Social Comparison and State–Trait Dynamics:
Viewing Image-Conscious Instagram Accounts Affects College Students’ Mood and Anxiety

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Abstract

The present experiment examined the extent to which appearance-focused accounts on Instagram (a photo-sharing social-media platform) negatively influence people's moods and anxiety levels. Undergraduates at the University of Florida ($N = 81$, ages 18–30 years, $M = 19.07$, $SD = 1.56$) were randomly assigned to scroll through Instagram accounts with either image-conscious photos (fitness, model, and beauty-blogging accounts) or control photos (food, nature, home-decor accounts). Before (Time 1) and after (Time 2) the experimental manipulation, participants completed state-based mood and anxiety measures, and a one-time measure of trait anxiety. Controlling for Time-1 measures, regression results showed that viewing photos from image-conscious accounts related to decreased positive mood and increased negative mood and anxiety at Time 2. Exploratory analyses showed that people with lower trait anxiety were especially susceptible to feeling more state anxiety after viewing image-conscious photos. These findings advance theory by suggesting that state–trait anxiety dynamics are important to understanding how people react to viewing image-conscious Instagram accounts. Further, a social comparison theory of viewing image-conscious photos online should integrate information about people's short-term reactions (states, moods) and long-term predispositions (traits, individual differences).

Public Policy Relevance Statement

This research examined the effects of viewing images from fitness, model, and beauty-blogging Instagram accounts (vs. control images) on changes in college students' moods and state anxiety. Students viewing image-conscious Instagram accounts (vs. control) reported decreases in positive mood and increases in negative mood and state anxiety, which depended on their trait anxiety. State–trait dynamics play a role in the social comparison of image-conscious photos.

Keywords: Instagram; Social Media; Social Comparison; Fitspiration; Mood; Anxiety

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Although interacting with social media and social networking sites (SNSs) can provide benefits, including increased communication and sense of community, excessive use may also cause or exacerbate mental health problems (for a review see Reid & Weigle, 2014). For example, recent research found that young people (grades 7–12) who spend more than two hours per day on SNSs have higher levels of psychological distress, more suicidal ideations, and poorer self-rated mental health (Sampasa-Kanyinga & Lewis, 2015). Moreover, the average U.S. 12th grader spent six hours per day on social media in 2016, which is about double the time spent in 2006 (Twenge, Martin, & Spitzberg, 2019).

One SNS particularly popular with younger people is Instagram (Instagram.com), a social photo-sharing platform that is used primarily on mobile devices, especially smart phones. People use Instagram for multiple reasons, including archiving, escapism, self-expression, social interaction, creativity, coolness, documentation, and surveillance and knowledge of others (i.e., peeking or lurking; Lee, Lee, Moon, & Sung, 2015; Sheldon & Bryant, 2016). A groundswell of recent research suggests that Instagram use—particularly exposure to attractive, physically-fit, image-conscious others—can negatively affect people’s mental health, including their anxiety, self-esteem, and perceptions of body image (for a review see Ryding & Kuss, 2019).

Instagram, Body Image, and Mental Health

Multiple studies have shown negative body-image and mental-health outcomes related to Instagram use. For example, a correlational study of young women found that following appearance-focused accounts on Instagram positively related to negative outcomes (thin-ideal internalization, body surveillance, drive for thinness; Cohen, Newton-John, & Slater, 2017). A

similar study found that Instagram use in general related to increased self-objectification, and greater exposure to fitspiration—fitness inspiration—photos in particular related to greater body-image concerns (Fardouly, Willburger, & Vartanian, 2018). A recent content analysis of 1,000 fitspiration posts on Instagram showed that most of these posts featured people who were rated as muscular or having low body fat (Deighton-Smith & Bell, 2018). The authors concluded that such posts likely relate to both self-objectification and sexual objectification of fit bodies.

In a correlational study of men and women, Instagram selfie-posting and Instagram-related conflict (i.e., with a current or former romantic partner resulting from a selfie post) sequentially mediated the direct effect of body image satisfaction on negative relationship outcomes (e.g., “Has Instagram selfie postings led to breakup/divorce?”; all relations positive; Ridgway & Clayton, 2016). Appearance-based self-schema and self-discrepancy sequentially mediated the negative direct effect linking Instagram use and body image satisfaction; this direct effect was stronger (more negative) for those with higher self-esteem (Ahadzadeh, Sharif, & Ong, 2017). Despite that viewing attractive others may harm people’s body images, Instagram viewers prefer authenticity, because unfiltered selfies often receive more likes on average than filtered selfies (Hong, Jahng, Lee, & Wise, 2019). Regarding anxiety, a sample of 423 adolescent Instagram users (ages 14–21 years) showed that problematic social media use (e.g., experiencing withdrawal, compulsion) correlated with both neuroticism ($r = .26$) and trait anxiety ($r = .18$; Balta, Emirtekin, Kircaburun, & Griffiths, in press). A similar study examining 491 Turkish adolescent Instagram users (ages 14–19 years) also showed that problematic Instagram use correlated with both general ($r = .22$) and social ($r = .28$) anxiety (Yurdagül, Kircaburun, Emirtekin, Wang, & Griffiths, in press).

