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Adolescents' differential responses to social media browsing: Exploring causes and consequences for intervention



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ABSTRACT

Browsing Instagram is a daily practice for many teens, yet the relationship between social browsing and psychological well-being remains controversial. Recent research finds that negative social comparisons mediate the relationship between social browsing and ill-being outcomes, such as depression. The current study systematically examined the role of negative comparisons in the relationship between Instagram browsing and affective well-being immediately post-browsing. Teens ($n = 507$) participated in an online survey that included an Instagram browsing experience. Participants were randomly assigned to a 'highlight reel' condition or to one of two browsing interventions designed to reduce affective consequences of comparison. Participants completed the Positive and Negative Affect Scales (PANAS) pre- and post-browsing and reported social comparisons in response to the featured accounts. Regression analyses controlling for baseline emotions indicate that regardless of browsing condition, teens who reported higher levels of negative social comparison had significantly worse post-browsing affect than peers who reported less negative comparison to the stimuli. No main effects of browsing condition were found. However, browsing condition moderated the relationship between social comparison and affective well-being: the interventions reduced post-browsing negative affect for those at higher levels of negative comparison. Results suggest differential responses to both social browsing and social media interventions.

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1. Introduction

Social media use is commonplace among U.S.-based teens: 94% of 13–17-year-olds use one or more social networking site (SNS) and most teens (89%) have access to smartphones, which facilitate constant access to social apps (AP-NORC, 2017). Instagram, a visually-oriented SNS for sharing photos and short videos, is used daily by a majority of U.S. teens (AP-NORC, 2017; Piper Jaffray, 2016). Instagram was launched in 2010 and currently ranks 18th among the most popular websites worldwide (Alexa Internet, 2017); the site has over 500 million active users (Instagram, 2016).

As the public adopted SNSs like Instagram en masse, researchers turned attention to the influences of social media on psychosocial functioning. Yet the relationship between social media use and well-being remains controversial (Best, Manktelow, & Taylor, 2014; Pantic, 2014). SNSs can support well-being via social connectedness (Cornejo, Tentori, & Favela, 2013; Neubaum & Krämer, 2015),

opportunities for identity expression (Grieve & Watkinson, 2016), and interest-driven learning (Ito et al., 2009). At the same time, heavier social media use predicts declines in life satisfaction and self-esteem (Kross et al., 2013). Notably, the aforementioned beneficial functions of SNSs relate to *active* uses of social media (e.g., connecting, expressing, exploring), whereas *passive* social media use is most often implicated in studies of disruptions to well-being (Kross et al., 2013; Lup, Trub, & Rosenthal, 2015; Steers, Wickham, & Acitelli, 2014).

Passive social media use, also called social browsing, involves scrolling through others' digital posts (Lup et al., 2015). Social browsing is a dominant SNS activity and a focal practice in studies of social media and reduced well-being (e.g., Krasnova, Wenninger, Widjaja, & Buxmann, 2013; Lup et al., 2015; Steers et al., 2014). The posts encountered during social browsing generally constitute others' curated, favorable self-presentations (DeAndrea & Walther, 2011; Ellison, Heino, & Gibbs, 2006). Although the desire to present oneself favorably predates social media (e.g., Goffman, 1959), SNSs provide readily-accessible tools for impression management (DeAndrea & Walther, 2011; Lang & Barton, 2015; Marwick, 2015).

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As individuals curate desirable portrayals, their social media representations collectively form a corpus of positively-skewed depictions of others' lives (Steers et al., 2014). Browsing others' highlight reels is a daily custom for networked teens, which raises questions about how and why social browsing influences well-being.

1.1. Social comparison

SNS feeds are extensive sources of self-relevant information and therefore offer a "perfect basis for social comparison processes" (Haferkamp & Krämer, 2011, p. 309). Social comparison is a component of social information processing; people engage in social comparison when they evaluate an aspect of their lives by comparison with others (Suls & Wheeler, 2013). Festinger (1954) originally proposed social comparison as a function of the dual motivations for accurate self-evaluation and self-improvement. Festinger argued that people prefer objective comparison metrics, but rely on social comparison when nonsocial metrics are unavailable. Subsequent expansions of social comparison theory broaden the application of Festinger's theory: social comparison transpires across multiple domains (e.g., related to abilities, opinions, judgments) and stems from a breadth of motives including but not limited to accurate self-evaluation (Kruglanski & Mayseless, 1990; Wheeler, 1991).

Social comparisons can be 'upward' or 'downward' (Suls & Wills, 1991) Upward comparisons reference those believed to be superior or better off, whereas downward comparisons reference those believed to be inferior or worse off. Upward and downward comparisons can each produce positive or negative emotions (Buunk, Collins, Taylor, VanYperen, & Dakof, 1990). The affective consequences of social comparison depend on context, including both individual disposition and situational factors (Eid & Larsen, 2008; Lyubomirsky & Ross, 1997). For example, upward comparisons can trigger positive emotions when the outcome is perceived as personally achievable, but negative emotions when the outcome seems unattainable (Krayer, Ingledeew, & Iphofen, 2008). Social comparison is not therefore inherently problematic or distressing. However, comparison detracts from subjective well-being when it evokes responses such as envy (Hill & Buss, 2008; Smith, Parrott, Diener, Hoyle, & Kim, 1999).

Adolescents are prone to social comparison, which plays an important role in identity development (Krayer et al., 2008). In early childhood – before emerging cognitive skills facilitate comparison for the purpose of self-evaluation – self-perceptions are distorted and exaggeratedly positive (Harter, 2015). Among adolescents, the capacity for social comparison facilitates more realistic though also more negative self-appraisals (Harter, 2015). Coconstruction theory posits continuity between adolescents' online and offline lives, and alerts researchers that teens' networked experiences are therefore characterized by the same developmental tasks and issues of offline life (Subrahmanyam, Reich, Waechter, & Espinoza, 2008; Underwood & Ehrenreich, 2017). For contemporary adolescents, a developmental period of heightened sensitivity to upward comparison coincides with the potential for around-the-clock social browsing. This concurrence underscores the merit of research into the relationship between social browsing and psychological well-being.

