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DX0169

Social Comparison and Facebook: Feedback, Positivity, and Opportunities for Comparison

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ABSTRACT

People compare themselves to one another both offline and online. The specific online activities that worsen social comparison are partly understood, though much existing research relies on people recalling their own online activities post hoc and is situated in only a few countries. To better understand social comparison worldwide and the range of associated behaviors on social media, a survey of 38,000 people from 18 countries was paired with logged activity on Facebook for the prior month. People who reported more frequent social comparison spent more time on Facebook, had more friends, and saw proportionally more social content on the site. They also saw greater amounts of feedback on friends' posts and proportionally more positivity. There was no evidence that social comparison happened more with acquaintances than close friends. One in five respondents recalled recently seeing a post that made them feel worse about themselves but reported conflicting views: half wished they hadn't seen the post, while a third felt very happy for the poster. Design opportunities are discussed, including hiding feedback counts, filters for topics and people, and supporting meaningful interactions, so that when comparisons do occur, people are less affected by them.

Author Keywords

Social comparison; Facebook; envy; social media; well-being

CCS Concepts

•**Human-centered computing** → **Social networking sites;**

INTRODUCTION

People take cues from others around them, both online and offline. Whether we intend to or not, we compare our accomplishments, traits, and feelings to others' [24], which in turn affects how we see ourselves [69]. Concerns about social comparison predate social media [22], but online streams of wedding announcements, travel photos, and glamorous selfies have raised questions about whether social networking apps amplify unrealistic comparisons [65, 10]. A person's propensity for social comparison mediates the link between social media use and lower well-being [2, 40, 65, 46]. In one study, people with higher social comparison orientation reported spending more time on Facebook and being more negatively affected by what they saw there than people with lower social comparison orientation [73]. Though social comparison is an enduring human process [77], we can try to understand the kinds of online experiences that worsen it and look for ways to foster interactions that are more supportive of well-being.

The present work is a large, empirical study of social comparison (37,729 people in 18 countries). Surveys measuring social comparison were combined with aggregated server log data to understand the kinds of activities most strongly associated with social comparison (e.g., seeing more feedback on others' posts). Previous studies primarily rely on self-reports of one's online activities, which are challenging to report accurately [18, 37], in detail [39], and without being influenced by other questions on the same survey [54]. By contrast, the present study uses log data of respondents' activities the prior month, such as the number of posts they viewed and the amount of time they spent looking at profiles of demographically similar people. To further inform design opportunities, participants reflected on a recent occurrence in which they felt worse via comparison on Facebook: its intensity, duration, and whether they wished they hadn't seen the post.

The findings not only confirm past research that found that people who spent more time on Facebook reported experiencing social comparison more often [73], but also reveal differences in how they spend their time. People who reported more frequent social comparison saw more social content (produced by friends, friends-of-friends, or people they followed rather than by news media, businesses, or other organizations), had more friends overall, saw more likes and comments on others' posts, saw content with greater positive affect, spent proportionally more time viewing profiles, and saw proportionally more content from people close in age. There was mixed evidence that social comparison happened more between people of the same gender, and no evidence that it happened more with acquaintances than close friends. When asked to recall a specific recent experience, 1 in 5 could remember one, and their experiences varied widely. Even when people felt worse about themselves, with half wishing they hadn't seen the comparison-inducing content, one-third still reported feeling very happy for their friends who shared that content. Because experiences are not uniformly negative, designing to reduce social comparison is challenging. Nonetheless, we discuss several design opportunities informed by these results.

*Both authors contributed equally to this research.

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SOCIAL COMPARISON AND SOCIAL MEDIA

Social comparison is both an individual trait—a person's predisposition to compare themselves to others [24]—and a behavior influenced by a person's social context, such as how many relevant targets for comparison they encounter. Social comparison can be upward (i.e., comparing oneself to others perceived as better off) or downward, with upward comparison more common on social media [74]. It can also have positive or negative outcomes—inspiring people to exercise or change careers, or upsetting them when aspirations feel unattainable. To better understand when the latter might occur and potentially identify design improvements to reduce such negative outcomes, the present study focuses on comparisons that cause people to feel worse about themselves on social media.

Social media has been described as a "highlight reel" [65] linked to a variety of negative outcomes. Though the causal direction is unknown, these negative outcomes include depression [20, 65], envy [52, 43], decreased self-esteem [74, 73], worse body image [55], and lower well-being [40]. Inspirational social comparison is not the focus on this paper, but we discuss how social comparison can also be motivating in the Discussion section.

Prior research on the relationship between social media and social comparison spans several themes reviewed below. Some themes relate to how often opportunities for comparison present themselves. Other themes cover technology's impact on individuals—factors driven by peers' norms online and algorithmic ranking—particularly the amount of feedback and positivity they see in their News Feeds, or how people's propensities to compare themselves to others drive how they use social media, such as how often they visit friends' profiles. We also review past work studying general differences by age and gender.

Opportunities for comparison

When people are exposed to more potential targets for social comparison online, they are likely to experience it more often [47]. Thus, people who spend more time on social media, have larger friend networks, and see proportionally more social content (content from friends or other individuals rather than from the news media, businesses, or other organizations) may be more likely to report more frequent social comparison.