Although compelling, these correlational studies cannot support causal explanations. In contrast, research using an experimental manipulation found that a 10-min exposure to one's own Facebook account (vs. an appearance-neutral control website) predicted a significant increase in negative mood, but not an increase in body dissatisfaction or weight-and-shape discrepancy (Fardouly, Diedrichs, Vartanian, & Halliwell, 2015). Showing evidence of temporal precedence, Instagram scrolling at Time 1 (March 2014) related to increased depressed mood at Time 2 (October 2014) in a longitudinal panel study of 12-to-19-year-old Flemish adolescents. Additionally, using a cross-lagged model in which Time 1 scores were controlled, depressed mood at Time 1 related to increased Instagram posting at Time 2, suggesting a feedback loop (Frison & Eggermont, 2017). In addition to showing a correlation between Instagram use and physical appearance anxiety, an experimental study that exposed women to either image-conscious (beauty, fitness) or control (travel, none) Instagram images found that image-conscious photos decreased women's self-ratings of attractiveness, and this decrease correlated with their anxiety (Sherlock & Wagstaff, 2019). Collectively, because most of these results involve comparing oneself to images of others, social comparison theory may provide a powerful theoretical lens through which to view these diverse findings.

Instagram and Social Comparison Theory

Viewing positive images of attractive others can negatively affect one's feelings, especially if those others—or the activities they're engaging in—are relevant to one's goals. This ironic, counterintuitive effect can happen when people engage in upward social comparison (Festinger, 1954). Social comparison theory contends that when people encounter others (real, imagined, or in the media) whom they perceive to be better than them on a relevant or important dimension (fitness, attractiveness), it threatens their sense of self-worth on that dimension, and

often produces anxiety, frustration, or other negative feelings (Festinger, 1954; Suls & Wheeler, 2013; Tesser, 1988). These negative feelings can either be harnessed as inspiration (“I’m going to be fit or famous like them someday”) or, more commonly, be causes for negative self-evaluation (“I’ll never be that fit, good-looking, or famous”). Thus, although viewing images of others who are especially fit or attractive may spur some people to improve themselves in the long term, the short-term effects can often be detrimental (anxiety, negative mood). Thus, social comparison theory provides a potentially powerful psychological perspective for understanding the effects of exposure to others’ image-conscious social media accounts.

Several Instagram studies have examined social comparison processes as independent, mediating, and moderating variables. As an independent variable, higher levels of self-reported social comparison positively related to dieting intention, but this effect was weaker for selfie photos (vs. neutral), and neither of these effects replicated in a second study (Jin, Ryu, & Muqaddam, 2018). The positive link between intensity of social comparisons on Instagram and inspiration (motivation to be better) was mediated by benign (vs. malicious) envy, which elicits beneficial self-improvement motivation. Moreover, inspiration on Instagram related to greater positive affect (Meier & Schäfer, 2018). In a fitspiration experiment, men were randomly assigned to view one of three sets of Instagram photos of other men working out in a gym setting that cued upward, lateral, or downward social comparison. Men viewing upward (vs. lateral) social-comparison photos scored higher on measures of self-improvement but lower on self-enhancement; the inverse was true for men viewing downward (vs. lateral) social-comparison photos (Peng, Wu, Chen, & Atkin, 2019).

Social comparison can also be a mediator. For example, one experiment randomly assigned women enrolled in an Australian university to view either fitspiration or travel images

on Instagram, finding that state appearance comparison mediated the direct effect of the image manipulation on negative mood, body dissatisfaction, and appearance self-esteem (Tiggemann & Zaccardo, 2015). A systematic literature review of 40 studies found that SNS use positively related to body dysmorphic disorder, and that appearance-based comparisons mediated this relationship (Ryding & Kuss, 2019). For example, one study found that Instagram photo activity (assessed with a self-report index; see Meier & Gray, 2014) positively related to drive for thinness and body dissatisfaction, and these effects were mediated by appearance-based social comparison (Hendrickse, Arpan, Clayton, & Ridgway, 2017). A related study found that frequency of Instagram use positively related to depressive symptoms, but only among users following an above-average percentage of strangers; percentage of strangers also moderated the indirect effect between frequency-of-use and depressive symptoms via social comparison (Lup, Trub, & Rosenthal, 2015). Another study showed that the link between self-worth and self-esteem was mediated by social comparison on Instagram, and the link between intensity of Instagram use and social comparison was moderated by self-worth based on approval from others (Stapleton, Luiz, & Chatwin, 2017). Among women, time spent on Instagram correlated negatively with self-esteem and positively with depressive symptoms, trait anxiety, social comparison, and measures of body image and physical appearance anxiety. More often than not, social comparison mediated the direct relation between Instagram use and the abovementioned measures (Sherlock & Wagstaff, 2019). In an experiment, women who were exposed to beauty or fitness Instagram images (vs. travel images or a no-image control) showed decreases in self-rated attractiveness, which were in turn related to lower self-esteem as well as higher trait anxiety, depressive symptoms, and physical appearance anxiety (Sherlock & Wagstaff, 2019). Some of these mediation effects may generalize to multiple cultures. In a sample of Singaporean

