Anticarrots, and the Power of Sunk Opportunity Costs:
A Field-Experiment at an Amsterdam Gym[*]

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[Please Do Not Cite or Circulate]

Abstract: This experiment suggests that sunk opportunity costs can causally affect behavior. New student subscribers to a University of Amsterdam gym were randomly assigned to one of three groups. The control group was merely asked to assess their level of satisfaction. The two other "temptation" groups were made one-time financial offers to quit the gym before being asked to assess their level of satisfaction. The "Money-Back Temptation" and "Bonus Temptation" groups were given one-time offers to quit the gym in exchange for receiving, respectively, 100% and 110% of their subscription payments (before being asked to assess their level of satisfaction). None of the temptation group subjects accepted the temptation. Initial analysis suggests that members of the "Bonus Temptation" group were more likely to visit the gym and had higher post-treatment grades.

INTRODUCTION

One of the most famous exemplars of heroic persuasion in theater is King Henry's St. Crispin's Day speech in Shakespeare's *Henry V*. Generations of students learn the lines ("We happy few. We band of brothers.") and analyze how Henry encourages his soldiers to envision a future when they will proudly look back on this day of honor. But less emphasized is how the King's exhortation begins with a perverse financial incentive. When he overhears a lieutenant bemoaning the fact that the English troops are outnumbered 5 to 1, Henry counters:

> Do not wish one more [solider]!
> Rather proclaim it, Westmoreland, through my host
> That he which hath no stomach to this fight,
> Let him depart. His passport shall be made,
> And crowns for convoy put into his purse.

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Instead of threatening deserters with execution, Henry offers his soldiers safe passage and money to boot if only they will leave. Instead of using the traditional carrot of a reward if you stay, Henry dangles what might be called an anti-carrot, a financial incentive ("crowns for convoy") to quit.

Henry explains that he would not want to die in the company of any man that would accept such an offer. This explanation, on its face, sounds like a response to what economists would call the problem of adverse selection. Henry only wants to die in company of a certain type of soldier. But this explanation would only work if some soldiers took him up on the offer. No one does.

A more satisfying explanation is that the offer helped steel his soldiers' resolve. Each soldier by resisting Henry's temptation learned something about themselves. They learned that they were not the kind of person who would quit and run for a few crowns. By offering money to quit before battle, Henry may have reduced the chance that they would quit during battle. Resisting the temptation might have played a role in creating Henry's band of brothers.

The Internet shoe behemoth, Zappos, may not realize it, but for years it has been emulating the St. Crispin's Day incentive. After initial training, new employees are made offered money to quit. New employees are ushered into a room and made a one-time offer to end their employment in exchange for $2,000. Most employers are trying to reduce turnover, but Zappos offers employees to walk away their jobs more quickly. Like Henry, the leader of Zappos has defended the policy as making sure that the company employs only people who really want to work there. But the deeper explanation might again be the power of resisted temptation. Almost everyone turns down the initial offer to quit, and once you turn down the money, you'd feel like a fool to quit a month later for nothing. So perversely, offering employees/soldiers money to quit, may keep them on the job longer.

It is a scary offer for an employer to make. If many of Henry's soldiers had accepted the offer, Henry would have died at Agincourt. If Zappos employees take the bribe, Zappos would lose a bundle. It's therefore not surprising that a decade ago when Zappos first started tempting new recruits to quit, they only offered $200. Only after learning that the vast majority resisted the $200 offer did Zappos start raising the size of the temptation. Fast forward to today and new employees are currently offered $5000 to quit (still with exceedingly few takers). If the fictional Henry had known what Zappos knows now, he might have offered his happy few even more money.

This article explores the power of resisted temptation in a field experiment at an Amsterdam gym. 350 new users are randomly assigned to one of three groups – two of which were offered varying one-time temptations to quit the gym. None of the tempted users accept the offered temptation. We find evidence that users receiving a bonus temptation of 110% of their initial subscription were more likely to go to the gym and had higher post treatment grades than a control group of subjects.

The remainder of this paper is divided into three parts. Part I sets out our theory of anti-carrots and anti-stick, and relates this theory to prior literatures. Part II describes our experimental design, and Part III our result. We should emphasize that we prepared this conference paper in a rush and that our results are very much still in progress.

II. Theory

[This section will lay out distinct mechanism by which resisted temptation might operate and link those theories to prior literature. Layout alternative mechanisms by which resisted temptation treatment might operate including as screening/signaling mechanism, versus as mechanism by which subjects learn about themselves versus establish "self-reputation." Bénabou and Tirole (2004) map a theoretical framework for "willpower activities" like resisting temptation. They hypothesize that resisting temptation is "hard" information that even people with imperfect recall about their state of mind—for example, being committed to going to the gym—can use to build an enduring image of themselves.[3] Acting in conformity with this image reduces cognitive dissonance.]

