

Effects of Public Commitments and Accountability in a Technology-Supported Physical Activity Intervention

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ABSTRACT

Walking and other forms of physical activity have many health benefits, but people often fail to follow through on their own goals of being more active. To address gaps in current understanding of how to design technology-supported physical activity interventions, we conducted a randomized field experiment of a commitment device: making public announcements. In a control condition, weekly commitments were kept private. In two treatment conditions, they were announced on Facebook and by email. In one of the two, the announcements also included results: whether the previous week's commitment was kept. We find that, with or without public results, these posts can elicit supportive replies from the poster's social networks. People in both public announcements conditions were less likely to make commitments. We conclude that the prospect of public accountability may suppress the making of commitments in a way that counteracts the benefits of that accountability. Designers will need to address this limitation in order to make effective use of public accountability as a commitment device.

Author Keywords

Commitments; goals; performance; sharing; privacy; physical activity; social network sites; persuasive technology

INTRODUCTION

Physical activity can improve health and wellness and reduce mortality [14], but as of 2012 only 50% of US adults report achieving recommended amounts of aerobic activity and nearly 30% report no regular physical activity in their leisure time [31]. The medical, public health, and HCI communities have developed and evaluated interventions, many supported by technology, to promote physical activity. Common and effective features include goal setting [8,27], performance feedback [17], and social support [14].

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There has been considerable prior research into goal setting and using social network sites to solicit social support for health and wellness behaviors. Some experiments and commercial applications have deployed financial commitment devices, where people create financial rewards and punishments for themselves for keeping their commitments [2,4]. Important questions remain, however. In particular, it is not clear whether and how social accountability can be harnessed as a commitment device. The literature also offers conflicting guidance on the prospect of whether public reports of results are necessary for public commitments to create increased accountability [10,13]. Additionally, researchers have argued for the potential benefits of sharing health and wellness behavior with one's pre-existing social network, but found substantial barriers to adoption or to eliciting those benefits [18,19,21]. Previous papers offer guidance on designs for messages that might get more – as well as more supportive – replies, but these suggestions have largely been untested.

We conducted a randomized field experiment evaluating the effects of public commitments in the domain of physical activity. We compare commitments posted to the social network site Facebook and shared by email, to commitments made privately. Based on the results, we offer insights for both theory and practice. In particular, our contributions are:

- evidence that it is possible to catalyze instrumental and emotional support from people's existing social networks for a physical activity program;
- evidence against the theory that public announcements of goals without the prospect of public reporting of results will backfire and reduce motivation;
- evidence that selection effects can undermine the value of public announcements, because the potential gains from public accountability may be offset by a reduction in willingness to make commitments;
- a challenge for designers to keep the social network's interest in providing support and accountability repeatedly for the same kind of commitment;
- a challenge for designers to harness the potential gains from public support and accountability without suppressing the benefits that come from private goal setting activity.

BACKGROUND AND MOTIVATION

Physical activity is known to help reduce obesity [20] and the co-morbidities that accompany it (such as type 2 diabetes and heart disease [30]). Walking has many benefits that make it an excellent way for obese people to increase their physical activity: (1) there is no need for special equipment or training, (2) it can be done when it fits into one's schedule, and (3) it is safe and effective even when multiple risk factors for cardiovascular disease exist [11].

Objective monitoring of physical activity has been widely used in physical activity interventions (e.g., [6,7,15]). Wearing a pedometer creates an objective assessment of whether walking goals were met, and several studies have found that pedometers are a valuable tool for supporting self-monitoring and self-regulation in walking interventions [3,12,24]. It is hard, however, for people to stick with walking programs. We review relevant prior work and extract implications into a conceptual model (see Figure 1).

Social Support

Interaction with other people can increase adherence to walking programs [22] (link $C \rightarrow H$ in Figure 1) and can lead to better health outcomes [32]. Other people can provide emotional support, such as kind words in difficult times or cheers for accomplishments. They can also provide informational and instrumental support, such as practical tips on shoes and snacks, or walking together to make it more fun.

Many people already share progress reports through Facebook, Twitter, and communities on fitness tracking websites [28]. However, participants in previous studies reported limiting their posts for fear of appearing boring or boastful and experiences with the posts going unnoticed or receiving negative replies [18,19,21]. Instead, many prefer to connect to strangers on special-purpose peer support sites, where they find a more understanding, supportive and accepting audience [21].

