

The Dark Side of Positive Social Influence

Completed Research Paper

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Abstract

Social influence in the form of social norms has been widely used to transform behaviors, and is argued to be especially efficacious in the context of health related activities. However, can such externally induced compliance produce negative outcomes? When individuals feel compelled to conform to the behavior of the majority, does it lead to an unexpected backfire effect? We conducted a randomized field experiment of more than 10,000 individuals for a two-month period on an online physical activity community to examine if there is a dark side to social influence. We studied the effect of social norms on users' goal setting and goal achievement behavior. While social influence increases the rate of goal setting, strikingly, we also observe a dark side to social influence in that such influence yields lower rates of goal achievement. Our findings have important implications for the design of interventions in the context of mHealth technologies.

Keyword: Social norms; goal setting; self-determination theory; goal commitment

1. Introduction

Social influence, of which social norms are one important form, has been widely used to transform individual behavior. With roots in psychological theories of conformity, the social norms approach has been described as “socially desirable behaviour change – that is, telling people about what lots of other people do” (Burchell et al. 2013). Compared to other types of behavioral nudges, such as monetary incentives, social norms have been shown to be efficacious in motivating behavioral change (Allcott 2011). As a result, norms have been extensively used to influence behavior in many areas, such as towel reuse programs (Goldstein et al. 2007) and energy consumption (Schultz et al. 2007). In the context of health-related behavior, social norms have been used to cope with binge drinking problems in colleges (Wechsler et al. 2003) and gambling (Larimer and Neighbors 2003). In recent years, with the rise of mobile health (mHealth), social norms are being embedded in messages to motivate people to exercise more, eat healthy, and lose weight (Bittner and Kulesz 2015; Napolitano et al. 2013; Patrick et al. 2014; Robinson et al. 2013).

However, even in the presence of abundant evidence that social norms provide a powerful means to promote desirable behaviors, little is known about any potential negative impacts that may arise. The expectation of adverse effects is suggested by theories from psychology. According to self-determination theory (Deci and Ryan 2002), a theory of motivation that focuses on individual self-motivation, high autonomous motivation would result in higher performance because it is accompanied by enjoyment and

pleasure. By contrast, conformity induced by social influence might crowd out the intrinsic spontaneity, and could lead to undesirable outcomes. We refer to this phenomenon as the “dark side” of social influence.

Our conceptualization of the dark side of social influence is different from negative social influence that results in conformity to undesirable behaviors and has been studied in the literature related to smoking, obesity, and depression. For example, Christakis and Fowler (2007) assessed a group of more than 12,000 densely interconnected individuals for 32 years, and found that obesity would spread through social ties: “A person’s chances of becoming obese increased by 57% if he or she had a friend who became obese in a given interval (p. 370)”. The dark side that we study is also different from the well-known boomerang effect caused by social norms messages (Schultz et al. 2007): users who behave better than others (such as in energy consumption) will reduce their performance in accordance with the majority of others’ mean performance. We focus on positive social influence, i.e., messaging that promotes desirable behavior, and argue that its effect might be overly potent, thereby leading to undesirable outcomes. Using a metaphor from medicine, although an antibiotic drug may help combat infection, too high a dose can cause harm. To the best of our knowledge no studies have examined the downside of positive social influence..

In this research, we study the unintended outcomes, i.e., the dark side of social norms-based behavioral interventions in a distinctive and important context: that of mHealth. We focus on an increasingly popular trend: using mobile devices for self-tracking to motivate greater physical activity. Recent years have witnessed a growth in the Quantified Self (QS) movement that incorporates modern tracking technology into a person’s daily activities. While self-tracking is not a novel idea, new technologies such as GPS tracking, sensors, and wearable computing have simplified the process of doing so considerably.¹ Free fitness apps such as Nike+ or Pedometer++ help track running or walking distances. These new technologies empower individuals to understand themselves through granular information.

A frequently used tactic by mHealth providers is to encourage users to set up goals, such as running 10 miles per week or going to a gym twice a week. A goal helps individuals establish a reference point, and failure to achieve the goal would lead to a psychological loss. Such mechanisms belong to a broad category of behavioral tactics called “commitment devices”, defined as “an arrangement entered into by an individual with the aim of helping fulfill a plan for future behavior that would otherwise be difficult owing to intrapersonal conflict stemming from, for example, a lack of self-control” (Bryan et al. 2010). Indeed, classic research indicates users who set up a goal work harder (Locke and Latham 2002). Therefore, understanding how to motivate users to set up goals is a critical first step towards behavioral change.

We examine the potential negative effects of using social norms for motivating goal setting. We conducted a randomized field experiment in collaboration with one of the largest online physical activity communities in Taiwan. In the experiment, motivational messages were sent out at the beginning of the study period. We designed three versions of messages: Message 1 is simply a reminder to set goals. Message 2 adds language referencing the benefits of setting goals. Message 3 then adds social norms motivation compared to Message 2. We randomize the users into the control group and three message groups².