Chinese, intensive Instagram use positively related to social comparison and eating disorder risk, and the latter relationship was fully mediated by appearance comparison (Teo & Collinson, 2019).

As a moderator, social comparison is equally important. For example, 14–18-year-old girls randomly assigned to view retouched (vs. original) Instagram selfies felt worse about their body image; this effect was larger among girls scoring higher on social comparison (Kleemans, Daalman, Carbaat, & Anschütz, 2018). Instagram posing or broadcasting related positively to loneliness, whereas browsing and interaction related negatively to loneliness; the interaction–loneliness link was true only for users scoring low on social comparison orientation (Yang, 2016). In summary, social comparison appears to play an important and fairly consistent role in mediating and possibly moderating the links between exposure to attractive images on SNSs and outcomes involving mood and self-perception (e.g., anxiety, self-esteem, body image).

The Present Study

In the present study, university students (a) completed Time-1 measures of mood (positive, negative) and state anxiety, (b) were randomly assigned to view photos from either neutral or image-conscious Instagram accounts (i.e., model, fitpiration, beauty-blogging), and then (c) completed the same measures at Time 2. They also completed a one-time measure of trait anxiety. We examined university students not only because they are frequent Instagram users, but also because emerging adults are often grappling with issues of self-image, mood, and anxiety (Arnett, 2007). Drawing on social comparison theory, we hypothesized (Hypotheses H₁–H₃) that exposure to image-conscious photos would predict decreases in positive mood (H₂) and increases in negative mood (H₁) and state anxiety (H₃). We operationalized these hypotheses by examining the extent to which having people view either image-conscious or neutral Instagram

accounts (randomly assigned) affected changes in their moods and state anxiety level before and after viewing the Instagram stimuli (see Method section).

On an exploratory basis, we also hypothesized (H_E) whether trait anxiety moderates the effect of image-conscious photo exposure on changes in state anxiety. We operationalized this exploratory hypothesis by examining three-way interaction between baseline state anxiety, trait anxiety, and the image manipulation (i.e., viewing image-conscious or neutral Instagram accounts; see Method section). Recent theoretical advances in personality psychology such as whole trait theory have supported the notion that traits (e.g., trait anxiety) reflect a density distribution of states (e.g., state anxiety) over time, situations, or both (Fleeson, 2001; Fleeson & Gallagher, 2009; Fleeson & Jayawickreme, 2015; Hadden, Smith, Osborne, & Webster, 2017). In other words, within-person (state-level) variability in a given individual difference (anxiety or neuroticism) may be key to understanding its between-person (trait-level) variability. One implication of this view is that traits and states can—and often do—interact dynamically in predicting attitudes and behaviors. For example, within-person differences in state (e.g., daily) self-esteem over time correlate with trait measures of self-esteem instability (Webster, Smith, Brunell, Paddock, & Nezlek, 2017), which in turn interact with trait self-esteem level in predicting aggression (Webster, Kirkpatrick, Nezlek, Smith, & Paddock, 2007). Thus, in the present study, we explored the extent to which trait anxiety moderated (or interacted with) our experimental manipulation of images in predicting changes in state anxiety.

Method

Participants

The initial sample consisted of 83 participants, but because two provided insufficient data, the analyzed sample had 81 people (28 men, 53 women), with 43 and 38 randomly assigned

to the control (neutral photos) or experimental (image-conscious photos) groups, respectively.

With 81 participants, a post-hoc analysis showed that we had .80 statistical power to detect effect sizes of moderate magnitude or larger ($|r|s \geq .30$) at $\alpha = .05$, two-tailed. Most participants identified as Caucasian (65%) and reported being 18 to 21 years old, except for one 30-year-old ($Mdn = 19.0$, $M = 19.07$, $SD = 1.56$). Participants were recruited from introductory psychology courses at the University of Florida and received course credit for participating; there were no inclusion or exclusion criteria. Following APA research ethics guidelines, the present study was approved by our university's IRB and participants gave consent prior to partaking in the study. In addition, we completed all research without funding and had no competing financial interests.