1.2. Social comparison on social media

Recent studies indicate that negative comparison – upward social comparison that leads to negative assessments of one's own circumstances (Frison & Eggermont, 2016) – plays a critical role in

the relationship between social browsing and well-being disruptions (Frison & Eggermont, 2016; Steers et al., 2014; Tandoc, Ferrucci, & Duffy, 2015). Quantity of social media use does not alone predict depression (Jelenchick, Eickhoff, & Moreno, 2013). However, social comparison during SNS use mediates the relationship between Facebook logins and depressive symptoms (Steers et al., 2014). General reports of negative comparison during browsing (e.g., "When I read my newsfeed I often think that others are having a better life than me") also predict decreases in life satisfaction over time (Frison & Eggermont, 2016). Further, envy in response to browsing ("When on Facebook, I catch myself envying ...") mediates the relationship between passive following and life satisfaction (Krasnova et al., 2013). Likewise, the relationship between adults' passive Facebook use and declines in their affective well-being over time is initially statistically significant yet becomes non-significant once one controls for reported feelings of envy (Verduyn et al., 2015). Controlling for comparison-fueled envy, SNS use may instead lessen depression (Tandoc et al., 2015)).

At the same time, heavier social media users are more likely to believe that others are happier and have better lives (Chou & Edge, 2012). However, directionality is unclear. It is possible that those who are more vulnerable to negative comparison are also heavier social media users. In another study of young adults, tendency toward social comparison was positively correlated with Facebook use such that young adults who scored high (versus low) on a measure of social comparison orientation tended to be heavier Facebook users (Vogel, Rose, Okdie, Eckles, & Franz, 2015). Related to coconstruction theory, the rich-get-richer and the poor-get-poorer hypotheses propose social technologies as amplifiers of offline differences, providing disproportionate benefits to those who are socially competent and exacerbating challenges for those who are more vulnerable (see Reich, 2016; Underwood & Ehrenreich, 2017 for discussion). Popularity, for example, moderates the relationship between technology-based social comparison and feedback-seeking (e.g., "I use electronic interaction to compare my life with other people's lives") and depressive symptoms: Nesi and Prinstein (2015) find the strongest associations between online negative comparison and depressive symptomatology among adolescents who are less popular offline.

Yet while it is feasible that those who are more vulnerable to negative comparison happen to be heavier SNSs users, it is also possible that social browsing enhances negative comparison and dissatisfaction. Kross et al. (2013) used an experience-sampling method to demonstrate that adults' Facebook use predicts subsequent declines in affective well-being and more Facebook use overall predicts declines in life satisfaction during a two-week period. Chou and Edge (2012) suggest that social media use may exacerbate negative comparisons and dissatisfaction because of two cognitive biases: the availability heuristic and the correspondence bias. The availability heuristic suggests a tendency to base judgments on immediately recalled examples (Tversky & Kahneman, 1973). To this end, social browsing equips the browser with easily-recalled, positively-skewed information about others' lives as a basis for comparisons. The correspondence bias posits a tendency to infer that others' behaviors are a function of stable personality traits, rather than situational cues (Gilbert & Malone, 1995). In keeping with the correspondence bias, an Instagram post that depicts the poster smiling is more likely judged as an indication that she is happy and has a great life rather than as an indication that she simply had a particularly enjoyable experience.

In theory, distorted comparisons should be more pronounced for parasocial relationships, for which people do not have counter-examples from personal experience. Indeed, more frequent Instagram use is directly associated with depressive symptoms among those whose followers include high proportions of strangers,

though not among those whose followers include few strangers (Lup et al., 2015). Lup, Trub and Rosenthal's finding suggests the importance of content: the composition of an individual's SNS feed and therefore what she browses influences the effects of her social media use. Among popular SNSs, Instagram may be especially ripe for distorted comparisons. Instagram enables non-mutual following and therefore functionally supports parasocial relationships more easily than Facebook. The platform is also designed for photo-based sharing and images are typically interpreted as compelling information sources (i.e., the myth of photographic truth; Ellison et al., 2006; Lee, Lee, Moon, & Sung, 2015; Marwick, 2015).

The aforementioned studies point to the importance of negative comparison in the relationship between social browsing and well-being. However, participants in the studies (i.e., Frison & Eggermont, 2016; Krasnova et al., 2013; Nesi & Prinstein, 2015; Steers et al., 2014; Tandoc et al., 2015) reported social comparisons in response to their own social browsing experiences. Because the study designs did not afford access to the content of participants' social browsing, it remains unclear whether negative comparison is influential as a difference in individuals' responses to their social browsing and/or as a difference in the content they browse. Importantly, these possibilities suggest distinct processes and paths for intervention.

A preponderance of studies concerning SNSs and well-being focus on adults and/or university students (e.g., Chou & Edge, 2012; Haferkamp & Krämer, 2011; Krasnova et al., 2013; Kross et al., 2013; Lup et al., 2015; Tandoc et al., 2015; Vogel et al., 2015). Yet teens may be particularly vulnerable to negative effects of social media use (O'Keeffe & Clarke-Pearson, 2011). Evidence that teens are among the heaviest users of SNSs including Instagram (Lenhart, 2015; Perrin, 2015) therefore begs questions about the specific nature of adolescents' social browsing experiences.

2. The current study

Expanded knowledge about the mechanisms by which social browsing influences well-being contributes opportunities for targeted intervention. In the current study, I use an experimental design to explore three research questions and corresponding viable but untested hypotheses that follow from extant literature. I then draw on semi-structured interviews conducted subsequent to the experiment to further probe the relationship between social browsing and negative comparison.

Research Question 1: Does social comparison in response to social browsing predict immediate changes in adolescents' post-browsing affective well-being?

A first hypothesis that follows from current literature is that individual differences in response to social browsing account for the negative influence of SNS use on well-being. If a group of adolescents browses the same social media profiles, differences in the extent of the group members' negative comparisons predict immediate post-browsing affective well-being.