Compared to prior research, our experiment is unique in the following ways. We first observe whether social norms affect the rate of goal setting, which is the direct effect. Second, and importantly, we are able to capture two outcome measures: the actual running distance and the goal achievement rate. It is important to note that the running distance is non-binding, thereby reflecting the individual’s intrinsic motivation. Our measures allow us to isolate the (potentially negative) effect of different interventions on goal achievement.

¹ Counting every moment. <http://www.economist.com/node/21548493>

² We also designed two other treatments for users with connected friends only, which are separate from this study as the users do not overlap.

The context of the physical activity community provides a rich setting to examine the extent to which individuals conform to others, and, importantly, whether such conformity leads to a backfire effect on one's physical activity. We address two specific research questions: (1) how social norms affect the proportion of individuals who set up a goal, and (2) whether the subsequent effect of such externally induced goals is different from that of purely self-motivated goals. Limited literature has investigated how to induce individuals to set up a goal, especially from the perspective of social influence. Thus, the degree to which such externally nudged but self-imposed targets affect subsequent behavior is still an empirical question.

Our experiments generate three main findings. First, our results confirm that social norms are indeed powerful in motivating individuals to set up a goal. Compared to other messages, as well as the control group, the message with social norms leads to the greatest increase in goal setting. Second, our results reveal that the social norms group has the lowest running distances, compared to other groups. Third, social norms also lead to significantly lower rates of target achievement as compared to both the control group and the pure benefit group. There are several possible explanations for the low target achieve rate in the social norms group. It is possible that the individuals who set up a goal because of social norms might experience motivation in the form of introjected regulation, as described by Ryan and Deci (2002). As a result, they have lower intrinsic motivation to exert effort. Another alternative explanation would be that in their desire to conform to the majority of others, individuals set up a goal that beyond their own capabilities. Our results shed light on the complex nature of using social influence to motivate people's behavior, and call for more careful mechanism design for behavioral interventions in mHealth.

2. Background and Prior Literature

2.1 Background

In light of the well-documented benefits of physical activity and the fact that a majority of individuals do not engage in sufficient exercise, behavioral interventions have become imperative for improving public health. Because physical activity tends to be episodic for many, it becomes challenging to form a habit. With the proliferation of ubiquitous sensors, the Quantified Self movement is expected to revolutionize the way we understand our bodies. The majority of wearable manufacturers (e.g. Jawbone, Fitbit) underscore the potential benefits of their devices, including improved physical performance and habit formation. However, the empirical evidence to support the link between self-tracking and a healthy life is still in question (Piwek et al. 2015). There are not enough longitudinal studies to examine such a relationship, and users' engagement with wearable devices persists as a practical challenge. Our research is motivated by the facts that while most people have the initial impulse to exercise, they are unable to maintain the momentum. For example, many people download a free app to track their physical activity or workout status, but are unable to sustain the use of the app and abandon it after an initial trial period. According to a recent national survey of 1,604 mobile phone users throughout the United States (Krebs and Duncan 2015), there were approximately 58% of individuals who had downloaded a health-related mobile app with fitness and nutrition the most common categories, but about half of the respondents (46%) had stopped using the health apps. Clearly, what is needed is a cost-effective way to engage individuals with the technologies on an on-going basis.

The challenge of users' continued engagement with new technologies has long been a focal point in the IS field (Ma and Agarwal 2007; Ray et al. 2014). Although modern technologies provide many potential benefits to users, the lack of long-term usage remains a critical obstacle to be overcome. According to a recent industrial report published by Endeavour³: "about a third of owners of smart wearable abandon these devices after six months." Patel et al. (2015) urged researchers and practitioners to encourage users to sustain engagement by using concepts from behavioral economics, and emphasized that "the successful use and potential health benefits related to these devices depend more on the design of the engagement strategies than on the features of their technology." Indeed, while most individuals in

³ Inside Wearables – Part 2. <http://endeavourpartners.net/assets/Endeavour-Partners-Inside-Wearables-Part-2-July-2014.pdf>

the online community we study used a free mobile application to keep track of their running activities, many users could not sustain their behaviors and stopped using the application. This is an extremely common problem, which even the industry leader in fitness gadgets (Fitbit) has to contend with⁴.

How can habit formation be accomplished? It is generally accepted that a variety of interventions may promote the formation of habits. Evidence for the efficacy of interventions is prevalent in diverse contexts such as increasing employee productivity, ceasing smoking, or increasing exercise. Monetary incentives are among one of the most commonly used methods for inducing behavioral change. For example, Charness and Gneezy (2009) asked whether incentives are an effective way to encourage individuals to form good habits. They found through two studies that gym attendance increased and individuals' health indicators improved after the intervention, and they concluded that a financial incentive might serve as a way to encourage individuals to form good health habits. Mochon et al. (2015) go beyond the direct effect of incentive intervention on nutrition behavior to discuss post-intervention behaviors and spillover effects. They found users exhibiting long-lasting behavioral change even after treatment, and they observed no negative externalities impacting individuals' other behaviors, such as exercise. Despite the effectiveness of monetary incentives on health behavior, however, they are not a panacea for all problems. Acland and Levy (2015) found that financial incentives increase gym attendance only during the intervention period, and users greatly over-predict their future attendance. Mellström and Johannesson (2008) conducted a field experiment to examine whether monetary incentives crowd out the supply of blood donors and found out that there is a significant crowding-out effect for women. Angelucci et al. (2015) found out that peer influence would affect the effectiveness of incentives. Other interventions, such as giving feedback, have also been utilized, and often linked to the pursuit of goals. Both positive and negative feedback help motivate goal achievement, but under different circumstances (Fishbach et al. 2010; Kluger and DeNisi 1996). However, feedback might also hurt performance when feedback leads to a reduction of individual effort (Schroeder and Fishbach 2015).