Measures

State anxiety. The first survey was the two-item Generalized Anxiety Disorder scale (GAD-2), which asked participants to report how often they have experienced “feeling nervous, anxious or on edge” and “not being able to stop or control worrying” over the past two weeks (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007). The scale asked the participants the extent to which they agreed with the abovementioned statements based on their *current* state using a six-point scale from *strongly disagree* (0) to *strongly agree* (5). State anxiety scores were calculated by averaging scores across both questions; higher scores reflected greater state anxiety. Because one person completed no state anxiety items, $N = 80$ for analyses involving this variable.

Positive and negative mood. The second survey was the Abbreviated Profile of Mood States Questionnaire (POMS; Grove & Prapavessis, 1992), which contained 40 adjectives that reflected various mood states (e.g., grouchy, tense, full of pep). Participants were asked to report the extent to which the word or phrase described how they currently felt using a five-point

scale—*not at all* (0), *a little* (1), *moderately* (2), *quite a lot* (3), *extremely* (4). The measure had five negative mood subscales (Time-1 α , Time-2 α): Tension (.87, .91), Anger (.86, .83), Fatigue (.81, .81), Depression (.86, .88), and Confusion (.74, .78). It also had two positive mood subscales: Vigor (.85, .90) and Esteem-Related Affect (.74, .78). The five negative-mood and two positive-mood subscales were, respectively, positively intercorrelated at both Times 1 and 2, producing acceptable α s (Table 1). We then summed across subscales within each mood valence (positive, negative) and time point (Table 1).

Trait anxiety. After the Time-2 assessments of both abovementioned measures, participants completed the Big Five Inventory 2 (BFI-2; Soto & John, 2017), which assesses five personality traits: extraversion, agreeableness, conscientiousness, negative emotionality, and open-mindedness. We were solely interested in one of three facet subscales of negative emotionality—*anxiety*—which was assessed with four items using the stem “I am someone who...” (i.e., “is relaxed, handles stress well” [reverse-scored]; “can be tense”; “worries a lot”; “rarely feels anxious or afraid” [reverse-scored]) using a scale from 1 (*Disagree Strongly*) to 5 (*Agree Strongly*), with higher scores reflecting greater trait anxiety (Table 1).

Procedure and Stimuli

Participants first completed the GAD-2 scale and POMS questionnaire. Participants were then randomly assigned to either a control ($n = 43$) or an experimental ($n = 38$) condition using a tracking sheet that had predetermined randomly-generated assignments for each student.

Regardless of condition, participants were then given the following instructions:

In this portion of the study, you will be scrolling through an Instagram feed. You will have 10 minutes to do so. You are only permitted to use the up and down arrows on the computer, and you may not press any other buttons or leave this page.

The experimental group scrolled through image-conscious, appearance-based photos on a pre-made Instagram feed. The control group scrolled through photos on an Instagram feed in which no people, faces, or bodies appeared. The control group was logged into one account, and the experimental group was logged into a separate account. Each account was only following 99 accounts to ensure a fair amount of content in the Instagram feed.

The control group followed 33 home-decor accounts, 33 nature accounts, and 33 food accounts, all selected to be broadly representative of each category; none of the food accounts depicted explicitly or exclusively healthy foods. The experimental group followed 33 fitness accounts, 33 model accounts, and 33 beauty-blogger accounts, all randomly selected (featuring 18 accounts of men, 75 of women, and six of both men and women). We selected Fitness or fitspiration accounts if they aimed to motivate people to get more physically fit, by either exercising or eating healthy. We chose both male and female fitspiration accounts for the study. We selected beauty-blogging accounts if they shared ideas or items that added something to one's appearance, including (but not limited to) images of makeup, clothing, and hair. We selected only women-focused beauty-blogger accounts because of the small number of men-focused beauty-bloggers on Instagram. We selected model accounts of men and women if they posted pictures of themselves to promote or share sponsored content.

In each group, the participants scrolled through the feed for 10 min. Participants were only allowed on the feed page and only allowed to use the arrow keys, mouse, or mouse pad on the desktop computer. After they scrolled through the feed for 10 min, participants completed the same GAD-2 and POMS measures. This study measured mood and state anxiety both before and after the experimental manipulation to examine the effects of scrolling through an appearance-focused (vs. control) Instagram feed. After both Time-2 surveys, participants also completed a

trait anxiety measure and demographic questionnaire, including questions about their gender, age, ethnicity, and education.

Data Analysis and Transparency

We analyzed data using both difference scores as outcomes (Time 2 minus Time 1) and the residualized change (or regression covariance) approach (regressing Time 2 onto Time 1). In studies with random assignment such as the present experiment, “the residualized change model and difference score models will arrive at the same inference, but the former has the advantage of having more power because it makes the correct assumption about the distribution of baseline scores” (Castro-Schilo & Grimm, 2018, p. 47). Data and analysis code are available here:

<https://osf.io/z2h4n/>.