Connections on peer support networks, however, are less able to offer instrumental support, and may offer less meaningful emotional support, because they do not have an existing, ongoing, or physically proximate relationship with the poster. Noting these limitations, prior publications urge designers and researchers to continue to explore ways to solicit support through people's existing social networks. Recommendations include supporting selective access to people's personal networks and making specific requests for what the poster wants from the audience [18,21]. Thus, in principle public announcements to people's existing online networks have the potential to elicit social support (links $A \rightarrow C$ and $B \rightarrow C$ in Figure 1), but there is a design challenge to successfully do so in practice.

Goal Setting

Self-Regulation Theory models behavior changes that require ongoing, rather than one-time, decision-making. Research shows that specific and challenging goals that are

combined with timely feedback about discrepancies between desired and actual performance lead to higher performance [16]. A meta-analysis of walking interventions identified goal-setting as one of the most important components, leading to a difference in improvement over baseline of more than 2,000 daily steps when compared to interventions without goal-setting [3]. Thus, Figure 1 includes the links $E \rightarrow H$, $F \rightarrow H$, and $G \rightarrow H$.

Commitment Devices

To create accountability for completing the goals that people commit to, they sometimes use "commitment devices" that create rewards or punishments for success or failure [4]. For example, on a site like stickk.com, a user can specify an amount of money to be charged to their credit card if they fail to complete a goal. As we describe in the next section, we explore social rather than financial rewards and punishments, but the expected mechanism for impact on behavior is the same.

In terms of Schelling's analysis of "anticipatory self-command" [26], there is a strategic interaction between the self who creates the commitment device and the future self who is influenced by it. Indeed, it involves a three-stage interaction among the selves at three different times: when one makes a commitment (time 1), when one chooses to engage in an activity such as deciding between walking and watching TV (time 2), and when rewards or punishments are meted out (time 3). The commitment device is entered into by the self at time 1 because s/he expects that, absent the commitment device, the self at time 2 will make a different choice than the self at time 1 wanted. The commitment device creates accountability at time 2 so that the self at time 2 makes the choice that the self at time 1 wanted. Thus, Figure 1 includes the link $D \rightarrow E$.

One major challenge in creating effective commitment devices is establishing the credibility of consequences (rewards or punishment) [2]. To create incentives for performance, the self at time 2 has to believe that the punishment will be carried out at time 3 if the goal is not met. If a person, either the individual or some third-party monitor, has to carry out the punishment, then the more severe the punishment, the less credible the threat that it will actually be carried out. For example, if the threat is to confiscate all one's material possessions for not meeting one's walking goal, then the incentive's effect is undermined because the walker knows that the threat will not be carried out. Pedometers with upload features enable automation of the monitoring process and programs can automatically trigger actions, such as sharing of step counts with friends [1,6]. Automating monitoring and delivery of consequences removes the credibility challenge that has afflicted commitment contracts.

A second major challenge in creating effective commitment devices is self-selection. If the consequences involve punishments and the self at time 1 is not sufficiently confident that the self at time 2 will meet the commitment,

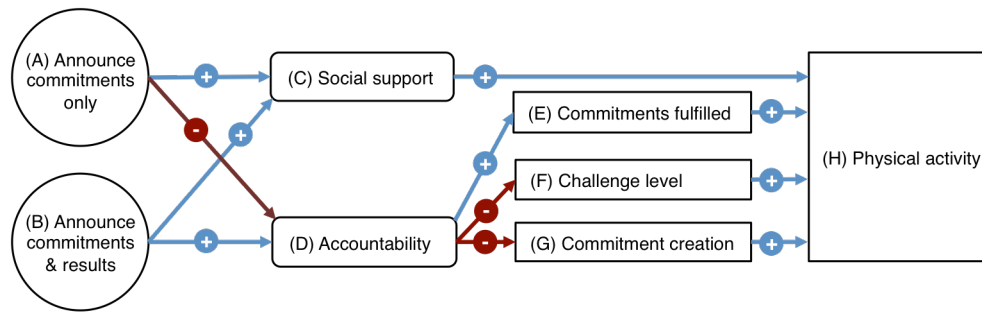


Figure 1. Conceptual model

s/he may be reluctant to voluntarily create the commitment device. In the context of our walking program, if the walker has low self-efficacy for walking, s/he may refuse to create commitments or may create less challenging commitments (links D→G and D→F in Figure 1).

Social Accountability through Public Commitments

We explore commitment devices where the rewards and punishments come from social accountability. There is conflicting theory and evidence about the effects of public announcement of goals on personal commitment to the goals and thus on performance. Some work argues that public announcement increases goal commitment, because people want to appear consistent to others [13,25]. This is especially true with a mechanism where results about completion of commitments will be automatically announced, and thus we have the link B→D in Figure 1.