2.2 Goal Setting

Self-control problems have received considerable attention in both psychology and economics. A runner who engages in physical activity but cannot sustain the behavior suffers from a typical self-control problem, described as “there is an ideal action that the agent would like to take and there is something that tempts the agent to deviate from the ideal” (Ameriks et al. 2007). Rewards and penalties are common methods for attenuating the negative effects of low self-control. Such rewards and penalties are often coupled with a goal to serve as a commitment device. Why do goals help individuals to self-regulate? Koch and Nafziger (2011) tried to answer this question from the viewpoint of both psychology and behavioral economics. They argued that a goal serves as a reference point of performance and that individuals who fail to achieve their goals suffer from psychological loss. However, a challenging goal is also a painful disciplining device, and a goal as a self-regulation mechanism might be too challenging for individuals who are biased towards the present and discount the future heavily.

Goals can be useful even when they are not explicitly accompanied by rewards or punishments. Individuals also use non-binding goals to self-regulate. For instance, researchers set self-imposed deadlines, and dieters set a specific weight as their target. Hsiaw (2013) argued that such a non-binding goal “provides internal motivation by acting as the reference point for a present-biased agent” (p. 2). However, only individuals with sufficient commitment are able to achieve goals, and they must exhibit a high level of self-control. The literature also suggests that although goal setting serves as a means to self-regulate, there is considerable variation in its effects across individuals. Baumeister and Heatherton (1996) reviewed the patterns of self-regulatory failures and concluded that “when stress or fatigue depletes an individual's strength, self-regulatory failures become more likely” (p. 13).

Research has framed goal setting as an instrument of self-regulation in the presence of the self-control problem. The effect of a goal becomes stronger when a goal is combined with self-reward or self-

⁴Fitbit Has A Problem – And It Isn't Apple Watch.

<http://www.forbes.com/sites/dandiamond/2015/05/07/fitbit-has-a-problem-and-it-isnt-apple/#27a837a343e5>

punishment (Koch et al. 2014). Goal setting has long been investigated and is proven to be an effective way of increasing performance. Locke and Latham (2002) examined 35 years of empirical research on goal-setting theory and found that goals affect performance through four mechanisms. First, goals direct attention toward the task. Second, a high goal leads to a greater effort than a low goal, isolating the energizing function of a goal. Third, a goal affects persistence by allowing individuals to better control their time. Fourth, goals affect action by increasing task-related knowledge. In terms of the effect of goal setting on physical activity, Shilts et al. (2004) conducted a thorough literature review and concluded that “moderate evidence indicates that implementing goal setting as a dietary or physical activity behavior change strategy is effective with adults” (p. 92).

Although goal setting has been shown to be a powerful mechanism to drive behavioral change, most previous research focuses on its effect on performance (Locke and Latham 2002), or on the means of pursuing the goal (Schroeder and Fishbach 2015), or on the consequences of a miscalibrated goal (Ordóñez et al. 2009). Less is known about persuading individuals to set up a goal or about what occurs after a goal has been set. In their study of individual behavior subsequent to goal setting, Ariely and Wertenbroch (2002) conducted a series of studies on procrastination, a typical self-control problem, and found that people would self-impose a meaningful or costly deadline to overcome this problem. However, the self-imposed deadline was not as effective as some externally imposed ones in improving task performance. In contrast to Ariely and Wertenbroch’s (2002) setting, our research focuses on first, whether an external message could motivate a user to set up a goal, and second, a comparison of the purely self-imposed target to an externally nudged (but still self-imposed) one.

2.3 Social Norms

Social norms can be regarded as rules of behavior that are considered acceptable in a group. Mackie et al. (2012) defined social norms as “what people in some group believe to be normal in the group, that is, believed to be a typical action, an appropriate action or both” (p. 7). The effectiveness of social norms for inducing desirable behaviors is well documented. Goldstein et al. (2007) conducted two field experiments to examine the effect of a descriptive norm (e.g. the majority of guests reuse their towels) on an environmental conservation program. Their study found that signage containing normative appeals outperforms traditional appeals. Schultz et al. (2007) conducted a field experiment to examine the effect of a descriptive norm (doing what others do) combined with an injunctive norm (doing what others think one should do) on energy consumption, and found that an injunctive message eliminated the boomerang effect. Theoretically, a possible reason that people follow a norm is that they are doing so in the attempt to enhance affiliation with a social group and become liked (Higgs 2015). Given the strong theoretical effect of social norms on health-related behaviors but the relative scarcity of empirical evidence, Ball et al. (2010) conducted a survey in which participants self-reported their physical activity and eating behaviors, which supported the theoretical importance of social norms. Lally et al. (2011) found that individuals have misperceptions about peers’ dietary behaviors and concluded that interventions to correct such a misperception have the potential to promote healthy diets. Similarly, Robinson et al. (2014) conducted a meta-analysis of norms and eating behaviors, and concluded that norms could be used to promote healthy changes to dietary behavior. Given the prevalence of social norms and their power to modify individuals’ behaviors, individuals in an online community might conform to other users who have already set up a goal.