For example, past work found that people who reported more time spent on Facebook also reported comparing themselves to others more [65]. People with larger friend networks may also experience more social comparison, given that people with larger networks tend to have a greater proportion of friends that are acquaintances [48]. Having more acquaintances was also associated with more social comparison [10]. Self-disclosure about more difficult moments—the inverse of the "highlight reel"—is also more prevalent in smaller, denser networks [75, 6]. Nonetheless, other research found both negative and null relationships between overall network size and social comparison [10, 41]. The causal relationship between social comparison and social media use may be bi-directional. People more prone to social comparison may choose to spend more time in socially relevant places like Facebook, and what they see there may cause them to experience comparisons more often. Thus, we hypothesize:

H1. Frequency of social comparison on Facebook is positively correlated with:

(a) time spent on Facebook

(b) network size

(c) the proportion of content people view coming from friends or friends-of-friends rather than organizations

Feedback volume

Feedback—such as Likes, comments, or Reactions (one-click emotive feedback like a heart or laughing face)—signals attention and appreciation [61] and is a form of relationship maintenance [17]. Feedback is linked to improvements in the recipient's well-being [7], but the impact on viewers (other than the sender and recipient) may be mixed. Seeing friends support each other may boost feelings of community and positive empathy [51], but may also induce jealousy if viewers compare the volume of feedback they view on others' posts to their own, particularly among teens, for whom peer validation is especially important [63, 42, 11]. The quantitative nature of Like counts may cause people to value them more as a signal [74]. The problem of feedback is exacerbated by two related network paradoxes: the "friendship paradox" [21] and the "Like paradox" [61]. The friendship paradox is a phenomenon in which most people have fewer friends than their friends have. It stems from a sampling bias in which people with larger networks are more likely to appear in the friend networks of everyone else. On Facebook, this property of a person's friends having more friends than he or she has has also been observed. It also results in people's friends receiving more Likes because their friends have more friends to give those Likes [61]. Furthermore, ranking algorithms may prioritize posts with more feedback, since feedback is one signal of the posts people want to interact with [35]. Altogether, this means that people are more likely to see their friends' highest-feedback posts. If people compare the feedback they receive on their own posts to the feedback their friends receive, they may overestimate their friends' popularity and feel worse by comparison. Thus, we hypothesize:

H2. People who see a greater proportion of posts with high feedback report more social comparison.

Positivity

Both online and off, people are reluctant to transmit bad news [57, 5]. Consequently, people underestimate their peers' negative experiences [36]. This phenomenon may be compounded online, since people have more control over how they present themselves and selectively share more positive aspects of their lives [47, 15, 72]. One large empirical study of the Facebook News Feed found that among posts with feeling annotations (such as "feeling blessed" or "feeling lonely"), 57% were positive and 43% negative [6]. Thus, scrolling through friends' predominantly happy news about their lives may make viewers feel worse by comparison [65, 10]. We hypothesize:

H3. People who see a greater proportion of positive emotion in their News Feeds report more social comparison.

Impression management in profiles

Social media profiles allow people to curate how they appear to others, not just through selectively posting about positive emotions, but by removing unflattering content about themselves that others post [78]. When people visit others' profiles (e.g., by tapping on a name in a post they see in their News Feeds), perhaps to find out what others have been up to, they may stumble into a comparison based on what they see. Thus, social comparison and viewing others' profiles are likely to be correlated [2]. Past work found that seeing the profiles of attractive others increased the likelihood of perceiving oneself more negatively [29, 74]. Furthermore, people more prone to comparison may focus on their own profiles as well, editing them to present themselves in the best light and comparing how they present themselves in their profiles to how others do it [14, 11]. Still, viewing one's own profile can also be self-affirming [70] and self-esteem boosting [27], providing a way to manage feelings of social comparison. Overall:

H4. People who spend a greater proportion of time looking at profiles (and in particular, their own profile) report more social comparison.

Network characteristics: Similarity and Acquaintances

As online social networks are large and homophilous [71], they provide many potential targets for social comparison. People choose to befriend others who are similar to them [38, 49], and people tend to compare themselves to others who have similar attributes [22, 76, 26]. The present study focuses on age and gender similarity because they were emphasized in past work [76, 50, 68] and are part of most Facebook profiles, but other demographic dimensions such as life stage, education level, and income may also matter. We expect that people whose online social networks consist of more people who are demographically similar to themselves will experience more frequent social comparison:

H5. People who view a larger proportion of social media content from demographically-similar others experience social comparison more often.

Social media networks are also largely composed of acquaintances [71]—people whose more difficult moments we may not be aware of [4]. Seeing acquaintances' idealized lives online without having background information on their troubles may make viewers feel worse by comparison. In an experiment where participants spent five minutes browsing the profile of a Facebook friend that they considered an acquaintance, browsing their own profile, or browsing mobile phone reviews, participants with higher levels of social comparison orientation felt worse after browsing the acquaintance's profile [73]. However, as there was no condition in which people browsed the profile of a close friend, we do not know whether the outcome of comparing with close friends versus acquaintances differs. Other work [44] found that people were happier when good news on social media came from a strong tie rather than a weak one. We hypothesize:

H6. People who view a greater proportion of content from acquaintances rather than close friends experience social comparison more often.

Age and Gender

Much research on social comparison suggests that in both online and offline contexts, it is higher among women than men and highest among teens, decreasing with age. Women have been found to have higher levels of social comparison orientation than men [24, 28]. Similarly, teen girls have higher levels of social comparison than teen boys [53]. Other work found no evidence of gender differences in comparison [65]. Comparison decreases with age [67, 66, 31, 8]. Explanations include that younger adults favor social comparisons over self-comparisons while older adults favor self-comparisons (e.g., to themselves at earlier life stages) [67] or that adults feel less deprived of what they deserve [8]. Relatedly, work found that women and adolescents may also be more likely to experience negative outcomes of social comparison such as depression [53] and body dissatisfaction [30]. Overall, we expect:

H7. Frequency of social comparison on social media decreases with age.

