel type of dual task, one previously not considered in the literature. Photography is a task that people engage in during an experience that is integral, or at least not unrelated, to the experience. While much research has examined dual-task situations that divide and shift attention (e.g., Pashler, 1994), we find that taking photographs as part of an experience can actually focus attention on the experience. We also find through eye-tracking in a natural setting that photo-taking directs people's attention to the specific aspects and moments of the experience they want to capture, rather than heightening engagement across all aspects of the experience. As such, one implication is that devices that record *any* moment of an experience without the individual's active participation (e.g., GoPro video cameras or the recently introduced Narrative Clip, a tiny camera that attaches to one's clothing and automatically takes a photo every 30 s) are unlikely to have the same effect. We also note that it is, of course, possible for photo-taking to turn into an attention-dividing, secondary task, but that depends on how photo-taking is implemented. For example, as we showed, a bulky camera or the act of deleting photos during the experience can cause distraction and limit any photo-taking benefits. In addition, people may engage in other secondary activities while taking photos, such as applying filters or writing captions. The types of additional activities, and the way in which people engage with them, will determine the extent to which attention will be divided and enjoyment affected.

Open Questions and Future Research

Our goal in this paper was to systemically explore how taking photos affects the experience itself. However, this focus leaves open a number of interesting questions.

Number of photos taken. In this paper, we have focused on the effect of taking photos versus not taking photos, and have shown that photo-taking can increase engagement and enjoyment of positive experiences, as long as it does not interfere with the experience. However, one may expect that taking an excessive number of pictures may eventually interfere with the experience and thus reduce enjoyment. Our empirical evidence does not support this prediction. Individually, none of our studies show a linear or quadratic effect of number of photos taken on enjoyment.

In order to more directly examine the effect of number of photos taken, we conducted two additional lab studies (fully reported in the supplementary online materials) in which we manipulated how many photographs participants could take (10, 30, unlimited photos) over the course of 4–5-min nature videos. As intended, in both studies participants took significantly more pictures with larger budgets (Supplementary Study 1: $M_{10} = 8.24$, $M_{30} = 18.031$, $M_{\text{unlimited}} = 23.75$; Supplementary Study 2: $M_{10} = 9.10$, $M_{30} = 19.60$, $M_{\text{unlimited}} = 37.00$). Importantly, however, enjoyment did not differ between different photo-budgets. The only difference we find is that participants in all three photo-taking conditions enjoyed the experience more than participants in the no-photo condition (Supplementary Study 1: $M_{\text{Photo}} = 4.318$, $SD = 1.747$, $M_{\text{No Photo}} = 3.323$, $SD = 1.661$), $F(1, 112) = 7.84$, $p = .006$, (Supplementary Study 2: $M_{\text{Photo}} = 4.795$, $SD = 1.476$, $M_{\text{No Photo}} = 4.02$, $SD = 1.503$), $F(1, 198) = 10.47$, $p = .001$. Again, we did not find a negative effect of number of photos taken. Rather, findings from this study, as well as those from Study 5 where participants only planned to take photos, support the notion that it is not the act of taking photos per se, but rather the decision whether to take photos that affects enjoyment.

Still, it is possible that each individual study is too underpowered to detect an effect of number of photos taken, but that all studies combined would provide sufficient power to detect such an effect. In order to examine this possibility, and to provide this effect the best chance to be detected, we combined photo-taking data from the nine studies reported above ($N = 1{,}439$), excluding the same conditions that were excluded for the meta-analysis reported earlier. Across different specifications (details of different analyses can be found in the supplementary online materials), the strongest effect we observe is a linear effect of number of photos on enjoyment that, even with this data aggregation, just passed statistical significance ($b = 0.004$, $SE = 0.002$), $F(1, 1{,}428) = 3.96$, $p = .047$. The quadratic effect is never significant. Further, the sign of the effect is positive, not negative as an interference process would predict. Still, it is possible that the range of photos taken within our studies was simply not large enough to capture any potential negative interference. Future research may want to examine this relationship even more closely.

Another feature of our studies (and of real-life photography) may offer additional insight as to why we do not find a relationship between number of photos taken and enjoyment: the number of photos taken is generally under the control of the photographer. This feature suggests two additional possible explanations. First, it is possible that those in the photo conditions who enjoy the experience more choose to take more pictures, as discussed above. Second, it is possible that people choose to stop taking pictures before photo-taking starts to interfere with their experience. In Study 9, we found that participants took fewer photos during negative than positive experiences, suggesting participants may respond to the effects that photo-taking is having on their experience. Similarly, photographers may stop taking pictures if and when they feel photo-taking becomes too intrusive to their experience. Thus, while many people lament that *others* take too many pictures and are not enjoying their experiences, those who take the photos may not feel that way.