Other work has found that public announcements of goals can be counterproductive to achieving stated goals if not also accompanied by public announcements of results [10]. The explanation offered is that benefits, such as being seen as the type of person who can achieve that goal, occur when the goal is announced. There is then less motivation to actually meet the goal, since all the reputation benefits have already been received. Based on this, Figure 1 includes the negative link A→D. There are other factors, however, that might make this relationship positive rather than negative. For example, public announcement of a goal might increase self-accountability [5].

THE STUDY

We conducted a randomized controlled trial (ClinicalTrials.gov #NCT01811407) to test the effects of including public announcements in a pedometer-based walking program. Subjects were given Fitbit pedometers that automatically upload step counts over the Internet. Each week for twelve weeks, participants had the opportunity to create a walking commitment for the upcoming week. Participants were randomized into three conditions, summarized in Figure 2.

Hypotheses

We describe the hypotheses and research questions below. Following each one, we indicate the path or paths in the conceptual model of Figure 1 that lead to the hypothesis.

H1 Social support: Public posts to people's existing social networks will catalyze responses that offer emotional, instrumental, and informational support. (A→C; B→C)

H2a "Announce without results" increases commitment creation: Announcing commitments without results will reduce accountability, and thus increase the number of commitments that are created. (A→D→G)

H2b "Announce with results" decreases commitment creation: Announcing commitments with results will increase accountability, and thus reduce the willingness to create commitments. (B→D→G)

H3a "Announce without results" increases challenge level: Announcing commitments without results reduces accountability, and thus increases the challenge level of commitments that are created. (A→D→F)

H3b "Announce with results" decreases challenge level: Announcing commitments with results increases accountability and thus decreases the challenge level of commitments that are created. (B→D→F)

H4a "Announce without results" decreases completion: Announcing commitments without results decreases accountability and thus decreases the percentage of created commitments that are completed. (A→D→E)

H4b "Announce with results" increases completion: Announcing commitments with results increases accountability, and thus increases the percentage of created commitments that are completed. (B→D→E)

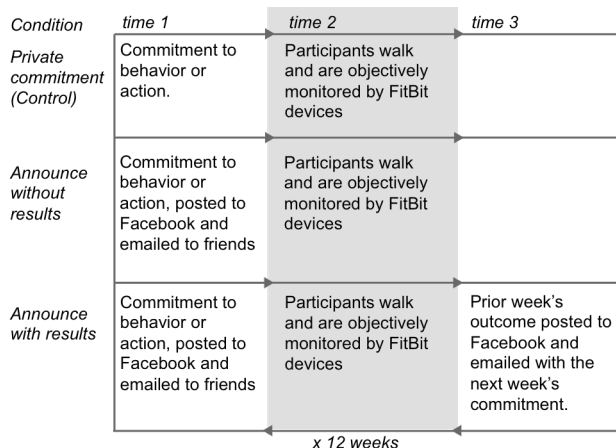


Figure 2. Study design



Figure 3. Commit to Steps dashboard

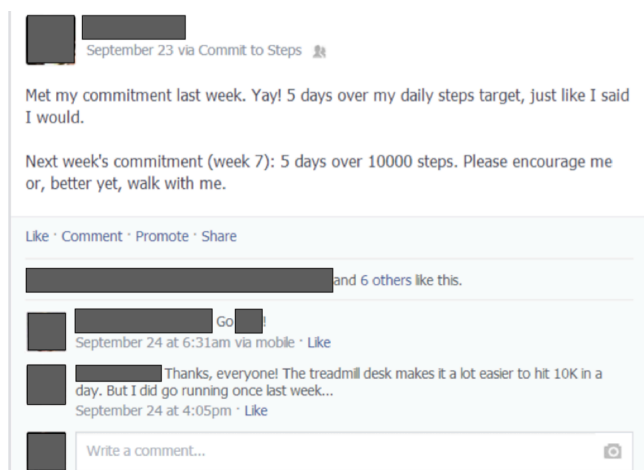


Figure 4. Example accountability post

Given these hypotheses about impacts on creation and completion of commitments, we do not have a clear prediction about the net effect of either treatment on physical activity levels. For example, announcing with results should reduce the number of commitments (and hence reduce physical activity) but increase the probability of completion for those that are created (and hence increase physical activity level). Thus, we describe research questions rather than specific hypotheses for the net effects.

