# When Every Day is a High School Reunion: Social Media Comparisons and Self-Esteem

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Abstract

Although past research has shown that social comparisons made through social media contribute to negative outcomes, little is known about the nature of these comparisons (domains, direction, and extremity), variables that determine comparison outcomes (post valence, perceiver's self-esteem), and how these comparisons differ from those made in other contexts (e.g., text messages, face-to-face interactions). In four studies ($N$=798), we provide the first comprehensive analysis of how individuals make and respond to social comparisons on social media, using comparisons made in real-time while browsing news feeds (Study 1), experimenter-generated comparisons (Study 2), and comparisons made on social media vs. in other contexts (Studies 3-4). More frequent and more extreme upward comparisons resulted in immediate declines in self-evaluations as well as cumulative negative effects on individuals' state self-esteem, mood, and life satisfaction after a social media browsing session. Moreover, downward and lateral comparisons occurred less frequently and did little to mitigate upward comparisons' negative effects. Furthermore, low self-esteem individuals were particularly vulnerable to making more frequent and more extreme upward comparisons on social media, which in turn threatened their already-lower self-evaluations. Finally, social media comparisons resulted in greater declines in self-evaluation than those made in other contexts. Together, these studies provide the first insights into the cumulative impact of multiple comparisons, clarify the role of self-esteem in online comparison processes, and demonstrate how the characteristics and impact of comparisons on social media differ from those made in other contexts.

*Keywords:* social comparisons, self-esteem, social media, Facebook, Instagram

When Every Day is a High School Reunion: Social Media Comparisons and Self-Esteem

In just over a decade, social media use has skyrocketed. In 2005, only 5% of Americans reported using one or more social media platforms; by 2019, this number had risen to 72% (Pew Research Center, 2019). Furthermore, the majority of Facebook, Instagram, Snapchat, and YouTube users visit these sites at least once per day, contributing to a global average of over two hours per day spent on social media per person (Clement, 2020). Although social media can enhance social connection (Ellison, Steinfield, & Lampe, 2007; Liu, Ainsworth, & Baumeister, 2016) and provide opportunities for self-disclosure and perceived social support (Davis, 2012; Ko & Kuo, 2009), the preponderance of research indicates that social media use is associated with negative outcomes, such as envy, romantic jealousy, decreased self-esteem and subjective well-being, increased loneliness and social isolation, and depression (Burke, Marlow, & Lento, 2010; Hwang, Cheong, & Feeley, 2009; Kalpidou, Costin, & Morris, 2011; Krasnova, Wenninger, Widjaja, & Buxmann, 2013; Kross et al., 2013; Muise, Christofides, & Desmarais, 2009; Tandoc, Ferrucci, & Duffy, 2015; Verduyn et al., 2015; Valkenburg, Peter, & Schouten, 2006; Vogel, Rose, Roberts, & Eckles, 2014; Woods & Scott, 2016; for reviews, see Best, Manktelow, & Taylor, 2014 and Verduyn, Ybarra, Résibois, Jonides, & Kross, 2017). Despite these negative associations, however, social media use continues to grow (Clement, 2020; Pew Research Center, 2019); thus, it is important to understand when and how social media will result in negative outcomes, and for whom these negative outcomes will be most significant.

**Social Media is Associated with Threatening Social Comparisons**

A growing body of research suggests that social media exerts a negative impact on users through social comparison processes: Individuals see that others on social media appear to be experiencing more positive outcomes, and consequently feel worse about themselves. Indeed, a

number of studies point to associations between Facebook use, upward comparisons, and negative outcomes. Heavy users, in contrast to infrequent users, are more likely to agree that others are happier, have better lives, and are doing better (Chou & Edge, 2012; de Vries & Kühne, 2015). Furthermore, making more upward Facebook comparisons has been associated with negative self-perceptions of one's own social competence and attractiveness, increased depressive symptoms, and lower overall well-being (Appel, Crusius, & Gerlach, 2015; de Vries & Kühne, 2015; Fardouly & Vartanian, 2015; Feinstein et al., 2013; Gerson, Plagnol, & Corr, 2016; Liu et al., 2017; Steers, Wickham, & Acitelli, 2014; Tandoc et al., 2015; Vogel et al., 2014; Wang, Wang, Gaskin, & Hawk, 2017). These negative effects, moreover, seem especially pronounced for low self-esteem individuals (Cramer, Song, & Drent, 2016; Jang, Park, & Song, 2016). This past research, however, does not provide clear evidence that social comparison is responsible for negative social media outcomes (Appel, Gerlach, & Crusius, 2016). Because these studies relied primarily on retrospective reports, it may be that individuals who are experiencing negative outcomes in these domains are simply more likely to recall or report on comparisons to superior others.

It is unclear, moreover, which characteristics of the social media context lead to particularly negative social comparison outcomes. Because past studies showing the connection between social media and social comparison have focused exclusively on social media contexts (e.g. Appel et al., 2015), it remains unclear how these processes may differ from other, non-social-media contexts. Presumably, the cognitive mechanisms underlying social comparison will be similar regardless of whether one is exposed to a superior other on social media, another online context, or in real life, with upward comparisons typically leading to threats to self-esteem and diminished mood and life satisfaction (Gerber, Wheeler & Suls, 2018). One may feel worse

if one learns about a friend's superior academic performance regardless of whether one hears about the friend's success through social media or face-to-face interaction. Why then, are social media comparisons associated with especially negative outcomes?

In the present studies, we identify specific attributes of social media comparisons that are especially damaging to the self. Through examining comparisons in real-time in lab studies, as well as in studies using both experimental and experience-sampling designs, we make three key contributions to the literature: First, we show that social media provides more opportunities for individuals to make comparisons, in particular to superior others; individuals thus make more frequent upward comparisons when using social media than in other contexts. Second, because social media posts tend to be highly positive, individuals make comparisons that are more extreme in their "upwardness" than in other contexts. This greater frequency and extremity of upward comparisons results in a particularly negative impact of social media use on the self. Third, we advance the literature on social comparison and self-esteem by showing that low self-esteem individuals are especially likely to make more frequent and extreme upward comparisons, which in turn leads to a more negative impact on their self-evaluations; we further examine whether social media amplifies these negative outcomes relative to other contexts.

**Social Media and Upward Comparison Frequency**

Social media provides a continuous stream of information about other people's accomplishments. Past research suggests that social comparisons occur automatically (Chatard, Bocage-Barthélémy, Selimbogović, & Guimond, 2017; Gilbert, Giesler & Morris, 1995; Mussweiler, Rüter, & Epstude, 2004); when individuals encounter information about another person, their own self-perceptions will be affected. The sheer number of posts in a news feed,

each offering a thumbnail sketch about another person, would thus seem likely to yield numerous comparison opportunities.

Furthermore, to the extent that social media posts are positive, they are most likely to yield upward comparisons, resulting in negative outcomes for the self (Gerber et al., 2018). Indeed, evidence suggests that news feed content is predominantly about positive experiences. Although people do not typically post false information about themselves online (Back et al., 2010), they do engage in selectively positive self-presentation (Walther, 2007; Wilson, Gosling, & Graham, 2012) and are more likely to post positive rather than negative content (e.g., Dorethy, Fiebert, & Warren, 2014; Qiu, Lin, Leung, & Tov, 2012; Seidman, 2013). As a result, individuals browsing their news feeds are more likely to see posts about friends' exciting social activities than dull days at the office, affording numerous opportunities for comparisons to seemingly better-off others.

To date, research has not directly tested whether social media exerts a negative impact on the self by eliciting more frequent upward comparisons than in other, non-social-media contexts. A number of studies suggest that individuals who are especially prone to making comparisons experience negative outcomes when using social media (Alfasi, 2019; de Vries, Möller, Wieringa, Eigenraam, & Hamelink, 2018; Hanna et al., 2017; Stapleton, Luiz, & Chatwin, 2017; Vogel, Rose, Okdie, Eckles, & Franz, 2015; Wang et al., 2017). These studies, however, did not explicitly measure comparison frequency, instead assessing whether an orientation to make comparisons more generally (Gibbons & Buunk, 1999) or comparison tendency on a particular platform (e.g., "Today, when I was on Facebook, I felt less confident about what I have achieved compared to other people"; Steers et al, 2014) might be related to social media use outcomes. Such global reports may not accurately reflect the degree to which individuals were engaging in

actual comparison activities (Gerber et al., 2018) and may instead reflect individuals' lay theories regarding social comparisons on social media. That is, individuals' perceptions of how often comparisons are occurring may not match how often they actually make comparisons on social media (Cramer et al., 2016).

Moreover, although recent research suggests that individuals with a greater orientation toward making social comparisons experience worse outcomes after using social media (Lee, 2014; Vogel et al., 2015; Wang et al., 2017), research conducted prior to the advent of social media suggests that these individuals experience similarly negative outcomes, such as increased depressive symptoms and social anxiety, in non-social-media contexts (Gibbons & Buunk, 1999). Consequently, it is unclear whether frequent social media comparisons are associated with more negative outcomes, or whether individuals with a propensity to compare themselves experience more negative outcomes in any context. One experience-sampling study that did measure comparison frequency demonstrated that physical appearance comparisons made on social media were actually *less* frequent than comparisons resulting from in-person encounters (Fardouly, Pinkus, & Vartanian, 2017). Given this study's focus on physical appearance, however, it is unclear how social media comparison frequency predicts comparison outcomes more broadly. In the present research, we examined whether upward comparisons would be more frequent on social media than in other contexts, and whether this greater frequency in turn would be associated with more negative social media use outcomes.

**Social Media and Upward Comparison Extremity**

We propose that social media will exert a negative impact not only by eliciting a greater number of comparisons to superior others, but also by prompting individuals to make comparisons that are especially "upward." According to the selective accessibility model

(Mussweiler, 2003; Mussweiler & Strack, 1999), individuals first assess whether they are similar or dissimilar to a superior other at a holistic level; they then go on to test their specific hypothesis either that they are similar or dissimilar to the target. Social media posts are especially likely to highlight large discrepancies between the comparer and the poster, leading to a holistic assessment of dissimilarity, and a subsequent test for evidence of dissimilarity. The characteristics of social media will yield particularly compelling evidence that other people are very superior to the self. Posters tend to focus on particularly positive events, showcasing a "newsreel highlight" of their lives (Steers et al., 2014; Zhao, Grasmuck, & Martin, 2008); for example, individuals do not merely post albums of vacation photos, but rather carefully choose, and often digitally enhance, a few select photos that indicate that their vacation was spectacular (Lo & McKercher, 2015). Moreover, such posts are likely to present a strong contrast with the immediate experiences of post viewers, who are, by definition, staring at an electronic device, often while engaged in mundane activities (Tien & Aynsley, 2019). Thus, we argue that comparisons on social media are often to superior others who are not simply better off than the self, but rather who appear to be *much* better off than the self. These more extreme comparisons may in turn be particularly threatening: To the extent that individuals perceive these highly positive outcomes to be unattainable, they will feel worse about themselves (Lockwood & Kunda, 1997). Consistent with this argument, one study on physical appearance comparisons found that women made more extreme upward comparisons to social media targets than to in-person targets, and subsequently evaluated their attractiveness more negatively (Fardouly et al., 2017). It is unclear, however, whether this effect extends to domains beyond physical appearance. In sum, the present studies are the first to assess whether individuals make more

extreme upward comparisons when using social media than in other contexts, with a negative impact on self-evaluations, mood, and life satisfaction.

**Self-Esteem and Social Media Comparisons**

The frequency and extremity of upward comparisons may also explain why social media exerts an especially negative impact on individuals with low self-esteem. To the extent that low self-esteem individuals chronically view themselves as of lower worth than other individuals, it seems likely that they will be especially prone to view successful others as upward comparison targets. Consistent with this possibility, a number of studies indicate that lower self-esteem is indeed associated with more frequent upward comparisons (Locke & Nekich, 2000; Vohs & Heatherton, 2004; Wayment & Taylor, 1995; for a review, see Wood & Lockwood, 1999). Other studies suggest, however, that low self-esteem individuals suffer not because they find many instances in which they are inferior to others but because they find few instances in which they are superior to others (Locke, 2005; Wheeler & Miyake, 1992). Thus, the literature on self-esteem and upward comparison frequency in offline contexts is mixed. Research focused specifically on social media contexts has found that individuals lower in self-esteem report a greater tendency to make Facebook comparisons in general (Cramer et al., 2016; Jang et al., 2016); however, these studies did not directly examine the role of self-esteem in predicting the actual frequency of upward relative to downward social media comparisons, nor did they compare frequency of social comparisons across different contexts.

For low self-esteem individuals, social media offers especially fertile ground for making upward comparisons. Given their negative self-perceptions, they may find it difficult to construe themselves as being “in the same league” as someone experiencing success (Collins, 1996); as a result, social media posts about even modestly positive achievements may be perceived as

upward comparisons. Thus, although low self-esteem individuals will make more upward comparisons than will higher self-esteem individuals in general, this difference in frequency may be amplified in social media contexts, where opportunities for comparisons abound, resulting in especially negative consequences for the self.

In addition, to the extent that low self-esteem individuals chronically view themselves as having lower self-worth than others, social media posts may yield especially extreme comparisons. Low self-esteem individuals may be habitually likely to make a holistic evaluation that they are dissimilar from successful others. Consistent with the selective accessibility model (Mussweiler, 2003), this initial judgement will trigger a search for evidence that they are inferior successful others. The exaggerated positivity of social media posts (Walther, 2007; Wilson et al., 2012), in combination with the already impoverished self-evaluations of low self-esteem individuals, should lead to perceptions of an especially large discrepancy between the self and the poster – and thus a more extreme upward comparison. Consistent with this possibility, one study found that participants with more contingent self-esteem were more likely to make more extreme upward comparisons and subsequently experience worse mental health outcomes; however, this research examined only physical appearance comparisons in non-social-media contexts, and focused on contingent rather than low self-esteem (Patrick, Neighbors, & Knee, 2004). We argue that although individuals in general will make more extreme social comparisons when using social media relative to other contexts, this will be especially true of low self-esteem individuals; consequently, they will experience the greatest reduction in their self-evaluations, mood, and life satisfaction following social media use.