H8. Women experience social comparison more often than men.

METHODS

To quantify the relationship between social comparison and Facebook use, a voluntary survey was conducted on Facebook in November 2018 and responses were combined with server logs of the participants' activity on Facebook in the four weeks prior. Facebook was chosen because of its size, global reach, and diversity of features. To protect participants' privacy, all data were de-identified after joining, then aggregated and analyzed on Facebook's servers. No identifiable or individual-level data were viewed by researchers. All data were observational and no experiment was performed. Beyond responding to the opt-in survey, no participants' experiences on Facebook were any different than normal. An internal research board reviewed the study design ethics and privacy practices prior to its start.

Participants

Participants (N=37,729; 52% female; mean age 33.4) were recruited via an ad on Facebook targeted at a random sample of people in 18 countries: Brazil, Germany, Denmark, France, Great Britain, Indonesia, India, Japan, Korea, Mexico, Norway, Philippines, Sweden, Singapore, Thailand, Turkey, the United States, and Vietnam. Compared to people who were active on Facebook each month, respondents were on average 0.5 years older, 8% more likely to be female, and had 52% more friends (all comparisons $p < 0.001$). To account for these differences, regression analyses control for country, gender, age, friend count and overall time spent, except where noted.

Social comparison frequency scale *(Cronbach's α = 0.75)*
On Facebook, how often do you observe what other people are doing to decide how you should act? *(item-total r=0.75)*
On Facebook, how often do you compare your own accomplishments to the accomplishments of other people? *(r=0.79)*
On Facebook, how often do you think about how you present yourself to other people? *(r=0.72)*
On Facebook, how often do you feel worse about yourself after comparing yourself to someone else? *(r=0.75)*
Never, Rarely, Sometimes, Often, Always
Description of a recent experience
In the past two weeks, have you seen a post by someone else on Facebook that made you feel worse about your own life in comparison?
Yes / No *(For respondents who chose 'Yes')*
How much worse did it make you feel?
No worse at all / A little worse / Somewhat worse / Quite a bit worse / A great deal worse
You said it made you feel *answer*. How long did that feeling last?
Less than a few minutes / A few minutes to half an hour / Half an hour to an hour / An hour to a day / A day to a week / More than a week
How happy did you feel for the person who shared it, if at all?
Not at all happy, A little happy, Somewhat happy, Very happy, Extremely happy
Do you wish you hadn't seen the post?
Yes / No

Table 1. Survey questions. The first four items were combined into a social comparison frequency scale.

Social Comparison Survey

Participants responded to a survey (see Table 1) that included a four-question social comparison frequency scale (Cronbach's α = 0.75) adapted from instruments used in past literature [24, 60] (e.g., the INCOM scale). Questions were modified by converting from agree-disagree to frequency response choices to reduce acquiescence bias [58], the phrase "On Facebook" was added to the beginning, and stems were simplified to facilitate translation. One question was added to explicitly measure an outcome of social comparison ("How often do you feel worse about yourself after comparing yourself to someone else.") Though this question was originally intended to be analyzed separately, a factor analysis suggested that a single factor was more appropriate, so the scale comprised all four questions. Separately, participants then described a recent experience of social comparison on Facebook: its intensity, duration, how they felt about the poster, and whether they wished they hadn't seen the post. These questions were not part of the social comparison scale, but rather were used to understand how people felt about a specific experience, and thus provide more context for design ideas. All questions were randomized within blocks. Surveys were translated into respondents' languages.

Behavioral Measures

Participants' survey responses were combined with counts of their activities on Facebook for the prior four weeks. All data were aggregated and de-identified after joining.

Opportunities for comparison

The following data were analyzed to test whether people who had more potential targets for social comparison reported experiencing social comparison more often. The total amount of time participants spent on Facebook in the four weeks prior to the survey was included, along with the sizes of their friend networks and the proportion of content they viewed in their News Feeds that was "social" (posted by friends, friends-of-friends, or people they followed, rather than Pages, which typically represent news media, businesses, or other organizations).

Feedback quantity

The analysis included the number of comments, Likes, and Reactions on other people's posts participants viewed in their News Feeds, at the time of viewing. There were two measures—one for Likes and Reactions, because a single person can only give one Like or Reaction to any given post; and one for comments. The proportion of posts a person viewed that received 20 or more Likes (or Reactions), or 20 or more comments was calculated. Results were qualitatively the same with other cutoffs (1, 10, and 50 pieces of feedback).

Positive and negative emotion viewed

VADER [33] was used to calculate the percentage of positive and negative affect in posts and comments participants viewed. VADER assigns sentiment scores to sentences and can account for negations like "but," emphasis from punctuation or capitalization, and degree modifiers like "sort of." The VADER analysis was limited to English. All counts were done automatically on de-identified data; researchers did not view any text.

Profile views

The study included the proportion of time on Facebook that people spent viewing other people's profiles, as well as the proportion of time on profiles that they spent on their own profile.

Demographic similarity

The study included the fraction of content a participant viewed from people who identified as the same gender (on their profiles) as the participant, and separately, from people who were within one year of the participant's age. Results were qualitatively similar when using three- and five-year age differences. These fractions were calculated separately for content participants viewed in three main areas: News Feed, profiles, and

Stories. Stories are ephemeral photo- and video-based posts that appear at the top of the Facebook app and expire after 24 hours.