Study Hypothesis 1. Controlling for pre-browsing affect, adolescents who respond with more negative comparison to an Instagram browsing experience fare worse in post-browsing affect than peers who respond with less negative social comparison.

Research Question 2: Can interventions that target the highlight reel nature of social browsing improve adolescents' post-browsing affective well-being?

A second hypothesis based on current research is that the highlight reel nature of social media portrayals contributes to reduced well-being. Browsing others' highlight reels arguably

distorts perceptions of others' happiness (e.g., related to the availability heuristic and the correspondence bias), which in turn worsens the browser's mood.

Study Hypothesis 2. Adolescents who browse positive-only Instagram portrayals (Condition 1) experience worse post-browsing affective well-being than those whose social browsing a) targets the correspondence bias with an explicit reminder that others' SNS posts reflect situational cues rather than stable personality traits (Condition 2) and/or b) targets the availability heuristic via inclusion of posts about others' bad days, which provide 'available' counter-examples (Condition 3).

If Hypothesis 2 holds but Hypothesis 1 does not, the aforementioned mediating role of negative comparison may primarily reflect differences in the *content* of persons' social browsing rather than *individual differences* in response to browsing.

Research Question 3: Are adolescents who engage more heavily in negative social comparison differentially affected by changes to the context or content of a social browsing experience?

Hypotheses 1 and 2 are not necessarily oppositional. It is feasible that both individual response differences and content differences influence post-browsing affective well-being. That is, perhaps those who engage more heavily in negative comparisons are differentially affected the nature of a social browsing experience.

Study Hypothesis 3. Browsing experience (Condition) moderates the relationship between social comparison and adolescents' affective well-being. The adverse effect of negative comparison on emotions is reduced when browsing experience is less likely to evoke upward comparisons (See Fig. 1).

3. Methods

3.1. Participants and data collection

I collected data for the current study in a single public high school in a suburban school district in the Northeastern United States. I used a passive parental consent and two-step active student assent procedure, which was approved by the governing university's Institutional Review Board as well as school district administrators. Working with school administrators, I sent parents a letter with study details and data collection plans along with information about how to opt teens out of participation. I obtained students' active assent to both initial participation in the survey and to the use of their responses for the research study. Students completed the study's online Qualtrics survey in their health (9th and 10th graders) and English (11th graders) classes during designated class periods convenient to the school and host teachers.

Five hundred and eighty-eight students ($M = 15.26$ years; $SD = 0.97$; 292 Male, 280 Female) participated in the survey via school-provided Chromebooks. Participants represented 90% of the

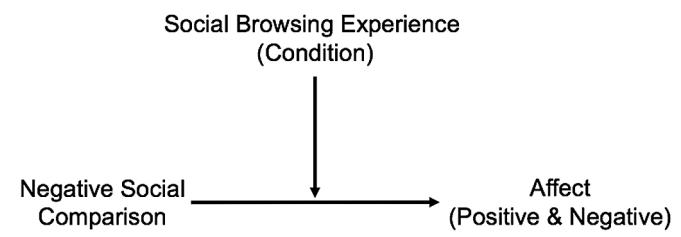


Fig. 1. Hypothesized moderation relationship (H3).

9th grade, 86% of 10th grade, and 51% of 11th grade students. The study opt-out rate was 3.9%. For the current investigation, I limited the analytic sample to those who completed all relevant study questions and measures ($n = 507$). I summarize characteristics of the analytic sample group in **Table 1** (below).

One threat to internal validity of an experiment is that differential attrition between treatment groups (e.g., randomly assigned browsing conditions) might lead to imbalance, particularly if certain types of individuals systematically attrit. In the current study, there are no significant differences in the number of students in each of the three condition groups who provided partial versus full responses. Attrition analyses generally indicate no differences in baseline characteristics (gender, age, grade, ethnicity, number of daily SNSs, age of first SNS, baseline affects) of participants who provided partial versus full information, with one exception for percent of 9th graders, $t(588) = -2.760$, $p = 0.006$. Baseline characteristics do not jointly predict attrition ($F(8, 557) = 1.47$; $p = 0.163$).

3.2. Study design

On the survey, participants reported on their personal social media use, browsed two simulated Instagram feeds, indicated social comparisons in response to each of the feeds, and completed affect measures at baseline and post-browsing. The browsing simulation comprised Instagram feeds likely to elicit upward social comparisons: attractive strangers (Haferkamp & Krämer, 2011; Lup et al., 2015). All participants viewed one male and one female profile, which were displayed in random order. I compiled the photographs (17 per feed) from the publicly available Instagram accounts of an on-the-rise teen model (female) and a teen athlete (male) who was identified by a popular magazine as among the “hottest guys of college sports.”

I embedded a randomizer within the survey flow to assign participants randomly to one of three groups (between-subjects setting). One group ($n = 172$) browsed positive-only versions of the Instagram feeds (i.e., highlight reels). A second group ($n = 172$) browsed the same feeds preceded by a prime designed to remind them about the highlight reel nature of others' social media presentations. For the prime condition, participants viewed a message on prior screen that read: “Please remember that most people post only their best moments and most flattering pictures on social media. They have struggles and bad days, too.” A third group

($n = 163$) browsed more balanced versions of the feeds that included non-positive content, specifically posters' acknowledgments of having ‘bad days.’ I obtained the 6 bad day posts integrated into the feeds for Condition 3 ($n = 3$ per feed) from public Instagram posts to the hashtag #badday.” Prior to inclusion in the simulation, I ran a pre-test with 25 reviewers on Amazon Mechanical Turk to confirm intended perceptions regarding whether or not posts indicated that the poster ‘had a bad day.’

