Facebook, Social Comparison and Happiness:
Evidence from a Quasi-Natural Experiment

Ayala Arad, Ohad Barzilay and Maayan Perchik

Coller School of Management, Tel Aviv University

Abstract

The ubiquity of Facebook usage compels us to study its effects on well-being. We identified a unique sample of Facebook users and non-users who are employed at a security-related organization, where Facebook usage was differentially restricted (even at home) creating a quasi-natural experiment. Performing between-subject analysis, we found significant differences between Facebook users and non-users with regard to levels of social comparison and happiness. Given the exogenous nature of the assignment into groups (i.e. users and non-users), we attribute these differences to the accumulated effect of Facebook usage. Specifically, we infer that Facebook usage increases engagement in social comparison which is liable to reduce user happiness. Social comparison fully mediates the effect of Facebook on happiness, but only among young employees and only among those who believe that others have many more positive experiences than they do. The findings hint at a new and somewhat more subtle mechanism than suggested by previous studies, in which even if Facebook users understand that their friend's posts are positively biased, the increased engagement in social comparison may adversely affect those who believe that their friends' lives are better than their own.

Keywords: economics of information systems; happiness; Facebook; information and communication technologies; quasi-natural experiment; social comparison

1. Introduction

Facebook is currently the largest online social network with over two billion users worldwide. Over the past decade, social media has become an integral part of everyday life. In the US, 90% of the 18–29 age group use social media, with older age groups catching up rapidly.[1] It is estimated that users spend an average of 38 minutes each day interacting on Facebook.[2] The analysis presented here is intended to understand the effect of Facebook usage on users' subjective well-being and contribute to the literature on the effect of information and communication technologies (ICT) on social welfare and subjective well-being (see, for example, Ganju et al., 2016; Greenstein and McDevitt, 2011).

The Internet, and online social networks in particular, now largely mediate communication and social interactions (Kim and Lee, 2011; Preece and Shneiderman, 2009; Walther, 2011). Online social networks are used for relaxation, entertainment and socializing (Ku et al., 2013; Park et al., 2009). Like their offline counterparts, they have been found to fortify one's self-esteem (Gentile et al., 2012; Gonzales and Hancock, 2011; Toma and Hancock, 2013), reinforce group identity (Fox and Warber, 2015; Zhao et al., 2008) and increase trust and cooperation (Bapna et al., 2017). Additional benefits include increased social capital, social support and relationship maintenance (Ellison et al., 2007; McEwan, 2013; Nabi et al., 2013). Since these benefits and the subjective well-being of users are strongly associated (e.g. Bjørnskov, 2003; Helliwell, 2001; Leung et al., 2013), it is reasonable to assume that participating in online social networks has a positive effect on well-being.

However, there is increasing evidence to the contrary, leading to what is referred to as the "Internet paradox". It suggests that Internet technology in fact reduces psychological well-being, as manifested in increased depression and loneliness (Kraut et al., 1998). The design of Internet-based platforms affects behavior on the platform, as demonstrated in a broad variety of contexts (see, for example, Dellarocas, 2005; Overby et al., 2010; Tiwana et al., 2010). It is possible that Internet

---

[1] About 82% of the individuals aged 30 to 49 and 69% of those aged 50 to 64 use some social media. See: https://www.pewresearch.org/internet/fact-sheet/social-media/

[2] See: https://marketingland.com/time-spent-on-facebook-snapchat-remains-flat-but-instagram-sees-growth-261705

technology, and in particular online social networks, which are designed to streamline the flow of information among users, constitutes a two-edged sword when it comes to user well-being. In the case of Facebook, the design of the news feed creates an overwhelming emphasis on the positive experiences of others (Chou and Edge, 2012), which may give rise to envy, rumination and jealousy (Feinstein et al., 2013; Fox and Moreland, 2015; Tandoc et al., 2015), as well as depression, anxiety and stress (Farahani et al., 2011; Labrague, 2014). Social media may also lead to diminished enjoyment of one's own experiences (Rifkin et al., 2015) due to the fear of missing out (FOMO) (Przybylski et al., 2013).

The broad spectrum of positive and negative effects on well-being that are attributed to Facebook and other online social networks needs to be understood (Verduyn et al., 2017; Appel et al., 2016). This study exploits a quasi-natural experimental situation that makes it possible to compare users and non-users of Facebook in order to understand its effect on social comparison and happiness, as well as to measure individuals' perceptions of the positive/negative experiences of their friends and investigate the interplay between these three factors.

We explore a possible mechanism by which Facebook affects one's subjective well-being. Facebook's architecture leads users to compare themselves to one another, which may play a key role in determining subjective well-being, a view supported by findings that (offline) upward social comparison reduces happiness (Argyle, 2013). Non-users of Facebook are not bombarded by constant reminders of how much better the lives of others are relative to their own and can live in comfortable denial. In contrast, Facebook users observe the positive experiences of others more vividly and more frequently, thus triggering upward social comparisons (see Bamberger and Belogolovsky (2017) for a similar argument in a different context). We note that the proposed mechanism is independent of the one proposed in the literature, according to which Facebook biases one's perception of others' positive experiences. This perception bias may affect happiness even if one's social comparison level (the tendency to compare) has not increased, while increased engagement in upward social comparison due to Facebook use may affect happiness even if one's perceptions haven't been altered by Facebook use.

A significant challenge to identifying a causal link between Facebook usage and happiness is built-in selection bias. Individuals who choose not to use Facebook are likely to differ in character from Facebook users (Ljepava et al., 2013; Nadkarni and Hofmann, 2011) which makes it difficult to devise

a proper control group of Facebook non-users. Moreover, since the vast majority of the population uses Facebook, it is reasonable to assume that those who avoid it may have unique personality traits.

A similar selection problem exists in studies that compare the subjective well-being of users who are characterized by different types or intensities of usage (Chou and Edge, 2012; Tandoc et al., 2015). It is possible that a person's general disposition will affect how they use Facebook (e.g., passive use vs. active use, frequency of use, etc.). For example, it might be that people with a high level of well-being use Facebook in a different manner as opposed to the converse, namely that the manner in which they use Facebook raises their level of well-being. As a result, one may not be able to identify the impact of the type or intensity of Facebook usage on happiness in such a comparison. Even longitudinal within-subject studies that compare subjective well-being across time and types of usage (e.g. Kross et al., 2013; Verduyn et al., 2015) may be subject to bias since in periods when the participants are happier they might also choose to use Facebook more or less intensively.

Some studies use path analysis (Baron and Kenny, 1986) to explore the mediating effect of envy, rumination and social comparison on depression (Feinstein et al., 2013; Tandoc et al., 2015) or life satisfaction (Krasnova et al., 2013; Locatelli et al., 2012). However, this approach does not eliminate the possibility of underlying endogeneity (see Appel et al., 2016).

The current study investigates the impact of Facebook on social comparison and on happiness, using a unique sample of users and non-users for whom not using Facebook is mainly due to their circumstances rather than their personal preferences. This setting reduces the inherent self-selection associated with not using Facebook. All the participants are employees of a large and well-known security-related organization in which the use of Facebook was at first entirely forbidden to employees for security reasons (during the period 2008-2012), and subsequently was allowed for some employees. We use the policy change as a quasi-natural experiment by dividing the employees into two groups: users and non-users. In January 2015, 144 randomly selected employees filled out a pencil-and-paper questionnaire which asked about their demographics, friends' experiences, personal experiences, social comparison orientation (using Gibbons and Buunk, 1999), happiness (using The Oxford Happiness Questionnaire, Hills and Argyle, 2002), and Facebook use (based on Ellison et al., 2007). The results

were analyzed using a moderated mediation model (Hayes, 2013; Preacher and Hayes, 2004) that captures our proposed theoretical model.

