Commitment Devices in Online Behavior Change Support Systems

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ABSTRACT

Commitment devices--a self-imposed contract that helps an individual stick to a plan of action--have been widely used to make a positive influence on one's behavior change. We analyze commitment contract posts in StickK.com, an online behavior change support system to characterize the types of target behaviors and the effectiveness of different commitment devices for behavioral changes. We provide several practical implications for designing behavior change support systems that could inform further directions for research in behavioral economics and psychology.

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KEYWORDS

Commitment Contract; Commitment Device; Financial Commitment Device; Social Commitment Device; Behavior Change Support System

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INTRODUCTION

For successful behavior changes, people often use commitment devices or commitment contracts that bind rewards or punishment to their behavioral change goals [2]. There are two types of commitment devices that are widely used. *Financial commitment device* imposes financial penalties for failure, or award financial rewards for success. For example, an individual can gain access to the deposit only when a weight loss goal is achieved. *Social commitment device* is designed to primarily cause psychological consequence (i.e., social reputation, accountability) as a result of one's action. For example, people can publicly announce their goals on social media [14], which brings a sense of achievement in case of success and shame or low self-esteem in case of failure [2].

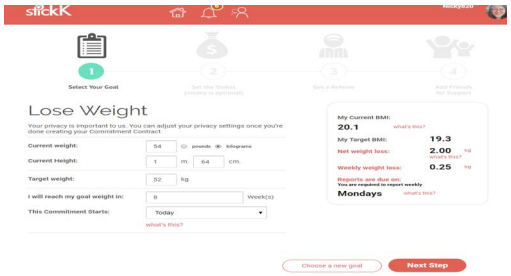
The public health, behavioral economics, psychology and HCI communities have studied and evaluated the effect of commitment devices in various domains of behavior change. For example, financial commitment devices were applied to improve work productivity [8], and exercise adherence [3, 18], and social commitment devices were also used to promote weight loss [16].

In recent years, various online behavior change support systems that help people to leverage commitment devices have emerged such as StickK and Beeminder. As in persuasive technologies, we expect that these systems can play a huge role in motivating people to better achieve behavior change goals. However, so far there is a lack of our understanding about commitment and engagement patterns in online behavior change support systems. This knowledge is critical for designing online systems that can better support diverse commitment devices in a more effective way. In this work, we seek to answer the following research questions:

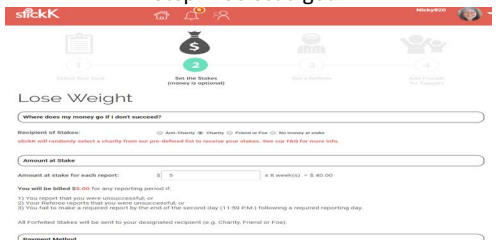
- What are the types of behavior people wish to change from an online behavior change support system?
- What facilitates engagement with an online commitment device that helps successful behavior change?

To answer these questions, we investigate StickK, an online behavior change support system that helps people to set financial and social commitments for their behavioral change goals. For a given goal, StickK allows a user to optionally select financial stake by specifying the amount and recipient (charity, anti-charity, or a friend) of stake. The system automatically transfers the allocated amount of money to the recipient if the user fails to meet the goals (e.g., weekly exercise goals). Users can nominate a referee to verify their progress weekly (i.e., self- or friend-referee) and can further specify optional supporters who can help encourage goal achievement. As a first step, we collect a sample of 1000 commitment contract posts from StickK for in-depth analyses of commitment behaviors.