To summarize the background literature for this study, changing individuals’ behaviors for positive outcome is generally difficult and becomes even more challenging when it comes to physical activity because of a typical self-control problem. Recent research by the Centers for Disease Control and Prevention (CDC) in 2011⁵ showed that almost 80% of Americans failed to achieve the recommended amount of physical activity each week. Wearable devices and mobile fitness apps offer a unique opportunity to “nudge” users towards forming healthy habits. However, even with the aid of modern technologies such as real-time geo-tracking and immediate detailed information related to health indicators and performance, few individuals are able to sustain their usage. Goal setting has been shown

⁵Adult Participation in Aerobic and Muscle-Strengthening Physical Activities — United States, 2011 http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6217a2.htm?s_cid=mm6217a2_w

to be efficacious to counter the adverse effects of poor self-control and aid in habit formation. Against this backdrop, we study the effects of social norms to induce users to set up a goal, and observe how individuals respond to such intervention.

3. Experiment

3.1 Research context

To estimate the causal effect of social influence on individuals' goal setting and subsequent physical activity, we conducted a controlled field experiment following the methodology proposed by List and Rasul (2011). We observe individuals' running behaviors across a period of time in a controlled environment, and individuals are not aware that they are under observation. This design enables us to eliminate the undesirable Hawthorne effect (Adair 1984), which is also referred to as the observer effect, a type of reaction in which individuals change their behavior in response to their awareness of being observed.

The company we collaborated with to conduct the randomized field experiment hosts one of the largest online physical activity communities in Taiwan. This firm provides services for runners who are keen to keep track of their running activities using electronic devices. A user in this online community can upload their running activity either through the website or by using the mobile application provided by the company. With modern GPS technology, users can easily track the paths they run, monitor their running pace, and adjust their activities accordingly. The online physical activity community is an ideal environment for testing the effects of social influence on behavioral change because the community not only provides features for users to keep track of their physical activity, but also offers social-related functions such as a follower-followee relationship and a personal 'wall' (similar to the Facebook wall) containing self and friends' physical activity information.

3.2 Experimental design

Prior to the start of our experiment, the website had already created a feature for goal setting. Any individual who logs in to the system can set up a monthly goal in a given month. A user could fill in an arbitrary number (in kilometer units) as a target for that month. Our study sought to examine the effectiveness of social influence on the willingness to set up a goal, and users' subsequent behaviors after setting up a goal. We randomly assigned individuals to different groups and sent a corresponding message based on the group. Table 1 shows the message design for each group. In total, there is one control group and three treatment groups. Users in the *Control* group do not receive any message; users in the *Remind* group receive information that only reminds them to set up a goal; users in the *Benefit* group receive information that underscores the benefit of setting up a goal (a 17% increase in running time, which is calculated based on historical data from this online community); users in the *B+SN* group would receive benefit information and social norms information that mentions the number of individuals setting up a goal last month (e.g., there were 5,223 individuals setting up a goal in January and 5,715 individuals in February). Similar to Burtch et al. (2015), we attempt to establish descriptive social norms of what other people on the platform do by displaying the absolute number of individuals setting a goal in previous month.

When individuals log into the online community for the first time in any specific month, they receive a pop-up message. In a given month, an individual will receive only one message regardless the device or platform he/she use (website or mobile). Both website and mobile app users are directed to a page that displays the message, shown in Table 1, and a box to input the monthly goal. We did not force users to set up a goal, and a user can simply close the window or click a return button to leave this page without setting up a target.

Table 1. Message design of each group

Group	Message
Control	No message.
Remind	Please set up a goal.
Benefit	Goals help you form a habit of running; the statistics show runners who set up a goal can increase running time by 17% per month. Please set up a goal.
Benefit +Social Norms (B+SN)	Goals help you form a habit of running; the statistics show runners who set up a goal can increase running time by 17% per month. Last month, [Number] of runners set up a goal. Please set up a goal. ([Number] is 5,223 in January and is 5,715 in February.)

Our experiment occurred over a two-month period in February and March 2016. Starting at 00:00 am February 1st, 2016, an individual who logged in to the system, either through the website or the mobile app, would be randomly assigned to one of the above-mentioned groups. The randomization process is based on the user's identification number (*user_id*) generated by the online community when the user registered. Therefore, the online user ID is independent of users' preferences and capabilities.