Acquaintances vs. close friends

Closeness was approximated by calculating the fraction of content participants viewed from their top fifty friends based on mutual friend count [64]. Results were qualitatively similar with more complicated closeness models incorporating features such as communication frequency [25]. The cutoff of 50 was based on Dunbar and colleagues' descriptions of a person's "active" or "close" network as comprising approximately 50 people [32]. Results were qualitatively similar using other cutoffs, including a person's top 5, top 10, and top 20 friends. These fractions were calculated separately for News Feed, profiles, and Stories.

RESULTS

We begin by examining how often people felt social comparison on Facebook and how this varied by demographics. We then explore how different uses of Facebook were associated with social comparison. Then we report participants' descriptions of a recent experience.

Frequency of social comparison

After weighting responses by country, age, and gender to represent people who use Facebook monthly, the average frequency across the four questions in the social comparison scale in Table 1 was 2.4 on a 5-point scale, about halfway between "rarely" and "sometimes" (Figure 1). More than one-third (41%) said they "rarely or never" experienced comparison on Facebook, while 7.5% experienced it "often or always." These numbers suggest that social comparison is an occasional occurrence for most people, but a small fraction of people experience it chronically. This small group may benefit from different design approaches, and we discuss potential features for them below.

Consistent with previous research [67, 66, 31, 8], social comparison decreased with age—it was highest among teens and young adults (Figure 1). Teens reported approximately one-third of a standard deviation more social comparison than people age 18 or older ($b = 0.33$). In a regression controlling for age and country, there was no difference between women and men in reported frequency of social comparison ($p = 0.11$). These results contrast with past research that found that comparison was higher among women [24, 28]. However, much of this past research has focused on the West. The present study included countries with large populations of social media users that are less commonly covered in the literature on social comparison, such as India and the Philippines. In fact, men reported experiencing more frequent social comparison in many of the non-Western countries, particularly India, but lower among women in Western countries, particularly in the UK. Though we did not explore country-level differences in the present paper for scope, social comparison among men may be equal to or higher than women in many regions of the world and deserves additional research.

Activities associated with social comparison

To understand the relationship between people's feelings of social comparison and how they use Facebook, we performed a series of regressions, starting with a base model that includes demographic variables and variables that likely correlate with increased opportunities for social comparison.

Opportunities for comparison: time spent and friend count

This base model, shown in Table 2, controls for age, gender, country (omitted for space), friend count (logged base 2) and overall time spent (logged base 2). All continuous variables were standardized, so beta values represent the increase in social comparison in standard deviation units for a one-standard-deviation increase in the variable of interest. Supporting H1a and H1b, social comparison was higher among people who had more Facebook friends ($b = 0.10$) and who spent more time on the site ($b = 0.02$). All p values here and below were < 0.001 unless noted, and are FDR-adjusted to account for multiple comparisons and reduce the likelihood of spurious associations.

For all of the following analyses, a separate regression was run, adding the variable of interest (e.g., proportion of social content viewed) to the base model. In some cases, additional control variables (e.g., the total amount of content viewed) were added to a model and are noted. Table 2c shows one such model; additional tables are omitted for space and the relevant statistics are noted inline.

Opportunities for comparison: social content in News Feed

To understand how the proportion of social content a person views relates to social comparison, a control variable was first added to the base model to account for the total number of posts people saw in their News Feeds (logged base 2), which was associated with *less* frequent social comparison ($b = -0.02$, see Table 2b). However, Table 2c shows that when accounting for the proportion of that content that came from people rather than organizations, social comparison was 5% of a standard deviation higher ($b = 0.05$). Together, these models suggest that simply scrolling through News Feed itself did not amplify social comparison, but rather it depended on what kind of content people saw. When people had more relevant targets for comparison (other people), they experienced more social comparison. Together, these findings confirm Hypothesis 1c.

Feedback on posts viewed

Consistent with the idea that viewing friends' high-feedback posts may trigger social comparison (H2), social comparison frequency increased with the proportion of posts people saw in their News Feeds that received 20 or more pieces of one-click feedback (Likes or Reactions, $b = 0.06$), or received 20 or more comments ($b = 0.05$). These models controlled for the total number of posts participants saw in their feeds from people to attribute the impact to the feedback rather than the number of posts they viewed. While some of this relationship between social comparison and viewing high-feedback posts may be due to selection—people prone to social comparison may have chosen friends who also sought status and received a lot of feedback—it's more likely that seeing other people receive social validation triggered feelings of comparison, and the "Like paradox" discussed above (that people's friends receive

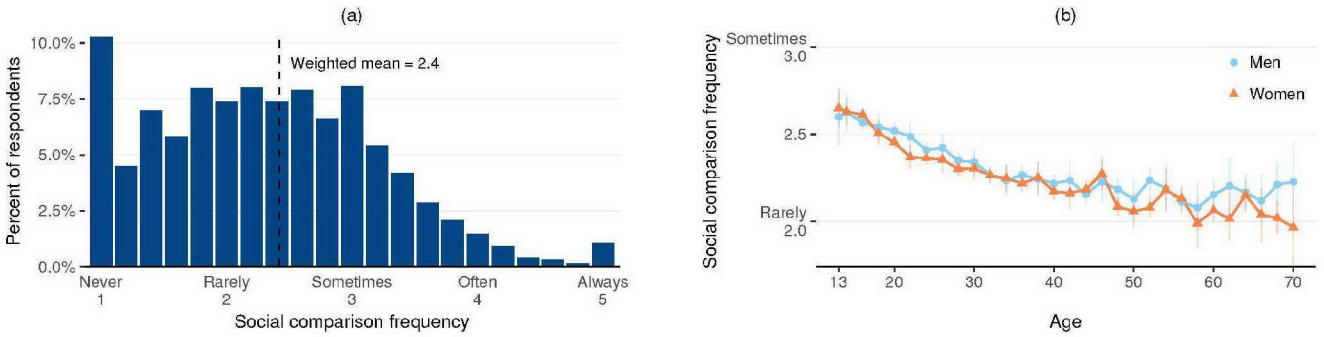


Figure 1. Frequency of social comparison on Facebook, measured as the average of the four questions at the top of Table 1. (a) While many people report rarely experiencing comparison, 7.5% experience it "often or always," and thus may have different design needs. (b) Social comparison (y-axis) was highest among teens and decreased with age. There was no statistically significant difference between women and men. Error bars represent 99% bootstrapped confidence intervals.