In an ideal natural experiment, the organization would have assigned its employees *randomly* into users and non-users and would have ensured full compliance (i.e. that all employees who were assigned to the group allowed to use Facebook would indeed do so, and vice versa). In such circumstances, we could have surveyed the employees regarding their social comparison orientation and happiness level and been able to interpret any difference between users and non-users as causal. However, in our setting, Facebook usage was manipulated by *exogenously* imposed organizational restrictions, based on security considerations and according to the projects in which the employee was involved. We note that the Facebook restrictions were determined by type of project, rather than the position of the employee in the organization. For example, an administrator and a scientist might have identical restrictions placed on them while two engineers might have different ones. Nevertheless, because the exogenous assignment of the employees was not necessarily random, we need to address the concern that it is correlated with employees' individual characteristics, which are in turn correlated with our dependent variables, i.e. social comparison and happiness. Furthermore, we wish to address the possibility that there are non-compliers who freely decided not to use Facebook although they were not restricted.

In order to reduce concerns regarding potential selection bias and its effect on our estimates, the analysis was conducted on a matched sample of employees using propensity score matching on their observable covariates. We also carried out the following analyses, which are described in detail in the appendix: (1) Personal interviews – In order to estimate the magnitude of self-selection in our original sample, post-study interviews were conducted among the organization's non-user employees in order to understand their reasons for not using Facebook and how those reasons relate to the restrictions placed on them. The interviews suggest that the extent of self-selection is very small. (2) Sensitivity analysis – We simulate the effect of selection bias on our matched sample using a confounding function and then re-estimate the effect of Facebook usage on a confound-adjusted outcome. We find that as long as the influence of the unmeasured confound is not much larger than that of the observable variables, our interpretation of the original estimation is not altered.

Facebook usage was found to have a positive effect on social comparison only among young employees (25 years old and younger) and had no significant effect among older employees. In turn, social comparison had a significant negative effect on happiness. Thus, the moderated mediation model showed that social comparison fully mediated the impact of Facebook on happiness, although the effect is significant only for those who believe that their friends have many more positive experiences than they do. We did not find any indication that Facebook affects the perception of others' experiences (compared to one's own experiences). Thus, the findings provide empirical support for our proposed mechanism, in which increased levels of upward social comparison may affect happiness even if one's perceptions haven't changed due to Facebook use.

The research makes a number of contributions to the literature regarding the effect of social networks on well-being. First, it proposes a revised mediation model for the mechanism by which Facebook affects user well-being. Previous studies have suggested that Facebook's negative effect is a direct result of users being envious of their peers. We propose a somewhat subtler model based on two new questionnaires that ask participants to estimate the frequency of their own positive and negative experiences and those of their friends. These novel questionnaires allow us to demonstrate that even if Facebook does not affect a user's perception of their peers' positive and negative experiences, the greater frequency of social comparison intensifies the negative feelings resulting from the (independent) perception of others' lives as better than one's own. Put differently, if you believe that your friends are living a better life than your own, then using Facebook might make you less happy.

The study is also innovative in its experimental setting, which facilitates a quasi-natural experiment in a workplace, thus providing the following advantages:

- **Exogenous assignment**. The partially exogenous nature of the assignment into two groups, i.e. users and non-users, reduces the inherent selection bias which has been evident in previous studies. Although it is not a random assignment, the results allow for causal interpretation to some extent.

- **Age**. To the best of our knowledge, this is the first study to examine how the effect of Facebook usage on well-being varies with age. Contrary to previous studies, which used more

homogenous subject groups, usually consisting of students (Wenninger et al., 2014), we analyze a sample of employees of varying ages (ranging from 18 to 44, with an average of 26.7). We find that the older members of the sample were somewhat less vulnerable to Facebook's influence on their social comparisons and in turn on their happiness.

- **Passive usage**. A unique feature of the study's setting is the relatively passive usage of Facebook by employees in the sample. Due to the need for security in their work, even employees who were allowed to use Facebook were asked to be cautious about the information they share online. For example, many of them were asked not to upload photos and not to share information about their work. Although one might think that this type of usage is not typical of the population, it is in fact fairly common, according to a recent official Facebook blogpost,[3] articles in the popular media,[4] and academic studies conducted on students (e.g., Verduyn et al. 2015), as well as a parallel survey of students we carried out (see the appendix). Thus, the findings contribute to the growing literature that points to the negative implications of passive social media usage.

- **Cumulative effect**. The setting allows us to account for the cumulative effect of Facebook usage "in the wild", in contrast to lab experiments and brief-duration field studies (Kross et al., 2013; Lin and Utz, 2015; Verduyn et al., 2015; Vogel et al., 2015).

2. Theory building

We seek to investigate Facebook's effect on social comparison and happiness, while considering users' perceptions of the positive/negative experiences of their friends, and to study the interplay between these factors. Specifically, the proposed theoretical framework distinguishes between two constructs: (a) the degree to which one considers one's own actions in light of what others do, i.e. social comparison orientation; and (b) the perceived difference between one's own positive experiences and those of one's friends, denoted as $\Delta(pos)$. The theory is outlined in Figure 1.

---

[3] https://newsroom.fb.com/news/2017/12/hard-questions-is-spending-time-on-social-media-bad-for-us/
[4] https://www.theguardian.com/technology/2017/dec/15/facebook-mental-health-psychology-social-media

People have an innate drive to evaluate their own opinions and abilities (Festinger, 1954), with the goal of reducing uncertainty (Gibbons and Buunk, 1999) and establishing their standing relative to others (Brown et al., 2007). Since humans are social creatures, self-evaluation often depends upon comparing oneself with other people, a process called "social comparison" (Festinger, 1954). Formally, social comparisons are defined as "comparative judgments of social stimuli on particular content dimensions" (Kruglanski and Mayseless, 1990). People vary considerably from one another in the extent to which they engage in social comparison, which can be measured by a widely used index called "social comparison orientation" (Gibbons and Buunk, 1999).

The Facebook platform, like other social media, is… well, social. Many online user interactions on Facebook correspond to offline social interactions and have social effects, such as enforcing group identity (Fox and Warber, 2015; Zhao et al., 2008), and increasing social capital, social support and relationship maintenance (Ellison et al., 2007; McEwan, 2013; Nabi et al., 2013). Facebook's design, and in particular the news feed, intensifies the social experience. The news feed stacks the experiences of multiple people, laying them out one on top of the other, and making the comparison to one's own experiences unavoidable. Furthermore, the ubiquity of Facebook may make the increased social comparison a habit that manifests outside of Facebook. Facebook friends are often also real-world friends, and thus it is reasonable to expect a social comparison spillover.

We hypothesize that the effect of using Facebook on social comparison is moderated by age. Social comparison is a part of human development that supports self-evaluation and changes with age (Ruble et al., 1980). Consistent with Suls and Mullen's (1982) life-span model of comparison processes, it was found that older adults report less of a tendency to socially compare than younger adults (Callan et al., 2015). Hence, it is important to control for age when estimating the effect of Facebook usage on social comparison. Furthermore, since Facebook provides an additional channel for social comparison, it may intensify already existing differences in social comparison between age groups.[5] Recent evidence suggests that the type and intensity of Facebook usage varies according to age (Pettijohn et al., 2012)

---

[5] It is also likely that younger users rely on Facebook as a source of social information to a greater extent than older users, who are "used to" collecting social information from offline sources.

and that passive Facebook usage (e.g., examining others' profiles rather than sharing experiences and engaging with other users) is very common among young users (Pempek et al., 2009; Verduyn et al., 2015). The passive form of usage intensifies social comparison using Facebook and it becomes the core experience (Rousseau et al., 2017). Combined with evidence that young adults are more easily influenced by external factors and their character is more malleable than that of older adults (Finn, 1986; Gardner and Steinberg, 2005; Helson and Moane, 1987; Siegler et al., 1990), it is likely that the effect of Facebook on social comparison orientation is larger for young adults than for older ones.