**Present Research**

In sum, the present research provides the first evidence identifying the characteristics of social comparisons on social media – heightened frequency and extremity – that differ from social comparisons in other contexts. We also provide the first evidence that these particular characteristics in turn contribute to social media's harmful effects on the self, particularly for individuals lower in self-esteem. In Study 1, we examined low and high self-esteem individuals' actual comparison behavior in real time by assessing their reactions to posts in their own social media news feeds. This enabled us to assess the direction, extremity, and impact of each comparison made, as well as the cumulative effects of the frequency and extremity of these comparisons at the end of the browsing session. In Study 2, we experimentally manipulated post content; this enabled us to assess whether self-esteem would determine the perceived extremity and impact of comparisons, while holding post content constant. In Study 3, we manipulated context by asking participants to use social media or engage in other online activities on their smartphone, and then assessed social comparison activity and outcomes. In Study 4, we used an experience sampling methodology to examine, in a naturalistic setting, whether the frequency, direction, and impact of comparisons on social media would differ from those in other contexts.

Across studies, we predicted that participants would make more frequent upward than downward social media comparisons, which in turn would negatively impact state self-esteem, mood, and life satisfaction (Studies 1-4). We also predicted that these upward comparisons would be to more extremely superior others, and that, for each comparison, extremity would be associated with a more negative impact on self-evaluations (Studies 1-4). Further, we predicted that the frequency and extremity of upward comparisons would be greater in social media than in other contexts, and so would have more negative outcomes (Studies 3 and 4). In addition, we predicted that low self-esteem individuals would make more frequent and extreme upward social

comparisons than high self-esteem individuals, and consequently would experience the greatest comparison threat (Studies 1-3); we predicted that these self-esteem effects would be especially potent among individuals using social media relative to other contexts (Study 3).

## Study 1

In Study 1, we assessed social comparisons among participants browsing their social media news feeds on either Facebook or Instagram. After viewing each post, participants indicated whether they had made a social comparison, and if so, the comparison domain, direction, and impact on their self-evaluations. In addition, to assess the cumulative effects of the posts viewed, we measured participants' mood, state self-esteem, and life satisfaction after the browsing session. Whereas past studies have used global retrospective self-reports regarding social comparison activity on social media, participants in the present study reported on the social comparisons they made while browsing their news feed in real time in the lab; this enabled us to more accurately measure the frequency, direction, and extremity of social media comparisons, while reducing potential bias in recall. We predicted that the more extreme the upward comparison, the more negative the immediate impact on self-evaluations. In addition, we predicted that individuals would make more upward comparisons than downward or lateral comparisons, and these upward comparisons would have a cumulative negative impact on their self-evaluations, mood, and life satisfaction.

Study 1 also allowed us to examine the role of self-esteem in determining the frequency, extremity, and outcomes of comparisons occurring during an actual social media session. We predicted that lower self-esteem participants would make more extreme upward comparisons than high self-esteem individuals, and thus report feeling worse about themselves after each comparison. In addition, we predicted that low self-esteem individuals would make more

frequent upward comparisons, which in turn would result in more negative mood, self-evaluations, and life satisfaction at the end of the session.

Participants browsed either their Facebook or Instagram news feed on their smartphones and answered questions about the first 20 posts on a desktop computer. We examined comparisons on two popular social media platforms (Greenwood, Perrin, & Dugan, 2016) to confirm that our results would generalize to more than one site.

## Method

### Participants

We recruited 251 introductory psychology students for a study on social media use. Thirty-eight were excluded from our analyses: Nine participants experienced technical problems with the survey, 18 participants did not complete the survey within the allotted time, four participants indicated at the end of the session that they did not understand the instructions, four participants behaved in a manner indicating that they did not take the study seriously (e.g., stated that they gave random answers to finish the study faster), and three were unable to use their smartphones to browse their social media feeds. Our analyses included 213 introductory psychology students (157 women and 56 men; $M_{age}$=18.98 years, $SD$=1.64 years) who participated for course credit. We collected sufficient data (i.e., at least 85 observations; Cohen, 1992) to detect a small effect at both levels of our multilevel models ($N_{L1}$=1796; $N_{L2}$=206). Post-hoc power analyses revealed that we had at least 81.06% power for our primary multilevel results. For our other analyses, sensitivity analysis revealed that we had sufficient power to detect a small-to-medium effect ($r$=.19).[1]

[1] Across all studies, we had relatively small samples of males and thus limited statistical power to detect significant gender effects.

**Procedure**

Participants who use both Facebook and Instagram were invited to take part in a study on social media use. Upon arrival at the lab, participants first completed the 10-item Rosenberg Self-Esteem Scale (e.g., "I take a positive attitude toward myself"; α=.87; Rosenberg, 1965). Participants rated themselves on a 7-point scale with endpoints ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The pretest also included questions about frequency of Facebook and Instagram use; all participants indicated using both Facebook and Instagram at least once per week. Finally, to ensure that participants understood what a social comparison was and could complete the task successfully, they each completed a brief training session in which they were provided with a detailed description of what does (and does not) constitute a social comparison, and practiced identifying social comparisons in sample scenarios.[2]

After the training session, participants were randomly assigned to either the Facebook or Instagram condition and were asked to open the corresponding app on their smartphone. To ensure that participants using both platforms were following a similar procedure, we asked them to answer questions about the first 20 posts in their news feed. Participants were asked to complete the questionnaire without navigating away from their news feed. For each post, participants indicated the extent to which they had made a social comparison while viewing the post (1=*not at all*; 7=*completely*). If participants had made a comparison (i.e., answered 2 or above), they answered additional questions about the comparison.

**Comparison questions.** For posts that led to comparisons, participants first indicated in which domain(s) the comparison occurred (from a list based on options provided in an earlier study; Wheeler & Miyake, 1992), with the option of selecting one or multiple domains, or

[2] The full version of the training session, including our comparison scenarios, is available in our study materials on OSF (https://osf.io/acyzu/).

selecting 'other' and providing their own domain label (see Table 1 for a list of domain options). Participants then reported the comparison direction, by indicating whether the comparison was to someone worse- or better-off than themselves on a 7-point scale with endpoints ranging from -3 (*much worse off than me*) to +3 (*much better off than me*). This item enabled us to assess not only the direction of the comparison, but also the extremity. For example, a score of either +1 or +3 would indicate an upward comparison, but the +3 indicates a more extreme upward comparison (Patrick et al., 2004). They then rated themselves on two self-evaluation items ("After making this comparison, I felt better about myself" and "After making this comparison, I felt worse about myself" [reverse-scored]) on a 7-point scale with endpoints ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Responses for the two self-evaluation items ($r$=-.71, $p$<.001) were averaged to create a composite score of post-comparison self-evaluations.

**Post-social media questionnaire.** After answering questions about 20 posts, participants were instructed to put down their smartphones. They then completed measures assessing their affect, self-esteem, and life satisfaction.

***State affect.*** Participants first completed the 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Ratings were made on a 5-point scale (1=*not at all,* 5=*extremely*; α=.82).

***State self-esteem.*** Participants then completed a state self-esteem measure (Heatherton & Polivy, 1991), indicating how true a series of 20 statements were for them "right now" on a 5-point scale (1=*not at all,* 5=*extremely*; α=.92).

***Life satisfaction.*** Finally, participants completed the five-item Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985), indicating their agreement with each item on a 7-point scale (1=*strongly disagree,* 7=*strongly agree;* α=.85).[3]

## Results

### Overview of Analyses

We first analyzed our data at the comparison-level, examining the domain, direction, extremity, and impact of individual comparisons. We next examined our data at the session-level, in order to assess whether frequency of upward comparisons predicted post-session outcomes. Unless otherwise noted, we analyzed our data using R 3.6.0.[4]

### Individual Comparisons

**Domains.** Both Facebook and Instagram comparisons occurred in a variety of domains (see Table 1). For both platforms, the top three domains of comparison were looks/attractiveness, popularity/friendship, and vacations/activities/lifestyle.

**Direction, extremity, and self-evaluations.** Participants made comparisons that were, on average, upward in direction ($M$=1.04, 95%CI [0.97, 1.11][5], $SD$=1.54). An intercept-only multilevel model indicated this was significantly greater than the scale midpoint of 0, $b$=1.04, 95% CI [0.93, 1.15], $SE$=0.06, $t$(193.13)=17.99, $p$<.001. Moreover, a multilevel model with direction separated into its between- and within-person components and a random slope of comparison direction revealed that when individuals made comparisons that were more upward in direction than usual, they reported lower self-evaluations after the comparison $b$=-0.64, 95%

[3] Participants in this and subsequent studies answered additional questions not analyzed for this set of studies. The complete questionnaires and datasets for these studies are available by emailing the authors.
[4] Syntax for all manuscript analyses are available on OSF (https://osf.io/2k6vd/).
[5] All 95% confidence intervals are calculated using the bootstrap percentile method.

CI [-0.72, -0.55], $SE$=0.04, $t$(175.25)=-14.98, $p$<.001.[6] That is, for each participant, their more "upward" comparisons (relative to that individual's average comparison direction) resulted in more negative outcomes than their less "upward" comparisons.

***Self-esteem and self-evaluations.*** We then tested whether social media comparisons are especially damaging for individuals lower in self-esteem because they make more extreme comparisons. To test this hypothesis, we conducted a 2-1-1 multilevel mediation model because the predictor (i.e., self-esteem) varied only at the level of the person, but the mediator (i.e., comparison extremity) and outcome variable (i.e., self-evaluations) varied across all posts, which were nested within individuals. Thus, the person-level average of comparison extremity was included as a covariate in the final model and direction was person-centered (Zhang, Zyphur, & Preacher, 2009). This mediational hypothesis was tested using a variant of the bootstrap procedure (Preacher & Hayes, 2008) amended for 2-1-1 multilevel mediation using the indirect function in R (indirect.mlm; Page-Gould & Sharples, 2016) with 5,000 bootstrapped samples to accurately estimate the indirect effect and its 95% confidence interval. Furthermore, because the relationship between comparison extremity and self-evaluations could vary from person-to-person, we modeled this path (i.e., $b$ path) as a random slope (see Figure 1). Our analysis revealed that trait self-esteem was associated with lower self-evaluations as a function of its relationship with comparison extremity, $ab_{within}$=0.01, 95% CI [0.006, 0.02], $ab_{between}$=0.01, 95%CI [0.007, 0.02]: Individuals with lower self-esteem made comparisons that were more upward, $a$=-0.03 [-0.04, -0.02], which in turn made them feel worse about themselves, $b_{within}$=-0.42, 95% CI [-0.45, -0.38], $b_{between}$= -0.48, 95% CI [-0.54, -0.39]. Although the effect of trait

[6] We compared a full model that included platform, trait self-esteem, person-mean comparison direction, person-centered comparison direction, and their interactions to a model that included main effects only. Platform did not moderate this effect, $\chi^2(2)=2.15$, $p$=.34.

self-esteem on self-evaluation was significant, $c$=0.06, 95% CI [0.05, 0.07], the direct effect of self-esteem on self-evaluation was reduced when the indirect path through comparison extremity was taken into account, $c'$=0.04, 95% CI [0.03, 0.06]. Thus, compared to individuals with higher self-esteem, those with lower self-esteem felt worse after social media comparisons, at least in part because these comparisons were more extreme in their upwardness.

**Overall Session**

**Comparison frequency and post-session outcomes.** Of the 20 posts viewed by participants, an average of 8.42 (*Mdn*=8.00, *SD*=5.07) resulted in a social comparison. Furthermore, a one-way repeated-measures ANOVA corrected using Greenhouse-Geisser estimates (ε=.78) revealed a significant effect of comparison type on comparison frequency, $F(1.56, 329.53) = 140.60$, p<.001. Participants made more upward (*M*=5.32, *SD*=3.85) than downward (*M*=1.20, *SD*=1.55; $t(211)=14.80$, $p<.001$) or lateral (*M*=1.90, *SD*=2.46; $t(211)=11.05$, $p<.001$) comparisons. They also made more lateral than downward comparisons, $t(211)=3.78$, $p<.001$.[7]

We then examined whether comparison behavior over all 20 posts influenced subsequent reports of mood, state self-esteem, and life satisfaction. To account for correlations between the outcome measures, we conducted a multivariate regression in which mood, state self-esteem, and life satisfaction were regressed simultaneously on the number of upward, downward, and lateral comparisons made by participants. The total number of upward comparisons predicted outcomes, $F(3, 206)=8.95$, $p<.001$, but number of lateral, $F(3,206)=1.81$, $p=.15$, or downward

[7] Platforms did not differ in terms of number of comparisons reported, $b$=-0.02, $SE$=0.02, $z$=-0.96, $p$=.34. However, relative to participants using Facebook, participants using Instagram were especially likely to make upward comparisons relative to any other type of comparison, $b$=-0.54, $SE$=0.18, $z$=-3.03, $p$=.002, *Odds Ratio*=1.71:1. Participants who used Instagram had a 71.39% chance of making an upward comparison, whereas participants who used Facebook had a 59.36% chance of making an upward comparison.

comparisons did not, $F(3,206)=0.87$, $p=.46$. Univariate analyses indicated that making a greater number of upward comparisons was associated with less positive affect, $b=-0.02$, 95% CI [-0.04, -0.002], $SE=0.01$, $t(208)=-2.18$, $p=.030$, $r=.15$, lower state self-esteem, $b=-1.26$, 95% CI [-1.84,-0.70], $SE=0.25$, $t(208)=-4.96$, $p<.001$, $r=.33$, and lower life satisfaction, $b=-0.10$, 95% CI [-0.14,-0.05], $SE=0.02$, $t(208)=-4.22$, $p<.001$, $r=.28$. There were no effects of number of lateral or downward comparisons, $ts<1.87$, $p>.06$. Thus, regardless of the number of downward and lateral comparisons participants made while viewing their news feeds, making more upward comparisons predicted worse mood, lower state self-esteem, and diminished life satisfaction after individuals viewed the 20 posts.