3.3. Measures of key variables

3.3.1. Affect

Participants completed the Positive and Negative Affect Scales (PANAS) as a measure of emotions (Watson, Clark, & Tellegen, 1988). The PANAS includes 20 adjectives (10 positive, 10 negative; 5-point Likert scale). Scoring produces separate Positive Affect (PA) and Negative Affect (NA) scores. To measure change in emotions as a function of the exposure to the highlight reels, participants completed the scale twice: before (T1) and after (T2) exposure to the simulated Instagram feeds (within-subjects setting). In the current study, PA2 and NA2 are dependent variables (Cronbach's $\alpha_{\text{positive emotions}} = 0.91$, $\alpha_{\text{negative emotions}} = 0.87$). PA1 and NA1 are covariates (Cronbach's $\alpha_{\text{positive emotions}} = 0.89$, $\alpha_{\text{negative emotions}} = 0.84$).

3.3.2. Social comparison

Participants responded to two negative social comparison questions per Instagram feed (4 questions total; 5-point Likert scales): he/she has a better life than me, he/she is happier than me. I selected the items based on review of prior operationalizations of negative comparison; both questions are directed versions of the items used in Chou and Edge's (2012) study and included in Tandoc, Ferrucci, and Duffy's (2015) measure of Facebook envy. Items are ‘directed’ in the sense that they direct social comparisons to the browsed feeds rather than to a generalized other. To calculate a composite comparison score for each participant, I averaged the four items ($M = 3.48$, $SD = 0.54$).

3.3.3. Social media use

Past research indicates that quantity of social media use may influence well-being (e.g., Chou & Edge, 2012; Kross et al., 2013). Both to examine and control for social media use, I asked participants to report age of first SNS account ($M = 11.69$ years, $SD = 2.24$) and to indicate, from a list of seven popular apps (from Lenhart, 2015: Facebook, Instagram, Snapchat, Twitter, Google+, Vine, Tumblr), number of social media accounts with daily use ($M = 2.86$, $SD = 1.38$).

3.4. Analysis

I examined all main study variables for deviations against multivariate normality. Negative affect (NA1, NA2) was skewed; I used a log-transformation to normalize its distribution. I then tested proposed hypotheses using a series of OLS regression analyses. In keeping with the PANAS, my analyses examined positive affect and negative affect as distinct outcomes. I controlled for baseline affect (instead of using change scores) to model flexibly the relationship between pre- and post-browsing affect, rather than assuming the relationship equal to 1. In Step 1, I included T1 affect, age, gender, and social media use. In Step 2, I added condition group to the model; in Step 3, I added social comparison. For Step 4, I generated and added interaction terms between dummy coded condition variables and the comparison composite. Between Steps 2 and 3, I ran an additional regression to examine the influence of

Table 1
Participant characteristics for full study analytic sample and interview sub-sample (gender, age, grade, ethnicity, and condition random assignment).

		Study Sample (n = 507)	Interviewees (n = 24)
Gender	Male	261 (51.6%)	11 (45.8%)
	Female	239 (47.2%)	13 (54.2%)
Age	9	M = 15.3; SD = 1.0	M = 15.7; SD = 1.2
	10	213 (42.1%)	6 (25.0%)
	11	179 (35.5%)	8 (33.3%)
Ethnicity	White	113 (22.4%)	10 (41.7%)
	Asian	439 (86.6%)	17 (70.8%)
	Other	41 (8.1%)	6 (25.0%)
	African American	18 (3.6%)	1 (4.2%)
	Hispanic	16 (3.2%)	1 (4.2%)
	Native American	12 (2.4%)	
	Pacific Islander	6 (1.2%)	
Condition	Prefer not to specify	4 (0.8%)	
	Highlight Reel	7 (1.4%)	
	Prime	172 (33.9%)	8 (33.3%)
	Full	172 (33.9%)	9 (37.5%)
		163 (32.2%)	7 (29.2%)

Table 2

Means, standard deviations, and bivariate correlation coefficients of study variables (n = 507).

	M	SD	1	2	3	4	5	6	7	8	9
1. Age	15.25	0.98	1	0.08 [†]	0.18***	0.25***	0.05	0.14**	0.14**	0.01	0.01
2. Gender (Male = 1)	0.52	0.50		1	-0.26***	-0.04	-0.15***	0.06	0.10*	-0.12**	-0.14**
3. N Daily SNS used	2.86	1.38			1	0.02	0.11*	0.11*	0.09 [†]	0.13**	0.14**
4. Age of first SNS	11.68	2.02				1	-0.02	0.09*	0.05	-0.01	-0.00
5. Social Comparison	3.48	0.54					1	-0.10*	-0.15***	0.27***	0.29***
6. Positive Affect (T1)	24.60	7.81						1	0.86***	0.12**	0.12**
7. Positive Affect (T2)	22.71	8.38							1	0.09*	0.10*
8. Negative Affect ^a (T1)	2.57	0.28								1	0.85***
9. Negative Affect ^a (T2)	2.50	0.27									1

[†]p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001.^a log-negative affect.

condition group on comparison.

3.5. Follow-up interviews

To further explore how adolescents who report high versus low negative comparison differ in their responses to social browsing, a trained co-interviewer and I conducted 24 follow-up interviews: 12 interviews with teens who reported higher than average negative comparison in response to browsing (i.e., teens with comparison composite scores above the survey sample average) and 12 interviews with teens who reported lower than average negative comparison in response to browsing (i.e., teens with comparison composite scores below the survey sample average). Parents/guardians provided signed consent to interview participation and teens provided signed assent. The interview protocol included open-ended “think-alouds” while browsing Condition 3 simulated Instagram feeds, followed by specific questions about the browsing interventions (e.g., “Do you think it would make a difference if someone reminded you, prior to browsing the feeds, that these are normal people who have bad days, too? Why or why not?”). During the interview phase, we were blind to participants’ survey comparison scores. I summarize characteristics of the interview subsample in Table 1 alongside characteristics of the full study sample.

4. Results

4.1. Bivariate correlations

Prior to the regression analyses, I examined bivariate correlations to explore the relationships of demographic characteristics to social comparison and affect. Table 2 presents means, standard deviations, and inter-correlations of key study variables. Age is positively correlated with number of daily SNSs and positive affect. Females tend to use more daily SNSs and to report more negative comparison and negative affect than males. Number of daily SNSs is positively correlated with comparison, positive affect, and negative affect. I therefore included age, gender, and daily SNSs as control variables in all subsequent analyses.