	Base Model			Model b			Model c		
Predictor	β	*CI*		β	*CI*		β	*CI*	
Intercept	-0.06	[-0.09 , -0.03]	***	-0.06	[-0.09 , -0.03]	***	-0.07	[-0.09 , -0.04]	***
Age (years)	-0.12	[-0.14 , -0.11]	***	-0.13	[-0.14 , -0.11]	***	-0.13	[-0.14 , -0.12]	***
Is female	-0.02	[-0.04 , 0.00]		-0.02	[-0.04 , 0.00]		-0.02	[-0.04 , 0.00]	
Country (not shown)									
Friend count	0.10	[0.09 , 0.11]	***	0.10	[0.09 , 0.11]	***	0.08	[0.07 , 0.09]	***
Time spent	0.02	[0.01 , 0.03]	***	0.04	[0.02 , 0.05]	***	0.04	[0.03 , 0.06]	***
Feed posts viewed				-0.02	[-0.04 , -0.01]	***	-0.01	[-0.03 , 0.00]	
Prop. social posts viewed							0.05	[0.04 , 0.07]	***

Table 2. A series of regressions was run to understand the relationship between feelings of social comparison and Facebook use. The base model controls for age, gender, country, friend count, and overall time spent. To understand the impact of a relevant variable such as the proportion of posts viewed that were social, an additional relevant control variable (feed posts viewed) was first added (Model b), and then Model c presents the addition of the variable of interest (proportion of social posts). All subsequent models in the paper follow a similar formula: Base model + relevant controls (specified in the paper) + variable of interest. (* $p < 0.001$, ** $p < 0.01$, * $p < 0.05$).**

more Likes and Reactions because those friends themselves have more friends to give feedback) may have worsened this effect. The feedback itself may have drawn attention to the content of the posts themselves.

Positivity viewed

Consistent with the theory that seeing others expressing idealized or positive lives on social media can worsen social comparison (H3), participants who viewed a greater proportion of positive emotion terms in posts and comments in their News Feeds reported experiencing social comparison more often ($b = 0.09$). Thus, for every standard-deviation increase in positivity people viewed (equating to about 50% more positivity), their feelings of social comparison were about 9% of a standard deviation higher. As noted above, this model controlled for age, gender, country, Facebook friend count, and time spent on Facebook, so the results are not explained away by differences in emotional expression by people from different demographic groups. Overall, this could have two explanations: hearing about friends' positive news causes people to feel worse about themselves by comparison, or people who have a higher propensity to compare themselves to others select friends who share a greater volume of positivity about their lives. This finding on Facebook mirrors offline behavior: people believe others around them have more positive experiences [36]. Correspondingly, seeing negative emotion terms was associated with less social comparison ($b = -0.07$). Altogether, people who saw more positive and less negative content from friends felt more social comparison. This suggests that when friends share negative experiences in their lives, the impact of social comparison may be tempered. There are multiple potential explanations: Seeing negativity could make people feel better by comparison, make them feel less alone in their own troubles, or it could cause viewers to want to help their friends, and providing social support may buffer the negative impact of social comparison by taking the focus off the self.

Viewing profiles

Consistent with the hypothesis that people with higher levels of social comparison seek out social information to compare themselves against (H4), people who reported more frequent social comparison spent proportionally more time viewing profiles ($b = 0.04$), and spent a greater proportion of that time viewing their own profiles ($b = 0.03$).

Seeing similar people: Similar age

Seeing demographically similar people can increase potentially relevant targets for social comparison. People who saw

more content from people within one year of their age on News Feed, profiles, or stories reported more frequent social comparison ($b = 0.04$, $b = 0.03$, $b = 0.02$, respectively). Each model included a control for the amount of content people were exposed to in that channel (the number of posts in their News Feeds, the number of profiles they viewed, or the number of stories they viewed, respectively). Results were qualitatively similar using 0, 3, and 5-year age ranges.

Seeing similar people: Same gender

Results for gender were mixed. There was no relationship between the proportion of people someone saw of their own gender in their News Feed ($p = 0.15$). In profiles and Stories, there was some evidence of a positive relationship ($b = 0.01$, $p = 0.01$; and $b = 0.02$, $p = 0.002$ respectively). The models controlled for demographics, so the differences are unlikely to have resulted from demographic differences in the people who chose to view profiles or Stories of people of the same gender. Additional research is needed to understand why gender would matter more in these specific contexts. Therefore, Hypothesis 5 was only partially supported.

Seeing acquaintances vs. close friends

No evidence was found to support the hypothesis that seeing more acquaintances triggered greater social comparison. The proportion of content a person viewed from acquaintances rather than close friends on News Feed, Profiles, or Stories had no relationship to frequency of social comparison (H6 was not supported). Setting different cutoffs for "close friends" (top 5, 10, or 20) did not affect the results.

Figure 2 summarizes the results, showing the association between each of the variables of interest and social comparison.