Interestingly, in the context of Facebook usage it was found that comparison orientation is the mediating variable between age and the intensity of Facebook activity, suggesting that younger adults are more inclined to compare themselves with others and therefore use Facebook more than older adults (Ozimek and Bierhoff, 2016). Here, we reverse the direction of this mediation. Thus, based on the exogenous assignment of non-users, we propose the following hypothesis:

- **H1 (social comparison)**: Facebook usage increases one's social comparison orientation, an effect that is moderated by age (such that younger users are more affected than older users).

Social comparison can be in two directions – upward or downward (Gibbons and Buunk, 1999; Wills, 1981). In an upward comparison, one perceives another to be superior along some dimension while in a downward comparison, the opposite is the case. A number of previous studies have focused on the mediating role of envy in reducing subjective well-being (Cohen-Charash, 2009; Smith et al., 1999; Vecchio, 2000). Envy is a possible outcome of upward social comparison. However, the theory proposed here is somewhat subtler in that it distinguishes between Facebook's effect on the *intensity* of social comparison and the *direction* of the comparison (upward or downward). Each of these two effects may lead to increased envy. In particular, it may be that Facebook increases one's social comparison level (in line with H1) but does not affect one's perception of others' experiences relative to one's own, which may cause either upward or downward social comparison, depending to the user's *unbiased* perception of others vs. that of himself.

Based on the existing literature (off-platform), we expect that Facebook usage will decrease user happiness in the case of upward social comparison (Argyle, 2013; Wood et al., 1985). Non-users are

not constantly viewing the experiences of others and can ignore them if they wish to, whereas Facebook users encounter the positive experiences of others more vividly and more frequently, which is liable to trigger upward social comparison (see Bamberger and Belogolovsky (2017) for a similar argument).

Therefore, we also make the following hypothesis:

- **H2 (social comparison as mediator for happiness)**: The effect of Facebook usage on happiness is mediated by social comparison orientation and moderated by the relative frequency of friends' positive experiences as perceived by the user (i.e., $\Delta(pos)$).

3. Method

The sample consists of employees from a large, well-known security organization. They must go through a rigorous security clearance process before being hired. The employees consist of knowledge workers, IT experts, administrators, scientists and managers. The ages in the sample vary from 18 to 58 (mean=26); 40% are females; 26% are married; and 56% have at least a college degree while the rest have at least a high school education. The average income in the sample is above the average in Israel and their socioeconomic background is comparable to that of university students in Israel.

In January 2015, 144 randomly selected employees filled out a pencil-and-paper questionnaire we had formulated. All of those who were asked to take part in the study agreed to, thus mitigating the risk of happiness-associated volunteer bias (Heffetz and Rabin, 2013). Employees who did not have an active Facebook account at the time of the study (in 2015) were classified as *non-users* and those with an active account as *users*. The sample consisted of 95 users and 49 non-users.[6]

The assignment to the groups of users and non-users is described below, followed by a description of the questionnaire, descriptive statistics and the data analysis method.

---

[6] Most of the non-users have never opened a Facebook account. Ten out of them had an account in the past but closed it well before the study (2.34 years before, on average), where the most recent non-users are three employees who closed their account 6 months before the study.

3.1 Quasi-exogenous assignment of employees

For security reasons, the organization's employees were not allowed to use social networks during the period from 2008 to 2012 (neither at work nor at home). Employees with an existing Facebook account, including employees joining the organization during this period, were asked to delete their account. In 2012, the restrictions were relaxed and the policy became dependent on the projects an employee is involved in (rather than his job in the organization). For example, an administrator and a scientist may have identical restrictions placed on them while two engineers might have different ones.

The changes in policy serve to create a quasi-natural experiment by assigning employees to one of two groups: users or non-users. Our main claim is that the restrictions imposed on the employees serve as an external barrier to using Facebook, which encourages employees to avoid using Facebook entirely (thus "assigning" them to the non-users group). This "encouragement" operates by means of two channels:

1. **Present prohibition**. This includes employees who were not allowed to use Facebook at all at the time of the study (2015). Considering the nature of the organization, the importance of an employee maintaining his credibility within the organization, the possibility that Facebook usage is monitored, and the periodic polygraph testing, it is safe to assume that employees who were instructed not to use Facebook complied with the restriction.

2. **Previous blanket ban**. This includes employees who worked in the organization prior to 2012. They were forbidden to use Facebook during the period 2008-2012; even subsequent to that period, many of the employees who were allowed to have a Facebook account were still forbidden to use their full name or to upload photos, restrictions that compromised their Facebook experience. Post-interviews indicate that these employees were also used to not having Facebook and therefore decided not to use Facebook even though they were allowed to.

In our random sample of 144 employees, 49 (34%) did not have an active Facebook account, compared to only 4% of non-users in a comparable student group. A difference of this order of magnitude suggests that the extent of Facebook abstinence in the sample is related to the organization's restrictions on usage (whether current or previous).

Nonetheless, there is a concern that non-users and users have different characteristics, which are associated with the projects they work on. For example, it may be that the projects in which Facebook use is forbidden are top secret, and working on such projects may be systematically associated with high job satisfaction, which, in turn, is correlated with the dependent variables, i.e. social comparison and happiness. Furthermore, it may be that employees in these projects were assigned to them because they have some specific trait desirable in those projects, which again may bias the estimates.

Although this is a valid concern, we believe that it does not create a systematic bias in the estimates, given the nature of the organization and the administration of the questionnaires. Specifically, the questionnaires were administered over a three-week period on the organization's campus. The participants, both users and non-users, were physically dispersed in different buildings and in different offices and were employed in nine different departments (in various divisions) and 18 different teams. Furthermore, both groups included employees in a variety of positions (administrators, scientists, engineers, managers, etc.). Thus, the diversity in the sample mitigates some of the risk of systematic in-group bias. Moreover, many of the non-users were in fact allowed to have a Facebook account at the time of the survey, but chose not to because of the previous blanket ban and the current restrictions (see the second channel above).[7] In addition, we found that the frequencies of the various everyday experiences of users and non-users in the sample were not significantly different.

There is also a concern regarding non-compliance, as in any field experiment. In our context, this involves employees who were allowed to use Facebook without restriction, but refrained from doing so nevertheless. Thus, the 2015 snapshot distinguishes between treated subjects (non-users) and non-treated subjects (users), although this is not necessarily in perfect alignment with the restrictions imposed on the subjects. This potential non-compliance is a manifestation of self-selection and may bias the estimated effect. We assessed the magnitude of this selection bias by means of post-interviews and found it to be of a small magnitude. We also reduced the effect of potential selection bias on the

---

[7] We find that the users group consists of relatively young employees, which is consistent with the above assignment description. Thus, young employees are more likely to be new to the organization and hence did not experience the previous ban and are more likely to be involved in less sensitive projects. Furthermore, they are probably more accustomed to using Facebook. We perform a matching procedure in order to balance the ages (as well as other observables) between the two groups and further control for age in our estimation.

estimation by using a matching procedure, which creates two balanced groups based on their demographic features, and estimating our model on the matched sample (the post-interviews and a sensitivity analysis are described in detail in the appendix).