3.3 Data

Since we are interested in knowing how persuasive a message is, we need to exclude users who are already inclined to set up a goal. Further, we seek to understand whether setting a goal increases individuals' performance in terms of total monthly running distances. To address these objectives, we clean the sample using the following procedures. First, we retain only individuals who have running records but do not set up a goal in January (recall that the website already had a goal-setting feature). This helps us exclude users who are self-motivated to establish a goal, and yields a sample of 4,669 individuals in February. Second, we repeat the process by keeping individuals who have running records but do not set up a goal in February; yielding a sample size of 6,216 in March. Combined together, we have a total sample of 10,885 individuals for a two-month observation period.

Table 2 shows the number of individuals in each group. There were approximately 1,800 individuals of individuals in *Control* and *Remind* groups, and 3,600 of users in *Benefit*, and *B+SN* groups. Since our main treatment groups are *Benefit* and *B+SN*, we purposely made the *Benefit* and *B+SN* groups twice as large as the *Control* and *Remind* groups.

Table 2. Number of individuals in each group

	Freq.	Percent
Ctrl	1,910	17.6%
Remind	1,767	16.3%
Benefit	3,682	33.9%
B+SN	3,514	32.3%
	10,873	100.0%

Figure 1 shows details about the number of individuals who log into the system for each group by each day. An individual will receive only one message per month when she first logs in to the system in that given month. We keep 29 days of both February and March and merge these numbers into one graph (2016 is a leap year, therefore there were 29 days in February). We drop the last two days of March to keep the graph parsimonious because the number of individuals receiving messages in those two days is small enough to neglect. As can be seen on the top half of Figure 1, most messages were sent out on the first few days when users log into the system. The bottom half of Figure 1 presents the proportion of individuals in each group. We see that the proportions are quite stable across time; offering some initial evidence for the success of the randomization procedure.

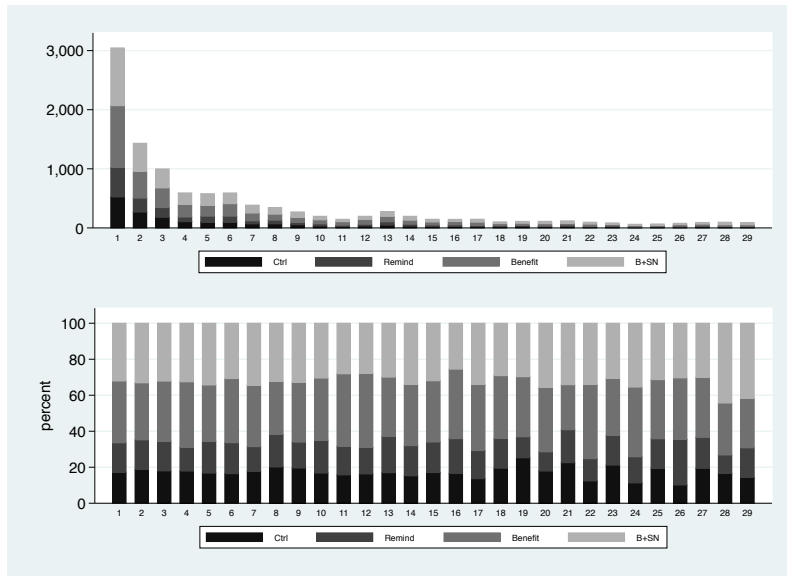


Figure 1. Daily number of individuals who log into the system

We conducted an ANOVA analysis as a randomization check by comparing means among all four groups for various characteristics, including age, percentage of female users, average distance run in the previous month, percentage of accounts created using Facebook, and percentage of users who completely disclose their running records to the public in that online community (Table 3 presents means for all variables across the four groups)⁶. The ANOVA test results indicate that all attributes, except for distance run in the previous month, have no significant differences among groups. Although *user_id* should be independent of runners’ performance, we see that individuals in the *Remind* group have a slightly higher running distance than the other groups. We address this issue with a matched samples procedure described later.

Table 3. Randomization check

	Age	Percent of female	Distance in previous month	Account created by Facebook	Extent of publicity
Ctrl	38.8	21.0%	68.3	50.5%	87.6%
Remind	39.1	18.2%	74.4	48.0%	87.5%
Benefit	39.0	19.1%	65.8	47.4%	87.0%
B+SN	38.9	19.0%	66.2	49.8%	87.6%

4. Results

4.1 The Effect of Social Norms

Table 4 presents the “Set Target Rate” and the “Target Achieve Rate” for different groups. “Set Target Rate” is the percentage of individuals in a group setting a monthly goal, and “Target Achieve Rate” indicates the percentage of those runners in each group who set up a goal and successfully achieve it (total running distance \geq target). Figure 2 graphically presents the raw treatment effects among groups for these outcomes. As can be seen in both Table 4 and the top half of Figure 2, all treated groups have a higher Set Target Rate than the *Control* group, and the *B+SN* group is among the highest (9.4%). This suggests that sending a message to a user would successfully nudge her to set up a goal. Individuals in the *Control* group do not receive any message, one can regard the behavior of individuals who set a target in

⁶ Users in this online community could either make a running record accessible to the public or make it completely private; we calculated the percentage of times a user makes her records completely public.

this group as organic. The difference between other message groups and *Control* group is the effect of push message. Compared to the *Control* group, both *Remind* and *Benefit* groups motivate roughly $(7.6\%-5.8\%)/5.8\% = 30\%$ more individuals to set up a target than the *Control* group. The Set Target Rate in the *B+SN* group is $(9.4\%-5.8\%)/5.8\% = 62\%$ more than the *Control* group, indicating a strong effect of social norms on encouraging goal setting.