4.2. Hypothesis testing

In Table 3, I present results of the regression analyses. H1 stated that individuals who engage in more negative comparison in response to browsing others’ Instagram feeds fare worse in post-browsing affective well-being. Controlling for baseline affect, those who engaged in more negative social comparison had both less positive T2 affect ($\beta = -0.07$, $t(500) = -3.22$, $p = 0.001$) and more negative T2 affect ($\beta = 0.05$, $t(500) = 2.07$, $p = 0.039$). Confirming H1, these findings indicate that the extent to which an individual engages in negative comparison predicts changes in his or

her affective well-being.

In Table 4, I present estimated differences in T2 positive affect and log-negative affect for prototypical teens at three levels of negative comparison. Based on the associated parameter estimates, a prototypical teen who judges the individuals in the featured Instagram accounts as ‘about as happy’ as she is and with lives ‘about as good’ as her own (i.e., no reported negative comparison; composite comparison score = 3) scores 1.14 scale points higher – approximately 14% of a standard deviation – on positive affect than a prototypical peer with the same pre-browsing affect who instead views the featured teens as ‘somewhat happier’ and with ‘somewhat better’ lives (i.e., moderate negative comparison; composite comparison score = 4). The difference between prototypical teens with no reported negative comparison versus high reported negative comparison (i.e., viewing the individuals featured in the Instagram accounts as ‘much happier’ and with ‘much better’ lives; composite comparison score = 5) corresponds to a difference of 2.28 scale points in positive affect – 29% of a standard deviation. For negative affect, the difference between a prototypical teen with no reported negative comparison is associated with an estimated difference of -0.03 log-scale points (9.5% of a standard deviation) versus moderate negative comparison and -0.05 log-scale points (19% of a standard deviation) versus high negative comparison.

H2 predicted that individuals who browse positive-only Instagram feeds are more likely to have worse emotional states post-browsing than those who a) are primed to consider the correspondence bias while browsing and/or b) browse more balanced versions of the Instagram feeds, which provide available counter-examples to the perception of others’ lives as only positive. However, random assignment to any one of the three conditions does not cause differences in T2 positive or negative emotions. That is, the three conditions are not significantly different from each other nor from zero for PA ($F(2, 493) = 0.07$; $p = 0.93$) or log-NA ($F(2, 493) = 2.07$; $p = 0.13$). There is also no main effect of condition assignment on comparison ($F(2, 493) = 1.71$, $p = 0.19$).¹

H3 predicted that browsing condition moderates the relationship between social comparison and emotional well-being, such that random assignment to one of the intervention conditions reduces the relationship between negative comparison and T2 emotions. There are significant comparison by condition interactions on T2 log-negative affect for Conditions 2 and 3 ($\beta = -0.48$, $t(500) = -2.63$, $p = 0.009$, $\beta = -0.48$, $t(500) = -2.44$, $p = 0.015$, respectively) relative to Condition 1.

In Table 5, I present estimated differences in T2 log-negative

¹ One additional hypothesis related to H2 may be that the effects of the intervention differ by gender, such that either male teens or female teens are more likely to be influenced by browsing condition(s). I tested gender by condition interactions and find no significant interactions suggestive of a difference in treatment effect by gender.

Table 3

Results of regression analyses: Significant predictors of post-browsing (T2) affect.

	Model 1			Model 2			Model 3			Model 3b			Model 4		
	b	SE	β	b	SE	β	b	SE	β	b	SE	β	b	SE	β
T2 Positive Affect															
Intercept	-3.31	2.97		-3.30	2.99		0.30	3.16		0.19	3.14		0.43	3.52	
T1 Positive Affect	0.92	0.02	0.86***	0.92	0.02	0.86***	0.91	0.02	0.85***	0.91	0.02	0.85***	0.91	0.02	0.85***
Gender (Male = 1)	0.86	0.39	0.05*	0.86	0.39	0.05*	0.70	0.39	0.04†	0.70	0.39	0.04†	0.71	0.39	0.04†
Age	0.19	0.20	0.02	0.19	0.20	0.02	0.23	0.20	0.03	0.23	0.20	0.03	0.23	0.20	0.03
N Daily SNSs	0.02	0.15	0.00	0.02	0.15	0.00	0.05	0.15	0.01	0.04	0.15	0.01	0.05	0.15	0.01
Condition															
2 (Prime)				0.13	0.46	0.01	0.15	0.45	0.01				0.52	2.92	0.03
3 (Bad days)				-0.04	0.46	-0.00	-0.14	0.46	-0.01				-1.58	3.24	-0.09
Social Comparison															
Condition*Comparison							-1.16	0.36	-0.07***	-1.14	0.35	-0.07***	-1.22	0.62	-0.08*
2*Comparison													-0.11	0.82	-0.02
3*Comparison													0.42	0.93	0.08
R^2	0.752			0.752			0.758			0.757			0.758		
T2 log-Negative Affect															
Intercept	0.44	0.12		0.45	0.12		0.40	0.12		0.39	0.12		0.25	0.13	
T1 Negative Affect	0.80	0.02	0.83***	0.80	0.02	0.83***	0.79	0.02	0.82***	0.78	0.02	0.82***	0.78	0.02	0.82***
Gender (Male = 1)	-0.02	0.01	-0.03	-0.02	0.01	-0.03	-0.01	0.01	-0.03	-0.01	0.01	-0.03	-0.01	0.01	-0.03
Age	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	-0.00	0.01	-0.00
N Daily SNSs	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01
Condition															
2 (Prime)				0.02	0.02	0.03	0.02	0.02	0.03				0.27	0.10	0.50**
3 (Bad days)				-0.02	0.02	-0.04	-0.02	0.02	-0.03				0.25	0.11	0.45*
Social Comparison															
Condition*Comparison							0.02	0.01	0.05†	0.03	0.01	0.05*	0.07	0.02	0.15***
2*Comparison													-0.07	0.03	-0.48**
3*Comparison													-0.08	0.03	-0.48*
R^2	0.696			0.697			0.703			0.700			0.708		

† $p \leq 0.10$, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.**Table 4**

Estimated values and differences in T2 positive and negative for prototypical female teens at three levels of negative comparison.