[Relate to literature on willpower training theory of temptation (Roy Baumeister) and distinguish implications from the learning/self-signaling theory of temptations described above.]

[Discuss Angrist, Imbens and Rubens (1996) and possible failure of monotonicity assumption – existence of both compliers and defiers.]

[Relate to sunk cost literature: Several behavioral studies have established how sunk costs influence people's behavior. But this is the first study testing whether sunk opportunity costs impact behavior. Subjects who give up the opportunity to receive money have incurred an opportunity cost – which we find has an impact on future behavior even though the opportunity cost incurred is sunk. Thus, we provide evidence of behavioral impacts notwithstanding that rational decision makers would not fall prey to what by analogy be termed the "sunk opportunity cost fallacy."]

[Relate to habit-formation literature: studies have shown the short-term effects of financial incentives of heathy activities, such as going to the gym, but have also documented that such effects are likely to disappear as soon as the program stops. Commitment contracts have been shown to sustain the effects of the program beyond the short-term (Royer, Stehr and Sydnor 2015).[4] Our study uses a one-off 15-second intervention with effects months later.

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[3] Roland Bénabou and Jean Tirole. "Willpower and Personal Rules." Journal of Political Economy, 2004. Pp. 848-886.

[4] Heather Royer, Mark Stehr, and Justin Sydnor. "Incentives, Commitments, and Habit Formation in Exercise: Evidence from a Field Experiment with Workers at a Fortune-500 Company." *American Economic Journal: Applied Economics*, 2015, 7(3): 51–84.

Anti-carrots and Anti-sticks as Resistance Incentives.

The potential power of resisted temptation comes from subjects resisting a facial incentive. This paper's core experiment concerns an "anti-carrot" incentive, which tests whether resisting a contingent reward can induce the opposite behavior. The refund offers superficially give a carrot incentive to do the opposite of what the mechanism designer wants. On their face the refund offer incentivizes quitting the gym, but the designer hopes that by inducing resistance subjects will not only not quit but go to the gym more often.

The evidence of anti-carrot effects, which we detail below, suggests the possibility that what might be called "anti-stick" incentives might also be effective in changing behavior. Anti-sticks like anti-carrots would give a superficial incentive to do the opposite of what the mechanism designer wants. And anti-sticks like anti-carrots would have this effect by inducing subject resistance to this superficial incentive.

For example, imagine that a new gym user confronted unexpectedly unpleasant weather in the first week of gym membership that made it more difficult to travel to the gym. The unpleasant weather would on its face be a short-term deterrent to using the gym – and hence relative to expectation a stick-like disincentive for gym use. However, if the subject resists this incentive and nonetheless goes to the gym, then it is possible that the user will be more likely to continue to go to the gym in the future when the weather disincentive is taken away. As with the anti-carrot refund offers, the anti-stick weather disincentives give the users an opportunity to learn something about themselves and establish a self-reputation that might make it easier for them to continue gym use in the future. Incurring the sunk cost of traveling to the gym during unpleasant weather might induce impact subject willingness to go to the gym in the future. In future drafts, we hope to test this effect by investigating whether new subscribers who experience unexpected inclement weather during the first week of their subscription are more likely than other subscribers to continue using the gym.

Hazing rituals of fraternities may also have this anti-stick quality. Fraternities may artificially increase the difficulty of joining so that once you've endured the pain of hazing (resisted the disincentive to join), you are less likely to quit the fraternity. Anti-sticks get some of their power from sunk-cost fallacy. They are another circumstance where sunk costs do matter. A new fraternity member might feel silly if he went through all the hazing and then quit a month later.

The possibility of anti-carrot and anti-stick incentives accordingly creates a four-fold typology of incentives. As shown in Table 1, there are not only traditional and carrots and sticks where the incentive's goal is to induce subject compliance with the contingent-reward or punishment, but also two resistance incentives where the incentives' goal is to induce subject defiance of a disincentive:

Table 1: 4-Fold Typology of Compliance and Defiance Incentives

		Incentive Goal	
		Compliance Incentives	Defiance Disincentives
Baseline Incentive	Rewards	Carrot	Anti-Carrot
	Punishments	Stick	Anti-Stick

The diagonal incentives in the tables have similarities with regard to imposition of the incentive: Anti-carrots are like sticks in that if they are effective, the incentive does not need to be imposed. The subject that resists the anti-carrot turns down the offer so the refund does not need to be paid; and the subject that complies with the stick's conditional punishment is deterred so that the punishment does not need to be imposed. The alternative diagonal requires imposition of the incentive to be effective. Anti-sticks are like carrots in that if they work, the incentive does need to be imposed. With anti-sticks, it is the one-time imposition of the stick that makes the person more likely to keep going in the future.