The bottom half of Figure 2 and Table 4 present the Target Achieve Rate. The higher this rate, the higher the proportion of individuals who achieve their self-imposed goals. While individuals in the *Benefit* group achieve moderately less than those in the *Control* group (19% less), individuals in the *Remind* and *B+SN* treatments have substantially lower achievement (approximately 33% less).

Finally, each group’s goal ranged, on average, from 108 km to 117 km, and individuals in those groups run from 95 km to 110 km. As showed in Table 4, one can observe that individuals in the *Remind* and *B+SN* groups run 11km to 15km less than their self-determined target (on average), while for individuals in the *Control* and *Benefit* groups, running distance is quite close to the target (on average). As discussed earlier, individuals in the *Remind* group have a higher running distance in the previous month than other groups. Therefore, unsurprisingly, they also set a slightly higher goal than the other groups. We address this heterogeneity in Section 4.3.

Table 4. Treatment effect

	N	Set Target Rate	Target Achieve Rate	Target	Distance
Control	1910	5.8%	54.1%	112.6	110.7
Remind	1767	7.8%	33.3%	116.9	99.3
Benefit	3682	7.6%	43.5%	108.4	104.0
B+SN	3514	9.4%	36.1%	109.0	95.2

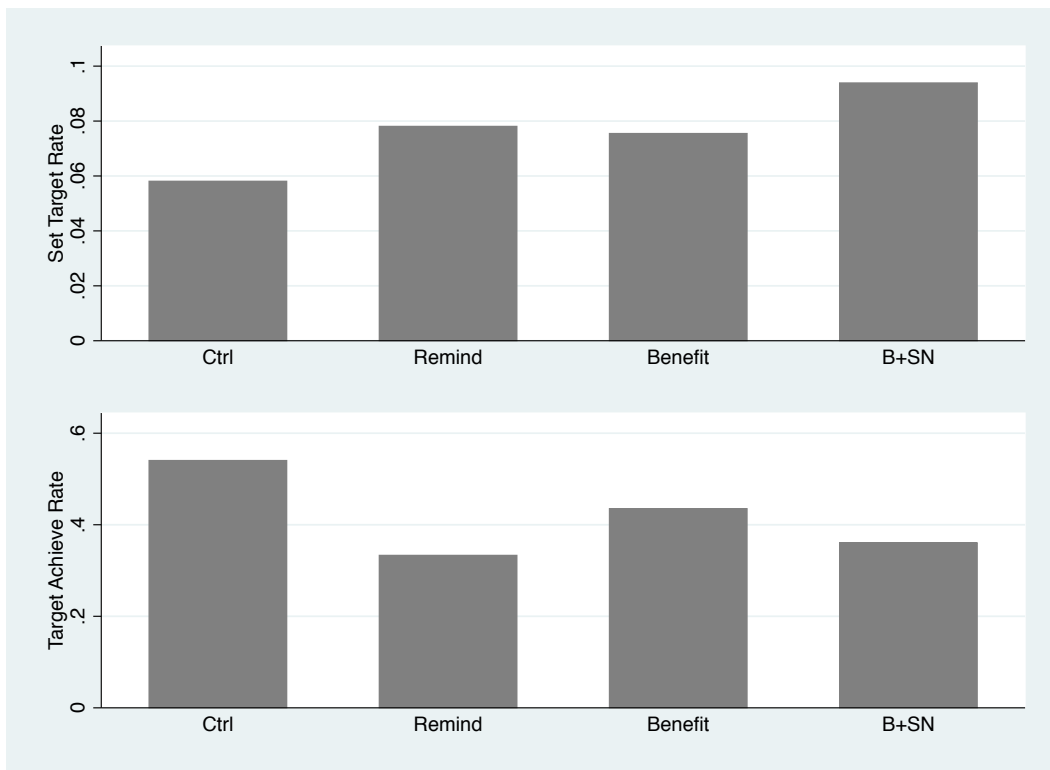


Figure 2. Set Target Rate & Target Achieve Rate

We now statistically compare the outcome measures across the control and treatment groups. In essence, we are measuring the intent-to-treat (ITT) effect, which is an important metric in randomized controlled trials (RCTs) in healthcare. The ITT has long been a principle of experimental design in RCTs and has been adopted widely by the Food and Drug Administration (FDA) and in government-funded

RCTs (Ten Have et al. 2008). FDA formally described ITT as: “The intention-to-treat principle implies that the primary analysis should include all randomized subjects. Compliance with this principle would necessitate complete follow-up of all randomized subjects for study outcomes (Food and Drug Administration 1997).” Analysis of ITT is based on the experiment’s initial treatment assignment not on the treatment received. That is to say, the focus of ITT is to estimate the effect of treatment assigned. The analysis of ITT is to compare the outcomes of each randomized group regardless of their status of non-adherence or compliance to the treatment. Because our study falls into the broad stream of treatments focused on improving health behavior, we follow the ITT approach to analysis. In our case, we are interesting in analyzing set target rate and target achieve rate based on our randomized treatment (message received by different groups).