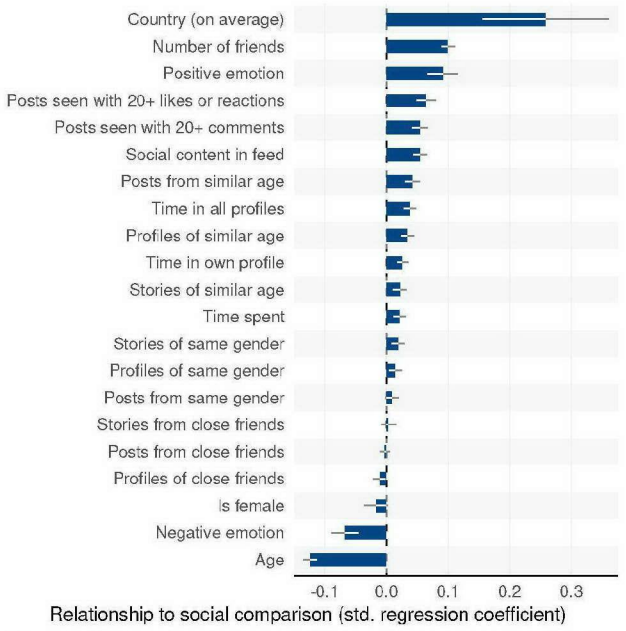


Figure 2. Relationship between social comparison frequency and demographic and activity variables. Bars indicate standardized regression coefficients described in the text. The variables most strongly associated with social comparison are country, younger age, high friend count, viewing proportionally more positivity and less negativity, and viewing more feedback on others' posts.

Description of a recent experience

The results discussed to this point are based on logged data for how participants used Facebook, in order to understand where social comparison may occur and for whom. To illuminate subjective experiences, participants also reported about a recent experience. In the two weeks prior to the survey, 20% of respondents recalled an incident in which they felt worse about themselves by comparison after seeing a post from someone on Facebook (see Figure 3a, all stats weighted for age, gender, and country to represent people who use Facebook monthly). Among this group, average intensity was relatively low, with a mean of 3.1 out of 5 (feeling "somewhat worse," see Figure 3b). However, 29% reported feeling "quite a bit" or "a great deal" worse. How long the feeling lasted varied widely: 34% said it lasted less than a half hour, 37% said a day or more, and the rest in between (Figure 3c). Duration and intensity were moderately correlated ($r = 0.48$). However, as people are more likely to remember and report past negative experiences [59], the findings may overestimate prevalence and intensity.

Despite feeling worse about themselves, respondents' feelings were mixed. Almost one-third (31%) reported feeling "very" or "extremely" happy for the person who posted the comparison-inducing content (Figure 3d). How happy people felt for the poster had little to do with how intense the comparison was ($r = -0.06$). Similarly, about half (45%) wished they hadn't seen the post (Figure 3e). We discuss these conflicting feelings—feeling happy for the poster and wanting to see the post while still feeling worse about oneself—in the Discussion section below.

DISCUSSION

The findings reveal that people who frequently experience social comparison use Facebook differently from those who rarely experience comparison. Though the present study cannot determine the causal direction, those differences are likely bi-directionally causal. People prone to comparison choose to spend more time on the site, build larger networks, and seek out others' profiles. Furthermore, the kinds of experiences they have online increase the likelihood that they feel worse: Seeing others receive more feedback, reading about others' positive lives, and viewing content from people about their age were all associated with more frequent social comparison.

The relationship between experiences on Facebook and social comparison was relatively small. On average, a standard-deviation change in Facebook use results in social comparison changing by 2% of a standard deviation. In comparison, a standard-deviation change in age decreases social comparison by 11% of a standard deviation. Country differences are also substantial; for example, social comparison is an average of 49% of a standard deviation lower in Mexico than in the US. Understanding these country differences remains important future work. The small size of the relationship between Facebook use and social comparison does not mean that social media has no impact on social comparison, but rather that the relationship is modest. Social media may still trigger feelings

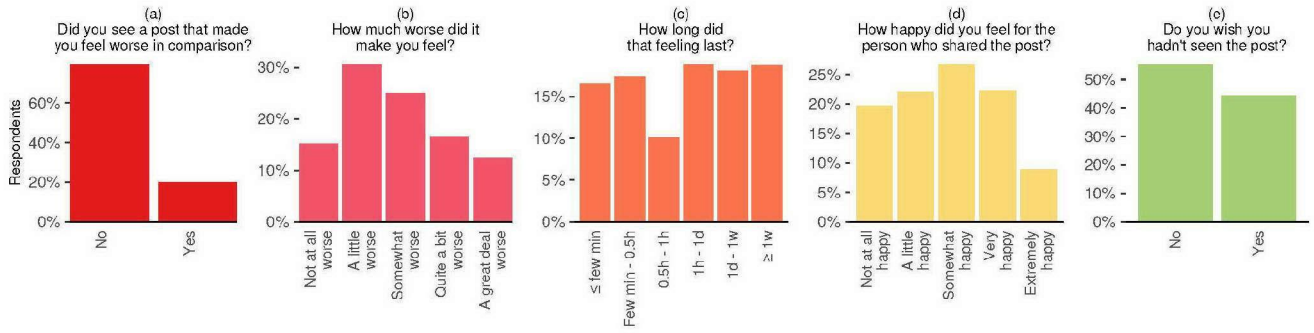


Figure 3. Approximately 1 in 5 respondents (22.5%) could recall an experience in which they felt worse about themselves from comparison on Facebook in the past two weeks (a). The experiences varied widely in intensity (b) and duration (c). About one-third felt "very" or "extremely" happy for that person (d). About half wished they hadn't seen the post (e).

of social comparison at times when those feelings wouldn't come up otherwise, such as when people are alone and bored and look to their phone, or when winding down for bedtime.