Anti-carrots and anti-sticks will tend to be more effective "early on" when the subject has less independent information about the behavior. Fraternity frazing as an anti-stick and Zappos offers to quit are applied to new group members who are trying to determine their level of commitment.

II. EXPERIMENTAL DESIGN

The study was conducted at the Sportcentrum Universtum, or University Sports Center (USC), a gym affiliated with the University of Amsterdam and located in Amsterdam Science Park. Subjects of the study were new subscribers to the USC whose subscription contract including a provision consent to participate in the study. Subjects had either had no previous subscription or had no more than a "promotional" subscription of one month. In addition, to qualify for the study, subjects had to visit the gym a second time within one week after subscribing. The rationale for these qualifications was to identify new gym members whose commitment level is still malleable and subject to updating based on new information about themselves and who had sufficient immediate investment in their subscription that they were less likely to accept a temptation to quit the gym. The second visit within a week requirement was also designed to limit the number of "quits" by tempting them at the beginning of their membership while they were still excited about their new commitment and when they were ready to enter the gym prepared to work out, workout bag in hand.

As a new subject attempted to enter the gym (on her second visit within a week after subscription) by placing her thumb on an electronic thumb-print reader at the main entry gate, a screen on the electronic gate would direct the subject to computer kiosk located approximately 10 meters away from the main entry gate. At the computer kiosk, the

subject would be shown a screen calling for them to choose Dutch or English as their preferred language.[5]

Subjects were randomly assigned to one of three groups: two treatment groups or a control group. Randomization was implemented with blocking by subscription type. The subjects in the three different groups then were one of three different screens.

"Bonus Temptation" subjects were told they had been randomly selected to receive a one-time offer to cancel their membership in return for a refund of "the entire sum you paid plus an additional 10%." This treatment screen emphasized that to receive the refund they must act now and also explained that if a subscriber chose a refund that she would be prohibited from buying another membership in the next three months.

[Figure 1 about here]

"Money Back Temptation" subjects received a similar one-time offer, but the refund was limited to "the entire sum you paid."

[Figure 2 about here]

Control group subjects were presented with identical greeting and ending sentiments. The control group treatment screen, however, simply acknowledging their second visit and expressed that the gym wanted "to make sure that you are satisfied with your membership."

[Figure 3 about here]
Subjects in either of the temptation groups that clicked on "I want to cancel my subscription and receive my refund" were then shown a screen soliciting their satisfaction with the gym (on an integer scale from 1 through 9) and directing them to the reception desk to collect their refund was presented.

[Figure 4 about here]

Subjects in either of the temptation groups who turned down the temptation offer and all of the control group subjects were shown a screen soliciting their satisfaction.

[Figure 5 about here].

The computer kiosk and electronic gates were programmed so that qualifying subjects had to complete the kiosk tasks (including indicating a level of satisfaction) before receiving a refund or being able to enter the main gate.

III. RESULTS

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[5] Screenshots of the language preference screen and all Dutch screens can be found in the online appendix.

A. Blocking and Balance

Table 2 shows how the study's 350 subjects were distributed across the Bonus Temptation (BT), Money Back Temptation (MBT) and Control groups and shows that blocking by subscription type was successfully implemented.

[Table 2 about here].

The subjects were treated between Sept. 5, 2015 and June 30, 2016.[6] New members register at this University gym at different times of the academic year, which we've categorized in Figure 6 into four different waves:

[Figure 6 about here].

Table 3 provides descriptive statistics on pre-treatment characteristics of our subjects. Subjects were primarily (76%) students at the University of Amsterdam (UvA), although the subject pool also included a few university employees (1%) and students at Vrije University (VU – 9%) and Hogeschool van Amsterdam (HvA – 12%), the Amsterdam University of Applied Sciences. 49% of subjects were female and 39% were born in the Netherlands. We also had access to grade information on 235 subjects who were students at UvA (of whom 171 had pre-treatment grades and 211 had post-treatment grades), and found that on a 10-point grading scale that the average pretreatment grade of these subjects was 6.22.

[Table 3 about here].

Regressions of these pretreatment variables on the treatment dummies suggest that randomization was successful in balancing. Table 4 shows that of the 66 regressions with 132 treatment coefficients (BT and MBT in each regression) that only 0.76% of treatment coefficients (1 instance) were significant at $p < 0.01$, only 1.51% of treatment coefficients (2 instances) were significant at $p < 0.05$ and that only 3.03% of treatment coefficients (4 instances) were significant at $p < 0.10$.[7]

[Table 4 about here]

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[6] We are continuing to include new subjects and have added two additional treatments – offering 120% and 150% refunds.