Regression analysis for Set Target Rate is presented in Table 5 Column (1). All the coefficients in the treated groups show positive and significant effects compared to the *Control* group, indicating that the messages induced more individuals to set up a target. Compared to the *Control* group, each intervention group has a higher proportion of individuals who set up a target. Both *Remind* and *Benefit* groups are statistically significant at the 5% level, and the *B+SN* group is statistically significant at the 1% level.

Strikingly, the Target Achieve Rate analysis in Table 5 Column (2) yields a different story. All groups compared to the *Control* group have negative signs. While the *Benefit* group is significant at the 10% level, the *Remind* and *B+SN* groups are both significant at the 1% level. The regression analysis results are consistent with the pattern revealed in the summary statistics.

To isolate the effect of social norms, we further compare the *Benefit* group to the *B+SN* group. The t-test shows that individuals in the *B+SN* group are statistically different from individuals in *Benefit* group in setting up a goal ($p < 0.01$). Compared to the *Benefit* group, the *B+SN* message induces 24% more individuals to set up a goal. This effect clearly supports the conventional wisdom underlying the widely used social norms campaigns: individuals comply with the majority of others to set up a target.

However, if we examine Target Achieve Rate between these two groups, we observe a clear backfire effect. The results of the t-test show a significant difference between *Benefit* group and *B+SN* group ($p < 0.1$). Compared to *Control* group, there were 17% fewer individuals who successfully achieve their targets.

We further analyze what drives the reduction in Target Achieve Rate in the *B+SN* group compared to the *Benefit* group. Individuals in both groups set a similar target (*Benefit*: 108.4 km vs. *B+SN*: 109.0km). Interestingly, however, those who set a target in the *B+SN* group are in general less capable runners than those who set a target in the *Benefit* group: the average distance in previous month in the *B+SN* group is 68.6 km, compared to 73.5 km in the *Benefit* group. These results suggest that the social norms motivates less capable runners to set a target similar to others, and subsequently, they experience challenges in achieving their (stretch) goal.

Table 5. Regression analysis

	(1)	(2)
	SetTarget (Probit)	AchieveGoal (Probit)
Remind	0.153** (0.064)	-0.533** (0.163)
Benefit	0.135** (0.055)	-0.265* (0.141)
B+SN	0.254*** (0.055)	-0.459*** (0.139)
_cons	-1.571*** (0.046)	0.102 (0.119)
<i>N</i>	10873	857
Log pseudolikelihood	-2987.93	-570.51
Prob > Chi2	0.00	0.00

Robust Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

To summarize, although previous literature emphasizes the benefits of social influence to urge individuals to conform to the majority of others, most studies focus on the first level effect such as adopting a new technology or trying new products. Our results reinforce the existence of such an effect that has been documented in other studies. However, and more importantly, our result reveals the importance of focusing on and observing a subsequent effect. An individual might tentatively try to conform to the behavior of others because of a perceived pressure to do so. However, such conformity may be accompanied by an adverse side-effect. Even though we see there were more individuals setting up a goal in the social norms group, some runners are motivated to set targets beyond their reach, and therefore suffer from a much lower Target Achieve Rate. This result is consistent with the core tenets of self-determination theory: a less autonomous motivation is likely to lead to a worse performance.

4.3 Addressing Imperfect Randomization

Recall that the *Remind* group has a higher running distance in the previous month than the other groups. Therefore, our randomization is less than perfect. To address this concern, we conducted a non-parametric coarsened exact matching. This method helps us reduce imbalance in covariates between treatment and control groups, and it has been widely used in other studies (Azoulay et al. 2013). In order to apply CEM to our sample, we need to select a set of covariates on which we would like to ensure balance between the treatment and control group. We used all the variables described in the previous data description section: age, gender, distance in previous month, account created by Facebook, and extent of publicity.

We applied this matching algorithm to the *Control* and *Remind* groups. We then discarded unmatched observations from each group, yielding 1,563 individuals in the *Control* group, and 1,415 observations in the *Remind* group. After adjusting by CEM, the t-test of distance in the previous month between *Control* and *Remind* groups became insignificant. This procedure helps us to conduct a fair comparison between *Control* and *Remind* groups.

After matching, the findings remain qualitatively similar. Set Target Rate and Target Achieve Rate between these two groups are different. The *Remind* group still has a higher Set Target Rate (7.9% vs. 5.9%, $p < 0.05$) and low Target Achieve Rate (52.1% vs. 31.2%, $p < 0.01$) than the *Control* group. The results further corroborate our assertion that a message leads to a higher proportion of individuals setting up a target, but the invocation of an external nudge comes at a price (lower Target Achieve Rate). These results (7.9% and 31.2%) of the matched sample are very similar to the original un-matched one (7.8% and 33.3%), alleviating the concern of our imperfect randomization outcome.