One of the more surprising findings was that there was not a statistically significant difference between women and men in their reported frequency of social comparison on Facebook. Much past research documents higher levels of comparison among women (e.g., [24]). However, much of this past work is based in western countries (with some exceptions, such as [28]). The present study encompasses 18 countries, including India, Indonesia, and the Philippines, where little research on social comparison has been published. In several of these under-studied countries, men reported more frequent social comparison than women. Averaging across countries washes out these gender differences. These differences are not described in more detail in the present paper for scope. We are currently conducting interviews around the world to better understand how experiences of social comparison on social media differ by country as well as by gender.

Teens experienced more social comparison than adults, and beyond baseline sensitivities caused by their cognitive development and social environment, teens may also be more receptive to particular cues on Facebook, such as seeing Likes [42]. The design opportunities discussed below may be particularly relevant to teens, including hiding Like counts and reminding people that others' lives are not as ideal as they may seem, both online and offline.

The present study found no evidence that viewing content from acquaintances rather than close friends made a difference. We had expected that because people don't know about acquaintances' troubles as well as they know about close friends', they might feel worse when exposed to acquaintances' news. But that wasn't the case: the proportion of close friends people saw in their News Feeds, in Profiles, and in Stories was not related to their frequency of social comparison. This null result may come from using mutual friend count as a proxy for closeness; this is just one of many components of relationship closeness and may, for example, confuse work colleagues (who may have many mutual connections) with close friends. However, using a more sophisticated model of closeness similar to [25] that included frequency of communication and length of relationship produced similar results: feelings of social comparison did not differ between people who viewed a greater proportion of close friends or acquaintances on Facebook. Thus, feelings of closeness to the person posting may be less important to combating social comparison, and perhaps the assumption that people know about close friends' difficulties than acquaintances' is faulty. Because seeing a greater proportion of negativity was associated with less frequent comparison, design ideas that encourage others to reveal their own struggles may still be relevant and are discussed below.

Furthermore, the data show substantial variability in experiences of social comparison—they are both rare and common, mild and severe, short-lasting and long-lasting. When people recalled experiences of social comparison on Facebook in the past two weeks (as 1 out of 5 did), roughly equal numbers of people said the feelings dissipated within a few minutes as lasted more than a week, and the intensity of those experiences ranged from not affecting them at all to making them feel a great deal worse. People also held complex views about those experiences, often feeling good for their friends and still wanting to see comparison-inducing posts. This variability suggests that there may be no one-size-fits-all solution. Any design changes, such as machine-learning based filters or tools to allow people to hide certain topics, would be challenging to get right. For instance, false positives may hinder other benefits of staying in touch with friends (even passively). Other design challenges are discussed below.

The experiences identified above as being associated with greater social comparison—spending more time online, having larger networks, seeing high feedback, seeing more positivity, viewing more profiles, and seeing people near one's age—suggest multiple opportunities to adjust the design of social media to mitigate the downsides of social comparison. We discuss design opportunities in two categories: those that reduce occasions for comparison in social media, and those that support well-being so that when comparisons occur, people do not feel worse as a result.

Opportunities to reduce comparison

Hiding feedback counts

Seeing content with high levels of feedback, especially one-click feedback like Likes and Reactions, was associated with

some of the highest levels of social comparison in the study. Therefore, one option is to hide or cap feedback counts from viewers other than the recipient. Feedback is important in its own right for relationship maintenance [17] and well-being [7]. Though viewers receive signals about their friends' relationships and participate in conversations by reading others' comments, the specific numbers may worsen social comparison. Like and Reaction counts could be displayed until they reach a cap (e.g., "20+ Likes"), reducing the opportunities for people to compare large numbers, and mitigating the impact of the "Like paradox." Notably, platforms are beginning to experiment with alternative forms of providing feedback. For example, Likes, comments, and Reactions on Stories on Facebook and Instagram are sent via a private message to the story creator, and only the story creator can see who viewed the story. Both Facebook and Instagram have considered tests in which feedback counts on posts are hidden from everyone but the post creator [13, 23]. Alternately, if feedback itself does not cause people to feel worse, but rather draws their attention to posts that induce comparison because of the content, another solution would be to change ranking algorithms to not weigh feedback as heavily. Nevertheless, this could have unintended repercussions if feedback were also a signal of quality. Reducing the importance of feedback in ranking algorithms could cause people to see lower-quality content and reduce the overall value they get from social media. Understanding the trade-offs of these different design approaches remains future work.

Filters

Roughly half of participants who had recently experienced social comparison wished they hadn't seen the post that caused it, so allowing people to choose whether to and what to hide may match their needs. Thus, another opportunity based on these findings is to give people options for filtering out content (e.g., particular people or topics) that spurs comparison for them. On Facebook, people-based filters already exist, including "unfollow," which hides a friend from News Feed while allowing the viewer to still visit that friend's profile and maintaining the pair's friend status; "snooze," which works like "unfollow" but for 30 days; and "take a break," which allows people to see someone less (like an ex) and prevent prompts to message them or tag them in photos [19]. These tools could be shown more prominently to address person-based social comparison. Topic-based filters are more challenging: they have been proposed more generally in other work to address psychologically difficult or triggering topics [1] and thus could be expanded to address social comparison as well. Some topics like travel, children, and romantic relationships may be straightforward machine-learning problems. However, other vectors for comparison may be more subtle, such as how funny a person is or that one's friends all seem to have more supportive friendships. Filters have many downsides as well. They may reduce opportunities for other meaningful interactions that build social support and keep friends apprised of each others' lives, may create "filter bubbles" by excluding certain topics like politics, and may hinder the poster's opportunities to interact with people who care about them. Since about half of respondents still wanted to see comparison-inducing posts, and the majority were still happy for the poster, designers should be thoughtful about when to introduce filters, even opt-in ones. Additional research is needed to understand where the potential reductions to social comparison outweigh any losses to meaningful interactions between friends.