Negative Comparison	T2 PA	T2 log-NA
Mean (Standard Deviation)	$M = 22.71 (SD = 8.38)$	$M = 2.50 (SD = 0.27)$
None	22.49	2.49
Moderate	21.35	2.52
Scale point change	$\Delta -1.14$	$\Delta +0.03$
High	20.21	2.54
Scale point change	$\Delta -2.28$	$\Delta +0.05$

affect by randomly assigned browsing condition for prototypical teens at three levels of negative comparison. For a prototypical teen who does not report negative comparison, post-browsing *log-negative affect* is lower (i.e., affective well-being is better) when randomly assigned to the highlight reel condition as compared to the intervention conditions; in contrast, a prototypical teen with either moderate or high reported negative comparison fares worse when randomly assigned to the highlight reel condition versus an intervention condition.

In Fig. 2, I present a simple slopes analysis. Post-hoc tests indicate no difference in estimated slopes or intercepts between Conditions 2 and 3. I do not find significant interaction effects for positive affect, and therefore find support for H3 with regard to negative emotions.

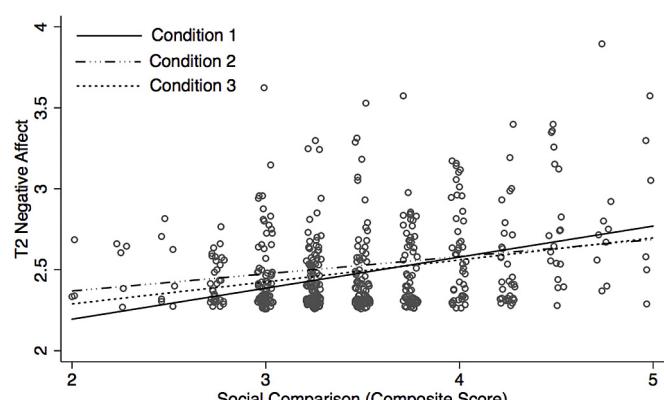
4.3. Follow-up interviews

Follow-up interviews provided an opportunity to explore how and why observed effects vary as a function of social comparison—specifically, whether participants with higher reported negative comparison respond differently to Instagram feeds and/or

Table 5

Estimated differences in T2 negative affect for prototypical female teens, by condition.

Negative Comparison	1. Highlight Reel	2. Prime	3. Non-highlight Reel
None	2.468	2.524	2.487
Moderate	2.542	2.525	2.484
High	2.615	2.525	2.481

**Fig. 2.** Simple slopes: Interaction of condition and social comparison on post-browsing *log-negative affect*.

browsing interventions than participants with lower reported negative comparison.

Based on survey responses, I clustered interviewees into two analytic groups: a *higher comparison* group ($n = 12$ interviewees) who reported moderate-to-high negative comparison, all of whom

Table 6

Interviewee characteristics and assessments of intervention utility, by comparison score and group.

Lower Negative Comparison Interviewee Group (SC Composite <3.5)					(9/12 No)	
	Age (Years)	Grade	Ethnicity ^a	Gender	Social Comparison	Designation ^b
1.	17	11	S	M	3.00	No
2.	16	10	S	F	3.25	No
3.	15	10	S	M	3.00	Yes
4.	17	11	O	M	2.75	No
5.	15	10	S	F	3.25	No
6.	17	11	S	M	3.25	No
7.	14	9	W	M	3.25	No
8.	17	11	W	F	3.25	No
9.	17	11	W	M	3.00	No
10.	15	10	W	M	3.00	Yes
11.	15	9	W	M	2.75	Yes
12.	16	11	W	M	3.00	No
Higher Negative Comparison Interviewee Group (SC Composite >3.5)					(8/12 Yes)	
13.	15	10	W, S	F	4.25	Yes
14.	14	9	W	F	4.00	Yes
15.	16	10	W	M	3.75	Yes
16.	16	11	W	F	4.00	Yes
17.	15	10	A	F	4.00	No
18.	17	11	W	F	4.25	Yes
19.	15	10	W	F	4.00	Yes
20.	16	11	S	F	4.00	Yes
21.	18	11	W	M	3.75	No
22.	14	9	W	F	3.75	Yes
23.	15	9	W	F	4.00	No
24.	15	9	W	F	3.75	Yes

^a W: White, A: African American, S: Asian, O: Other.^b Intervention Assessment Designation: Yes = Assessed interventions as helpful; No=Assessed interventions as unhelpful.

have comparison composite scores above the mean score of the full analytic sample) and a *lower comparison* group ($n = 12$ interviewees who reported no-to-low negative comparison, all of whom have comparison composite scores below the mean score of the full analytic sample). In Table 6, I summarize interviewees' assessments of the utility of the browsing interventions. Below, I describe headline interview findings alongside prototypical responses from three teens in each analytic group.

4.3.1. Lower comparison group

A majority of those in the lower negative comparison group (9/12) dismissed the personal value of the browsing interventions and indicated that reminders (i.e., that others generally share only their best moments on social media) would not improve their social browsing experiences. For these individuals, the expectation that social media portrayals are typically curated highlight reels is already well-established; they are cognizant that others share carefully selected, positively-skewed information about their lives.

For example, one female in the lower comparison group deemed the interventions unnecessary because she believes teens are already aware of the highlight reel nature of SNSs. In her view, everyone wants to share positive moments on SNSs and people do not typically post when they are unhappy; social media therefore inherently comprise highlight reels and should be viewed as such. She explained: "[The interventions would] Not really [make a difference], because ... [on] social media *everybody* posts what you want people to see. And I don't know why you would want people to see that you're having a bad day or you broke your phone. You wanna post good things that happen to you or fun times ... People, if they go somewhere and have a miserable time, they're probably not going to post a picture from there. But if you go to a really fun party then everyone uploads pictures with their friends."