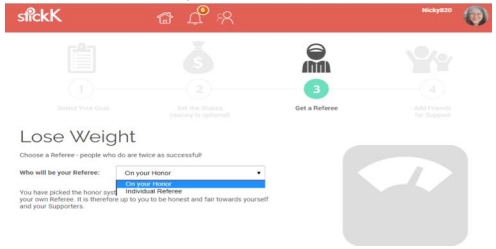
Our preliminary results showed that in StickK, popular goals include health-related behaviors and attitude changes (68%), but a long-tail of diverse goals are also observed (32%). When comparing financial and social commitment devices, we found that financial commitment yields relatively better results in achieving behavior change goals. We provide insight into designing commitment



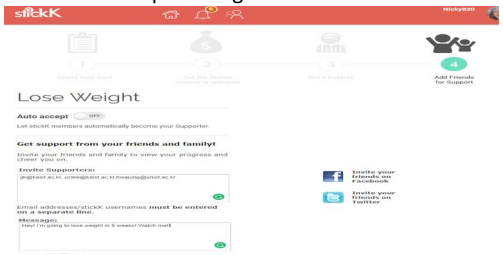
Step 1. Select a goal



Step 2. Select Stake



Step 3. Designate a Referee



Step 4. Invite Supporters

Figure 1: Four steps of making a commitment contract in StickK

devices to better support diverse goal types and offer design opportunities beyond current web-based intervention. Drawing insights from the study, we plan to expand our scope of dataset and provide design guidelines for commitment devices. Our work will promote further exploration of commitment device design in the HCI field, and a promising research direction is to incorporate wearable devices and Internet of Things for novel commitment device design.

RELATED WORK

Financial Commitment Device

Empirical studies have shown that both financial incentives and penalties affect behavior change. Volpp et al. conducted a weight loss program on 57 participants and observed that a group with a financial incentive lost significantly more weight than the control group [21]. Giné et al.'s study suggests financial penalty also drives desired behavior change, offering a six-month commitment contract for smoking cessation, where people deposited funds to an account and got money back after they passed a urine test, otherwise the money was forfeited to charity [5]. An underlying motive for this behavior change is *loss aversion*, which means people feel more sensitive to financial losses than to financial gains of a similar amount (e.g., losing $5 than to gaining $5) [20]. Taking this into account, we explore how financial commitment device motivates behavior change in a real-world data collected from the behavior change support system.

Social Commitment Device

Much of the prior work in social commitment device (i.e., reputational commitment) have proven to be vital in changing health attitudes and behaviors as well as household savings [7, 12, 22]. Social commitments have also served as a tool to boost morale in one's behavior change [15]. Interestingly, *reputational commitment* further enables social support that provides not only emotional support, such as cheers for one's achievement but also instrumental support, such as practical tips on one's goal [14]. However, findings from recent studies have raised questions on the efficacy of social commitment device. Empirical studies have shown that people are less likely to perform well in weight loss or make fewer commitments due to a fear of judgment and suppression [14, 19]. While discourse on its efficacy remains disputable, we aim to explore the importance of social commitment device on StickK and its relationship between users' behavior change.

Table 1: Types of commitment goals in 'Start/Increase' group

	Commitment Goals	Number of cases (%)
1	Health	420 (51%)
2	Learn or Perform a Specific Task for Education, Interest	183 (22%)
3	Meditation&Attitude	47 (6%)
4	Improve Expertise	44 (5%)
5	Sleep	39 (5%)
6	Money&Finance	33 (4%)
7	Time Management	24 (2%)
8	Contents Creation	13 (2%)
9	Relationship	11 (2%)
10	Chores, Errands, Simple Task	9 (1%)
Total		823

Table 2: Types of commitment goals in 'Stop/Decrease' group

	Commitment Goals	Number of cases (%)
1	Deter from Hazardous Habit, Food Consumption	86 (49%)
2	Sexual Abstinence	41 (23%)
3	Social Media Break	21 (12%)
4	Decrease Spending	17 (10%)
5	Stop Fidgeting Behavior	9 (5%)
6	Attitude	2 (1%)
7	Resolution to stop a certain behavior	1 (0%)
Total		177

RQ1: TARGET BEHAVIORS AND COMMITMENT TYPES

In this section, we categorize types of target behaviors in our dataset and provide descriptive analysis of the collected data to better understand the nature of commitment contracts in StickK.