RQ 5a: Net impact of “Announce without results” on physical activity. Do announcements of commitments without results lead to an overall positive or negative impact on physical activity outcomes? ($A \rightarrow D \rightarrow E, F, G \rightarrow H$)

RQ 5b: Net impact of “Announce with results” on physical activity. Do announcements of commitments with results

lead to an overall positive or negative impact on physical activity outcomes? ($B \rightarrow D \rightarrow E, F, G \rightarrow H$)

APPARATUS AND PROCEDURES

We developed a custom website that interacts with the Fitbit and Facebook APIs to create a custom experience for subjects. All subjects could see graphs of their past performance and were assigned a daily target each week. The daily target changed each week. It was set automatically, based on the subject's past walking history, adjusting upward as the participant walked [23]. Targets were capped at 10,000 steps per day because it is enough to produce most of the health benefits associated with walking [29] and there may be a risk of minor injuries from overuse in people who are overly motivated to best ever-increasing targets. Subjects could not manually change their daily targets. Subjects were prompted to make a commitment each week, quantified as the number of days on which they would meet or exceed the daily step target. Subjects chose the number of days to which they committed. Figure 3 shows an example of what the web page looked like. In the example, the daily target for this week was 3,400 steps, the subject committed to exceeding that target on 4 days, and has done so on 1 day so far.

The only difference between the control and the two treatment conditions was that in the treatment conditions the commitments people made were posted to Facebook and emailed to three contacts. In the “Announce without results” treatment condition, only the next week's commitment was posted. In the other, the “Announce with results” treatment condition, both the next week's commitment and the results of the previous week's commitment were posted. The example in Figure 4 shows a post (not for a real subject) with both. The “Met my commitment...” paragraph was omitted in the “Announcements without results” condition. Negative results were reported with neutral phrasing: “Fell short last week. 2 days over my daily steps target, even though I committed to 4”.

Prior work suggests that social network site posts about physical activities or goals include a specific call to action for the audience [18]. Following that advice, our posts conclude with, “Please encourage me, or better yet, walk with me.”

To ensure that public commitments were sufficiently “public,” all participants in both treatments were asked to select at least 20 Facebook friends to whom the posts would be visible, or to make their posts visible to all of their Facebook friends. We also asked each subject to enter email addresses for three contacts, to whom our site would send weekly updates. This design choice follows recommendations from prior literature that tools which encourage sharing of health and wellness data to personal informatics sites allow users to select a subset of friends with whom to share [18,19]. We also avoid difficulties with people not setting up their support groups by making this a required step [18].

SUBJECTS

We recruited 165 adult subjects from the University of Michigan Medical system. 385 responded to invitations sent by paper mail to recent patients over 18 who were obese (BMI \geq 30). They completed an online form to assess eligibility. Criteria included: self-reported weight and height that implied BMI \geq 30; sedentary but ambulatory and able to walk at least one block; over 18; and have more than 50 Facebook friends. 246 passed the eligibility screening. Of these, 220 consented to participation in the study.

After consent, subjects completed a registration process. This included connecting their account to Facebook and completing a questionnaire. 199 did so. After that, subjects were mailed a Fitbit with instructions. The Fitbit device was connected to an account on our custom website. We created accounts on fitbit.com for each pedometer used in the study but did not share the password for those accounts with the subjects—thus, subjects could access their step count histories only on our site, not on the Fitbit website.

After a two-week baseline period in which step counts were recorded but no commitments were made and nothing was shared with subjects' networks, subjects whose pedometers were successfully uploading step counts to the Internet were randomized to one of the three conditions. Of the 165 subjects who made it to randomization, 136 were women and 29 men, with a mean age of 47.

Subjects remained in their assigned conditions for the twelve weeks of the trial, having the option to make a commitment each week. At the end of the trial, they were asked to complete an exit questionnaire. After that, they were free to keep their pedometers and use the Fitbit website to track their ongoing walking.

Two subjects were removed from the study after randomization, due to medical conditions unrelated to the study. They are not included in the data analyses. One subject dropped out of the study after seeing what the Facebook posts looked like. That subject, and others who simply stopped participating, are included in the data analyses.

RESULTS

Overall, across all conditions, the walking program was well-received. In most online health interventions lasting several months, attrition is high, well above 50% [9]. By contrast, attrition in this study was very low: 131 of 165 subjects uploaded step counts in their twelfth week. The high continued participation occurred despite the onset of a severe winter toward the end of the twelve-week period for most participants.

Catalyzing social support and accountability

Of the participants who completed the post-study questionnaire and were in one of the two public treatments (n=81), 40 (49%) chose to limit the visibility of their posts to specific friends. The rest reported allowing the application to post to their newsfeed default. Those who

customized their audience described choosing to share with close friends who they felt would be encouraging, who would not judge, and *“who could really support me”* or *“support me no matter what.”* Many also chose to share with family, but others felt it was important not to share with family or partners. A few commented that they shared with exercise partners or friends who also struggled with weight management, specifically avoiding friends who *“do not care about exercise,”* or friends who were already very fit (e.g., they ran marathons). Some described wanting to *“avoid cluttering friends’ feeds.”*

Attitudes about posting commitments and results

Participants generally had positive feelings about posting commitments to Facebook. 17 of the 81 (21%) participants in one of the two treatment conditions who completed the post-study questionnaire explicitly mentioned the motivation or accountability they received as a result of sharing as the best feature of Commit to Steps, and reported mixed feelings about sharing them by email. Not all participants, though, always liked sharing their commitments. One participant mentioned deleting the automatic posts on Facebook.