A male teen, also in the lower comparison group, similarly assessed the interventions as undue because of his view that SNS posts are by nature unrepresentative highlights of others'

experiences: "I think I'm a very rational, intelligent person. I know that when someone's posting a picture of them [sic] on top of a mountain in Africa or in Aruba, or touching an elephant, it's like, okay, this is a high point. Obviously you've got to remind yourself that what you're seeing is the tip of the iceberg of what somebody's actual life is. And that's important to remember, too, when you're talking to that person or commenting on a photo or something like that. So I think I always have that in the back of my head."

A third teen in the lower comparison group suggested the interventions are unnecessary because bad days are a universal experience. Although others' lives might look perfect on Instagram, she routinely assesses social media presentations as partial representations. She explained, "I know that people have bad days. I understand that. Ya, I think I would feel the same [with or without the interventions] ... Sometimes [people] look like they have a perfect life when you're just going through their [Instagram] feed, but in the back of your mind you know that they are still human and they have like bad days."

4.3.2. Higher comparison group

On the other hand, responses from a majority (8/12) of those in the higher negative comparison group indicate that the interventions would alter their browsing experiences as intended. In contrast to the idea of "always" keeping in mind that "what you're seeing is the tip of the iceberg," their responses instead suggest that the curated, highlight reel nature of social sharing may be forgotten or overlooked while browsing SNSs.

For example, one female teen in the higher comparison group explained that she views social media representations as reliable indications of others' happiness. If she encounters evidence of a bad day while browsing someone's social media profile, she believes the person has bad days. In contrast, if she does not see evidence of imperfection, she assesses positive-only posts as an indication that the person is always happy. In her words, "I mean I guess I believe that people have bad days too— but if I didn't scroll up to see that

they have a bad day, I wouldn't think that. 'Cuz their Instagrams are just like—they're all happy in their posts.' She therefore deemed the browsing interventions—particularly the direct inclusion of non-positive posts—*influential*.

Another (male) teen in the higher comparison group similarly indicated that the interventions would change his browsing experience. Although he noted that he does not dwell on others' SNS posts, the interventions would nonetheless alter his interpretation of others' positive-only sharing: "[The interventions] would make me look at their page [sic] more open mindedly. But I wouldn't—I'm not gonna think about their page later on. And I'm not gonna go back to their page that night and like, obsess over it. I'm just gonna be like, 'oh, good for you,' and I'm gonna continue on."

A third (female) teen in the higher comparison group echoed the view that positive-only social media presentations indeed confer an impression that their poster has a perfect life and seems genuinely "happy and carefree." The interventions would therefore temper her global assessments of others' perfection. She explained, "The people who have the perfect lives, they seem happy and carefree. They always look so perfect. There's nothing wrong in the photos I guess I would say ... I don't know what an example would be, but it seems like they are the most unattainable person. They're the best you can be. But they're probably not, I guess? It'd be nice to get a glimpse of that [from the interventions]."

The difference in teens' perceptions of SNSs as unrepresentative highlight reels versus representative portrayals also presents during browsing think-alouds. We asked participants to share "any thoughts that pop into your head" while browsing the simulated profiles. Highlight reel distortions evidenced as global judgments about the profile owners based on their Instagram profiles. For example, one female participant (higher negative comparison group) commented based on the first two pictures that the profile target, "has a nice life." Without prompting, she subsequently explained,

I guess a lot of these photos would make me feel like questioning my worth [and] jealous of her. 'Cause it seems like she has a great life. She's pretty, she has nice friends, she has enough money to go on vacationing at that beach or something. [It] makes you feel like [it's] unattainable, the life she has ... Yeah, I can tell you that she looks like she has a good life. That she looks like she enjoys what she does ... Yeah, I would both be jealous of them [the male and female] if I was involved in their feeds and not just looking at this for a social media survey ... 'cause it's like, if I knew them, then I'd be jealous of them having that life. Like why couldn't I have had that life? Why do they get it and not me, I guessThey both look like they have great lives, perfect lives, and that they have fun and all that stuff.

Global judgments contrast with comments limited to reactions about particular posts. For example, another female participant (lower negative comparison group) contributed the following comments during her browsing: "that's a pretty cool picture," "not something I would post," "that's cute," "that's an artsy picture."

5. Discussion

The present work leveraged an experimental design to examine the influence of social browsing on teens' affective well-being. Over 500 ($n = 507$) teens browsed simulated Instagram feeds, reported social comparisons in response to the feeds, and completed pre- and post-browsing measures of positive and negative affect. Results support theories and findings that propose negative comparison as a basis for harmful effects of passive social media use (Chou & Edge, 2012; Frison & Eggermont, 2016; Steers et al., 2014; Tandoc et al.,

2015). Teens who engaged in more negative comparison in response to the browsing experience had significantly worse post-browsing affective well-being (less positive emotions and more negative emotions) than peers who engaged in less negative comparison (H1 supported).

Prior studies implicate negative comparison in the relationship between SNS use and reduced well-being. Young adults' general reports of negative comparisons and envy related to SNSs mediate the relationship between passive SNS use and clinical depression (Tandoc et al., 2015), as well as overall life satisfaction (Krasnova et al., 2013). Yet the current investigation is the first to contribute evidence that browsing colored by negative comparison predicts immediate reductions in adolescents' affective well-being. Results additionally reveal that negative comparison is influential as a difference in individuals' responses rather than simply as a function of different browsed content, which corroborates findings reported by Vogel et al. (2015). Teens who browsed the same Instagram feeds varied in reported negative comparisons to the stimuli—and these differences predicted post-browsing emotions. More generally, the findings suggest differential susceptibility among adolescents to social media effects (Valkenburg & Peter, 2013).