5. Discussion

5.1 Findings

In this study, we investigated the effects of social influence in the form of norms in motivating users to set a goal. Social norms campaigns have been extensively used in many contexts, such as gambling (Larimer and Neighbors 2003) and energy consumption (Schultz et al. 2007). The effectiveness of such campaigns is predicated on an innate human tendency to comply with what most other people do. The effect of social norms has been consistently ranked among the strongest in changing people's behavior. However, such behavior interventions might produce undesirable effects, and might even backfire.

In order to examine the dark side of such social influence, we conducted a randomized field experiment of more than 10,000 individuals. We find strong evidence that messages can be used to motivate goal setting. Compared to the *Control* group, individuals in all groups who receive a message are more likely to set up a goal. The increase in goal-setting rates ranges from 30% to 62%, yielding strong support for the validity of message design. However, this drastic improvement in goal setting comes at a price, especially when message designers attempt to use social norms to influence behavior. Compared to the *Control* group, all the other groups have a lower Target Achieve Rate. Among these groups, Target Achieve Rates in the social norms group were statistically different from the *Control* group and from the *Benefit* group. We provide two plausible explanations for the statistically negative effect. It may be the case that individuals in the social norms group have a lower degree of goal commitment than the

benchmark groups because while social norms effectively increase goal setting, they also induce the dark side of reducing intrinsic motivation. An alternative explanation is that the social norms message attracts relatively weak individuals setting an unreachable target, resulting in a lower performance.

The theoretical explanation for the dynamic we observed may be found in two dominant theories from psychology: self-determination theory and goal-setting theory. Externally imposed pressure might not completely transform into intrinsic motivation, and this will affect the extent to which an individual employs their willpower to commit to the goal. Therefore, such externally imposed social influence can on the one hand persuade more individuals to set up a goal, but, on the other hand, it may not evoke a pure intrinsic motivation. In turn, this results in fewer individuals who successfully achieve their monthly target. Our study provided varied type of external information to prompt individuals to set up a goal that may lead to an improvement in performance. Although setting a goal is a useful way to help individuals conceptualize an ideal future and motivate them to turn this vision of their future selves into reality, a limited number of people are able to successfully do so. Before a goal can help an individual, it must be both set up and accepted. Locke and Latham (2002) highlighted two primary factors that affect goal commitment: importance and self-efficacy. The first factor refers to “the importance of the outcomes that they expect as a result of working to attain a goal” (p. 707), and the second factor indicates “their belief that they can attain the goal” (p. 707). Therefore, in order to make social influence a practical tool for improving health incomes, it is essential not only to induce individuals to follow what others do, but to make them realize the importance of goal setting and believe that they can achieve the goal. It is also vital to nudge users to set a goal that is consistent with their own capabilities.

5.2 Implications

There is little disagreement about the health benefits of regular physical activity. Warburton et al. (2006) conducted a thorough review on physical activity and concluded that “there is irrefutable evidence of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases (e.g., cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis, and premature death” (p. 801). In order to maintain national health, most countries have some national guideline recommending regular exercise. For example, Haskell et al. (2007) suggested that “all healthy adults aged 18 to 65 years need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 min on three days each week” (p. 1081). However, as we mentioned previously, a recent research by the Centers for Disease Control and Prevention (CDC) showed that almost 80% of Americans failed to achieve the recommended amount of physical activity each week. Everyone has hectic days: long hours of work, errands to do, or family issues. One can always find an excuse to delay their exercise plan.

To the best of our knowledge, our field experiment is among the first to examine the effects of social norms on goal setting and the subsequent impact on goal commitments. Most previous studies on goal setting have focused on either a purely externally assigned goal or a purely self-imposed goal. Our study is distinctive in that we examine the possibility of utilizing external messages to nudge individuals to set a self-imposed goal. Although all individuals in our study set a goal autonomously, the extent of individual goal commitment might be different among different groups. This leads to differing Target Achieve Rates under different circumstances. Our study paves a way for future research to examine other mechanisms to increase the rates at which individuals both set and achieve goals. Furthermore, different from negative social influence such as drug abuse among adolescents, a positive social influence might also lead to an unintended outcome. Our study underscores the negative consequences of social influence on individual physical activity: external sources that drive individuals to comply with a larger group might not always lead to an optimal outcome.

Our findings offer potentially useful implications for managers. The evidence in this study suggests that push notifications sent through an online platform may be desirable insofar as they can motivate people to increase their physical activity. A push notification has nearly no cost or an extremely low cost, yet it has a strong effect on individual behaviors. Our study demonstrates that companies using external sources to affect individuals' intrinsic motivation should also take individuals' goal commitment or users' own capabilities into consideration. A future extension of our randomized field experiment might incorporate a feedback system to reinforce users' perception of the framed messages. A proper

design of the feedback system should increase users' goal commitment, which in turn may mitigate the possible backfire effect of social influence.

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