Types of target behaviors

To identify the types of target behaviors, we began with an existing classification scheme originally proposed by BJ Fogg's Behavior Grid [4]. Since not all contracts from our dataset fell into every grid of original BJ Fogg's model, we simplified the grid into two groups: i) start/increase, and ii) stop/decrease. If a person initiated or increased the intensity or duration of a certain behavior, we classified them as '*start/increase*', whereas we classified '*stop/decrease*' if a person tried to abstain or decreased the intensity or duration of a certain behavior. Two researchers manually and respectively went through sorting process to secure inter-rater reliability (Cohen's Kappa = 0.89).

'Start/Increase' Group

As shown in Table 1, the most dominant commitment contract type was health-related issues (e.g., weight loss, exercise). Followed were contracts of learning or performing a specific task for education or a personal interest (e.g., learn French). It is interesting to note that contracts related to meditation and mindset (e.g., positive thinking) were ranked the third place. Contracts to improve one's expertise (e.g., spend more time on online business), sleep (e.g., wake up early), money & finance (e.g., work on budgeting), time management (e.g., check to-do list), contents creation (e.g., upload a video a week), and relationship (e.g., be more loving) were followed.

'Stop/Decrease' Group

Table 2 shows that commitment contracts classified as 'Stop/Decrease' are related to self-control issues. The most selected contracts are commitments aimed to deter from one's hazardous habit including food intake (e.g., quit smoking, no artificial sweeteners). Other ranked contracts included sexual abstinence (e.g., no porn), break from social media (e.g., no Facebook), stopping fidgeting behavior (e.g., stop biting my nails), and changing a user's mindset (e.g., stop being angry about the past).

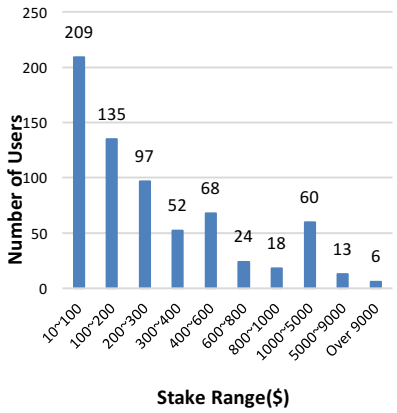
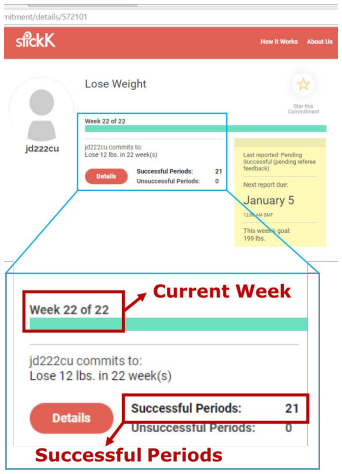


Figure 2: Number of Users according to Stake Range

Figure 3: Successful Weeks and Current Week given at user's personal account in StickK



Types of Commitment Devices

Financial Commitment Device

Our data shows that 682 users selected stakes (68%) (m=409, sd=1153). As to recipients, 288 users selected charity (42%), 209 users selected anti-charity (31%), and 185 users selected Friend (27%). We also calculated the average amount of stake per recipient. Charity (m=698, sd=1581.59) had the highest number of average stakes, Friend (m=583, sd=1214.21), and Anti-Charity (m=479, sd=1111.79) were followed.

Social Commitment Device

Out of 1000 contracts, 612 people (61%) chose to proceed their goal alone, whereas 388 people (39%) asked their friends to be a judge. Only 160 users (16%) out of the total users chose to invite supporters for their commitment and the remaining 840 users (84%) established their goals without a supporter.

Note that the average amount of stake was the lowest in 'Anti-Charity' group. 'Anti -Charity' refers to a list of organizations that support a disputable cause that may be against a user's values or beliefs (e.g., abortion issues and political parties). This reflects people's strong sense of 'loss-aversion' in what they detest [13]. As to a number of users according to amount of stake, almost 65% of the users are concentrated at a stake range in between $10 and $300 USD, indicating people tend to put a small or moderate amount of money than betting a high amount of money for their behavior change (see Figure 2).