3.2 The questionnaire

The questionnaire (which appears in the appendix) included six sections, which were presented to the subjects in the following order:

A. **Demographics**: age, gender, family status, a choice between three levels of education and five levels of income.

B. **Friends' experiences:** We were interested in ascertaining how participants perceive others' lives as compared to their own, but did not wish to reveal our intention in the questionnaire. Thus, in this section, the participants were asked to estimate the frequency of various positive and negative experiences in their friends' lives, while in section E, which appeared a few pages later, the same questions were asked with respect to the participant's own experiences. There were ten questions regarding the positive experiences in their friends' lives (such as how often during the week they go out, read a book, watch a movie, etc.) and five questions regarding the negative experiences (such as how often during the week they are upset, sick, etc.).

C. **Social comparison:** This section was based on the *Scale for Social Comparison Orientation* (Gibbons and Buunk, 1999). Participants were presented with eight statements and asked to indicate the degree to which they agree with each of them on a 6-point scale, from "strongly disagree" to "strongly agree". A high score indicates a high level of social comparison. The reliability of the scale was evaluated using Cronbach's alpha measure (alpha=0.803).

D. **Happiness:** This section is based on *The Oxford Happiness Questionnaire (*Hills and Argyle, 2002). Respondents were presented with eight statements and were asked to what extent they agree with each of them on a 6-point scale, as described above. A high score reflects a high level of satisfaction with one's own life. The reliability of the scale was evaluated using Cronbach's alpha measure (alpha=0.715).

E. **Personal experiences:** Participants were asked about the frequency of ten positive experiences and five negative experiences in their own lives, which correspond to the experiences they were asked about in Section B. Based on the answers to sections B and E, we measured the difference between the frequency of others' positive and negative experiences and one's own. Because the differences in frequencies for the various experiences (questions) use different scales, the difference for each experience was translated into a relative score, i.e. a percentile for that experience. We then averaged across the 10 positive experiences to obtain the variable $\Delta(pos)$ and averaged across the 5 negative experiences to obtain the variable $\Delta(neg)$. Thus, a high value of $\Delta(pos)$ ($\Delta(neg)$) indicates that, relative to the sample, an individual tends to believe that others have more positive (negative) experiences than he does.

F. **Facebook usage:** This section is based on Ellison et al. (2007). The questions concerned the frequency of Facebook usage and the type of activities that users engage in. For example, participants were asked how often they check their Facebook account, how often they upload photos, how often they tag, etc.

3.3 Descriptive statistics

Since the original assignment to the groups (users and non-users) was not random, we employ the propensity score matching method (Rosenbaum and Rubin, 1983; Dehejia and Wahba, 1999), using Matchit (Ho et al., 2007) in order to balance the two groups based on their demographic features and then perform the analysis on the balanced groups. The matching procedure uses the *nearest neighbour* method and *probit* as the distance function and discards observations with low quality matches that lie outside the common support of the distance measure (without replacement). The process resulted in two balanced groups: 41 non-users (out of the original 49 non-users) and 41 users. The demographics and main characteristics of users and non-users in the matched sample are shown in Table 1. The users spend an average of 48 minutes on Facebook each day (the median is about 30 minutes) and 78% of them check their account at least once a day (34% check it more frequently).

3.4 Empirical model

We carried out a linear regression analysis using the matched sample. In the basic analysis, we measure the differences between users and non-users but do not take into consideration the manner and scope of Facebook usage, which may be *endogenously* determined by the users. We later extend the basic analysis to include usage patterns and how these patterns relate to social comparison and happiness.

We start with the analysis of a simple model to capture the overall effect of Facebook on social comparison (H1). We then estimate a moderated mediation model (using PROCESS; Hayes, 2013), which examines the main hypothesis of the research (H2). According to the model (Figure 1), the effect of Facebook usage on happiness is mediated by social comparison. Age serves as a moderator for the effect of Facebook on social comparison and therefore it influences the indirect effect of Facebook usage on happiness. Furthermore, the effect of social comparison on happiness is moderated by the perceptions of others' positive experiences relative to the perceptions of one's own (Δ(pos)). Thus, we investigate the variable effect of Facebook usage according to age and according to the level of Δ(pos). The indirect effects are estimated using nonparametric bootstrapping procedure (Preacher and Hayes, 2004).

The moderated mediation model is given by the following equations:

$$Social\ comparison = \alpha_1 Facebook + \alpha_2 Age + \alpha_3 Facebook * age + \varepsilon_1 \tag{1}$$

$$Happiness = \beta_1 Facebook + \beta_2 \Delta(neg) + \beta_3 Social\ comparison + \beta_4 \Delta(pos) \\ + \beta_5 Social\ comparison * \Delta(pos) + \varepsilon_2 \tag{2}$$

We control for Δ(neg) for the sake of symmetry (the main effect of Δ(pos) is included in the model). As a test of robustness, we ran a number of variations of the model and found that using additional demographic covariates does not alter the qualitative results. In addition, all the estimates of the Facebook effect are robust to the inclusion of the propensity score measure (obtained in the matching procedure) as a covariate.

4. Results and Analysis

The findings show that Facebook usage increases social comparison (thus supporting H1), which in turn reduces happiness conditional on the perception of friends' positive experiences relative to the perception of one's own (thus supporting H2).

4.1 Social comparison

Table 2 presents the OLS estimations for six different models in which social comparison level is the dependent variable and Facebook usage is one of the explanatory variables. In Model 4, for example, social comparison was found to be positively affected by Facebook usage (B=2.455 (0.812), p=0.003). We did not find a direct effect of age on social comparison (B=0.022 (0.021), p=0.3); however, age's interaction with Facebook usage was negative and significant (B=-0.08 (0.03), p=0.009), suggesting that the effect of Facebook usage decreases with age, thus supporting H1. The results are robust to various specifications, as long as the interaction of age with Facebook usage is included in the model.

In view of the moderating role of age, we calculated the effect of Facebook usage for five ages: 19, 22, 25, 30 and 35, which correspond to the 10th, 25th, 50th, 75th, and 90th percentiles in our sample. It was found that Facebook usage increases social comparison among the mid and lower age groups, i.e. for the 50th percentiles and the lower percentiles. For the 19-, 22- and 25-year-olds, the effects are: 0.942 (p=0.002), 0.703 (p=0.004) and 0.465 (p=0.023), respectively and there is no significant effect for, 30- and 35-year-olds (p=0.759 and p=0.289, respectively). In fact, there is a significant positive effect only for employees who are under the age of 26, who account for 52% of the sample. Figure 2 illustrates the magnitude of these effects. Note that the sample size provides us with 80% power for identifying an effect of size 0.14 or larger (with 0.05 significance).

4.2 Moderated mediation model: The mediating effect of social comparison

We estimated the mediated moderation model outlined in Figure 1 and found a significant effect of Facebook on social comparison and significant interactions (Facebook X age and Social comparison X Δ(pos)), which confirms H2 and provides empirical evidence for the moderating effect of age and Δ(pos), respectively. Facebook usage has no *direct* effect on happiness (B=-0.139 (0.129), p=0.286). In

other words, social comparison fully mediates the effect of Facebook on happiness. The full regression results appear in Table 3. A Bootstrap estimation of confidence intervals for the regression's coefficients and of the indirect effect of Facebook on happiness appear in the appendix.