Results

Preliminary Analyses

Table 1 shows correlations among all variables, along with their descriptive statistics (means, *SDs*, and Cronbach’s alphas). Examining change scores in outcomes (Time 2 minus Time 1) generally supported a successful manipulation check (see Table 1) because the image manipulation (coded -0.5 = control, 0.5 = experimental) related to (a) increased changes in negative mood (point-biserial correlation or $r_{pb} = .25$, 95% CI [.03, .44]), (b) decreased changes in positive mood ($r_{pb} = -.26$ [-.45, -.04]), and (c) slightly—but not significantly ($p = .11$)—increased changes in state anxiety ($r_{pb} = .18$ [-.04, .39]). Thus, the image manipulation related to changes in mood and state anxiety in their expected directions. Some of the limitations of using differences scores as outcomes can be overcome by using the residualized-change approach via multiple regression, where the Time-2 outcome is regressed onto the Time-1 measure, and one or more other predictors of interest (e.g., the image manipulation; Castro-Schilo & Grimm, 2018).

We present these regression-based, residualized-change analyses that controlled for Time-1 scores throughout the remainder of the Results section.

Negative Mood

To examine changes in negative mood (H_1), we regressed Time-2 negative mood scores (intercept = 14.45, $t_{78} = 19.09$, $p < .001$) onto their respective mean-centered Time-1 scores ($b = 0.77$, $t_{78} = 15.22$, $p < .001$, $r_p = .86$ [.80, .91]) and the image manipulation ($b = 3.66$, $t_{78} = 2.42$, $p = .018$, $r_p = .26$ [.04, .46]). The significant manipulation effect suggests that viewing account profiles filled with image-conscious photos significantly increased people's negative mood states (on average, in terms of residual change between Times 1 and 2).

Positive Mood

To examine changes in positive mood (H_2), we regressed Time-2 positive mood scores (intercept = 18.66, $t_{78} = 36.22$, $p < .001$) onto their respective mean-centered Time-1 scores ($b = 0.94$, $t_{78} = 12.31$, $p < .001$, $r_p = .81$ [.72, .88]) and the image manipulation ($b = -2.36$, $t_{78} = -2.28$, $p = .025$, $r_p = -.26$ [-.45, -.03]). The significant manipulation effect suggests that viewing account profiles filled with image-conscious photos significantly decreased people's positive mood states.

State Anxiety

To examine changes in state anxiety (H_3), we regressed Time-2 state anxiety scores (intercept = 1.23, $t_{77} = 14.58$, $p < .001$) onto their respective mean-centered Time-1 scores ($b = 0.73$, $t_{77} = 12.83$, $p < .001$, $r_p = .83$ [.74, .89]) and the image manipulation ($b = 0.32$, $t_{77} = 1.89$, $p = .062$, $r_p = .21$ [-.01, .42]). The marginally significant manipulation effect suggests that viewing account profiles filled with image-conscious photos may have slightly increased people's state anxiety.

Exploratory Analyses with Trait Anxiety

Recall that participants also completed the BFI-2, including its four-item trait anxiety facet scale. On a post-hoc and purely exploratory basis (H_E), we chose to examine the possible moderating role of trait anxiety on changes in state anxiety as a function of the image manipulation (i.e., a three-way, Time-1-state-anxiety-by-image-manipulation-by-trait-anxiety interaction). Because interactions involving continuous interactions are harder to detect than those involving factorial designs (e.g., 2×2), we caution readers that this exploratory analysis has limited statistical power (McClelland & Judd, 1993). To this end, we regressed Time-2 state anxiety scores onto their respective mean-centered Time-1 scores, the image manipulation, trait anxiety scores, and all linear two- and three-way interactions involving these variables (Table 2).

The three-way interaction, which qualifies all other effects, was significant (Figure 1). We probed or decomposed this interaction following established procedures involving re-centering predictor variables (Judd, McClelland, & Ryan, 2017). We first examined the simple two-way interaction of image manipulation and Time-1 state anxiety at high and low trait anxiety (i.e., ± 1 *SD* from the trait-anxiety mean). Among participants with high trait anxiety, there was no interaction ($b = 0.005$, $t_{72} = 0.03$, $p = .976$, $r_p = .004$ [-.23, .24]); the mean Time-1–Time-2 slopes were unaffected by the image manipulation on average (Figure 1, bottom panel). In contrast, among those with low trait anxiety, the same interaction was substantial ($b = 0.69$, $t_{72} = 3.24$, $p = .002$, $r_p = .36$ [.14, .54]); the mean Time-1–Time-2 slopes differed by image manipulation (Figure 1, top panel).