Intentionality

Since the amount of time that people spent on Facebook was associated with their frequency of social comparison, designers may consider providing tools that allow people to be more intentional with their time. For example, platforms like Android and iOS allow people to view how much time they spend in apps and set time limits, as do individual apps like Facebook and Instagram (e.g., [56]). These tools may also help when people feel like they have difficulty controlling their time online [9]. A related option is to allow people to choose what kinds of experiences they want to have upon opening the app, such as interacting with specific friends so they are less likely to unintentionally encounter content that makes them feel worse by comparison. People prone to comparison may also benefit from opportunities to be more intentional in managing their friend networks: friend count had the strongest relationship with social comparison frequency. Nudges to "spring clean" friend lists or to use the person-based filters above may help.

Mitigating negative outcomes of comparison

Supporting well-being and thinking of others

Beyond reducing occasions in which people experience social comparison, prior literature suggests that supporting people's overall well-being may also reduce the impact of such comparisons when they happen. Some research [45] suggests that happier people are less sensitive to upward social comparison; they "use" comparison information differently. Similarly, reflecting on past experiences can bolster well-being [34], as may fostering higher-effort interactions with close friends [7]. Encouraging people to focus less on themselves and more on others may help too. Expressing gratitude for specific friends improves well-being [62], and negative outcomes associated with social comparison are lower when people experience positive empathy and experience others' positive emotions [51].

Educational campaigns

Another approach is to remind people that others' lives aren't as wonderful as they seem. Past literature indicates that we underestimate our peers' difficulties and overestimate their happiness [36], so occasional reminders, such as public-service announcements in social media feeds, broader advertising campaigns, or partnerships with celebrities may help. On the other hand, such campaigns may feel patronizing, so research is needed to understand what messages, if any, would be effective and wanted.

Encouraging people to share difficult moments

We found that viewing negative emotion in friends' posts is associated with decreased social comparison. As such, another option may be to encourage people to share more difficult moments of their lives on social media, so that friends see that they are not alone in their own difficulties. The #metoo

movement in 2017 is one example, in which celebrities encouraged victims of sexual abuse and harassment to share their own experiences [12]. A large study of Facebook from 2016 found that when people expressed negative emotions, their posts were met with an outpouring of support from friends: more comments overall, more supportive comments, and more private messages [6], and similar levels of support have been documented in qualitative research [16]. However, people may not want to share their difficult moments online, particularly if they have larger networks and multiple friend circles [75], and viewers may not want to respond when other individuals post sensitive news frequently, when it requires significant emotional labor, or when they do not have personal or professional experience to feel confident responding [1].

Inspiration

Finally, social comparison can be inspirational and motivate positive behavior change, such as learning a new skill or spending more time outdoors, because one sees one's friends doing it. Even if social media is a "highlight reel," those highlights help people see opportunities for themselves. Though we did not focus on motivational cases in the present study, our qualitative work in progress suggests that inspiration is a typical outcome from social comparison, not just feeling worse. People may simultaneously experience inspiration and negative feelings about themselves due to comparison. This may partially explain why half the respondents who felt worse due to comparison in this study still wanted to see the post that elicited comparison. Any design changes intended to mitigate social comparison should protect and promote these inspirational cases.

Limitations

The present study has several limitations. Its design was cross-sectional, so we cannot tell the causal direction between social comparison and Facebook use. Other variables, such as extroversion or self-esteem, may drive both social comparison and social media use. Participants' descriptions of recent experiences rely on retrospective self-reports. Specific instances of comparison that result in negative outcomes may be easier to recall, so prevalence may be higher than identified. On the other hand, people may report how they feel in general—or how they think they should feel—rather than accurately reflecting on a specific instance, and social desirability biases may cause respondents to under-report experiences of comparison. Participants were recruited on Facebook, so all had used the site at least once in the previous month; if a person had left Facebook due to social comparison they would not have been included in the study. Age, gender, household income, and race are all associated with different likelihoods of having an account [3]. Thus, the findings generalize to active Facebook users and the design recommendations are targeted to their needs, even though social comparison is also a common offline phenomenon. Facebook was selected as a platform for its size and variety of experiences, but other social media platforms may differ in the size and type of networks people cultivate, the synchronicity of communication, and the comparison-inducing topics that people share. Thus, not all results may generalize to other platforms. Finally, additional research is needed to understand differences across countries. The present study expands on past work by including 18 countries, but for scope we do not discuss country-level differences in this paper. The finding that, on average, men and women experience similar levels of social comparison contradicts previous findings, primarily from the West, that women experience it more than men. This indicates the need for additional research in countries that have not been widely included in past research. In-depth qualitative work is needed to understand specific differences driven by culture and context.

CONCLUSION

Social comparison is a common part of people's lives. Though it may be impossible to prevent all comparisons—and some may be inspirational—we can better understand the kinds of experiences people have that are associated with feeling worse by comparison, so that we can identify opportunities for technology to help. Providing people with tools so that they can hide feedback counts, use filters, be more intentional with their time, have more meaningful interactions, think more of others, share difficult moments, and be inspired can better support well-being online.

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