***Self-esteem and post-session outcomes.*** Next, we tested whether individuals lower in trait self-esteem would have lower state self-esteem, life satisfaction, and mood after browsing their news feeds as a result of making more upward comparisons during the session. First, we regressed number of upward comparisons on trait self-esteem using a Poisson regression with a log link function to account for the fact that the number of upward comparisons represented frequency counts and thus violated the normality assumption required for traditional regression. Consistent with our hypothesis, low self-esteem individuals made more upward comparisons, $b=-0.04$ [-0.06, -0.02], $SE=0.01$, $z=-6.70$, $p<.001$.[8]

We then conducted three mediation analyses, one for each outcome, using a bootstrapping procedure (Hayes, 2013) with 5,000 resamples and generating 95% confidence

[8] There was a main effect of platform, $b=-0.10$, $SE=0.03$, $z=-3.21$, $p=.001$: Participants made more upward comparisons on Instagram than on Facebook; this effect was qualified by a significant trait self-esteem by platform interaction, $b=0.02$, $SE=0.006$, $z=3.12$, $p=.002$. Although lower self-esteem predicted making more upward comparisons on both Facebook, $b=-0.02$, $SE=0.01$, $z=-2.42$, $p=.02$, and Instagram, $b=-0.06$, $SE=0.008$, $z=-7.21$, $p<.001$, this effect was much larger on Instagram than on Facebook. Thus, low self-esteem individuals' tendency to make upward comparisons is exacerbated when they browse Instagram relative to when they browse Facebook.

intervals for the indirect effects.[9] Number of upward comparisons mediated the positive association between trait self-esteem and state self-esteem, *ab*=0.13, 95% CI [0.03, 0.26], *SE*=0.06. Although the total effect of trait self-esteem on state self-esteem was significant, *c*=2.23, 95% CI [1.90, 2.54], *SE*=0.16, the direct effect of trait self-esteem on state self-esteem was reduced when the indirect path through number of upward comparisons was taken into account, *c'*=2.10, 95% CI [1.77, 2.44], *SE*=0.16 (see Figure 2 Panel A). Number of upward comparisons also mediated the positive association between trait self-esteem and life satisfaction, *ab*=0.01, 95% CI [0.001, 0.02], *SE*=0.01. Although the total effect of trait self-esteem on life satisfaction, *c*=0.16, 95% CI [0.12, 0.19], *SE*=0.02, was significant, the direct effect of self-esteem on life satisfaction was reduced when the indirect path through number of upward comparisons was taken into account, *c'*=0.14, 95% CI [0.11, 0.18], *SE*=0.02 (see Figure 2 Panel B). Finally, we tested whether number of comparisons would mediate the positive association between trait self-esteem and affect. Although this indirect effect was in the predicted direction, it was not reliable, *ab*=0.001, 95% CI [-0.003, 0.005], *SE*=0.002.[10] Thus, when using either Facebook or Instagram, participants with lower trait self-esteem reported making a greater number of upward comparisons, and thus experienced significantly lower state self-esteem and life satisfaction after the social media session.

## Discussion

[9] In the reported models, we treated number of upward comparisons as a continuous variable. However, we tested additional models that treated number of upward comparisons as a count variable (Geldhof, Anthony, Selig, & Mendez-Luck, 2018). These results were consistent with those reported in the manuscript and are reported in greater detail in supplementary materials (https://osf.io/9vbw6/).

[10] We tested whether there was a self-esteem by social media platform effect for any of the post-session outcomes measured. There were no platform effects for affect or life satisfaction, *t*s<.66, *p*s>.51; however, there was a significant trait self-esteem by platform interaction for state self-esteem, *b*=-0.42 [-0.74, -0.12], *SE*=0.15, *t*(208) =-2.70, *p*=.01, *r*=.18: This effect was much larger for participants using Instagram, *b*=2.67 [2.31, 3.05], *SE*=0.22, *t*(208)=11.90, *p*<.001, *r*=.64, than for those using Facebook, *b*=1.84 [1.31, 2.34], *SE*=0.21, *t*(208)=8.63, *p*<.001, *r*=.51. Thus, low self-esteem individuals feel worse about themselves after browsing Instagram than after browsing Facebook.

Study 1 demonstrates a direct link between comparison behaviors and their immediate consequences when browsing social media. Participants made comparisons that were primarily upward, and many individuals made multiple comparisons in a single session, with a median of 8 comparisons in 20 posts. Across both social media platforms, making more upward comparisons while viewing posts from others was associated with lower state self-esteem and life satisfaction following the social media session, regardless of the number of downward and lateral comparisons individuals had also made.

Additionally, we found that, compared to higher self-esteem individuals, those with lower self-esteem reported making more extreme upward comparisons, which predicted lower self-evaluations after each comparison. Furthermore, individuals with lower self-esteem reported a greater number of upward comparisons, which predicted more negative state self-esteem and life satisfaction after the session. This provides evidence that low self-esteem individuals may be susceptible to making more frequent and more extreme upward comparisons, which are both associated with more negative outcomes for the self.

Our results indicate that comparisons on social media occurred in a wide range of domains. Whereas past research examining offline comparisons found that individuals tended to make the most comparisons about academics and personality followed by physical appearance and lifestyle (Wheeler & Miyake, 1992), we found that individuals made more comparisons about attractiveness, popularity, and vacations and leisure activities when using social media. Indeed, only 10% of comparisons made on social media were in the domains of personality and academics (despite the fact that all participants were students). Thus, it appears that, with the rise of social media, the domains in which individuals make comparisons may have shifted, with a greater focus on physical appearance, popularity, and recreation activities. Although

comparison domain was not a focus of these studies, it is nevertheless useful to consider that social media may prompt comparisons that differ in domain as well as frequency and extremity. We note, however, that we did not directly compare comparisons on social media with those in other contexts; we examine this in Studies 3 and 4.

## Study 2

Study 1 provides evidence that self-esteem is associated with both more frequent and more extreme upward comparisons while using social media, which in turn are associated with more negative self-evaluations. We note, however, that this study used a correlational design. It is possible that low self-esteem individuals are simply viewing different content than are their higher self-esteem peers. For example, it may be that low self-esteem individuals have negative self-perceptions because they have many superior friends, in which case the posts they view from those friends on social media may be more positive and threatening, resulting in more extreme upward comparisons. In Study 2, we assessed participants' responses to a set of Facebook posts we created for the purpose of the study, thus holding the valence of post content constant for low and high self-esteem individuals. This design is similar to that employed by Vogel et al. (2014) in which participants viewed a post with more or fewer likes, a manipulation of popularity. In our study, we instead manipulated the content of the posts to determine the impact of content valence.

Participants were a community sample recruited via Amazon's Mechanical Turk (MTurk); all viewed social media posts in which individuals described events that varied in valence (positive, negative, neutral). Participants were told that posts were real examples taken from the social media pages of participants who had taken part in a previous study; in fact, the posts were created by the experimenters for the purposes of the study. After each post,

participants indicated whether they made a comparison and how they felt about themselves as a result of the comparison.

As in Study 1, we examined whether self-esteem would predict comparison extremity. Here, however, by exposing all participants to the same positive, negative, and neutral posts, we can also rule out the possibility that low self-esteem individuals report making more upward social media comparisons simply because they have friends who post a disproportionate amount of positive content online. We predicted that, after viewing the same posts as people with higher self-esteem, participants with lower self-esteem would report making upward comparisons that were more upward in direction (i.e., more extreme), which in turn would lead to more negative self-evaluations.

## Method

### Participants

Through MTurk, we recruited 103 individuals who were paid $1.00 USD. Participants were eligible for the study if they used Facebook at least once per month and passed two standard attention checks (Maniaci & Rogge, 2014). Nine participants failed one or both attention checks, and three participants indicated they used Facebook less than once per month. Our analyses included 91 participants (63 women, 27 men, 1 person of other/undisclosed gender; $M_{age}$=32.95, $SD$=10.19 years). As in Study 1, we were interested in within- and between-person effects and thus collected sufficient data to detect a small effect ($r$=.10) at each level (at least 85 observations; Cohen, 1992); post-hoc power analyses revealed that for all analyses (except one which had .70 power), our final sample sizes ($N_{L1}$=364; $N_{L2}$=91) had at least .81 power.

### Procedure

Participants were invited to take part in a study regarding social perceptions on Facebook. First, participants completed the same self-esteem scale (α=.93) used in Study 1. Participants were then presented with four posts, ostensibly written by past participants. Posts were presented one at a time. After each one, participants answered a series of questions. All participants saw two neutral posts that described everyday personal experiences (see Table 2); they viewed these as the first and last of the four posts. Participants were then randomly assigned to see either a positive then a negative post or a negative then a positive post. The positive post described either a personal achievement or a pleasant outcome (i.e., getting a good job or a positive relationship experience), and the negative post described a personal negative experience (i.e., a lay-off or a break-up). In sum, all participants viewed four posts – two neutral, one negative and one positive. We used two domains for each condition to ensure that results were not limited to one domain only.

**Facebook post questions.** In line with the study's cover story, participants read each post and answered a series of questions about their perception of the posters' personality. The last question was the comparison direction measure ("To what extent do you feel this person is worse-off or better-off than you?"); participants responded on a 7-point scale with endpoints ranging from -3 (*much worse off than me*) to +3 (*much better off than me*) with a midpoint of 0 *(neither worse off nor better off than me).* Participants then completed a two-item self-evaluation measure ($r$ = .69) similar to the one used in Study 1; they indicated the extent to which they felt worse about themselves and better about themselves on a 7-point scale ranging from -3 (*strongly disagree*) to +3 (*strongly agree*).

## Results

### Overview of Analyses

We first examined whether participants were more likely to make an upward comparison after viewing a positive (vs. neutral or negative) post and thus report lower self-evaluations. We then examined whether lower self-esteem participants were more likely than their higher self-esteem peers to make upward comparisons in response to positive posts. Finally, across all posts, we examined whether, as in Study 1, participants with lower self-esteem made comparisons that were more extremely upward and consequently experienced worse post-comparison outcomes. Unlike Study 1, all analyses in Study 2 were conducted at the level of the individual posts and comparisons, as participants viewed too few posts to assess frequency of comparisons as an outcome measure.

**Order effects.** There was a significant effect of order on comparison extremity, $b$=0.24, 95% CI [0.09, 0.39], $SE$=0.08, $t(346)$=3.17, $p$<.001: Participants who saw the positive post before the negative post (i.e., made an upward comparison first) rated comparisons to be more upward than participants who saw the negative post before the positive post (i.e., made a downward comparison first). Thus, although there was no effect of order on self-evaluation, $b$=-0.03, 95% CI [-0.17, 0.10], $SE$=0.07, $t(97.88)$=-0.50, $p$=.62, we controlled for the effect of order in all analyses.

**Comparison Direction and Extremity**

We then examined whether participants made different types of comparisons in response to the positive, neutral, and negative posts using a one-way repeated measures ANOVA corrected using Greenhouse-Geisser estimates (ε=.76) because post type was nested within person. Comparisons made in response to the positive posts ($M$=0.77, $SD$=1.46) were more upward than those made to the neutral posts ($M$=0.16, $SD$=0.77), which were, in turn, more upward than comparisons made to the negative posts, ($M$=-1.46, $SD$=1.19; $F$(1.51,

135.94)=108.80, $p$<.001, $t$s>3.81, $p$s<.001). This suggests that our manipulation of post content was indeed effective, with positive content posts leading to upward comparisons, and negative content posts leading to downward comparisons.

**Self-esteem and comparison extremity.** We then examined whether self-esteem influenced comparison extremity for each post type. Comparison direction was modelled as a function of self-esteem (grand-mean centered continuous variable), post valence (two dummy-coded variables), and their interaction while controlling for the effect of order. There was a main effect of post valence, $\chi^2(2)=162.41$, $p$<.001: Positive posts resulted in more upward comparisons ($M$=0.79, $SE$=0.12) than neutral ($M$=0.18, $SE$=0.09) and negative posts ($M$=-1.45, $SE$=0.12). There was also a main effect of self-esteem, $b$=-0.20, $SE$=0.08, $t$(93.20)=-2.63, $p$=.01: Individuals lower in self-esteem made more extreme upward comparisons. The post valence by self-esteem interaction was not significant, $\chi^2(2)=5.27$, $p$=.07. Although the overall interaction did not reach significance, we tested the effect of self-esteem for each post type because of our a priori hypothesis that individuals with lower self-esteem would report comparisons that were more upward after viewing a positive post (Howell, 2013). To test this hypothesis, we recoded the post valence variables so that each post valence was the reference group (Aiken & West, 1991), resulting in three 2-level multilevel models with random intercepts estimated using an unstructured covariance matrix and the Satterthwaite method of estimating degrees of freedom. Self-esteem effect sizes for each type of post is estimated using semi-partial $R^2$ (Edwards, Muller, Wolfinger, Qaqish, & Schabenberger, 2008).

For positive posts, there was a significant effect of self-esteem, $b$=-0.40, 95% CI [-0.63, -0.16], $SE$=0.12, $t$(315.30)=-3.28, $p$=.001, *semi-partial* $R^2$=0.03 (see Figure 3). In contrast, there was no effect of self-esteem for either neutral, $b$=-0.15, 95% CI [-0.33, 0.04], $SE$=0.09,

*t*(186.14)=-1.57, *p*=.12, *semi-partial* $R^2$=0.01, or negative posts, *b*=-0.06, 95% CI [-0.29, 0.19], *SE*=0.12, *t*(315.30)=-0.45, *p*=.65, *semi-partial* $R^2$=0.001. Thus, consistent with our hypothesis, when exposed to the same positive posts, individuals lower in self-esteem tended to make more extreme upward comparisons than individuals higher in self-esteem; however, lower self-esteem individuals did not differ from higher self-esteem individuals in comparison extremity after being exposed to neutral or negative posts. Because the overall interaction was not significant, we note that these results must be interpreted with caution.

**Self-Evaluations**

To test whether participants felt worse after viewing the positive posts, relative to other posts, as a result of making more extreme upward comparisons, we conducted a bootstrapped 1-1-1 multilevel mediation using a similar analytic strategy as Study 1. Because we were primarily interested in the occurrence of upward comparisons, and thus the effect of positive posts, we entered post valence as two dummy-coded variables, one that compared positive to neutral posts (0=positive, 1=neutral, 0=negative), and one that compared positive to negative posts (0=positive, 0=neutral, 1=negative). The predictor (i.e., post valence) varied within participants only. Thus, we did not enter the person-level average of post valence as a covariate in the final model. Furthermore, the relationships between post valence and direction as well as direction and self-evaluations could vary from person-to-person, so we modeled these paths (i.e., *a* and *b* paths) as random slopes. Because the function we used allowed us to specify only a single independent variable, we included the other dummy code as a covariate and ran the bootstrap analysis twice, allowing each dummy code to be the independent variable once and the covariate once (Hayes & Preacher, 2014). We also specified the same starting value (i.e., seed) to ensure

that the same bootstrap samples were used for both analyses. Finally, we controlled for the order in which the posts were presented.

Our first analysis revealed that the difference between positive and neutral posts affected self-evaluations as a function of its relationship with comparison direction, $ab_{within}$ = 0.23, 95% CI [0.09, 0.34], $ab_{between}$ = 0.20, 95% CI [0.10, 0.35]: When participants read a positive post, relative to a neutral one, they were more likely to make an upward comparison, $a_{within}$=-0.60, 95% CI [-0.85, -0.32], which in turn made them feel worse about themselves, $b_{within}$ -0.38, 95% CI [-0.45, -0.19], $b_{between}$= -0.33, 95% CI [-0.50, -0.23]. Although the difference between positive and neutral posts on self-evaluations was significant, $c$= 0.30 [0.07, 0.53], the direct effect of post valence was not significant when the indirect path through comparison direction was taken into account, $c'$= 0.01, 95% CI [-0.21, 0.23] (see Figure 4 Panel A). The population covariance for this model was estimated to be $\sigma_{ab}$=0, 95% CI [-0.03, 0.07]. This implies that the mediational model was consistent across individuals. Thus, posts appear to exert their impact on self-evaluations through social comparisons.