Probing this simple two-way interaction further (Figure 1, top panel), the image manipulation effect was largely absent for people with low trait and low state anxiety ($b = -0.29$, $t_{72} = -0.97$, $p = .333$, $r_p = -.11$ [-.34, .12]), but strong for people with low trait and high state

anxiety ($b = 1.78$, $t_{72} = 3.54$, $p < .001$, $r_p = .39$ [.17, .57]). Thus, looking again at Figure 1, it appears that people with chronically high trait anxiety were largely unaffected by the image manipulation, whereas people with low trait anxiety were affected by the manipulation. In other words, exposure to image-conscious photos (vs. control photo) appeared to make normally non-anxious people more anxious to the extent that they resembled chronically anxious people.

Discussion

The present experiment supports a social comparison theory (Festinger, 1954; Suls & Wheeler, 2013) explanation because people who viewed image-conscious photos (vs. control) showed increases in negative mood, decreases in positive mood, and a marginal increase in state anxiety. Specifically, participants viewing image-conscious photos likely engaged in upward social comparisons that at least temporarily threatened their self-evaluations, thereby decreasing positive mood and increasing negative mood as well as state anxiety, albeit slightly. Although we did not assess social comparison directly, our findings appear to corroborate prior work suggesting that social comparison can mediate the effects of SNS use or image exposure on negative moods, feelings, or self-views (e.g., Hendrickse et al., 2017; Lup et al., 2015; Ryding & Kuss, 2019; Sherlock & Wagstaff, 2019; Stapleton et al., 2017; Teo & Collinson, 2019).

Exploratory analyses suggested that trait anxiety moderated the effect of the image manipulation on changes in state anxiety, such that exposure to image-conscious photos increased state anxiety especially for people with the combination of low trait anxiety and high baseline state anxiety. Because this trait–state interaction was exploratory, our theoretical explanation for it is admittedly post-hoc and speculative. Nevertheless, we believe our finding is consistent with related research on the dynamic interplay of states and traits in predictors such as self-esteem instability (Webster et al., 2017) and outcomes such as aggression (Webster et al.,

2007). More broadly, that within-person changes in state anxiety (in response to viewing image-conscious photos) appears to depend on between-person differences in trait anxiety is emblematic of the dynamic personality processes expounded in whole trait theory (Fleeson & Jayawickreme, 2015). Although we wish to avoid hypothesizing after the results are known (HARKing; Kerr, 1998), one speculative explanation might be that people who score high on trait anxiety show high correlations in state anxiety over time (e.g., Time 1 to Time 2) regardless of the images they view. Perhaps their high trait anxiety produces a ceiling effect making the state anxiety more consistent over time. In contrast, people who score low on trait anxiety might have more room for variance in their state anxiety over time. Thus, their state anxiety may be more reactive to their immediate environment (e.g., viewing photos) than those with high trait anxiety. Consequently, people with the combination of low trait anxiety and high Time-1 state anxiety reported the highest Time-2 state anxiety, but only in the image-conscious (vs. neutral) condition. Although purely exploratory, we believe that this result highlights the need to examine both trait and state effects—and their interaction—when assessing Instagram’s effect on mood and anxiety.

Collectively, these findings suggest that exposure to social media images that can trigger self-evaluation (e.g., fitpiration accounts) may be at least temporarily upsetting to people regarding their mood and state anxiety. Further, these finding suggest that social comparison likely plays a key role in linking exposure to image-conscious photos to self-evaluation processes. But because we did not directly assess social comparison in the present research, we cannot know for certain the extent to which it—or other potential mediators—may help explain our findings—a limitation that we discuss in detail below. Nevertheless, the present research advances theory by showing that state–trait dynamics (e.g., Fleeson, 2001; Fleeson & Gallagher,

2009; Fleeson & Jayawickreme, 2015), especially regarding state and trait anxiety, may be pivotal to understanding how people react to viewing image-conscious photos on SNSs.

Specifically, social comparison processes may integrate both short-term reactions to images (mood, state anxiety) and long-term predispositions or individual differences (trait neuroticism or its facets, e.g., depression, anxiety). Future research in this area should consider assessing relevant constructs at both state and trait levels.

The present findings dovetail well with those from prior similar studies. These include similar temporal or experimental manipulations examining anxiety (Sherlock & Wagstaff, 2019) or negative moods (Fardouly et al., 2015; Frison & Eggermont, 2017; Tiggemann & Zaccardo, 2015). The present study was similar to at least two others (Fardouly et al., 2015; Tiggemann & Zaccardo, 2015) in that it combined aspects of temporal precedence via a pretest–post-test design (e.g., Frison & Eggermont, 2017) with an experimental image manipulation (e.g., Sherlock & Wagstaff, 2019). Consequently, we could assess (a) change over baseline scores in moods and anxiety, (b) differences between an image-conscious and neutral-control groups, and (c) their interaction, which was the focus of our hypotheses. The present research is unique, however, because it is the first to examine the role of state-trait dynamics in people’s reactions to image-conscious Instagram accounts, focusing on the interplay between state and trait anxiety.