As in the previous estimations, we found that Facebook usage increases social comparison only among the mid and lower age groups (up to the age of 25). Social comparison, in turn, has a significant negative effect on happiness among the upper 44 percentiles of $\Delta(pos)$, and no effect among the lower 56 percentiles (averaging across age). In particular, for the 75th and 90th percentiles of $\Delta(pos)$ (0.49 and 0.57, respectively), the average effects across age are -0.238 (p=0.003) and -0.349 (p<0.001), respectively. This finding suggests that increased social comparison *per se* does not necessarily reduce happiness and that the magnitude of $\Delta(pos)$ determines whether and to what extent social comparison decreases happiness.[8]

Age plays an important role in our setting. We found a significant negative indirect effect on happiness for the mid and lower age groups, conditional on a high value of $\Delta(pos)$ (above the 50th percentiles), and no effect for the older groups (Figure 3). Furthermore, fixing the value of $\Delta(pos)$, the estimated effect generally decreases with age. For example, for 19-year-olds in the 90th percentile of $\Delta(pos)$, the estimated effect is -0.329 (0.158), whereas for 22-year-olds with similar levels of $\Delta(pos)$ the effect is -0.245 (0.120), which is somewhat smaller.

One possible explanation for the age-related differences is that younger participants are more susceptible to Facebook's influence because they rely on Facebook as a source of social information to a greater extent than older adults, who are "used to" collecting social information from offline sources. This may be reflected in differences between younger and older adults in the use of Facebook's various features. We explore the age-related usage patterns among the employees in the organization and find that younger users tend to use Facebook more passively (i.e., they concentrate on obtaining information) and focus more on others than on themselves (i.e., they tag and comment more than uploading photos

---

[8] We estimated a variation of the model which does not include the interaction of social comparison and $\Delta(pos)$. Although social comparison significantly reduces happiness, we feel that this variation of the model misses an important element and, accordingly, the estimation's adjusted R^2 is lower than that of the original model's estimation (see the appendix for more details).

or posting statuses), which may trigger social comparison. Note that we found no age-related differences in the overall intensity of usage, although the frequency of checking the account was significantly larger for younger employees (see the appendix).

We complement the analysis in this section by examining the effect of Facebook usage intensity (which combines time spent on Facebook, frequency of use and feeling of association) on social comparison and happiness using a variation of the model presented in Figure 1, in which Facebook usage is replaced by Facebook intensity. The intensity of non-users is defined as being 0. We find that usage intensity is associated with a higher level of social comparison and a lower level of happiness for employees aged 25 and younger and for high levels of $\Delta(pos)$ (see the appendix for more details).

4.3 An alternative mechanism?

An alternative or complementary mechanism to explain the findings might be that Facebook usage affects an individual's actual perceptions of others' lives relative to those of his own life. In our setting, we measured the estimated frequency of others' positive and negative experiences relative to one's own, i.e. $\Delta(pos)$ or $\Delta(neg)$.[9] If Facebook increases $\Delta(pos)$ (or analogously $\Delta(neg)$), then even if Facebook usage had no effect on social comparison, the fact that others' lives now seem more attractive will make comparison to others more frustrating and reduce the user's happiness. However, we do not find any support for this mechanism in the data. Thus, we performed a number of statistical tests suggesting that there are no significant differences in $\Delta(pos)$ or in $\Delta(neg)$ between users and non-users. While this null result may be an outcome of a power limitation or that the participants referred to the experiences of their close friends (social media are likely to be used more to gain information on friends we are less close to), other studies have found that the perception of others' lives relative to our own is not affected by usage, even though affective well-being is (Verduyn et al. 2015). Furthermore, the measured effects are extremely small, and the absence of such effects in our setting allows us to attribute

---

[9]   Our measures differ from the comparative perception measures in Chou and Edge (2012), which are elicited directly and are meant to capture general perceptions rather than the perception of individual experiences.

the observed effect of Facebook usage on happiness to the increase in social comparison (see the appendix for more details).

5. Discussion

The findings indicate that using Facebook increases engagement in social comparison. The questionnaire was not restricted to on-platform comparison, but rather measured overall comparison orientation. We suggest that the Facebook user experience promotes social comparison (particularly via the news feed), and may establish a tendency to compare oneself to others both on- and off-platform. We did not find any indication that Facebook usage affects the belief that others' lives are richer in positive experiences than one's own. However, we did find indications that increased engagement in social comparison combined with a belief that others' lives are richer in positive experiences than one's own causes users to be less happy than non-users.

This finding is a refinement of previous ones that Facebook usage leads to increased envy and that Facebook usage influences subjective well-being (Verduyn et al., 2017). Our proposed model suggests that a user's decline in happiness is due to an *increase* in social comparison, even if neither Δ(pos) nor Δ(neg) are affected by Facebook usage. This has the important implication that designers of the Facebook platform should invest more effort in reducing Facebook's encouragement to compare, while the need to de-bias users' perceptions of others may be overemphasized.

Another contribution of the study relates to the moderating effect of age. Most of the studies on the effect of Facebook usage have been conducted among relatively young participants, most of them students (Wenninger et al., 2014). Our setting made it possible to examine a wide range of ages (18-44 years old) and to isolate the effect of its interaction with Facebook use on social comparison and happiness. We found that only young participants (aged 18-25) were susceptible to the Facebook effect on social comparison and consequently on happiness. Young users in our sample (and in general) tend to use Facebook more passively and to focus more on others than older users and we are unable to perfectly disentangle the effect of age and this pattern of Facebook usage.[10] One caveat to consider is

---

[10] It is important to note that in our setting, this pattern of usage was found to be unrelated to social comparison.

the possibility that young employees have a greater tendency to use other social media (e.g. Twitter) as well and that their levels of social comparison and happiness are not affected solely by Facebook usage. However, other social media platforms were not widely in use in Israel at the time of the study and we believe that communication channels (such as Facetime) that augment off-platform social relationships are less likely to reduce users' well-being.

Overall, the magnitude of the effects reported in the study is comparable to findings in previous studies that measured the effect of Facebook usage on well-being using different methodologies. For example, Verduyn et al. (2015) found that intensive passive Facebook usage, relative to non-passive usage, is related to a decrease of 5% in affective well-being. In our comparable age group (18-22-year-olds), the effects given mid and high levels of Δ(pos) are of similar magnitude and represent a decrease of 2%-7% in happiness due to Facebook usage.

This study is the first, to the best of our knowledge, to use a quasi-natural experiment in order to measure the cumulative effect of prolonged Facebook usage in a real-world setting. Although the assignment to groups (users and non-users) as a result of the organization's Facebook policy is not random as it would be in a lab experiment, we argue that it significantly reduces selection bias, which is an inherent problem in studies that examine the effects of social network platforms. The problem is further mitigated by using a matched sample. Although we were also limited to a relatively small sample, our natural setting has some advantages over lab experiments, in which there may be a need to simulate Facebook usage; participants may be influenced by an awareness of the research questions; and the effects measured in a lab may only be momentary. More generally, the research demonstrates a potential negative effect of using information and communication technologies—and in particular social network platforms such as Facebook—on users' subjective well-being.

References

Appel, H., Gerlach, A. L., and Crusius, J. (2016). The interplay between Facebook use, social comparison, envy, and depression. *Current Opinion in Psychology* 9, 44-49.

Argyle, M. (2013). *The psychology of happiness*. Routledge.