Most participants had at least some positive experiences with the Facebook sharing feature, noting that it *“was also exciting to see the comments that people wrote.”* Most described receiving encouragement and support, and even walking partners:

“I found sharing my Commit to Steps gave me a lot of encouragement, and it even encouraged many of my friends to walk with me or to go out and walk on their own.”

“It did keep me motivated to keep up with my commitment and it gave me something to talk about with people.”

“I found it very encouraging when people had read my status and sent me comments on Facebook or in person. I felt like I was really doing something great and had a wide audience of supporters.”

They also described feeling more accountable. For example:

“The threat of posting my failure definitely drove me to work harder and jog around the house at night when I was short on steps. I wanted to avoid failure because my friends would see my laziness.”

“I felt obligated to work harder, so I didn't let anyone down.”

Two participants described being reluctant, at first, to share but enjoying the experience more as time went on:

“It was a little intimidating at first, but each week I was encouraged to continue.”

“Reluctant at first, but great feedback and encouragement from people - throughout the study, in fact more as time progressed.”

For others, the experience was more neutral. Some experienced it as good when things were going well but

unpleasant on weeks when they did not meet their commitment:

"When I made the commitments with success, it was great. It made me feel good about the efforts. However, when I was unsuccessful it was truly embarrassing for me."

"I was embarrassed on weeks that listed I failed to meet my goals. At other times, it spurred me on to make those weekly goals!"

Others felt the experience was inconsistent with what they normally share ("Kind of odd. I like to be private") or that the tone of the automatic post was inconsistent with how they would choose to share the content ("asking them to support or walk with me is cheesy"). Their friends' comments picked up on this as well:

"I like the idea of this accountability checker for your walking goals, but it must be an automated message as the recurring use of the word 'Yay!' sort of gives it away."

"I'll keep encouraging you, but dude, at least change your request up a little bit."

One participant felt the experience was redundant to their existing, in person support ("It was ok didn't think it was necessary for me since me support was daily from people I workout with") and three commented that sharing was superfluous to their own motivation (e.g., "This is a personal goal of mine. Regardless of how supportive they were, it is all up to me in the end."). Some additional participants said they did not remember seeing the posts or did not recall any friends replying to their posts, which was a neutral or sometimes disappointing experience.

Four participants disliked the sharing feature and would prefer not to have it. The reasons they listed were embarrassment or potential embarrassment ("It's embarrassing and personal whether or not I achieved my goal", "I'm self-conscious about being overweight and did not want others to see what I'm doing"), it was a private experience ("It is none of their businesses how many steps per day I walk", "I would have preferred to not have shared this personal experience"), or the information was boring ("Plus, no one cares about the steps. People just get bored reading about it.").

Experiences with email sharing were more mixed. Some participants described this sharing as comparable to Facebook, while most said they got less of a reaction to their emails than on Facebook. Because emails were more personally targeted than Facebook posts, the lack of reply was more disappointing for at least one participant. Two commented that email was more likely to annoy their friends and that Facebook was a better place.

Response characteristics

To better understand the type of support participants received, we examined the comments on participants' automated Facebook posts. The posts were noticed by subjects' Facebook friends, who responded with a variety of types of support. Figure 5 shows the mean number of

likes and comments received for Facebook posts. Responses declined over time; by the last week, less than half of the posts received a comment, and the median received just one like.

The comments on posts were overwhelmingly positive. Of the 2,287 comments (this includes comments made by subjects), 1,303 comments explicitly offered emotional support. Friends cheered posters on, said missed commitments were okay and they would get back on track the next week, and offered prayers. Some offered memories of shared healthier, more active times. Several commenters called their friends' posts motivational or inspiring, and a few said that they bought fitness devices or downloaded apps to increase their own physical activity. 70 comments shared their own experiences with physical activity, sometimes in ways crafted to motivate. 28 commenters requested progress updates, which offered accountability.