Our second analysis revealed that the difference between positive and negative posts also affected self-evaluations as a function of its relationship with comparison direction, $ab_{within}$=0.93, 95% CI [0.70, 1.32], $ab_{between}$=0.73, 95% CI [0.53, 1.20]: When participants saw a positive post, relative to a negative one, they were more likely to make an upward comparison, $a_{within}$=-2.24, 95% CI [-2.53, -1.95], which in turn made them feel worse about themselves, $b_{within}$=-0.42, 95% CI [-0.55, -0.32], $b_{between}$=-0.33, 95% CI [-0.52, -0.24]. Although the difference between positive and negative posts on self-evaluations was significant, $c$= 0.88, 95% CI [0.63, 1.12], the direct effect of post type was not significant when the indirect path through comparison direction was taken into account, $c'$= -0.09, 95% CI [-0.54, 0.11] (see Figure 4 Panel B). As in the first model,

the population covariance for this model implies that that the mediational model was consistent across individuals, $\sigma_{ab}$=0.002, 95% CI [-0.02, 0.08]. Thus, consistent with our hypothesis, participants felt worse about themselves after being exposed to positive posts, relative to negative or neutral posts, because they made comparisons that were more upward in direction.

**Self-esteem and self-evaluations**. Finally, we tested whether, as in Study 1, self-esteem predicted worse self-evaluations after viewing individual social media posts as a result of making more extreme upward comparisons. We conducted a bootstrapped 2-1-1 multilevel mediation using the same analytic strategy described in Study 1. Furthermore, the relationship between comparison extremity and self-evaluations could vary from person-to-person; thus, we modeled this path (i.e., *b* path) as a random slope (see Figure 5) as we did in Study 1. We also controlled for order in this model. Our analysis revealed that trait self-esteem was associated with lower self-evaluations as a function of its relationship with comparison extremity, $ab_{within}$=0.11, 95% CI [0.03, 0.20], $ab_{between}$=0.07, 95% CI [0.02, 0.19]: Individuals with lower self-esteem made comparisons that were more upward, $a$=-0.29, 95% CI [-0.53, -0.08], which in turn made them feel worse about themselves, $b_{within}$=-0.37, 95% CI [-0.43, -0.25], $b_{between}$= -0.24, 95% CI [-0.46, -0.18]. Although the effect of trait self-esteem on self-evaluation was significant, $c$=0.45, 95% CI [0.29, 0.62], the direct effect of self-esteem on self-evaluation was reduced when the indirect path through comparison extremity was taken into account, $c'$=0.39, 95% CI [0.20, 0.49]. Thus, consistent with our hypothesis, lower self-esteem participants felt worse about themselves after viewing social media posts at least in part because they made upward comparisons that were more extreme in upwardness than those of higher self-esteem participants.

## Discussion

In sum, posts that were positive in valence did lead participants to make upward comparisons and, thus, feel worse about themselves. The more extreme the upward comparison, the more negative the impact on the self. Furthermore, although all participants were likely to make an upward comparison in response to the positive posts, lower self-esteem participants interpreted these posts as more upward than did higher self-esteem participants. Indeed, we replicated our first mediation model from Study 1: Compared to participants with higher self-esteem, those with lower self-esteem tended to make more extreme upward comparisons and, as a result, experienced greater decreases in their self-evaluations after being exposed to the same content. Thus, low self-esteem individuals do not merely have better memory for upward comparisons than their higher self-esteem peers, or view posts with more positive content. Moreover, this effect was limited to positive posts only: Low self-esteem individuals perceived individuals in negative and neutral posts similarly to higher self-esteem individuals; they were not less likely to see the worse-off others as downward comparisons and were not more likely to see neutral posts as upward comparisons. Therefore, these data provide initial evidence suggesting that it is not any comparison behavior in general (Steers et al., 2014), but rather positive posts resulting in more extreme upward comparisons that are a key contributor to low self-esteem individuals' more negative outcomes following social media use. Because the overall interaction between post valence and self-esteem was not significant, however, we note that the findings related to extremity and self-esteem must be interpreted with caution.

In Studies 1 and 2, participants reported on comparisons throughout the time they spent viewing social media posts. Although this provided information about participants' responses to each post they viewed, we note that this procedure may also have created demand characteristics, in that participants may have been especially likely to notice and report on social comparisons.

It may be that participants make fewer actual social comparisons when they are not prompted to think about them in this way. Accordingly, in Study 3, instead of asking participants to report on each comparison as it occurred, we instead asked them to report on comparisons at the end of the session, without alerting them in advance to the focus on comparison behavior.

## Study 3

We argue that social media may be especially likely to elicit upward comparisons, and that these comparisons will have a negative impact, particularly among individuals low in self-esteem, who make more frequent (Study 1) and more extreme (Studies 1 and 2) upward comparisons. Up to this point, however, we have not directly compared social media comparisons to those that occur in other contexts. In Study 3, we experimentally manipulated context to examine whether social media would indeed be especially likely to elicit threatening upward comparisons. Specifically, participants were randomly assigned to use their smartphone either to access social media or for any other purposes (e.g., surf the net, text, watch online videos) for 10 minutes; they then reported their self-evaluations and information about any comparisons they had made. This manipulation allowed us to examine whether social media comparisons differ from other technology-based comparisons, and to assess whether people feel worse after using social media relative to engaging in other technology-based activities as a result of the type of social comparisons they make. Finally, we evaluated whether low self-esteem individuals would be especially likely to make upward comparisons, and consequently be negatively affected, on social media relatively to other online contexts.

We also used this study to examine two variables found in previous research (Tesser, 1988) to be implicated in comparison outcomes: closeness of the comparison target and domain relevance. Past research indicates that individuals are more threatened when outperformed by a

close other in a domain that is important to them (Tesser, Millar, & Moore, 1988). Many social media contacts, however, are more distant and may even be past classmates or celebrities with whom one has no direct contact. Moreover, individuals often view posts about leisure activities or activities that may not be directly relevant to the self. This would suggest that, according to the self-evaluation maintenance (SEM) model (Tesser, 1988), social media comparisons might be less threatening than comparisons in other contexts. Accordingly, we measured both closeness and domain importance. Studies 1 and 2 provided initial evidence that comparisons on social media would be threatening to the self. Accordingly, we expected that, despite lower closeness and domain importance, social media comparisons would nevertheless pose a greater threat to the self than those in other contexts, due to their greater frequency and extremity.

## Method

### Participants

In total, 482 participants who indicated in a pre-screen survey that they owned a smartphone and currently used either Facebook, Instagram, or both completed the study for $1.50 USD. We excluded 67 participants from the analyses: Thirty-five participants did not follow the instructions for the browsing session (i.e., went on Facebook and/or Instagram in the no social media condition or did not go on Facebook and/or Instagram in the social media condition), 4 participants failed our comparison training session[11], and 28 participants submitted the survey more than once. For duplicate responses, we retained the first completed response and deleted subsequent responses.

Our analyses included 415 MTurk workers (245 women, 168 men, and 2 persons of other/undisclosed gender; $M_{age}$=37.55 years, $SD$=12.79 years). We collected sufficient data (i.e.,

[11] We considered answering fewer than half of the questions correctly as failing the comparison training session.

at least 85 observations; Cohen, 1992) to detect a small effect at both levels of our multilevel models ($N_{L1}$= 255; $N_{L2}$=124). For our other analyses, sensitivity analysis revealed that we had sufficient power to detect a small-to-medium effect ($r$=.14).

**Procedure**

**Pre-screen survey.** We invited participants to complete a 5-minute pre-screen eligibility survey that included questions about their technology and social media use. To be eligible for the study, participants had to indicate they owned a smartphone, which they would use during the experimental manipulation, and a second device they could use to complete the actual survey (i.e., laptop or desktop computer); in addition, they had to indicate that they used either Facebook, Instagram, or both platforms. As part of this pre-screen survey, participants completed the same self-esteem measure used in Studies 1 and 2 ($\alpha$=.93).

**Study questionnaire.** We asked participants to use their smartphones for 10 minutes, specifying that they either refrain from using social media (no social media condition) or spend the entire 10 minutes using Facebook and/or Instagram (social media condition). At the end of the browsing session, participants indicated what they did during the browsing session (see Table 3). To encourage honest reporting, we told participants that their compensation would not be affected by whether or not they followed the manipulation instructions. Next, participants in both groups completed the same comparison training session used in Study 1 and then reported whether they had made any comparisons during the 10-minute browsing session. If they reported making at least one comparison, they were asked to enter the first names of each target to whom they compared themselves. For each target they listed, participants were asked additional questions about the comparison. As in Studies 1 and 2, we asked in what domain the comparison occurred and the extent to which the comparison target was doing better or worse

than the self. In Study 3, we also asked participants to indicate how close they felt to the comparison target on a 7-point scale with endpoints ranging from 0 (*not at all*) to 6 (*extremely*). Participants also rated how important the domain was to them using a 7-point scale with endpoints ranging from 0 (*not at all important*) to 6 (*extremely important*). Finally, participants reported their state self-evaluations using a one-item measure ("Right now, how do you feel about yourself?") rated on a 7-point scale with endpoints ranging from -3 (*much worse about myself than usual*) to +3 (*much better about myself than usual*).

## Results

### Overview of Analyses

As in Study 1, we first present our analyses at the comparison-level, examining whether comparisons on social media differed from comparisons in other computer-mediated contexts in terms of domain, direction, and impact. We also examine whether, as in Studies 1 and 2, comparisons made by individuals lower in self-esteem were more upward in direction than those made by individuals with higher self-esteem. We then present session-level analyses in which we first examine whether context and self-esteem were associated with frequency of upward comparisons during the 10-minute session. In addition, we examine whether spending time on social media (vs. not using social media) predicted greater likelihood of making one or more upward comparisons and thus lower self-evaluations at the end of the session. Finally, we assessed whether this session-level effect was stronger for individuals with lower self-esteem: We assessed whether low self-esteem individuals using social media were especially likely to make one or more upward comparisons, and thus experience the most negative consequences to the self.

### Individual Comparisons

**Domains.** Consistent with Study 1, we found that social media comparisons occurred in a variety of domains (see Table 1), and the most common domains of comparison in this context again included looks/attractiveness and vacations/activities/lifestyle. In contrast, the most common comparison domains in other technology-based contexts were health/physical fitness, personality/morality, and skills/abilities. A series of logistic multilevel models, however, indicated that comparisons made on social media (0) compared to those in the no social media condition (1) were not significantly more likely to be about looks/attractiveness, $b$=-0.42, $SE$=0.66, $z$=-0.63, $p$=.53, or vacations/activities/lifestyle, $b$=-0.43, $SE$=0.54, $z$=-0.79, $p$=.43, but were less likely to be about personality/morality, $b$=1.12, $SE$=0.002, $z$=598.98, $p$<.001.

***Domain importance.*** We next examined whether domain importance ratings differed by experimental condition using a multilevel model. We modeled domain importance ratings as a function of comparison context (effects-coded: -1=no social media condition; + 1= social media condition) with a random intercept for each person. Experimental conditions did not differ in terms of domain importance, $b$=-0.01, 95% CI [-0.29, 0.26], $SE$=0.14, $t$(112.79)=-0.10, $p$=.92. Domains of comparisons made on social media ($M$=3.88, $SE$=0.16) and in other technology-based contexts ($M$=3.91, $SE$=0.22) were both rated as moderately important. Thus, we found no evidence that social media comparisons involve domains that are more (or less) personally relevant than comparisons in other technology-based contexts.

**Closeness to target**. We then examined whether closeness to the comparison target differed depending on the context in which a comparison was made; we used the same multilevel model as we used for domain importance. Experimental conditions did not differ in terms of target closeness, $b$=-0.04, 95% CI [-0.39, 0.31], $SE$=0.18, $t$(119.37)=-0.24, $p$=.81. Targets in social media comparisons ($M$=2.10, $SE$=0.21) and in other technology-based contexts ($M$=2.18,

*SE*=0.29) were rated as relatively low in closeness. In sum, we found no evidence that comparisons on social media were in domains higher (or lower) in importance, or to targets with greater (or lesser) closeness to the self. This suggests that neither closeness nor importance can account for any differences we observed in comparison outcomes between social media and other online contexts.[12]

**Direction, extremity, and self-evaluations.** Participants' self-evaluations after comparisons were modelled as a function of comparison context condition with a random intercept for each person, *b*=-0.18, 95% CI [-0.41, 0.05], *SE*=0.12, *t*(130.58)=-1.51, *p*=.13. Although this effect was not significant, it was in the expected direction: Compared to other contexts, comparisons made while using social media were associated with feeling worse about the self after the comparison. Next, extremity of comparison direction was modelled as a function of comparison context with a random intercept for each person. This analysis revealed that social media comparisons were not more upward in direction than those in other technology-based contexts, *b*=0.07, 95% CI [-0.19, 0.33], *SE*=0.13, *t*(127.04)=0.52, *p*=.60. Additionally, unlike in Studies 1 and 2, lower self-esteem did not predict making more extreme upward comparisons, *b*=-0.08, 95% CI [-0.34, 0.18], *SE*=0.13, *t*(132.10)=-0.59, *p*=.56. We review possible explanations for these findings below.

**Overall Session**

**Comparison frequency.** Next, we conducted a series of Poisson regressions to examine whether conditions differed in terms of number of comparisons. Participants assigned to the social media condition made more comparisons (*M*=0.84, *SD*=1.50) than those assigned to the no

[12] We did not have sufficient power to test the full SEM model (i.e. a potential 3-way interaction between domain importance, closeness, and context). However, differences in closeness across the two contexts did not mediate the difference in comparison outcomes between contexts.

social media condition ($M$=0.40, $SD$=1.20), $b$=0.36, 95% CI [0.14, 0.61], $SE$=0.07, $z$=5.50, $p$<.001. Furthermore, participants in the social media condition made a greater number of upward, $b$=0.35, 95% CI [0.11, 0.64], $SE$=0.08, $z$=4.58, $p$<.001, and lateral comparisons, $b$=0.48, 95% CI [0.08, 0.99], $SE$=0.19, $z$=2.59, $p$=.01, than those in the no social media condition. There was no difference between the two conditions for number of downward comparisons, $b$=0.31, 95% CI [-0.17, 1.04], $SE$=0.18, $z$=1.69, $p$=.09. Thus, individuals using social media made more comparisons than those simply browsing the Internet. Moreover, social media use was associated with an increased number of upward and lateral comparisons, but not downward comparisons. We note that participants reported less frequent comparisons relative to Studies 1 and 2. This is not surprising: Because participants in the social media condition were free to use the platforms in any way they chose (e.g., navigate away from their news feed to read an article, engage in other activities simultaneously such as listening to music or a podcast) rather than viewing only news feed posts (as in Studies 1 and 2), and reported all comparisons at the end of the social media session, rather than after each post (as in Studies 1 and 2), they likely had fewer opportunities to make and/or take note of their individual social comparisons. Although the overall frequency of comparison was lower, we nevertheless observed the predicted difference, with more upward comparisons in the social media condition. See Table 4 for comparison frequency overall and within each condition.