Regarding effects sizes, the absolute values of the partial correlations we obtained from our three hypothesized effects were .21, .26, and .26—all small-to-moderate in magnitude. The present work’s effect sizes were similar in magnitude to those of other related studies (i.e., Fardouly et al., 2015; Tiggemann & Zaccardo, 2015), which yielded effect sizes (correlations) ranging from .29 to .45 in absolute magnitude with a meta-analytic weighted mean of $r = .39$, 95% CI [.23, .53] (Hedges & Vevea’s [1998] random-effects model). Thus, the present work

produced two significant correlations ($r_s = .26$) within the meta-analytic range of similar studies. Consequently, our findings both replicated prior work and extended it by pioneering a trait-level moderation of a state-level effect. Perhaps more importantly, the three-way exploratory interaction suggested that both trait and state anxiety may be important in understanding college students' reactions to viewing image-conscious (vs. neutral) Instagram accounts. In addition, given that the mean effect size in published social-personality psychology articles is $r = .21$ (Richard, Bond, & Stokes-Zoota, 2003), our effect sizes were at least average or greater in absolute magnitude.

Limitations and Implications

The present work has multiple limitations. First, because the participants were psychology students at a large public university in the southeastern U.S., we caution readers to limit the generalizability of our findings to similar U.S. psychology students (Henrich, Heine, & Norenzayan, 2010). Specifically, the present findings may not generalize to other groups examined in similar studies, including adolescents and high-school students, adults aged 22 years and older, or non-U.S. samples. Nevertheless, because the primary users on Instagram tend to be in the same age range as our sample, and because college-aged adults (18–21 years) may be especially susceptible to comparing themselves to image-conscious photos, our sample of university students may be ideal for studying the effects of social media exposure on mood and anxiety, or at least more so than older adults. And because of the limited age range and relatively modest number of men in our sample, we chose to avoid examining age and gender as possible moderators of the effects of interest; future studies with larger samples should consider doing so.

Second, because we did not explicitly measure envy, distress, frustration, social comparison, appearance comparison, or changes in self-esteem, we cannot make any definitive

statements about the processes or mechanisms that may (or may not) link viewing image-conscious (vs. neutral) photos with increases in negative mood and anxiety. Because of our experimental manipulations and pre-test–post-test design, we can however be fairly confident about the causal link between the image manipulation and changes in mood and anxiety.

Third, because the present work relied exclusively on self-reports, we acknowledge that the usual limitations apply (e.g., social desirability, acquiescence bias; Paulhus & Vazire, 2007). Future research on this topic should consider (a) using a broader, more diverse sample; (b) using measures that supplement self-reports, such as peer-reports or behavioral observations; and (c) assessing possible mediator variables, such as envy, self-esteem, and social comparison.

Fourth, participants used desktop computer monitors to scroll through the experimental (or control) Instagram accounts. This potentially limits the generalizability of our findings because most people interact with Instagram’s mobile platform. Although one can access Instagram with notepad, laptop, and desktop computers, it was developed primarily for smart phones. Thus, the comparatively large photos viewed by our participants may have been more impactful than the smaller photos viewed on one’s smart phone or similar handheld device.

Fifth, because of possible selection bias, it remains unclear whether people with mental health issues simply spend more time viewing social media, if social media use negatively impacts mental health, or both. For example, whereas most studies have focused on the effects of SNS use on women’s anxiety, self-esteem, or body image, at least one study supported the notion that women who have lower self-esteem or negative body images—or those who experience self-objectification—are more likely to take and post selfies with the intent of empowering themselves (Veldhuis, Allewa, Bij de Vaate, Keijer, & Konjin, 2020). That is, selection effects may be partly responsible for some of the observed effects in the literature: Not only can SNS

use lead to a host of negative self-directed feelings for women, but also those same self-feelings (anxiety, self-esteem, body-image issues) likely influence their choice to engage in selfie-related behaviors in the first place.

Sixth, although it can provide a powerful lens through which to view the effect of SNS use on people's anxiety, body image, and self-esteem, social comparison theory is by no means the only theoretical approach worth considering. For example, some research (Stein, Krause, & Ohler, 2019) suggests that social comparison theory can be complemented by cultivation theory (Gerbner & Gross, 1976), whereby frequent use of—or exposure to—mass media can shift or bias people's thoughts, beliefs, and attitudes about what is normative (e.g., a false belief about societal expectations about weight or beauty standards based on Instagram use). Specifically, one study showed that Instagram browsing in particular—not Instagram use per se—was related to stricter weight ratings, but only among women (vs. men; Stein, Krause, & Ohler, 2019). Thus, although we have chosen to embrace a social comparison explanation for the present findings, other plausible theoretical perspectives, such as cultivations theory, may have much to offer.

Seventh, although our image manipulation was randomly administered between persons, our pretest–post-test design occurred within persons, meaning that our psychology student sample may have developed their own theories about some aspects of the experiment's purpose (e.g., demand characteristics). But then again, because each person saw images from one and only one condition (not both), it remains unlikely that our participants could be fully aware of our hypotheses, all of which relate to our between-person experimental manipulation.