The study also used an experiment to test whether highlight reel style SNS portrayals specifically disrupt well-being (Chou & Edge, 2012; Steers et al., 2014). Chou and Edge (2012) posit social media users employ heuristics when they form impressions of the people in their social networks; the correspondence bias and the availability heuristic arguably contribute distorted perceptions that worsen subjective well-being. If heuristics indeed contribute to negative SNS effects, they also present a relevant target for SNS browsing interventions. To test this hypothesis, adolescents were randomly assigned to browse (1) a positive-only ("highlight reel") version of two Instagram profiles, (2) the same profiles preceded by a prime designed to target the correspondence bias and remind teens of others' often-distorted, rosy portrayals on SNSs, or (3) more balanced versions of the same feeds, designed to target the availability heuristic and provide readily available counter-examples.

The randomly assigned browsing conditions did not cause differences in affective well-being (H2 not supported). Null effects of condition could be interpreted either as evidence that the manipulations were insufficient or that browsing highlight reels does not specifically reduce well-being. However, both the moderation effects and the interview narratives suggest another possibility. The browsing interventions significantly mitigated the toll of negative comparison on negative affect (H3 partially supported). Teens who were randomly assigned to the highlight reel condition and reported high negative comparisons fared worst with respect to affective well-being. Consistent with the poor-get-poorer hypothesis (e.g., see Underwood & Ehrenreich, 2017), those who are prone to social comparison online may therefore suffer most from the highlight reel nature of social media.

However, although negative social comparisons were related to increased negative affect immediately post-browsing, this link was moderated by experimental condition. Why might the interventions dampen negative affective responses among those who engage most heavily in negative comparison? Affective consequences of social comparison depend on an individual's response, and negative emotions can stem from perceptions that the outcome is personally unattainable (Eid & Larsen, 2008; Krayer et al., 2008). In the interview phase, teens who viewed social portrayals more critically—bearing in mind that social media posts are generally curated and positively-skewed—presented as less susceptible to negative influences of social browsing. These teens already presume that what they see on social media is as one participant described, "the tip of the iceberg of what somebody's actual life is."

Yet teens who reported higher levels of negative comparison on the survey tended instead to exhibit perceptions of SNS profiles as more accurate information sources. Their social browsing in turn contributed to perceptions that the profile owners are enviable and, in another teen's language, "the most unattainable." By targeting heuristics that contribute to distorted judgements, the interventions may reduce for these teens perceptions of the profile owners as unattainable exemplars. As quantitative findings suggest, the interventions were less effective for teens with lower or no reported negative comparison. Teens for whom intervention is irrelevant may experience corrective efforts as annoying or infantilizing.

More generally, the interview responses reveal that teens' awareness of the highlight reel nature of SNSs varies across individuals and may serve a protective function. Future research can build on the current work with more systematic investigation of teens' different SNS perceptions. Specifically, do teens who view social media presentations as representative slices of others' lives systematically fare worse than teens who view social media as inherently rosy and one-sided? And how do different perceptions of SNS presentations influence negative comparisons? Coconstruction theory posits youth play active roles in co-constructing their networked environments (Subrahmanyam, Smahel, & Greenfield, 2006; Underwood & Ehrenreich, 2017). Future research should therefore examine whether adolescents who are more susceptible to highlight reel distortions tend to follow more (or fewer) highlight reel style accounts.

The findings also suggest areas in which targeted intervention might be helpful practically. Participants in this study who experienced more negative comparison related to their browsing faced a greater risk of well-being disruptions. However, content modifications served a protective function. Unfollowing or unsubscribing from accounts that routinely trigger negative comparison is a simple yet potentially meaningful intervention. Actively considering the highlight reel nature of SNSs – as simulated by the prime (Condition 2) – may also reduce the toll of negative comparison for those who compare themselves against others' social media feeds.

5.1. Limitations

For the current study, I focused intentionally on a teen-aged sample. The results therefore provide insight into the adolescent social media experience, but require further investigation to examine generalizability to other age groups. The study is also limited by its focus on teens from a single, relatively homogenous community within the United States. Future research should examine social browsing effects both with more diverse populations of youth and across geographic and cultural contexts.

The Instagram profiles used in the current investigation simulate parasocial browsing. However, teens routinely leverage SNSs to connect with offline friends (Reich, Subrahmanyam, & Espinoza, 2012) and their affective responses may differ in response to browsing profiles of social rather than parasocial ties (as indicated by results from Lup et al., 2015). Relatedly, differences between highlight reel style profiles and more balanced profiles may evoke different response patterns when the profiles belong to teens' close friends.

The Instagram experience in the current study reflects a relatively low "dose" of social browsing as participants completed the entire survey experience in 30 or fewer minutes. It is therefore unsurprising that pre-browsing affect accounts for much of the observed variability in post-browsing affect. Yet social comparison is nonetheless a significant predictor, and may exert a more pronounced influence on emotions when teens browse Instagram for hours rather than minutes. Another limitation is that this study was

not designed for systematic examination of gender differences related to browsed feeds (i.e., differences in female vs. male teens' responses to the Instagram feeds of female vs. male subjects), which may be relevant to negative comparison and its effects (e.g., see Nesi & Prinstein, 2015). Finally, research designs that can control for baseline negative comparison will contribute to a more robust understanding of causality, as well as of dispositional differences.

6. Conclusions

Social apps afford around-the-clock access to curated streams of social information. With the expansion of mobile connectivity, teens browse social media as they move through the public and private spaces of their daily lives. The current study contributes to ongoing efforts to understand the relationship between teens' social media use and their well-being. Findings provide systematic evidence that negative comparison in response to social browsing predicts immediate changes in teens' emotional well-being. Negative comparison therefore represents an influential source of differential susceptibility: for teens who engage in more negative comparison in response to social browsing, SNS use presents a greater threat to well-being. Teens' perceptions of SNS posts as representative portrayals rather than skewed, highlight reels of others' lives may contribute to distressing social browsing experiences. At the same time, targeted interventions hold promise for mitigating the toll of social browsing among vulnerable youth. Future research can examine factors that contribute to negative comparison during browsing, as well as interventions that enable teens to leverage the benefits of social technologies without disruptions to their psychological well-being.

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