Bamberger, P., and Belogolovsky, E. (2017). The dark side of transparency: How and when pay administration practices affect employee helping. *Journal of Applied Psychology*, 102 (4), 658.

Bapna, R., Qiu, L., and Rice, S. C. (2017). Repeated interactions vs. social ties: Quantifying the economic value of trust, forgiveness, and reputation using a field experiment. *Management of Information Systems Quarterly*, 41 (3), 841-866

Baron, R. M., and Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research – Conceptual, strategic, and statistical considerations, *Journal of Personality and Social Psychology*, 51 (6), 1173–1182.

Bjørnskov, C. (2003). The happy few: Cross–country evidence on social capital and life satisfaction. *Kyklos*, 56 (1), 3-16.

Brown, D. J., Ferris, D. L., Heller, D., and Keeping, L. M. (2007). Antecedents and consequences of the frequency of upward and downward social comparisons at work. *Organizational Behavior and Human Decision Processes*, 102 (1), 59-75.

Callan, M. J., Kim, H., and Matthews, W. J. (2015). Age differences in social comparison tendency and personal relative deprivation. *Personality and individual differences*, 87, 196-199.

Chou H. T. and Edge, N. (2012). "They are happier and having better lives than I am": the impact of using Facebook on perceptions of others' lives. *Cyberpsychology, Behavior, and Social Networking*, 15 (2), 117-21.

Cohen-Charash, Y. (2009). Episodic envy. *Journal of Applied Social Psychology*, *39* (9), 2128-2173.

Dehejia, R. H., and Wahba S. (1999). Causal effects in nonexperimental studies: Re-evaluating the evaluation of training programs. *Journal of the American Statistical Association*, 94, 1053–62.

Dellarocas, C. (2005). Reputation mechanism design in online trading environments with pure moral hazard. *Information Systems Research*, 16 (2), 209-230.

Ellison, N. B., Steinfield, C., and Lampe, C. (2007). The benefits of Facebook "friends:" Social capital and college students' use of online social network sites. *Journal of Computer‐Mediated Communication*, 12 (4), 1143-1168.

Farahani, H. A., Kazemi, Z., Aghamohamadi, S., Bakhtiarvand, F., and Ansari, M. (2011). Examining mental health indices in students using Facebook in Iran. *Procedia—Social and Behavioral Sciences*, 28, 811–814.

Festinger, L. (1954). A theory of social comparison processes. *Human relations*, 7 (2), 117-140.

Feinstein, B. A., Hershenberg, R., Bhatia, V., Latack, J. A., Meuwly, N., and Davila, J. (2013). Negative social comparison on Facebook and depressive symptoms: Rumination as a mechanism. *Psychology of Popular Media Culture,* 2 (3), 161.

Finn, S. E. (1986). Stability of personality self-ratings over 30 years: Evidence for an age/cohort interaction. *Journal of Personality and Social Psychology*, 50 (4), 813–818.

Fox, J., and Moreland, J. J. (2015). The dark side of social networking sites: An exploration of the relational and psychological stressors associated with Facebook use and affordances. *Computers in Human Behavior*, 45, 168-176.

Fox, J., and Warber, K. M. (2015). Queer identity management and political self-expression on social networking sites: A co-cultural approach to the spiral of silence. *Journal of Communication*, 65 (1), 79-100.

Ganju, K. K., Pavlou, P. A., and D. Banker, R. D. (2016). Does information and communication technology lead to the well-being of nations? A country-level empirical investigation. *Management of Information Systems Quarterly*, 40 (2), 417-430.

Gardner, M., and Steinberg, L. (2005). Peer influence on risk taking, risk preference, and risky decision making in adolescence and adulthood: An experimental study. *Developmental Psychology*, 41 (4), 625–635.

Gentile, B., Twenge, J. M., Freeman, E. C., and Campbell, W. K. (2012). The effect of social networking websites on positive self-views: An experimental investigation. *Computers in Human Behavior*, 28 (5), 1929-1933.

Gibbons, F.X. and Buunk, B.P. (1999). Individual differences in social comparison: The development of a scale of social comparison orientation. *Journal of Personality and Social Psychology*, 76, 129-142.

Gonzales, A. L., and Hancock, J. T. (2011). Mirror, mirror on my Facebook wall: Effects of exposure to Facebook on self-esteem. *Cyberpsychology, Behavior, and Social Networking*, 14 (1-2), 79-83.

Greenstein, S., and McDevitt, R. C. (2011). The broadband bonus: Estimating broadband Internet's economic value. *Telecommunications Policy*, 35 (7), 617-632.

Hayes, F. A. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* The Guilford Press.

Heffetz, O. and Rabin, M. (2013). Conclusions regarding cross-group differences in happiness depend on difficulty of reaching respondents. *American Economic Review,* 103 (7), 3001-3021.

Helliwell, J. (2001). Social capital, the economy and well-being. *The review of economic performance and social progress*, 1.

Helson, R., and Moane, G. (1987). Personality change in women from college to midlife. *Journal of Personality and Social Psychology*, 53 (1), 176-86.

Hills, P., and Argyle, M. (2002). The Oxford Happiness Questionnaire: A compact scale for the measurement of psychological well-being. *Personality and Individual Differences*, 33, 1073–1082.

Ho, D., Imai, K., King, G., and Stuart, E. (2007). Matchit: Nonparametric preprocessing for parametric causal inference. *Journal of Statistical Software*, 42 (8). http://gking.harvard.edu/matchit/.

Kim, J., and Lee, J. E. R. (2011). The Facebook paths to happiness: Effects of the number of Facebook friends and self-presentation on subjective well-being. *CyberPsychology, behavior, and social networking*, 14 (6), 359-364.

Krasnova, H., Wenninger, H., Widjaja, T., and Buxmann, P. (2013). Envy on Facebook: A hidden threat to users' life satisfaction?. *Wirtschaftsinformatik,* 92, 1-16.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukophadhyay, T., and Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *American psychologist*, 53 (9), 1017.

Kross, E., Verduyn, P., Demiralp, E., Park J., Lee, D. S., Lin, N., (2013). Facebook use predicts declines in subjective well-being in young adults. *PLoS ONE,* 8 (8), e69841.

Kruglanski, A. W., and Mayseless, O. (1990). Classic and current social comparison research: Expanding the perspective. *Psychological bulletin*, *108* (2), 195.

Ku, Y. C., Chu, T. H., and Tseng, C. H. (2013). Gratifications for using CMC technologies: A comparison among SNS, IM, and e-mail. *Computers in Human Behavior*, 29 (1), 226-234.

Labrague, L. J. (2014). Facebook use and adolescents' emotional states of depression, anxiety, and stress. *Health Science Journal*, 8 (1), 80–89.

Leung, A., Kier, C., Fung, T., Fung, L., and Sproule, R. (2013). Searching for happiness: The importance of social capital. In *The exploration of happiness*, 247-267. Springer Netherlands.

Lin, R., and Utz, S. (2015). The emotional responses of browsing Facebook: Happiness, envy, and the role of tie strength. *Computers in Human Behavior,* 52, 29-38.

Ljepava, N. R., Orr, R., Locke, S., and Ross, C. (2013). Personality and social characteristics of Facebook non-users and frequent users. *Computers in Human Behavior,* 29 (4), 1602-1607.

Locatelli, S. M., Kluwe, K., and Bryant, F. B. (2012). Facebook use and the tendency to ruminate among college students: Testing mediational hypotheses. *Journal of Educational Computing Research,* 46 (4), 377-394.