Commenters also offered instrumental support. Responding to our post's request to "walk with me," 232 comments offered to set times to walk. We do not know how many of these turned into actual walks, but nearly 100 comments followed up coordinating locations and times for walks, and several other comments referenced successful meet-ups and suggested planning another. 53 comments offered to join virtually, including walking at the same time and talking on the phone, sharing fitness stats each day or week, or simply also committing to a plan to be more physically active. A smaller number of posts offered to give subjects rides to nice places to walk, to let them borrow their dogs for a walk, or to watch the participant's children so they could find time for a walk. They even offered soup when someone was sick.

Participants noted that their friends were supportive even when they did not achieve their commitment, e.g., "It was cool, nobody really gave me a hard time for missing my goal, and everybody was supportive in some way." We saw this reflected in the posts, though a few comments offered tougher or more ambiguous support, such as "you are going backward" or "Lol 0 days :-P." One commenter responded to a commitment post with "I have my doubts," a reply

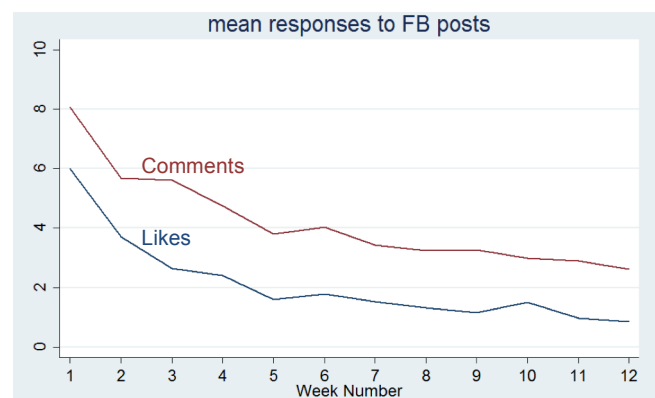


Figure 5. Responses (comments and likes) to Facebook posts declined as the study went on.

which another commenter criticized, “C'mon {{nickname}} help {{name}} out or don't u believe in [positive motivation]?”

Many commenters asked questions about walking (50). The most common question was how many steps are in a mile. 78 comments offered answers, and also suggestions and tips for where to walk and how to make time to walk, for remembering to wear the Fitbit, or for staying motivated. Eight additional comments offered suggestions of physical activities other than walking, though participants were sometimes resistant to these suggestions since they would not receive step count “credit” for many of those activities.

Study participants responded with “thank you” messages and progress reports. The progress reports celebrated successes and offered justifications for weeks they missed their commitments, such as being sick, forgetting to wear the Fitbit, or having trouble syncing.

Overall, we conclude that “H1 Social support” is supported. Public posts to people’s existing social networks catalyzed responses that offered emotional, instrumental, and informational support.

Impact of Public Announcements on Commitment Creation

Due to a bug in our software for a couple of weeks early in the trial, it was more difficult for subjects in one of the conditions (public announcements without results) to login and thus to make commitments. To eliminate any biasing effect this may have had, we include only weeks 5-12 in our analyses of commitment creation.

Most subjects created commitments most weeks. Subjects in the private condition, however, were somewhat more likely to do so. Figure 6 shows the percentage of subjects who created commitments, by week, for each condition. Overall, in the private condition, 88.2% of all possible commitments were created, compared to 78.6% with public announcements of commitments without results, and 77.3% with public announcements of both commitments and results.

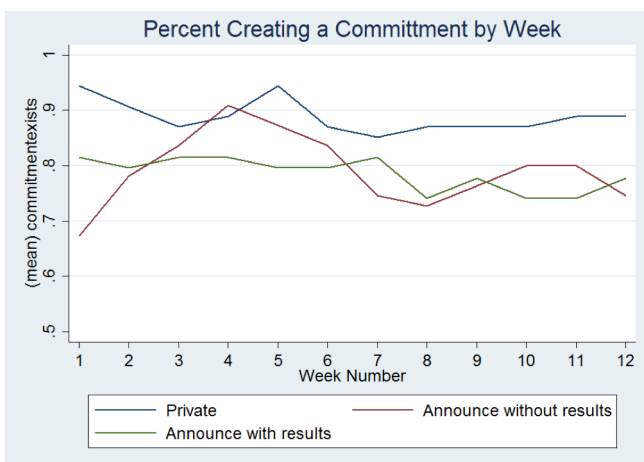


Figure 6. Commitment creation.