Conclusion

Using an experiment with a pre-test–post-test design, we showed that exposing U.S. university students to self-conscious images via an Instagram account (vs. neutral control

images) resulted in decreases in positive mood, increases in negative mood, and increases in state anxiety, especially when individual differences in trait anxiety were controlled. These findings are consistent with the negative self-evaluations that people often experience after making upward social comparisons. Thus, our results both support social comparison theory and extend it to the upward social comparisons that people often make when viewing others' faces, bodies, and activities via online social media. Although these results show possible short-term negative consequences of viewing image-conscious photos online (e.g., fitspiration accounts), social comparison theory also predicts that long-term benefits can also arise from upward social comparison, including the inspiration to better oneself on one or more self-relevant dimensions (e.g., exercise). We believe that future studies should continue to use experimental designs and consider state–trait interactions in exploring the growing symbiosis between social comparison theory and social media psychology.

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Table 1. Descriptive Statistics for—and Correlations among—All Variables

Variable	Mean	SD	α	Correlations									
				1	2	3	4	5	6	7	8	9	10
1. Negative Mood Time 1	18.33	15.01	.87										
2. Negative Mood Time 2	14.33	13.47	.83	.86									
3. Negative Mood Difference	-4.00	7.78	—	-.45	.08								
4. Positive Mood Time 1	20.62	6.79	.78	-.30	-.24	.16							
5. Positive Mood Time 2	18.73	7.85	.81	-.23	-.29	-.05	.80						
6. Positive Mood Difference	-1.89	4.75	—	.04	-.13	-.30	-.11	.51					
7. GAD-2 Time 1	1.67	1.50	.88	.64	.57	-.24	-.23	-.21	-.01				
8. GAD-2 Time 2	1.22	1.33	.88	.58	.70	.09	-.17	-.21	-.10	.82			
9. GAD-2 Difference	-0.45	0.86	—	-.22	.08	.54	.14	.04	-.14	-.47	.12		
10. Trait Anxiety Facet (BFI-2)	3.46	0.81	.70	.42	.45	-.02	-.33	-.42	-.22	.47	.48	-.07	
11. Image Manipulation ^a	-0.03	0.50	—	-.02	.12	.25	.11	-.06	-.26	.01	.13	.18	.13

Note. Negative Mood = Sum of tension, depression, anger, fatigue, and confusion subscales (Grove & Prapavessis, 1992). Positive Mood = Sum of vigor and esteem-related affect subscales (Grove & Prapavessis, 1992). GAD-2 = Two-item Generalized Anxiety Disorder scale (Kroenke Spitzer, Williams, Monahan, Löwe, 2007). BFI-2 = Big Five Inventory 2 (Soto & John, 2017). ^aCoded -0.5 = control, 0.5 = experiment; correlations for image manipulation are point-biserial correlations. $N = 81$ except correlations involving GAD-2, where $N = 80$. **Boldface:** $p < .05$, two-tailed.

Table 2. *Regression Results: Time-2 (Post-Test) Generalized Anxiety as Functions Time-1 (Pre-Test) Generalized Anxiety, Image Manipulation (Control vs. Experiment), and Trait Anxiety*

Variable	<i>b</i>	<i>t</i> ₇₂	<i>p</i> ≤	<i>r</i> _p [95% CI]
Intercept (Generalized Anxiety at Time 2)	1.19	13.05	.001	—
Generalized Anxiety at Time 1 (GAD-2 T1)	0.66	10.20	.001	.77 [.65, .85]
Image Manipulation (-0.5 = control, 0.5 = experiment)	0.53	2.90	.005	.32 [.10, .52]
BFI-2 Trait Anxiety Facet (Anxiety)	0.22	1.92	.058	.22 [-.01, .43]
GAD-2 T1 × Image Manipulation	0.35	2.68	.009	.30 [.07, .50]
GAD-2 T1 × Anxiety	0.05	0.62	.536	.07 [-.16, .30]
Image Manipulation × Anxiety	-0.27	-1.17	.248	-.14 [-.36, .10]
GAD-2 T1 × Image Manipulation × Anxiety	-0.43	-2.63	.010	-.30 [-.49, -.07]

Note. GAD-2 = Two-item Generalized Anxiety Disorder scale (GAD-2; Kroenke Spitzer, Williams, Monahan, Löwe, 2007). BFI-2 = Big Five Inventory 2 (Soto & John, 2017). *r*_p = Partial correlation (effect size).

Figure 1. Three-way interaction predicted scores for Time-2 state anxiety as a function of Time-1 state anxiety, the image manipulation (neutral vs. image-conscious) and trait anxiety: low (-1 SD; top panel) versus high (+1 SD; bottom panel).