McEwan, B. (2013). Sharing, caring, and surveilling: An actor–partner interdependence model examination of Facebook relational maintenance strategies. *Cyberpsychology, Behavior, and Social Networking*, 16 (12), 863-869.

Nabi, R. L., Prestin, A., and So, J. (2013). Facebook friends with (health) benefits? Exploring social network site use and perceptions of social support, stress, and well-being. *Cyberpsychology, Behavior, and Social Networking*, 16 (10), 721-727.

Nadkarni, A., and Hofmann, S. G. (2011). Why do people use Facebook? *Personality and Individual Differences*, 52, 243–249.

Overby, E., Slaughter, S. A., and Konsynski, B. (2010). Research commentary—the design, use, and consequences of virtual processes. *Information Systems Research*, 21 (4), 700-710.

Ozimek, P., and Bierhoff, H. W. (2016). Facebook use depending on age: The influence of social comparisons. *Computers in Human Behavior*, 61, 271-279.

Park, N., Kee, K. F., and Valenzuela, S. (2009). Being immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *CyberPsychology & Behavior*, 12 (6), 729-733.

Pempek, T. A., Yermolayeva, Y. A., and Calvert, S. L. (2009). College students' social networking experiences on Facebook. *Journal of Applied Developmental Psychology*, 30, 227–238.

Pettijohn II, T. F., LaPiene, K. E., Pettijohn, T. F., and Horting, A. L. (2012). Relationships between Facebook Intensity, Friendship Contingent Self-Esteem, and Personality in U.S. College Students. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace*, 6 (1), article 2.

Preacher, K. J., and Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior research methods, Instruments and Computers*, 36 (4), 717-731.

Preece, J., and Shneiderman, B. (2009). The reader-to-leader framework: Motivating technology-mediated social participation. *AIS Transactions on Human-Computer Interaction*, 1 (1), 13-32.

Przybylski, A. K., Murayama, K., DeHaan, C. R., and Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*, 29 (4), 1841-1848.

Rifkin, J., Cindy C., and Kahn B. (2015). Fomo: How the fear of missing out leads to missing out. *NA-Advances in Consumer Research,* 43, 244-248.

Rosenbaum P. R., and Rubin D. B. (1983). The central role of the propensity score in observational studies for causal effects. Biometrika, 70, 41–55.

Rousseau, A., Eggermont, S., and Frison, E. (2017). The reciprocal and indirect relationships between passive Facebook use, comparison on Facebook, and adolescents' body dissatisfaction. *Computers in Human Behavior*, 73, 336-344.

Ruble, D. N., Boggiano, A. K., Feldman, N. S., and Loebl, J. H. (1980). Developmental analysis of the role of social comparison in self-evaluation. *Developmental Psychology*, 16 (2), 105.

Siegler, I. C., Zonderman, A. B., Barefoot, J. C., Williams, R. B., Jr., Costa, P. T., Jr., and Mc-Crae, R. R. (1990). Predicting personality in adulthood from college MMPI scores: Implications for follow-up studies in psychosomatic medicine. *Psychosomatic Medicine*, 52, 644–652.

Smith, R. H., Parrott, W. G., Diener, E. F., Hoyle, R. H., and Kim, S. H. (1999). Dispositional envy. *Personality and Social Psychology Bulletin*, 25 (8), 1007-1020.

Suls, J., and Mullen, B. (1982). From the cradle to the grave: Comparison and self-evaluation across the life-span. In Suls, J. (Ed.) *Psychological perspectives on the self*, 1, 97-125.

Tandoc, E. C., Ferrucci, P., and Duffy, M. (2015). Facebook use, envy, and depression among college students: Is Facebooking depressing? *Computers in Human Behavior,* 43, 139-146.

Tiwana, A., Konsynski, B., and Bush, A. A. 2010. Research Commentary—Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. *Information Systems Research,* 21 (4), 675-687.

Toma, C. L., and Hancock, J. T. (2013). Self-affirmation underlies Facebook use. *Personality and Social Psychology Bulletin*, 39 (3), 321-331.

Vecchio, R. P. (2000). Negative emotion in the workplace: Employee jealousy and envy. *International Journal of Stress Management*, 7 (3), 161-179.

Verduyn, P., Lee, D. S., Park, J., Shablack, H., Orvell, A., Bayer, J., Ybarra, O., Jonides, J., and Kross, E. (2015). Passive Facebook usage undermines affective well-being: Experimental and longitudinal evidence. *Journal of Experimental Psychology: General,* 144 (2), 480.

Verduyn, P., Ybarra, O., Résibois, M., Jonides, J., and Kross, E. (2017). Do social network Sites enhance or undermine subjective well-being? A critical review. *Social Issues and Policy Review*, 11 (1), 274-302.

Vogel, E. A., Rose, J. P., Okdie, B. M., Eckles, K., and Franz, B. (2015). Who compares and despairs? The effect of social comparison orientation on social media use and its outcomes. *Personality and Individual Differences,* 86, 249-256.

Walther, J. B. (2011). Theories of computer-mediated communication and interpersonal relations. *The handbook of interpersonal communication*, 4, 443-479.

Wenninger, H., Krasnova, H., and Buxmann, P. (2014). Activity matters: Investigating the influence of Facebook on life satisfaction of teenage users. In *proc of the 22nd European Conference on Information Systems.*

Wills, T. A. (1981). Downward comparison principles in social psychology. *Psychological bulletin*, 90 (2), 245.

Wood, J. V., Taylor, S. E., and Lichtman, R. R. (1985). Social comparison in adjustment to breast cancer. *Journal of Personality and Social Psychology*, 49, 1169-1183.

Zhao S., Grasmuck S., and Martin J. (2008). Identity construction on Facebook: digital empowerment in anchored relationships. *Computers in Human Behavior*, 24, 1816–1836.

Tables

Table 1. Descriptive statistics of our matched sample. Gender: 1 is male, 2 is female. Education: 3 is high-school education, 5 is more than 15 years of education and 4 is in between. Income: 3 is the average income in the country, 1 is much lower and 5 is much higher than the average income. Family status: 1 is married, 2 is single. Social comparison and happiness are both between 1 and 6. Δ(pos) is the extent (potentially between 0 and 1) to which one finds others' lives richer in positive experiences compared to one's own; Δ(neg) is the analogous extent for negative experiences. The column titled p presents the p-value of a t-test comparing the two groups' means. The are no significant differences between Facebook users and non-users in the below variables' means, with the exception of the social comparison's means, which are significantly different at the 10% level.

	p	Non-users (N= 41)				Users (N=41)			
		Min	Max	Mean	Std.dev	Min	Max	Mean	Std. dev
Age	0.654	18.00	42.00	27.07	6.65	18.00	44.00	26.41	6.61
Gender	0.640	1.00	2.00	1.29	0.46	1.00	2.00	1.34	0.48
Education	0.453	3.00	5.00	4.51	0.84	3.00	5.00	4.37	0.92
Income	0.662	1.00	5.00	2.90	1.76	1.00	5.00	2.73	1.76
Family Status	0.646	1.00	2.00	1.63	0.49	1.00	2.00	1.68	0.47
Social comparison	0.097	1.00	5.38	3.35	0.84	2.00	5.50	3.69	0.98
Happiness	0.113	2.88	6.00	4.60	0.66	3.25	5.75	4.37	0.62
Δ(pos)	0.852	0.20	0.66	0.42	0.11	0.15	0.71	0.42	0.13
Δ(neg)	0.802	0.06	0.73	0.40	0.17	0.11	0.76	0.41	0.18
Own(pos)	0.407	0.08	0.61	0.36	0.13	0.19	0.70	0.38	0.12
Own(neg)	0.842	0	0.90	0.39	0.23	0	0.85	0.4	0.21