The nature of the experience. We have examined the effect of photo-taking across a range of situations from a self-paced museum visit to bus tours where progression through the experience was externally controlled. Across these different settings, we find that taking pictures enhances engagement and enjoyment. However, these experiences do not capture certain aspects that are central to other types of experiences; and as such, our findings will apply to many but not all experiences. Future research should identify circumstance where photo-taking might actually diminish the experience, beyond the case of negative experiences we examined.

For example, it is important to acknowledge that it is possible that the experiences we examined were sufficiently slow-moving or expandable in time that taking photos was possible without missing out on the experience per se. Future research should examine the effect of photo-taking on experiences with different temporal paces. In experiences that pass very quickly (e.g., the final seconds of a sports game), photo-taking may interfere with the experience and thus decrease enjoyment. Beyond speed, for

other experiences, emotions are a dominating aspect of the situation (e.g., watching one's child perform in a school play). In such experiences, taking photos may shift one's attention away from the rich emotional experience, reducing enjoyment. Similarly, it is possible that in social situations (e.g., dinner with a friend), photo-taking is more disruptive (e.g., to the flow of conversation) and could reduce enjoyment of the experience. Finally, for some experiences, key aspects are difficult to capture photographically (e.g., the vastness of the landscape at the Grand Canyon), and trying to do so may interfere with an essential part of the experience, diminishing awe and enjoyment.

One relevant aspect of photo-taking behavior is whether the current default is to take photos or not to take photos. Such a default could be situationally dependent or reflect a cultural norm. Note that in our investigations we examined experiences where people commonly take photos (e.g., during a bus tour) and also where people are less likely to take photos (e.g., during a mid-week lunch), and find similar effects of photo-taking. Still, future research may want to investigate whether there are any differences in the effect of photo-taking between experiences where the default is to take photos versus experiences where it is *not* to take photos (e.g., operas, plays, funerals or religious services)

Heterogeneity in photo-taking preferences. As we reported in the introduction, different people have different expectations about how taking photos will affect their experiences. It is possible that photo-taking impacts people differentially depending on their lay beliefs about photography. Our random-assignment procedure equates groups, in expectation, on any individual characteristic. However, in two studies (Study 2 and Study 8), we did specifically measure individuals' beliefs on whether photo-taking will enhance or degrade their experience. We analyzed data for those studies with measures of lay beliefs as moderators of the effect of photo-taking and found inconsistent results. In Study 2, where participants took photos during their lunch, we found that for those who believe that taking photos ruins experiences, photo-taking did not lead to greater enjoyment of their meal. That is, we find that photo-taking does not affect enjoyment (either positively or negatively) for the 20.2% of respondents who selected at least a 5 on a 7-point Likert scale in response to the statement that photo-taking ruins experiences. However, in Study 8, where participants either created or observed craft-projects, individual differences in lay beliefs did not moderate the effect of photo-taking. Future research may want to examine when and how lay theories and expectations, as well as other individual characteristics, might change the impact of photo-taking on enjoyment of experiences and other outcomes.

Memory of the experience. We examine photo-taking's effect on remembered enjoyment of an experience by measuring enjoyment up to a week after the experience has ended. However, the effect of photo-taking on remembered *content* of the experience was beyond our scope. One recent paper (Henkel, 2014) examined such content memory effects, showing that experimentally directing people to take photos of objects can reduce recognition of those objects (though not recall). However, it remains unanswered how content memory is affected when people *themselves* select which aspects of an experience they want to photograph, as they did in the situations we studied. If people select which photos to take, memory for these aspects of the experience could actually be enhanced from the decision to take a photo in the first place and the increased attention on the photographed features. Moreover, memory for visual information may be different from memory for other sensory (e.g., auditory) information encountered as part of the same experience (Barasch, Kristin, Jackie, & Gal 2016).

Photo-taking objectives. In this work, we contrast the effect of taking photos to not taking photos during experiences. However, individuals may take photos for different reasons and with different audiences in mind, which may further affect enjoyment of the experience. For example, an individual may take a photo so he can put it in his scrapbook to remind himself of the experience, or so he can post it on social media for all of his friends to see (Barasch, Zauberman, & Diehl, 2016). Whether people take photos to capture the experience for themselves versus to share with others may affect how people construe the situation (e.g., as an actor or an observer) and may affect enjoyment, memory, and the photos themselves.