To test for statistical significance, we conducted a logit regression predicting the outcome in each week of creating or not creating a commitment. One advantage of the panel structure of our data, with observation of whether each subject made a commitment in eight different weeks, is that we can take into account unobserved heterogeneity in our subjects. However, our analysis has to correct for the autocorrelation among the error terms across weeks. Without a correction, our p-values would be misleadingly small. We correct by estimating a random effects logit model. In particular, this allows correction for a particular kind of autocorrelation: some subjects being more willing than others overall to create commitments, and that willingness impacting each subject in a consistent way across all periods. Even with the correction, we find that both public treatments are significantly lower than the private control treatment in the probability of making a commitment ($p < .05$).¹ We conclude that H2a is not supported but H2b is: announcement without results led to creation of fewer commitments rather than more; announcement with results led to fewer commitments, as expected.

Impact of Public Announcements on Level of Challenge

Restricting attention to only those weeks when subjects did create commitments, we now investigate whether they challenged themselves less by committing to meet the daily target on fewer days. Contingent on making a commitment, the average number of days committed to was similar across treatments: 4.16 in the Private condition, 4.14 for public announcements without results, and 4.15 for public announcements with results. We estimated a random effects regression model, and the differences between conditions were not significant. We conclude that neither H3a nor H3b is supported: the challenge level of commitments created was not higher when commitments were announced without results nor lower when announced with results.

Impact of Public Announcements on Completing Commitments

We now investigate whether subjects were more likely to succeed at completing their commitments when they were publicly announced. Here, completing the commitment means exceeding the daily target step-count on at least as many days as to which they committed. In the private control condition, subjects completed 53.8% of the commitments they created, compared to 56.0% in “Announcements without results”, and 59.5% in “Announcements with results”. When correcting for autocorrelation with a random effects logit regression, including week number as control variable because the probability of completing commitments decreased with time, the differences were not significant. Neither H4a nor H4b is supported: the probability of keeping commitments was not

¹ Details of all statistical analyses are available in the online appendix.

lower when commitments were announced without results nor significantly higher when announced with results.

Net Impact on physical activity

Finally, we turn our attention to the net impact on physical activity. We computed the change in daily step count for each subject from his or her baseline daily step count, as measured in the two weeks before the treatment began. As shown in Figure 7, step counts increased dramatically in the initial weeks, and declined somewhat toward the end (as the weather got worse). Considering only weeks where the pedometer was worn at least one day (i.e., daily step count > 200), the average improvement in mean daily step count in the three conditions was 957 (private), 1030 (announcements without results), and 1,407 (announcements with results). However, standard deviations were large (1374, 1679, and 1948 for the three conditions) and the differences between conditions were not statistically significant. Therefore, we are unable to conclusively answer “RQ 5: Net impact on physical activity”.

DISCUSSION: IMPLICATIONS FOR THEORY

We observed an unwanted selection effect of an expectation of public accountability: people created fewer commitments when those commitments were made public. This is an especially problematic finding for situations where people repeatedly decide whether to make commitments rather than making them once, at a time when they are particularly optimistic or interested in constraining their future selves.

We did not observe a reduction in the number of days that people committed to, when they made a commitment, as we would have expected if social accountability were making people reluctant to create challenging commitments. Perhaps in a more continuous or more granular domain (e.g., if they chose their own step-count targets) we might see such a reduction. We speculate, however, that social accountability also prevents people from setting commitments that are too easy. It is also possible that people expected others to judge them on an absolute scale of how much they walked, rather than a relative scale based on the number of days they committed to, so that the

number of days committed to was only a private matter even if it was publicly announced.

We did not observe statistically significant differences in the probability of keeping commitments when they were public. One possibility is that the primary benefit (if any) of public posts was the emotional, instrumental, and informational support they triggered and that, once posted, accountability or lack thereof was relatively unimportant. Although the quotes from participants reported above suggest that at least some felt the public announcements created accountability, it is also possible that most people did not perceive posts reporting fewer days than committed as embarrassing. We had considered alternative phrasings for those posts that would have been more embarrassing, but opted for a neutral phrasing in order to reduce selection effects (people not creating commitments to avoid the risk of such posts) and possible negative impacts on self-efficacy when such posts were actually made. It is possible, however, that more negative phrasing would have created more accountability.

We also did not observe statistically significant differences in overall step counts. This may be due to countervailing effects of selection (creating fewer commitments) vs. accountability (greater likelihood of keeping those commitments that were made) and support (getting mostly positive feedback from friends and family). It is also possible that each of those effects had a negligible impact on step counts.

Before overinterpreting these negative findings, however, we caution about the danger of type II errors, given the limited sample size and high variability between subjects. The sample size for the experiment was chosen to enable detection, with power > 0.8, of an effect size of an extra one-half day per week in meeting the daily step count target. This is a very large effect size, given that the daily target automatically went up for the next week when someone walked more. The effects we observed on the probability of keeping commitments and on total step counts were clinically significant, but not reliable. It may be that, with more participants, the observed effects would have been statistically significant.