RQ2: CHARACTERISTICS OF SUCCESSFUL COMMITMENTS

In this section, we aim to analyze how successful were users in their contracts with a commitment device. To gauge each user's performance, we defined success rate as *Successful Weeks* which is the number of goal accomplished weeks divided by *Total weeks Elapsed from the start of the contract* (see Figure 3).

Financial Commitment Device

With stake vs Without stake

In order to identify the influence of financial commitment on a commitment contract, we compared the average success rate between users that selected stake and users that did not select stake. A t-test result shows that the average success rate of those with stakes was significantly higher than those without stakes, reporting 79.1% and 53.1% respectively ($t=14.06$, $p<.001$).

Conservative Investors vs Adventurous Investors

We compared the difference between groups with a small amount of stake with a higher amount of stake. The stakes people put on their commitments vary from 10 dollars to over 9000 dollars. Our data show that people invested approximately 600 dollars on average on their stakes. We defined users with stakes up to 200 dollars as a group with a small amount, namely '*Conservative Investors*', and users with stakes up to over 9000 dollars (upper 50% of stakes) as '*Adventurous Investors*'. '*Conservative Investors*' had lower average success rate (76%), whereas '*Adventurous Investors'* reported higher average rate (82.3%). This finding is statistically significant as well ($t= -3.5183$, $p<.001$).

Charity vs Anti-Charity vs To a Friend

We also explored how successful were contracts according to the recipient of stakes; Charity, Anti-Charity and To a Friend. The average success rate of each group was reported 82.6%, 78%, and 74.8% respectively. We performed a one-way ANOVA test and the result confirmed its statistical significance ($F=681$, $p<.0005$). It is intriguing to see that people who select "Charity" had highest success rate, assuming that people would be more willing to "slip" if they knew their money will be spent for a good cause.

Social Commitment Device

Self-Referee vs Friend-Referee

To find out if a referee contributes to achieving goals, we compared the average success rate between him/herself as a referee and users who invited friends as a referee. The average success rate as a self-referee was 68.7%, whereas contracts with a friend-referee resulted in the average success rate of 74.2%. This shows a significant difference in having a friend as a referee ($t=3.1720$, $p<.0005$).

With supporter vs Without Supporter

To determine the influence of a social support on the success rate, we further investigated the average success rate in two conditions: with supporter and without supporter. The average success rate from two groups was 73.8% and 70.2% respectively, with supporter group slightly higher than its counterpart. However, no significant difference between two groups was found ($t=1.97$, $p=0.1093$).

DISCUSSION

With our findings from the study, we make the following recommendations for future research.

- *Develop persuasive social support and commitment*: The study revealed that social commitment device has a relatively lesser impact on behavior change when used together with financial commitment device. This finding is contrary to prior studies in a sense that social support is widely known to be effective in behavior change [12, 17]. Thus, developing social commitment devices that enable user interactions in a multifaceted manner is required. StickK currently only provides a referee and a supporter as social commitment device, which respectively functions as reputational commitment and emotional supporter. In health communication, however, offering instrumental support that explains why and how to achieve recommended behavior have been considered as a successful strategy (e.g., smoke cessation [1], motivating physical activity [9]). Engineering social commitment device to provide timely, informational, and emotional feedback will be an appealing method of designing a persuasive user interface, ultimately offsetting the dominant impact of financial commitment device.
- *Apply commitment device to IT-based artifacts*: Through the study, we have demonstrated the efficacy of commitment device on behavior change. As people often set health related goals with varying devices that implement mobile, wearable, and IoT technologies, instilling the concept of commitment device into such devices and demonstrating its validity and reliability seems worth exploring. Studies have shown that multi-modal and interactive nature of technology-mediated intervention creates more engaging experience and increases one's capability [1, 6, 11, 23]. As such use of intervention tools (mobile, wearable, and IoT technologies) provides opportunities for designing novel intelligent positive computing services that address physical health and mental wellness issues, it will change the current landscape of healthcare and well-being [10].

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