***Self-esteem and upward comparison frequency.*** We then tested whether self-esteem was associated with number of upward comparisons made during the 10-minute session. As predicted, participants with lower self-esteem made a greater number of upward comparisons than participants with higher self-esteem, $b$=-0.38 [-0.52, -0.24], $SE$=0.06, $z$=-6.63, $p$<.001.

**Post-session self-evaluation**. Next, we tested whether context influenced how participants felt about themselves after the 10-minute smartphone session. Participants assigned to the social media condition (*M*=0.36, *SE*=0.08) reported lower self-evaluations at the end of the study than those in the no social media condition (*M*=0.58, *SE*=0.08), *b*=-0.11, 95% CI [-0.22, -0.005], *SE*=0.06, *t*(413)=-2.03, *p*=.04. We then tested whether making one or more upward comparisons (vs. no upward comparisons)[13] mediated this difference between the two experimental conditions (social media vs. no social media; see Figure 6).[14] Given the non-normal distribution of presence of upward comparisons, our mediator, we conducted a nonlinear mediation analysis based on the generalized linear model by specifying a path model with binomial and Gaussian (normal) distributions (Geldhof et al., 2018). We used nonlinear mediation analysis (Hayes & Preacher, 2010) to calculate conditional indirect effects (i.e., indirect effects at specific values of X) and used a bootstrapping procedure to calculate confidence intervals with 5000 resamples using *MPlus* 7.4 (Muthén & Muthén, 1998-2012)[15]. Consistent with our hypothesis, the indirect effect through presence vs. absence of upward comparisons was significant, *ab*=-0.16, 95%CI [-0.47, -0.04], *SE*=0.12, and the direct effect became nonsignificant, *c'*=-0.14, 95% CI [-0.37, 0.08], *SE*=0.11, once this indirect effect was included. Taken together, these findings suggest that individuals felt worse after using social media, relative to those who browse the Internet without using social media, because they were more likely to make one or more upward comparisons.

[13] Given the limited variance in number of upward comparisons (1.24), we transformed our count variable to a binary variable to test whether making at least one upward comparison mediated the effect of self-esteem on self-evaluations. Our indirect effects were nonsignificant when we treated number of upward comparisons as a count variable; however, based on the results of Study 1, we would predict that making more upward comparisons would predict worse outcomes.

[14] Our results for our simple and moderated mediation models remained consistent when we controlled for number of downward comparisons and number of lateral comparisons.

[15] We describe this and other analyses in greater detail in our supplementary materials (https://osf.io/9vbw6/).

***Self-esteem and post-session self-evaluation.*** Finally**,** we tested a moderated mediation model in which the association between dispositional self-esteem and self-evaluation at the end of the study was mediated by making one or more upward comparisons (see Figure 7). We expected this indirect effect to be larger in the social media condition than in the no social media condition. Given the non-normal distribution of the mediator, we used a similar analytic strategy as that described above; however, we amended this approach for a moderated mediation (Hayes, 2015). That is, we calculated conditional indirect effects at specific values of the predictor, self-esteem (i.e., one standard deviation above and below the mean), and the moderator, experimental condition. These conditional indirect effects are reported in Table 5. Consistent with our hypothesis, the direct effect, $c$'=0.10, 95% CI [0.008. 0.19], $SE$=0.05, $z$=2.19, $p$=.03, was reduced once we accounted for the indirect effect through presence or absence of upward comparisons. Then, we conducted an omnibus test to determine whether these conditional indirect effects at various levels of self-esteem differed between experimental conditions. This test indicated that this trend was not reliable, $\chi^2(2)=5.84$, $p$=.054. Nonetheless we take this trend as tentative evidence that our indirect effect was moderated by context. Taken together, these findings suggest that individuals lower in dispositional self-esteem may be more likely to make more upward comparisons than those higher in self-esteem, particularly when using social media; this greater number of comparisons on social media, in turn, is associated with lower self-evaluations for low self-esteem individuals following social media use.

## Discussion

Study 3 demonstrates that spending 10 minutes on social media, relative to other online activities, increases the chances of making one or more upward social comparisons and thus feeling worse about the self. Furthermore, the increased likelihood of making upward

comparisons mediated the link between social media use and lowered self-evaluations: Individuals using social media feel worse about themselves *because* they are likely to make more frequent upward comparisons. Moreover, this effect occurs despite the fact that social media comparisons involve targets no closer to the self and in domains that are no more personally relevant than comparisons made in other online contexts. This finding is theoretically significant because it suggests that social media comparisons may not play by the same rules as other comparisons. Past studies, including research supporting the self-evaluation maintenance model, indicates that comparisons to less close others are less likely to result in either a threatening contrast effect or a positive basking in reflected glory effect (e.g., Tesser, 1988). Social media comparison targets are no more close than other online comparison targets, yet they lead to more threatening upward social comparisons. It may be that social media contacts, while less psychologically close than individuals with whom one has more recent or in-person contact, may nevertheless represent important standards against which one measures one's life successes. One may not feel close to a former high school classmate, but one may nevertheless feel a pang when one sees a post from the classmate highlighting their superior career accomplishments, their recent engagement, or their children's academic successes. Our findings suggest that further research will be important to assess whether closeness is the best variable to evaluate the relevance of social media contacts as comparison others.

This study also provides important evidence that low self-esteem individuals are especially vulnerable to self-esteem threats as a result of their social comparisons. They were more likely to make upward comparisons than were high self-esteem individuals, and this self-esteem effect tended to be more pronounced among participants using social media. Contrary to our predictions, however, we did not find that individuals made more extreme upward

comparisons while using social media or that low self-esteem individuals made especially extreme upward comparisons. One possible explanation is that participants were reporting on all comparisons at the end of the session, and thus were unable to identify or report subtle differences in comparison extremity. In addition, we note that many individuals in the no social media condition were viewing videos or other online material in which they may have been exposed to celebrities or other very positive content. Thus, it is possible that the relatively smaller number of comparisons made in the no-social-media contexts were as extremely upward as the more numerous upward comparisons on social media. That is, it may be that upward comparisons are more extreme in all online media, whether social media, videos, or other websites.

In Study 3, we asked participants about their social comparisons at the end of the 10 minutes that participants spent on their phones, rather than after each opportunity for comparison, as in Studies 1 and 2. This methodology reduces the likelihood that individuals were reporting many comparisons because they felt prompted to do so after each post viewed. Indeed, participants reported fewer comparisons overall in Study 3 compared to Study 1, and although this may be partially due to spending less time on social media in Study 3, it is also likely due to reduced demand characteristics. Although the total number of comparisons made was lower, however, we nevertheless observed a greater frequency of social comparisons on social media than in other contexts; this difference across contexts cannot be attributed solely to demand characteristics because both conditions received the same instructions after using their phone and before reporting any social comparisons they made.

## Study 4

Study 3 provides important evidence that social media comparisons differ from those made in other technology-based contexts. It did not, however, include comparisons that occur in offline contexts, such as face-to-face interactions. Thus, in Study 4, we conducted an experience sampling study to examine participants' social comparison behavior across all contexts. Participants installed a custom-made experience sampling app on their smartphone for two weeks that prompted them six times a day to complete a short survey about any comparisons they had made since the previous report. This enabled us to: 1) examine the direction, frequency, extremity, and outcomes of social media comparisons as they occur in daily life; 2) compare social comparisons made on social media with those in all other contexts; and 3) assess whether the amount of time spent on social media predicts upward comparison frequency. Whereas the between-subjects design of Study 3 allowed us to assess whether individual differences in self-esteem predict different outcomes in different contexts (i.e., social media vs. other technology-based activities), Study 4 was designed to further investigate within-person effects of context on social comparison outcomes. That is, we were able to assess whether individuals make more frequent and more extreme upward comparisons when spending time on social media than they do when spending time in other contexts.

## Method

### Participants

We recruited 87 undergraduate students from a university in a large urban center to participate in a two-week long study on daily experiences[16]. Two participants were unable to participate because the smartphone app was incompatible with their devices, and six participants

[16]At the outset of the study, we aimed to recruit as many participants as possible, up to a maximum of 100. We ended recruitment at the conclusion of the semester, which coincided with the end of the academic year. We decided to end recruitment because we anticipated being unable to follow-up with a significant portion of participants during the summer months.

did not complete any experience sampling questionnaires after attending the intake session. In our final dataset, we had experience sampling data from 79 participants (51 women, 26 men, and 2 person of other/undisclosed gender; $M_{age}$=20.15 years, *SD*=2.40 years). Only 66 participants (83.54%) returned for the exit session and thus completed all three components of the study. Participants were invited to take part only if they owned a smartphone and reported that they used social media. We compensated participants up to $60, depending on the extent to which they participated in the study ($16 for the intake session, $2 per day that they completed 4 or more surveys, $3 for each completed week, and $10 for the exit session). On average, participants provided 62.51 surveys (*SD*=24.78) for 12 of the 14 survey days (*SD*=4.0; median response rate= 100), for a total of 4382 completed surveys.

**Procedure**

Participants first came to the lab for an intake session, during which they were asked to install the experience sampling app (ExperienceSampler, Thai & Page-Gould, 2018); a research assistant then instructed them on how to use the app and how to recognize and accurately report on social comparisons. Notifications were customized to participants' sleep and wake times and included an opportunity to specify different times for weekdays and weekends. For the following two weeks, the app randomly prompted participants to complete a short survey six times per day[17], in which they indicated the time they had spent on various activities (e.g., face-to-face interactions, texting, social media) and whether they had made a comparison since the previous survey. Whenever participants indicated they had made a comparison, they then reported to whom they had compared themselves (i.e., close friend, ordinary friend, acquaintance, past

[17] In accordance with recommendations outlined in Wheeler & Reis (1991), we opted for signal-contingent sampling, as we expected social comparisons to occur frequently (i.e., numerous times per day) and were interested in their relative distribution across a variety of domains.

friend, stranger, famous person, fictional character, sibling, other family member, romantic partner, or other) and their closeness to that person on a 7-point scale with endpoints ranging from 0 (*not at all close*) to 6 (*extremely close*). Participants then indicated the primary comparison domain from a list (see Table 1) and indicated the importance of that domain to them on a 7-point scale with endpoints ranging from 0 (*not at all important*) to 6 (*extremely important*). Next, they indicated in what context that comparison took place (i.e., in person/face-to-face, video call, voice-only phone call, other voice chat, email, texting/SMS, social media, dating app/website, other media/online context, or in a thought/daydream). If participants indicated the comparison was made while using social media, they were also asked to indicate the platform (e.g., Instagram, Facebook).[18] Finally, participants indicated the direction and outcomes of the comparison, using the same questions as in Studies 1-3. At the end of the survey, regardless of comparison behavior, participants reported their current self-evaluations on a 7-point scale with endpoints ranging from -3 (*Much worse about myself than usual*) to +3 (*Much better about myself than usual*). After the two-week experience sampling period, participants returned to the lab for compensation and debriefing.

## Results

### Overview of Analyses

As in Studies 1 and 3, we first present analyses conducted at the individual comparison-level, contrasting social media comparisons to those made in other contexts (e.g. those made face-to-face, in a thought/daydream, or in any other computer-mediated context other than social

[18] Participants were also asked to indicate which aspect of the social media platform (i.e., public feed, private chat/message, or group chat/message) they were using at the time of the comparison, to distinguish comparisons made in private messages from those made while browsing news feeds. Given that the news feed is a unique feature of social media that does not exist in other contexts and our focus on the effects of news feed posts on comparison behaviour in Studies 1-2, we compared news feed comparisons to comparisons made in all other contexts.

media). We then present analyses for the overall experience sampling period, examining the total number of comparisons participants made on social media compared to in other contexts.[19]

**Individual Comparisons**

**Domains.** Consistent with Studies 1 and 3, the two most common domains of comparisons on social media were looks/attractiveness and vacations/activities/lifestyle. In this study, unlike Study 3, looks/attractiveness was also a common domain in contexts other than social media, second only to academics/careers (see Table 1). This difference may be due to the samples involved in each study: Study 3 consisted of primarily middle-aged adults, whereas Study 4 consisted of primarily undergraduate students. Compared to middle-aged adults, undergraduate students are less likely to have established careers and be in long-term relationships, both of which may increase their interest in making comparisons in the academics/careers and looks/attractiveness domains. In the present study, a logistic multilevel model revealed that looks/attractiveness comparisons were 77.50% times more likely to occur on social media than in other contexts, $b$=1.24, $SE$=0.001, $z$=1311.77, $p$<.001, *Odds Ratio*=3.44:1. That is, although looks/attractiveness comparisons were common across all contexts, they were especially likely when individuals were using social media.

**Domain importance.** Relative to comparisons in other contexts, comparisons made while using social media were in domains that participants rated as less personally important, $b$=-0.10, 95% CI [-0.19, -0.01], $SE$=0.05, $t$(999.01)=-2.06, $p$=.039. Thus, consistent with Study 3, we found that social media comparisons did not involve domains that were more personally important to participants than comparisons made in other contexts.

[19] In contrast to Studies 1-3, we did not have the required number of participants to test for small effects at the person-level (i.e. 85; Cohen, 1992), so we did not examine the role of self-esteem in this study.