Examining photos after the experience. We purposefully did not expose participants to their previously taken pictures, so as to isolate the effect of photo-taking on evaluations of the experience. However, physical items can serve as important reminders of experiences (Abendroth & Diehl, 2006) and can elicit long-term utility, particularly when they are unique to an experience (Zauberman, Ratner, & Kim, 2009). As photos are often unique to the experience (and the individual), revisiting pictures should affect both remembered enjoyment and content memory of the experience. Further, we showed that photo-taking can increase enjoyment of experiences whether auditory aspects of the experiences are more or less important (Study 4). Capturing *all* aspects of the experience does not seem to be crucial for photo-taking to heighten retrospective enjoyment in the time spans we examined. However, when reviewing photos after longer delays (e.g., years), it may become more important to have captured these core aspects. As we purposefully did not study the effect of revisiting pictures, we can only guess about such long-term effects. We speculate that photos unique to one's experience will still boost enjoyment from revisiting these experiences, relative to not having any photos to look back on, even if certain senses of the event (e.g., sound, smell, taste) must be conjured up from memory.

While these and many more questions warrant future research, our current investigation provides an important step in better understanding the ubiquitous phenomenon of photo-taking.

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Appendix A

List of Areas Coded for Fixations in Study 6

1. Museum artifact; fixation on a specific artifact inside a display
2. Museum placard but not reading; fixations not following the order of words
3. Museum placard and reading; fixations following the order of words
4. Other space within display but not artifact or placard, including times when a display is not totally in focus yet, or participants are not "honed in on" a specific object within that display; also includes the "podium" of a display, right below an artifact of placard
5. Camera viewfinder
6. Camera but not the viewfinder (e.g., a camera button)
7. Camera, looking back at photo just taken; includes times when participants are looking back at the photo just taken, but the screen is still "blank" because the photo has not yet shown up on the screen
8. Another person in the exhibit
9. Floor
10. Ceiling
11. Wall
12. Space in between displays
13. No circle present
14. Self: Participant looking at own hands or body parts
15. Looked into China exhibit (exhibit in the room next door)

Appendix B

Pretest: Valence of Videos for Study 9

The focal videos for Study 9 were identified via pretest. The positive video depicted four warthogs and two foxes standing, looking around, and eating a recently killed animal. The negative video depicted a pack of six lions chasing and then eating a buffalo while it was still alive.

Participants read the same instructions as in the no-photo conditions from the previous studies, and then reported how much they enjoyed the experience after one of the two videos. They also reported, in randomly determined order, to what extent the video made them feel positive, negative, good, and bad, as well as several other states taken from the PANAS scale (afraid, alert, disgusted, distressed, excited, happy, interested, irritable, sad, scared, upset). All these measures were taken on 5-point scales (1 = *not at all*, 2 = *a little*, 3 = *moderately*, 4 = *quite a bit*, 5 = *extremely*).

Finally, participants completed the immersion questions used in our previous studies and also reported whether they paid close attention to the safari experience and whether their attention shifted away from the screen (1 = *strongly disagree* to 7 = *strongly disagree*). Means and standard deviations are reported in Table B1.

(*Appendices continue*)

Table B1
Descriptive Statistics of Video Evaluations Used in Study 9

Video evaluations	Positive video ($N = 31$)	Negative video ($N = 28$)
Enjoy*	4.77 (1.56)	2.75 (2.14)
Positive*	2.52 (1.29)	1.68 (1.31)
Negative*	1.81 (1.14)	3.21 (1.34)
Good*	2.48 (1.26)	1.75 (1.27)
Bad*	1.77 (1.23)	3.04 (1.35)
Happy*	2.55 (1.26)	1.68 (1.19)
Sad*	1.94 (1.39)	3.14 (1.35)
Interested	3.35 (1.11)	2.86 (1.56)
Distressed*	1.71 (1.16)	2.96 (1.45)
Excited	2.42 (1.23)	2.00 (1.41)
Upset*	1.84 (1.24)	3.18 (1.47)
Scared	1.71 (1.13)	2.07 (1.33)
Irritable*	1.58 (1.03)	2.54 (1.32)
Alert	2.97 (1.30)	3.57 (1.29)
Afraid	1.68 (1.08)	2.07 (1.30)
Disgusted*	1.90 (1.27)	3.04 (1.35)
Felt part of the experience	67.10 (27.33)	77.21 (25.92)
Immersed	5.06 (1.59)	5.68 (1.57)
Paid attention to the experience	6.71 (.53)	6.29 (1.33)
Attention shifted away from screen*	1.52 (1.18)	2.43 (2.03)

* Significant *t* test between the two valence videos.

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