We did not observe the predicted backfire effect from making commitments public without making the results public. Fewer rather than more commitments were created, and the other predicted effects were also in the wrong direction though not significant. We speculate that participants were not fully aware of whether the posts included results. Even when they knew posts did not include results, participants may have anticipated that posting the next week's commitment would prompt their friends to ask how the previous week went anyway. We observed few of these comments: two (both on the same comment) asked directly about the previous week's results while six inquired about progress during the week, and 21 others asked about progress with the program overall (were

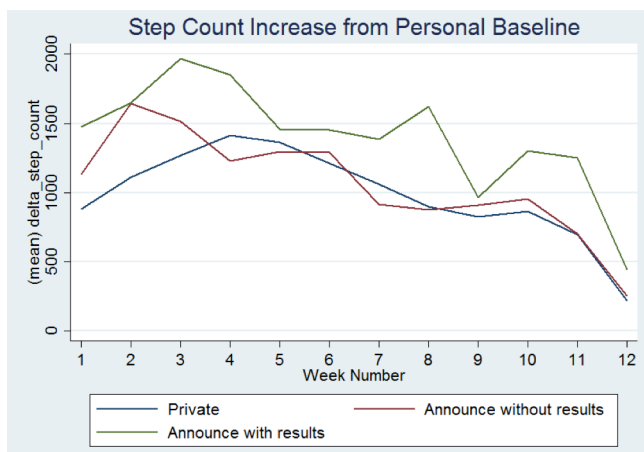


Figure 7. Week-to-week change in step count.

they losing weight? Feeling stronger?). It may have been sufficient, however, that participants anticipated such questions. They may also have been asked through other channels we could not observe, such as other Facebook posts, email, or face-to-face-conversations.

DISCUSSION: IMPLICATIONS FOR DESIGN

Our results offer designers challenges and guidance for the design of social features that share health and wellness activities and goals, and for the design of commitment-based health and wellness interventions.

Catalyzing support by sharing health goals and activity

Contrary to prior work, we found that the Facebook posts from Commit To Steps were effective at eliciting emotional, informational, and instrumental support, with very few negative replies from commenters. We followed recommendations from previous work: encouraging participants to select a supportive subset of their Facebook friends and including a specific ask (support or walking with them). The combination appears to have been successful, and we recommend that designers of future interventions follow these approaches.

There continue to be opportunities for improvement, however. As in previous studies, some participants were still reluctant to make commitments because they feared negative replies. Among those who posted, though, we saw very few examples of negative feedback. Participants in the public commitments conditions either received positive feedback and support and then became more open to or appreciative of the intervention, or received no feedback and became apathetic about the public posts. Assuming participants who were concerned about negative feedback would have received comparable feedback to those who did make and share commitments, future interventions might do more to help participants better anticipate positive reactions. Future interventions might also do more to match posts to respondents who may respond positively.

Other participants also reacted negatively to the specific language in the posts or their repetitiveness, and we saw a drop off in the number of replies over time. Allowing participants to customize their posts could mitigate concerns about tone and make them feel less “cheesy” or “canned” and allow people to make requests for more specific kinds of support. We had piloted such an interface but removed this ability, fearing it would overly increase the complexity of the interface. System designers could also build more variety into automated posts.

Managing tradeoffs in public commitments

There seems to be an inherent tradeoff in publicly announcing commitments that are voluntarily created. On the one hand, it deters some people from making any commitment at all. On the other hand, it encourages those who do make commitments to complete them. Alternative designs, however, might gain more of the benefits without all the costs.

First, it might be valuable to separate the announcement choice from the creation choice, so that people can create private commitments even when they do not want to accept the public accountability. For example, when setting a commitment, the interface could also present an individual with a checkbox for whether this particular commitment should be shared on Facebook.

A stronger intervention might be to pursue interventions in which people pre-commit to ongoing, system-set public commitments for an entire intervention period. For example, in Commit to Steps, participants might commit at the beginning to a 12-week program in which the system sets both their daily targets and weekly commitment to reaching them, and publicizes them each week. This, though, may have two undesirable consequences. First, it might lead people to avoid the intervention entirely. Second, a few participants who had health problems or unexpected life events that made it impossible to reach their commitments might become very frustrated when the system did not let them adjust for this; predicting busy or potentially sick times twelve weeks in advance is even less practical than anticipating them for the upcoming week.

CONCLUSION

Announcing commitments can catalyze support and accountability from existing social networks for health behavior change. However, that is not sufficient to guarantee a successful intervention. The prospect of accountability creates a selection effect that decreases the probability of making commitments. The challenge for future designers is to reduce the selection effect or reduce its consequences.

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