Table 2. The effect of Facebook on social comparison. The effect of using Facebook on the social comparison orientation is examined in six specifications, using an ordinary least square regression. The explanatory variables appear in the leftmost column of the table.

|	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Facebook	0.326 (0.201)	0.353* (0.2)	0.344* (0.2)	2.455*** (0.812)	2.231*** (0.811)	2.219*** (0.809)
Age	-0.018 (0.015)	-0.049* (0.026)	-0.013 (0.016)	0.022 (0.021)	-0.008 (0.03)	0.022 (0.021)
Gender		-0.202 (0.251)			-0.145 (0.244)	
Education		0.134 (0.146)			0.151 (0.142)	
Income		-0.001 (0.096)			-0.007 (0.093)	
Family status		-0.382 (0.274)			-0.298 (0.268)	
Facebook X age				-0.08** (0.03)	-0.071** (0.03)	-0.071** (0.03)
Own(pos)			-0.946 (0.785)			-0.592 (0.777)
Own(neg)			0.715 (0.474)			0.663 (0.46)
R^2	0.05	0.106	0.092	0.132	0.169	0.155
N	82	82	82	82	82	82

*$p<0.1$, **$p<.05$, *** $p<0.01$

Table 3. The results of the mediated moderation model outlined in Figure 1. We find a significant effect of Facebook on social comparison and significant interactions – Facebook X age and Social comparison X Δ(pos) – which provide empirical evidence for the moderating effect of age and Δ(pos), respectively.

	Social comparison	**Happiness**
Facebook	2.455*** (0.812)	-0.139 (0.129)
Age	0.022 (0.021)	
Facebook X age	-0.08** (0.03)	
Δ(neg)		1.214*** (.376)
Social comparison		0.44* (0.228)
Δ(pos)		3.69** (1.785)
Social comparison X Δ(pos)		-1.384*** (0.501)
R^2	0.132	0.267
N	82	82

*p<0.1, **p<.05, *** p<0.01

Figures
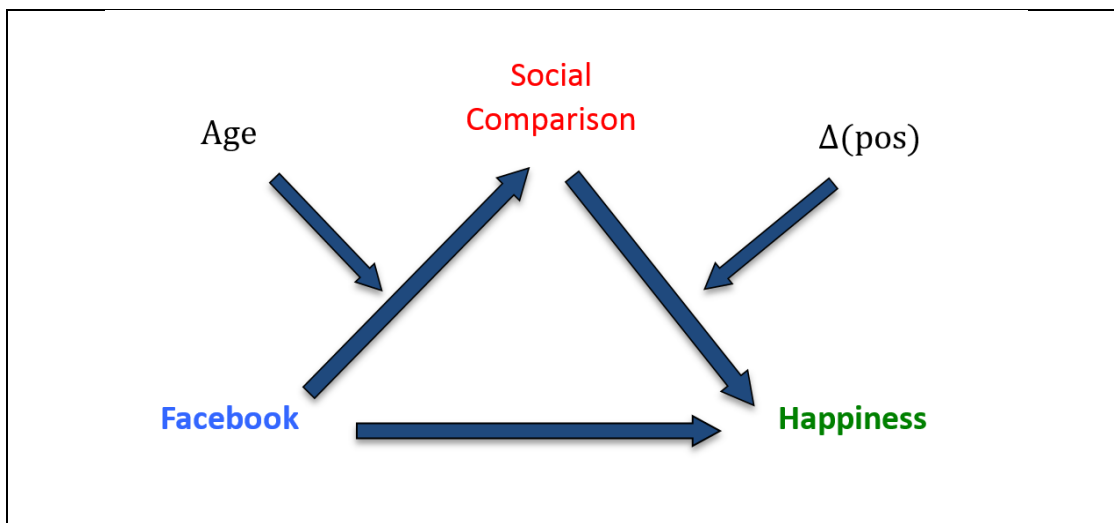
Figure 1: Outline of the theory on the effect of Facebook on one's happiness via the mediating effect of social comparison. Age serves as a moderator for the effect of Facebook on social comparison. The effect of social comparison on happiness is moderated by Δ(pos).
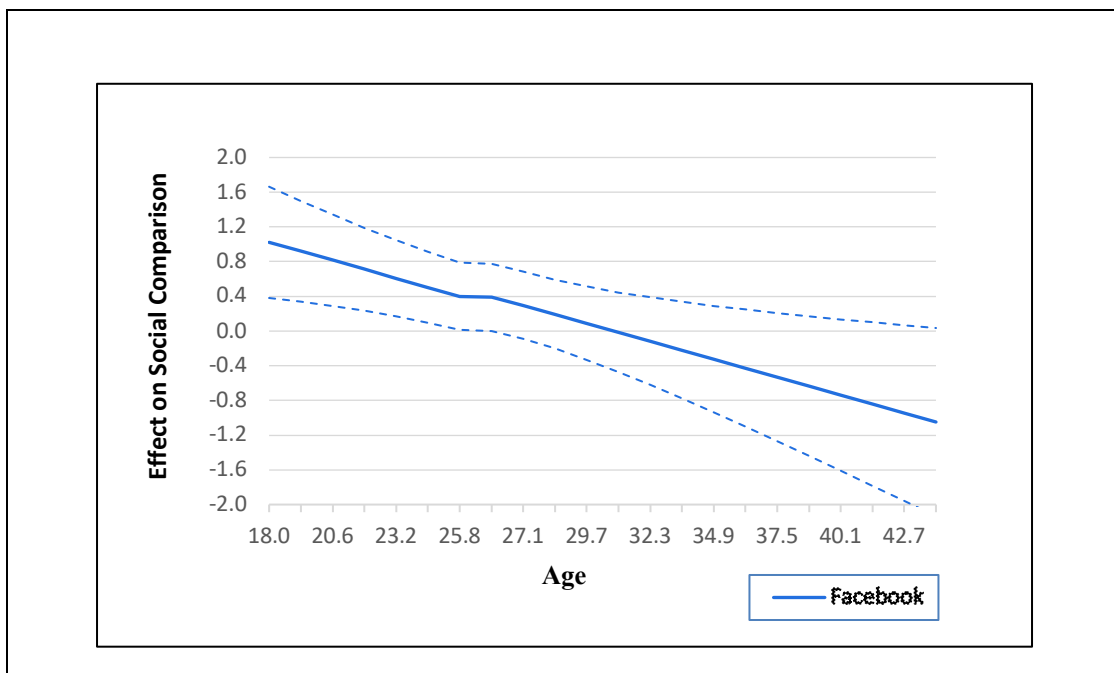
Figure 2: The effect of Facebook on social comparison by age. The estimated effect of Facebook usage on Social comparison; The dashed lines represent the upper and lower bounds of the 95% confidence interval. The estimates are based on the estimation results that appears in Table 3. The effect is significant for 18-25 years old employees.

Figure 3: Indirect effect of Facebook on happiness moderated by Δ(pos) for different age groups. The solid lines represent the indirect effect of Facebook on happiness (mediated by social comparison) and the dashed lines show the 95% confidence intervals by the level of Δ(pos). Figure 3(A) shows the significant effect corresponding to the 10th, 25th and 50th age percentiles (age 19, 22 and 25, respectively). Figure 3(B) shows no significant effect for the 75th and 90th age percentiles (age 30 and 35, respectively). The effect is significant for the 50th percentile of Δ(pos) and for higher levels.