**Closeness to target.** Relative to comparisons in other contexts, comparisons made while using social media involved targets that participants rated as less close to the self, *b*=-0.36, 95% CI [-0.49, -0.22], *SE*=0.07, *t*(1135.62)=-5.23, *p*<.001. These lower closeness targets nevertheless elicited a more negative impact on the self, as will be discussed next.[20]

**Comparison direction, extremity, and self-evaluations.** Next, we tested a mediational pathway such that comparisons made while browsing one's social media news feed, relative to comparisons made in other contexts (0= other contexts; 1= social media news feed), were more extreme (i.e., more upward), resulting in worse post-comparison self-evaluations. We conducted a bootstrapped 1-1-1 multilevel mediation using a similar analytic strategy as Studies 1 and 2 (see Figure 8). Because all predictors varied within person, we separated the predictor (context) and mediator (comparison extremity) into their between- and within-person components, but we report the within-person components only because we are primarily interested in the within-person differences in context. We also included time as a covariate in our model. Finally, because the relationship between context and comparison extremity (i.e., *a* path) as well as the relationship between comparison extremity and self-evaluations (i.e., *b* path) could vary from person-to-person, we modeled these paths as random slopes. Our analysis revealed that comparison context affected self-evaluations as a function of its relationship with comparison extremity, *ab*=-0.26, 95% CI [-0.44, -0.13]: Comparisons made on social media news feeds, relative to other contexts, did indeed result in comparisons that were more extreme in their upwardness, *a*= 0.74, 95% CI [0.37, 1.25], which in turn made participants feel worse about themselves, *b*=-0.35, 95% CI [-0.40, -0.32]. Although the difference between comparison

[20] As in Study 3, we did not have enough power to test the full SEM model (i.e., a potential 3-way interaction between domain importance, closeness, and context). Furthermore, neither decreased closeness to the comparison target nor lower domain importance mediated the effect of context on comparison outcomes, indicating that these variables may not play as much of a role in social media comparisons as in other contexts.

contexts on self-evaluations was significant, $c$=-0.44, 95% CI [-0.76, -0.16], the direct effect of context was not significant when the indirect path through comparison extremity was taken into account, $c'$=-0.02, 95% CI [-0.31, 0.21]. The population covariance for this model was estimated to be $\sigma_{ab}$=0, 95% CI [-0.015, 0.015]. This implies that the mediational model was consistent across individuals. Thus, participants felt worse about themselves after making comparisons on social media relative to comparisons in other contexts, at least in part because these comparisons were more extreme in their upwardness.[21]

**Overall Experience Sampling Period**

**Context and comparison likelihood.** We first examined whether time spent on each activity predicted the likelihood of making a social comparison for any given survey using a logistic multilevel model with a random intercept, the within- and between-person components of time spent on each activity, and time as a covariate. When individuals spent more time on social media than they usually did, they were more likely to report making a social comparison when they were signalled, $b$=0.01, 95% CI [0.008, 0.013], $SE$=0.002, $z$=5.07, $p$<.001. No other within-person effects were significant, $z$s<1.52, $p$s>.12. In addition, individuals who used social media more, relative to other participants, were more likely to report making a social comparison when they were signalled, $b$=0.05, 95% CI [0.004, 0.07], $SE$=0.01, $z$=3.28, $p$=.001. No other between-person effects were significant, $z$s<1.28, $p$s>.20.

[21] We tested whether comparisons made on Facebook and Instagram, the two most common social media platforms, differed in extremity. When individuals reported making a comparison on Instagram, relative to a comparison on Facebook, they reported a comparison that was more extreme in its upwardness; however, this within-person effect was not significant, $b$=0.66, $SE$=0.39, $t$(149.07)=1.67, $p$=.09. We also tested whether comparisons differed in terms of likelihood of being upward depending on the platform. Facebook and Instagram comparisons were equally likely to be upward, relative to other types of comparisons, $b$=0.84, $SE$=0.66, $z$=1.29, $p$=.20.

**Context and comparison frequency.** Next, we examined whether total time spent on each activity predicted total number of comparisons.[22] On average, participants reported making 1.44 comparisons per day (*SD*=1.27), of which fewer were made on social media (*M*=0.22, *SD*=0.42) than in other contexts (*M*=1.26, *SD*=1.08; *t*=-8.80, *p*<.001). However, a Poisson regression that included total time spent on various activities during the study and number of surveys completed revealed that total minutes spent on social media, *b*=0.0004, 95% CI [0.0002, 0.0008], *SE*=0.00004, *z*=9.87, *p*<.001, and dating apps, *b*=0.01, 95% CI [-0.02, 0.02], *SE*=0.002, *z*=2.99, *p*=.003, were positively associated with number of comparisons, whereas more time spent face-to-face, *b*=-0.00004, 95% CI [-0.0002, 0.00004], *SE*=0.00001, *z*=-3.07, *p*=.002, and on email, *b*=-0.003, 95% CI [-0.01, 0.01], *SE*=0.0007, *z*=-4.37, *p*<.001, were negatively associated with number of comparisons. Time spent on all other activities did not predict number of comparisons, *z*s<1.75, *p*s>.08.

Furthermore, additional Poisson regressions revealed that number of social media minutes were associated with a greater number of upward[23], *b*=0.004, 95% CI [0.0001, 0.001], *SE*= 0.0001, *z*= 6.27, *p*<.001, lateral, *b*= 0.0005, 95% CI [0.00003, 0.001], *SE*= 0.0001, *z*=4.14, *p*<.001[24], and downward comparisons, *b*=0.0005, 95% CI [0.0001, 0.001], *SE*=0.0001, *z*= 5.54, *p*<.001[25]. Paired t-tests indicated that upward comparisons were, however, more common on

[22] The data for total time spent on each activity (except social media, skewness =1.61) were highly positively skewed, skewness > 2.90. Thus, the bootstrapped confidence intervals for these coefficients may include 0.
[23] Time spent on dating apps was the only other activity that predicted making more upward comparisons, *b*=0.008 [-0.02, 0.02], *SE*=0.002, *z*=3.14, *p*=.002. More time spent emailing, *b*=-0.003, 95% CI [-0.01, 0.007], *SE*=0.001, *z*=-3.63, *p*<.001, face-to-face, *b*=-0.00004, 95% CI [-0.0003, 0.0001], *SE*=0.00002, *z*=-2.29, *p*=.02, on video calls, *b*=-0.0006, 95% CI [-0.004, -0.0003], *SE*=0.0002, *z*=-3.39, *p*=.001, and on other voice chat, *b*=-0.0007, 95% CI [-0.005, 0.001], *SE*=0.0004, *z*=-2.05, *p*=.04, all predicted making fewer upward comparisons. No other effects were significant, *z*s < 0.70, *p*s>.49.
[24] Time spent on dating apps was the only other activity that predicted making more lateral comparisons, *b*=0.01, 95% CI [-0.02, 0.03], *SE*=0.005, *z*=2.40, *p*=.02. More time spent face-to-face, *b*=-0.0001, 95% CI [-0.0006, 0.00003], *SE*=0.0001, *z*=-2.14, *p*=.03, predicted making fewer lateral comparisons. No other effects were significant, *z*s < 1.84, *p*s>.066.
[25] More time spent emailing, *b*=-0.004, 95% CI [-0.01, 0.009], *SE*=0.001, *z*=-3.05, *p*=.002, predicted making fewer downward comparisons. No other effects were significant, *z*s < 1.81, *p*s>.07.

social media than both lateral, $t(78)=3.14$, $p=.002$, and downward comparisons, $t(78)=3.03$, $p=.003$. In other words, spending more time on social media was associated with making more social comparisons, and these social comparisons were most likely to be upward.

The total number of comparisons made on social media was less than one might expect from Studies 1-3. It is possible that participants in this experience sampling study were simply forgetting about the less consequential comparisons made, or reporting relatively few to avoid completing additional questions on the app. Indeed, we allowed participants to report multiple comparisons each time they were signaled; thus, survey length increased if participants reported more comparisons. Past research has shown that participants are more likely to satisfice (i.e., impose a limit on how much effort they will apply to the survey) when responding to more time-consuming diary protocols (Barta, Tennen, & Litt, 2012). Regardless, it is noteworthy that participants made over 10% of their social comparisons on social media. Furthermore, other than spending time on dating apps (another context in which people engage in strategic self-presentation; for a review, see Finkel, Eastwick, Karney, Reis, & Sprecher, 2012), spending time on social media was the only recorded activity that predicted making more frequent comparisons. These results are consistent with our hypothesis that individuals are especially likely to make social comparisons when using social media.

## Discussion

In sum, consistent with Study 3, Study 4 demonstrates that individuals are more likely to make upward than downward or lateral comparisons when using social media, relative to other contexts. Further, we found evidence that comparisons on social media are more threatening and, in turn, result in worse self-evaluations than those in other contexts, despite being to less close others and in domains that are rated as less important. Additionally, we demonstrated that,

for any given individual, spending more time on social media was associated with making more social comparisons. This within-person finding is significant because although previous studies have demonstrated associations between time spent on social media and global, retrospective reports of comparison frequency (e.g., de Vries & Kühne, 2015), it was previously unclear whether this finding was due to the possibility that people who report making more comparisons also spend more time on social media. In this study, we show that, regardless of whether an individual spends more or less time on social media compared to other people, when that individual spends more time on social media, relative to her or his other daily activities, comparisons are more likely. In addition, relative to other contexts, those comparisons made on social media are more extremely upward and thus result in more negative self-evaluations. In sum, this study provides the first clear evidence that time spent on social media results in a greater number of upward comparisons, comparisons that are more extreme in their upwardness, and, consequently, more negative self-evaluations.

## General Discussion

Taken together, these studies provide the first comprehensive analysis of how individuals make and respond to social comparisons on social media and the characteristics of these comparisons that differ from those made in other contexts. Indeed, this research provides compelling evidence that social media is associated with frequent and extreme upward comparisons, which in turn have a negative impact on individuals' self-evaluations, mood, and life satisfaction.

### Upward Comparison Frequency on Social Media

First, we found that social comparisons on social media are frequent, and especially likely to be upward. Although past studies identified this upward direction as a significant feature of

comparisons on social media, they did not separately assess the relative frequency of upward and downward comparisons, instead focusing only on upward comparison frequency (e.g., de Vries & Kühne, 2015; Hanna et al., 2017; Vogel et al., 2014;) or general comparison frequency (e.g., Cramer et al., 2016; Feinstein et al., 2013; Gerson et al., 2016; Jang et al., 2016; Lee, 2014; Steers et al., 2014). The present studies directly compared the frequency of upward and downward comparisons made by individuals while browsing their own social media news feeds (Study 1), immediately after using social media (Study 3), and in an experience sampling paradigm during a two-week period (Study 4), confirming that upward comparisons consistently outnumber downward comparisons on social media. The preponderance of upward comparisons is consistent with past studies that have found that people are generally opt for superior or upward comparison targets (Gerber et al., 2018). However, the present studies are the first to demonstrate that upward comparisons are more frequent when individuals are using social media than when they are using other online technologies (Studies 3) or indeed than when they are engaging in most other daily activities (Study 4).

These studies are also the first to demonstrate that the more frequent upward comparisons that individuals experience while using social media are associated with more negative outcomes for the self, including worse mood, lower self-esteem, and decreased life-satisfaction. We show that the upward comparisons that individuals make while using social media not only have an immediate negative impact on their self-evaluations (Studies 1-4) but also cumulative negative effects on their self-esteem, mood, and life-satisfaction (Studies 1 and 3). In past research, investigators typically have examined the outcome of a single comparison, or have compared an upward to a downward comparison on various outcomes such as self-evaluation (e.g., Morse & Gergen, 1970), motivation (e.g., Lockwood, Marshall, & Sadler, 2005; Lockwood & Pinkus,

2008; Thai, Lockwood, & Boksh, 2020) affect (e.g. Buunk, Collins, Taylor, VanYperen, & Dakof, 1990; Gibbons & Gerrard, 1989; Pinkus, Lockwood, Marshall, & Yoon, 2012; Salovey & Rodin, 1984), closeness (e.g., Thai, Lockwood, Pinkus, & Chen, 2016), or domain relevance (e.g., Thai & Lockwood, 2015). In the present studies, we were able to test the cumulative effects of a series of comparisons, examining the relative impact of multiple upward and downward comparisons on state-self-esteem, life satisfaction, and mood. Our studies demonstrate that upward rather than downward comparisons have the greatest impact on individuals, and that this impact is overwhelmingly negative. Indeed, any downward or lateral comparisons did little to mitigate the sting of the more prevalent upward comparisons. Further, because upward comparisons are more frequent on social media relative to other contexts, these negative outcomes are more pronounced when individuals are on social media relative to other online contexts (Study 3) or engaging in other daily activities more generally (Study 4).

The present studies also provide the first evidence that, compared to other activities, spending time on social media increases the likelihood of making upward comparisons (Studies 3 and 4). This research thus provides new evidence to explain the negative outcomes that have been associated with increased social media use (Best et al., 2014) and may also at least partially account for the associations between smartphone use and lower well-being, especially among young adults (Boumosleh & Jaalouk, 2017; Twenge, 2017). When using social media, individuals are especially likely to compare themselves to superior, rather than inferior, others (Studies 1, 3, and 4), and they subsequently feel worse about themselves and less satisfied with their lives. The more time they spend on social media, the more upward comparisons they make (Study 4), and the worse they subsequently feel about themselves (Studies 1-4). In sum, these

studies suggest that social media may be leading to changes in daily social comparison behavior; individuals now make more upward comparisons that are more threatening to the self.

**Upward Comparison Extremity on Social Media**

These studies provide evidence that upward comparisons are not only more frequent on social media, they are also more extreme in their upwardness. Because these studies allowed us to assess, for the first time, the impact of upward comparison extremity within each individual, we were able to evaluate the degree to which the "upwardness" of each individual comparison would determine its impact. We found that, for any given individual, a comparison that was more extremely upward (than their other comparisons) resulted in a more negative effect on their self-evaluations immediately following the comparison (Studies 1, 2, and 4). Additionally, by comparing extremity across context, we were able to show that upward comparisons are more extreme on social media than in other daily activities (Study 4), and that this greater extremity accounts, in part, for the more negative outcomes experienced by individuals using social media. We note that the extremity results in Study 3 did not reach significance; it is possible that we did not have sufficient power to detect this effect. Alternatively, it may be that comparisons that take place in any online context are often more extreme in upwardness, given that much online content, whether on social media, dating platforms, videos, or celebrity news stories, may include carefully curated and predominantly positive content. In the future, it will be important to examine comparisons in additional contexts and evaluate their impact.

**Self-esteem and Comparisons on Social Media**

Up to now, we have discussed the contribution of this research to understanding the negative impact of more frequent and extreme upward comparisons on social media. This research also provides valuable insights into the role of self-esteem in determining comparison

outcomes, in any context. Past research on self-esteem and comparisons has yielded mixed results: Some research indicates that lower self-esteem individuals are especially prone to making upward comparisons (e.g., Locke & Nekich, 2000), whereas other theory and research suggests that low self-esteem individuals may be especially likely to avoid upward comparisons (e.g., Wood, Giordano-Beech, Taylor, Michela, & Gaus, 1994; Wood, Michela, & Giordano, 2000). Furthermore, other research has focused primarily on this relationship in the reverse causal direction, suggesting that more upward comparisons lead to lower self-esteem (e.g., de Vries & Kühne, 2015; Hanna et al., 2017; Leahey, Crowther, & Mickelson, 2007; Vogel et al., 2014; Wood, 1989).

The present studies focused on the role of self-esteem in determining comparison frequency and extremity. Specifically, we found that individuals lower in trait self-esteem made more frequent and more extreme upward comparisons, and as a result, reported greater declines in state self-esteem, life satisfaction, and self-evaluations, than individuals with higher self-esteem. Moreover, we found evidence that lower self-esteem individuals actually interpret information in a way that yields a more extreme upward comparison: Even when information in a social media post was held constant (Study 2), lower self-esteem individuals were more likely to see the poster as superior, and as more extremely superior, than were higher self-esteem individuals. Finally, the more frequent upward comparisons made by low self-esteem individuals tended to lead to negative self-evaluations among individuals in social media, rather than other online, contexts (Study 3). Because social media has dramatically increased opportunities for social comparison, and upward comparison in particular, a browse through a news feed appears to pose a higher risk for individuals lower in self-esteem. We note that we had insufficient power to test the moderating impact of self-esteem in Study 4; accordingly, it

will be important to examine how self-esteem influences reactions to social comparisons in a variety of contexts beyond the online contexts evaluated in Study 3.

**Domain Importance and Closeness**

We found that comparisons on social media were especially distressing; this was not, however, due to the greater importance of the comparison domains on social media. Social media comparisons were in domains similar in importance to those in other online contexts (Study 3) and were actually in domains *less* important than those in offline contexts more generally (Study 4). This suggests that social media comparisons are exerting a powerful impact despite the fact that they take place in less consequential domains. It may be that the carefully packaged information provided in social media posts packs a punch even when it is focused on relatively trivial domains such as restaurant meals or entertainment viewed, or even when posts simply showcase random (but attractively presented) selfies taken throughout the day. We note, however, that we assessed domain importance after the comparisons had been made, and a possible reaction to threatening upward comparisons is devaluing the comparison domain (Tesser, 1988; Tesser & Paulhus, 1983). Thus, future studies should examine prior domain importance when examining the impact of social media comparisons on self-evaluations.

Similarly, the more negative impact of social media comparisons was not due to greater closeness of the comparison others. Indeed, although individuals compare to less close others on social media than in other contexts, they nevertheless react more negatively to these comparisons (Study 4). Social media has opened up a vast array of individuals with whom one can compare, and this broad pool of comparison targets appears to intensify rather than dilute the outcome of comparisons. Instead of making occasional comparisons to people from one's past, at a reunion, wedding or other event, one is forced to view the achievements of less close contacts, whose

positive outcomes are carefully presented for maximum impact, whenever one is browsing social media. Every day has become like a high school reunion, in which one is forced to confront the apparently more successful lives of one's former friends and acquaintances, and comparisons to these remote contacts are no less threatening for their psychological distance.

**Future Directions and Conclusions**

The present studies focused on social media comparisons in the context of Facebook (Studies 1-4) and Instagram (Studies 1, 3, and 4), currently the most popular social media platforms worldwide (Pew Research Center, 2019)[26]. Facebook, in particular, is used by individuals of all ages for both social contact and business (Greenwood et al., 2016). In recent years, however, a number of other social media platforms have increased in popularity (Pew Research Center, 2019), and it will be important to examine the nature and impact of comparisons made on these other platforms. Given that all social media platforms afford individuals an opportunity to carefully manage the self-image they present to the world, we would expect to find a similar preponderance of upward social comparisons.

Further, to the extent that different platforms are popular among different age groups, it will be important to examine how social media use may lead to different comparison experiences and consequences among younger and older individuals. Indeed, we note that two of our four studies used first-year psychology student participants. It is possible that the type of posts that young adults see and their reactions to them differ systematically from other populations, such as older adults or those in a different stage of life. First-year undergraduates may be especially likely to compare on social media in general. They are in a period of transition (i.e., from high

[26] In this factsheet, YouTube is listed as the most popular social media channel; however, there is debate over whether it is, primarily, a social media platform (e.g., Abramovich, 2015). Furthermore, because we were interested in comparisons occurring in social media news feeds, we focused on the two most popular platforms with this feature.

school to university) and thus may be more interested in how well they are adjusting to their new life by comparing themselves to others (Lockwood, Shaughnessy, Fortune, & Tong, 2012), evaluating what they need to do to succeed (Blakemore & Mills, 2014; Suls, Martin, & Wheeler, 2002; Wheeler, Martin, Suls, 1997). The results of Studies 2 and 3, which involved online community samples, suggest that our findings are not limited to one age group. Nevertheless, future studies should examine social media comparisons across age groups and life stages.

In addition, we note that the present studies focused on vertical or status comparisons (upward vs. downward) rather than horizontal comparisons (contrastive vs. connective; Locke, 2003). It is possible that some individuals will use social media to seek out lateral or similarity-based comparisons that would result in more communal or positive outcomes (Locke & Nekich, 2000). Alternatively, it may be that opportunities for horizontal comparisons are more plentiful offline than online, as the former context may provide greater access to information about shared attributes, across multiple domains. For example, joint participation in an activity or discussion with a friend could make common interests or opinions as salient as observations about differences in appearance or particular skills. In future research, it will be important to consider the full range of comparisons, both vertical and horizontal, that may occur through social media and whether this differs from other contexts.

Social media platforms offer individuals unprecedented opportunities to connect with friends, stay in touch with family, share accomplishments, and feel part of a community. Indeed, past research suggests that Facebook can have positive outcomes such as helping maintain relationships (Ellison et al., 2007). The benefits of these platforms, however, also come with potential costs. The present studies reveal that upward comparisons on social media are commonplace and have both immediate and cumulative negative outcomes, especially for

individuals with low self-esteem. With ongoing growth of social media sites, continued research on how these platforms affect their users – especially those at vulnerable ages or life stages – is essential.

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*Table 1*. Comparison Domains.

| Comparison Domain | Study 1 (*N*=1795) | | Study 3 (*N*=250) | | Study 4 (*N*=1211) | |
|---|---|---|---|---|---|---|
| | Instagram (*n*=941) | Facebook (*n*=854) | Social media (*n*=169) | Other contexts (*n*=86) | Social media (*n*=124) | Other contexts (*n*=1087) |
| Looks / Attractiveness | 263 (27.9%) | 163 (19.1%) | 23 (13.6%) | 10 (11.6%) | 41 (33.1%) | 167 (15.4%) |
| Academics/ Career | 54 (5.7%) | 89 (10.4%) | 14 (8.3%) | 5 (5.8%) | 11 (8.9%) | 254 (23.4%) |
| Dating / Relationships | 48 (5.1%) | 47 (5.5%) | 5 (3.0%) | 6 (7.0%) | 7 (5.6%) | 65 (6.0%) |
| Popularity / Friendships | 98 (10.4%) | 119 (13.9%) | 15 (8.9%) | 5 (5.8%) | 3 (2.4%) | 46 (4.2%) |
| Vacations / Activities / Lifestyle | 219 (23.3%) | 162 (19.0%) | 26 (15.4%) | 9 (10.5%) | 16 (12.9%) | 83 (7.6%) |
| Personality / Morality | 38 (4.0%) | 86 (10.1%) | 12 (7.1%) | 9 (10.5%) | 3 (2.4%) | 112 (10.3%) |
| Skills / Abilities | 75 (8.0%) | 63 (7.4%) | 14 (8.3%) | 13 (15.1%) | 12 (9.7%) | 126 (11.6%) |
| Health / Physical Fitness | 65 (6.9%) | 62 (7.3%) | 20 (11.8%) | 13 (15.1%) | 16 (12.9%) | 80 (7.4%) |
| Wealth / Finances | 31 (3.3%) | 22 (2.6%) | 9 (5.3%) | 4 (4.7%) | 1 (0.8%) | 19 (1.7%) |
| Family | 21 (2.2%) | 19 (2.2%) | 10 (5.9%) | 6 (7.0%) | 0 (0%) | 17 (1.6%) |
| Other | 29 (3.1%) | 22 (2.6%) | 13 (7.7%) | 4 (4.7%) | 1 (0.8%) | 16 (1.5%) |
| Multiple domains | - | - | 8 (4.7%) | 2 (2.3%) | 13 (10.5%) | 102 (9.4%) |

*Note*: *N* is the number of comparisons reported across all participants. In Study 1, participants could select multiple domains; thus, the sum of all domains in Study 1 exceeds the total.

*Table 2*. Content of Facebook posts viewed by participants (Study 2).

| Post ID | Post Content |
|---|---|
| Neutral 1 | Any suggestions for good lunch spots? In the mood to try something new :P |
| Neutral 2 | OMGGG to the season finale of Walking Dead! Who else was shocked?!? |
| Negative 1 | got some bad news, I'm unexpectedly out of a job… but we guess I've got to pick myself up and move forward.. would really appreciate anyone that knows someone who is hiring! |
| Negative 2 | Heartbroken – trust me everyone, never fall in love… even when you think you know someone, it's impossible to actually know what is in their head – it is SUCH a myth that two people can become one… |
| Positive 1 | Finally got my dream job at John Hopkins Hospital!! Thank you to everyone who helped me get here…this is PROOF that hard work, tirelessness, and determination does pay off – you can all reach your dreams :) |
| Positive 2 | So thankful to be celebrating 1 year with my babe today…you make me smile like no one else can& make my life so much better. We can't wait for what is next for us.. love you xxxooo |

*Table 3*. Frequencies of participants' online activities (Study 3).

| | No Social Media Condition (*n*=213) | Social Media Condition (*n*=202) |
|---|---|---|
| Made a phone call | 20 | 5 |
| Answered a phone call | 12 | 5 |
| Read a text/message | 100 | 32 |
| Wrote a text/message | 67 | 16 |
| Read an email | 96 | 11 |
| Wrote an email | 24 | 4 |
| Read an article | 64 | 15 |
| Read a book | 10 | 1 |
| Listened to music | 26 | 7 |
| Listened to the radio | 7 | 5 |
| Listened to a podcast | 6 | 3 |
| Watched a video | 56 | 23 |
| Watched TV or a movie | 12 | 6 |
| Used a dating app/website | 5 | 2 |
| Checked Facebook | 0 | 172 |
| Checked Instagram | 0 | 90 |
| Used other social media | 36 | 5 |
| - Used Snapchat | 7 | 1 |
| - Used Twitter | 9 | 1 |
| Other activity | 85 | 6 |
| Multiple activities | 171 | 109 |

*Note:* Frequencies do *not* total condition sample size because participants were able to report multiple activities.

*Table 4.* Frequencies of participants' comparison activity (Study 3).

| | | Comparison Frequency | | | | Total # of |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 3+ | Participants |
| Whole Sample | Upward | 63 | 22 | 11 | 7 | 103 |
| (*n*=415) | Downward | 15 | 3 | 4 | - | 22 |
| | Lateral | 23 | 4 | - | 1 | 28 |
| No social media | Upward | 22 | 9 | 2 | 2 | 35 |
| condition | Downward | 3 | - | 3 | - | 6 |
| (*n*=213) | Lateral | 8 | 1 | - | - | 9 |
| Social media | Upward | 41 | 13 | 9 | 5 | 68 |
| condition | Downward | 12 | 3 | 1 | - | 16 |
| (*n*=202) | Lateral | 15 | 3 | - | 1 | 19 |

*Table 5.* Conditional Indirect Effects Through Number of Upward Comparisons on Self-Evaluation at Specific Values of Self-Esteem in Each Condition (Study 3).

| Self-Esteem Values | Experimental Condition | Indirect Effect Estimate | SE | 95% CI |
|---|---|---|---|---|
| Low (-1 *SD*) | No Social Media | 0.080 | 0.05 | [0.018, 0.195] |
| | Social Media | 0.113 | 0.04 | [0.039, 0.194] |
| High (+1 *SD*) | No Social Media | 0.034 | 0.01 | [0.01, 0.057] |
| | Social Media | 0.099 | 0.04 | [0.032, 0.193] |

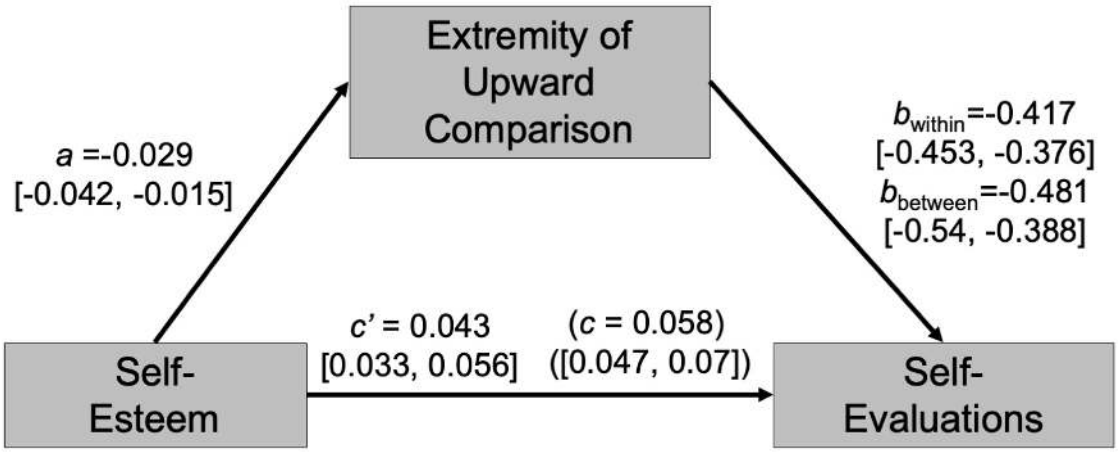


*Figure 1.* The association between self-esteem and self-evaluation is mediated by differences in comparison extremity (Study 1). Unstandardized regression coefficients and 95% bootstrapped confidence intervals are reported along the paths they model. Statistics reported within parentheses represent the total effect. Values with the subscript within represent the within-subject effects, and values with the subscript between represent between-subject effects. The direct and total effects have not been parsed into within- and between-person components.

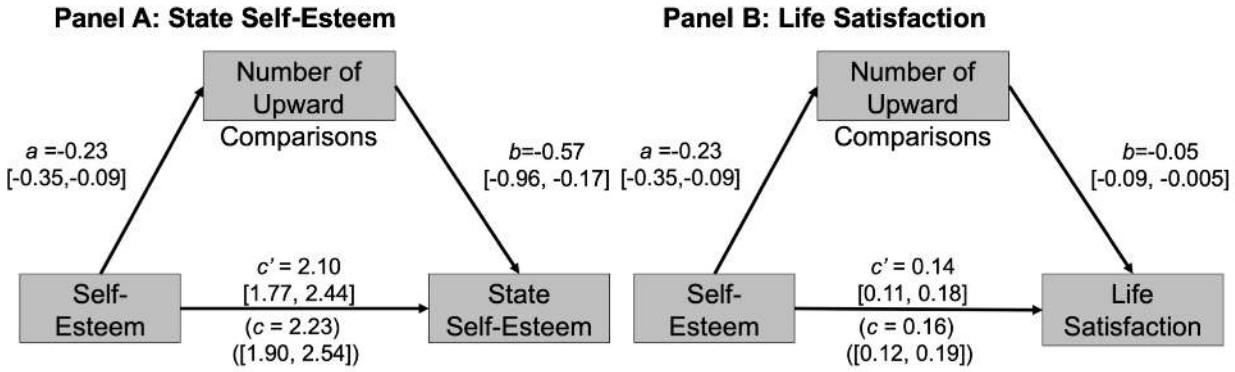


*Figure 2.* The association between self-esteem and post-browsing session outcomes are mediated by number of upward comparisons (Study 1). Panel A depicts the mediational model for state self-esteem, and Panel B depicts the mediational model for life satisfaction. Unstandardized regression coefficients and 95% bootstrapped confidence intervals are reported along the paths they model. Statistics reported within parentheses represent the total effect.

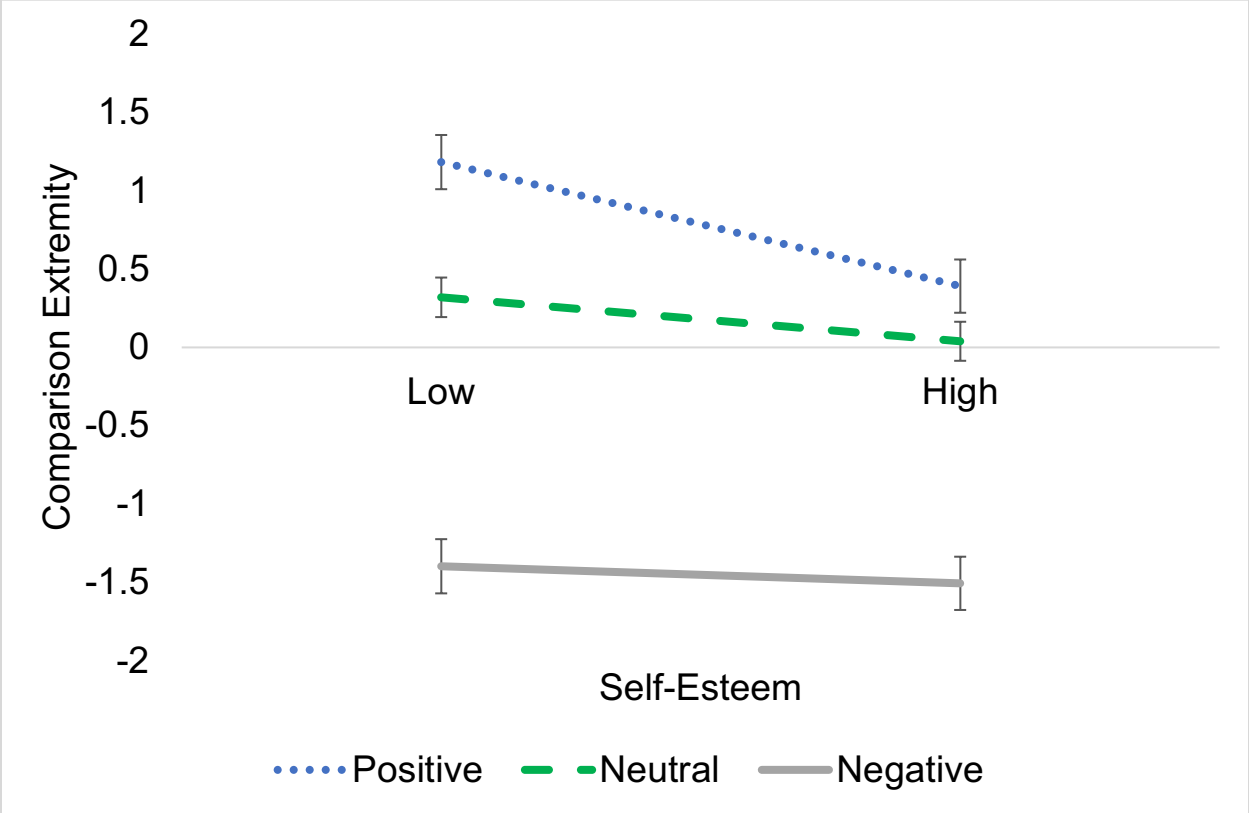


*Figure 3*. The effect of self-esteem on comparison extremity for each post type (Study 2) while controlling for order. Errors bars represent standard errors. Greater scores on the y-axis indicate a more extreme upward comparison.

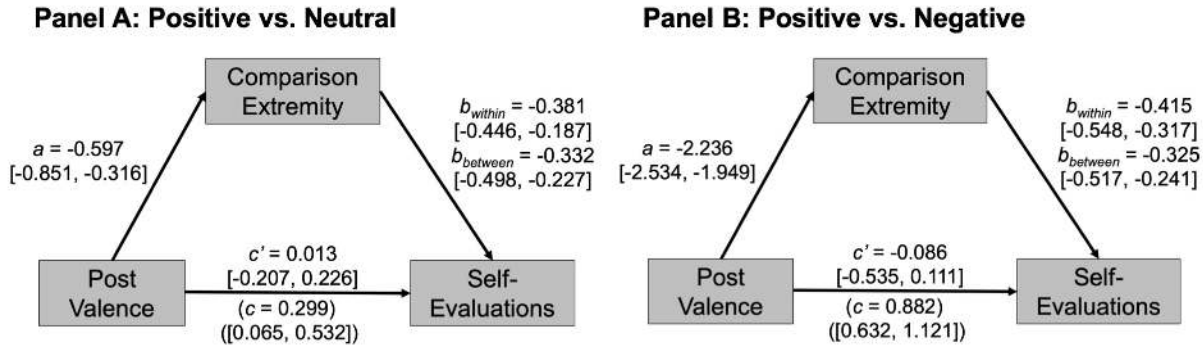


*Figure 4*. The association between post valence and self-evaluation is mediated by differences in comparison extremity (Study 2). Panel A depicts the mediational model for the difference between positive and neutral posts, and Panel B depicts the mediational model for the difference between positive and negative posts. Unstandardized regression coefficients and 95% bootstrapped confidence intervals are reported along the paths they model. Statistics reported within parentheses represent the total effect. The direct and total effects have not been parsed into within- and between-person components.

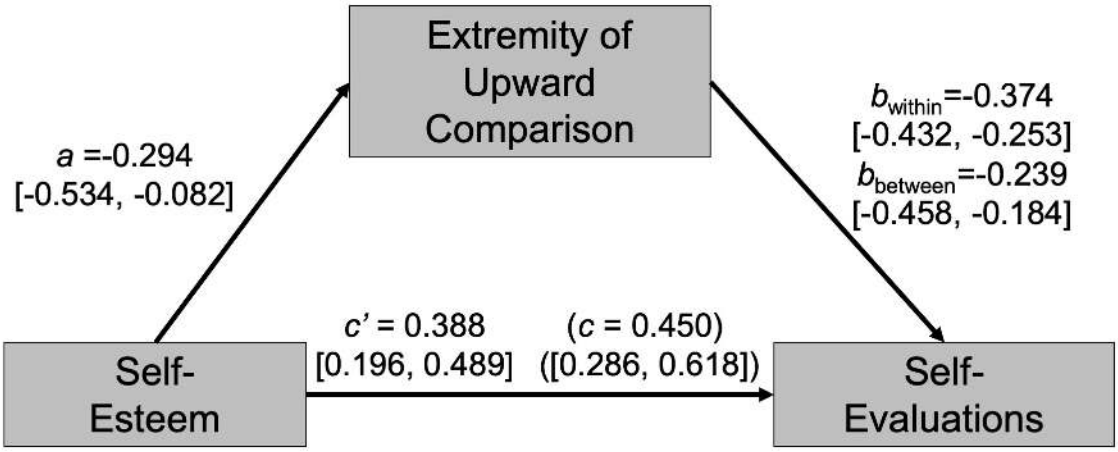


*Figure 5.* The association between self-esteem and self-evaluation is mediated by differences in comparison extremity (Study 2). Unstandardized regression coefficients and 95% bootstrapped confidence intervals are reported along the paths they model. Statistics reported within parentheses represent the total effect. The direct and total effects have not been parsed into within- and between-person components.

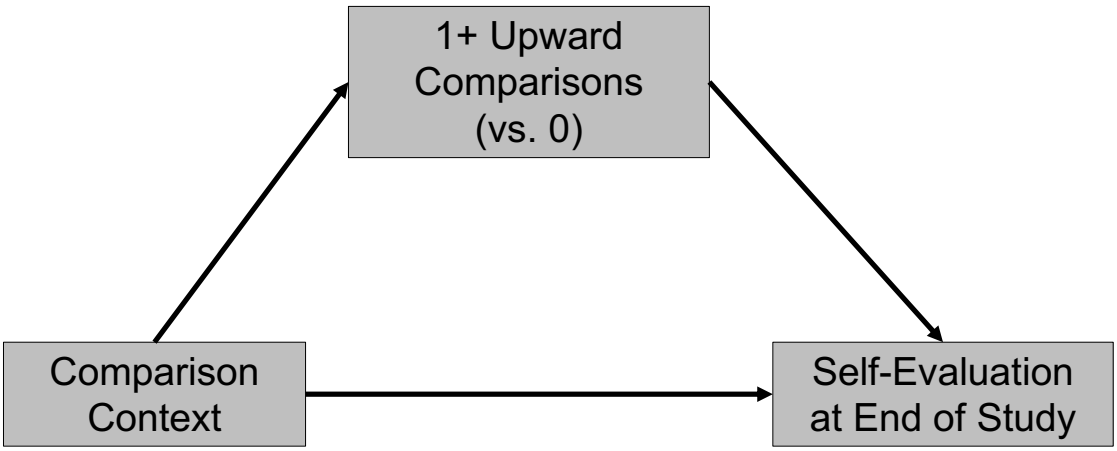


*Figure 6.* The association between comparison context (experimental condition: social media vs. other online contexts) and self-evaluation is mediated by greater likelihood of making one or more upward comparisons (Study 3). Statistics are reported in body of text given the non-normal distribution of the mediator (presence/absence of upward comparisons).

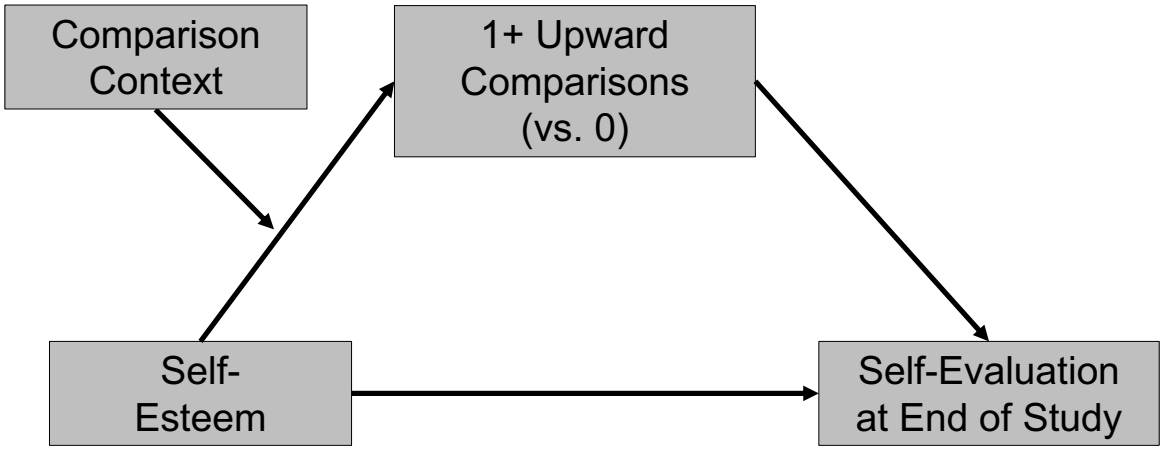


*Figure 7.* The moderated mediation model we tested. The association between self-esteem and self-evaluation is mediated by greater likelihood of making one or more upward comparisons, and this indirect effect differs depending on the comparison context (Study 3).

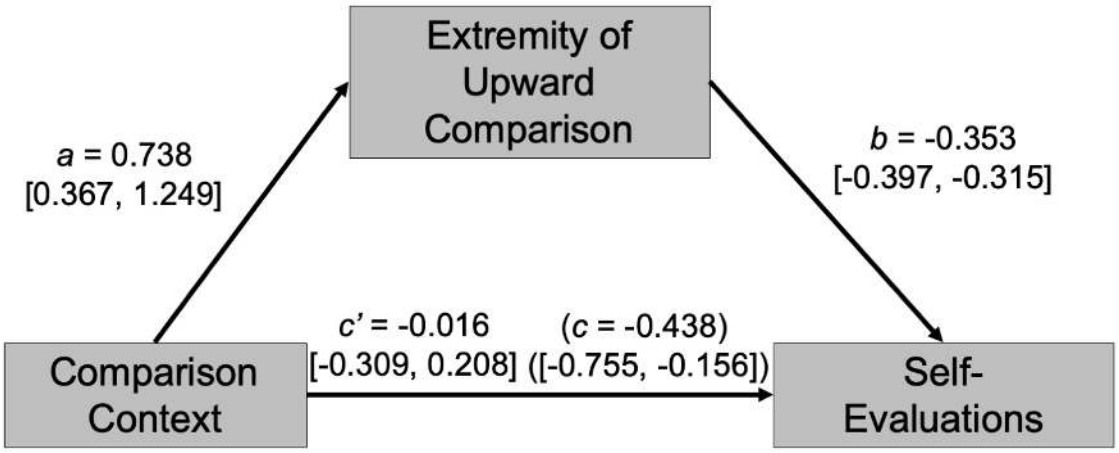


*Figure 8.* The association between comparison context (social media news feeds vs. all other contexts) and self-evaluation is mediated by differences in comparison extremity (Study 4). Unstandardized regression coefficients and 95% bootstrapped confidence intervals are reported along the paths they model. Statistics reported within parentheses represent the total effect. The direct and total effects have not been parsed into within- and between-person components.