[7] The 4 instances of imbalance were:
- (6) BT + coefficient $p < 0.10$ on gap_visits (# of visits between blocking and treatment)
- (46) BT - coefficient $p < 0.05$ on birth_1994 (Whether or not the subject was born in 1994)
- (54) MBT + coefficient $p < 0.01$ on uni_SHvA (Hogeschool van Amsterdam)
- (55) MBT - coefficient $p < 0.10$ on uni_SUvA (University of Amsterdam)

B. Treatment Effects

A test of resisted temptation would not be possible if subjects failed to resist. It would still be possible to conduct intent to treat analysis on temptation groups (for example, by attributing 0 post-treatment visits to all subjects with cancelled memberships). But as intended, all of the subjects studied resisted the temptation, declining our refund offer.

Table 5 shows the descriptive statistics on our core outcomes:

[Table 5 about here]

On a 9 point scale, subjects in each group reported mean satisfaction above 7.3 (with the MBT clocking in with the highest average, 7.42). On all other gym related behaviors, the table shows mean gym usage and resubscribing is positively correlated, as our theory suggested, with the size of the group's temptation –with BT group showing higher means than those of the MBT group which in turn were higher than those of the control group. For example, the BT group visited the gym on average .99 times per week post treatment, while the MBT and control groups on average visited, respectively, .95 and .86 times. 29% of the BT group purchased a new subscription post treatment, while only 25% and 21% of MBT and control group members purchased a new subscription. BT group members on average spent 20.5 Euros on these new subscriptions while, MBT and control group members spent respectively 15.9 and 13.4 Euros. Table 5 shows a similar pattern with regard to post-treatment grades for the UvA students for whom we have exam information. BT group members earned (on a ten-point scale) an average grade of 6.66, while MBT and control group members earned on average grades of 6.34 and 5.98, respectively.

Table 6 reports our core tests of treatment effects where we regress outcome variables on treatment effects and include fixed effects for the initial subscription type on which we blocked. Our regressions weight our subjects by the number of weeks they participated in the study. Using Seemingly Unrelated Regressions for our three non-graded outcomes for the full set of 350 subjects,[8] we find marginally significant ($p = 6.7\%$) that BT group members were more likely to visit the gym than control group members who did not receive a temptation treatment. In specification (1), the predicted BT average weekly visit is 17.7% greater than the predicted control weekly visit average (which represents an increase of 2.24 standard errors in the control group's weekly visit average. Specifications (4) and (7) show similarly that BT group members are (109%) more likely to make a post-treatment subscription purchase and have (8.89 euros) higher post-treatment spending than control group members, and that these treatment effects are significant and marginally significant ($p = 4.1\%$ and 6.3%, respectively).

[Table 6 about here]

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[8] OLS specifications with robust standard errors found similar patterns of sign, size and significance.

Specification (10) reports that the average post-treatment grades of the BT group were .725 points higher than those of the control group – which represents an increase of .82 standard errors in the average g.p.a. of control group members. This treatment effect on grades is estimated as statistically significant (p. = 1.9%), but caution is appropriate in interpreting the causal effect of our one-time, 15 second intervention on examination grades coming often months later. This is especially true because the intervening treatment effects on gym usage are only marginally statistically significant.

Figure 7 further explores the causal effect of treatment on gym usage by reporting the results of analogous regressions where the outcomes were the number of subject visits in particular weeks. Panel A reports the predicted week by week gym usage for BT and control subjects for subject who had been in the experiment 16 weeks or longer. For these 279 subjects, 4 weeks (weeks 5, 6, 10, and 11) exhibited statistically significant (p. < .05) increased elevated BT gym usage relative to the control group and 7 weeks (weeks 4-7, 10-11, and 13) with marginally significant (p. < .1) elevated BT usage.

[Figure 7 about here]

Again caution is in order in interpreting these results. One might have expected the strongest treatment effect immediately after the treatment and then seeing diminishing treatment effects across time. Then again, it is possible that new gym members had sufficient enthusiasm in first few weeks to come irrespective of treatment so that treatment effects only became observable after the initial blush of enthusiasm waned.

C. Heterogeneous Treatment Effects

Table 6 and Figure 7 also explored whether the new and promotion users might exhibit disparate treatment effects. New users might exhibit stronger treatment effects because these subjects' self-learning would represent a larger proportion of their gym related knowledge relative to promotional users who had previously visited the gym on a promotion subscription. On the other hand, promotional users might be less committed to using the gym than new users (who were willing to immediately commit to a longer-lived subscription), and hence promotional users might benefit more from learning that they can resist temptation.

We found substantially stronger treatment effects with regard to promotion users. Specification (3) of Table 6 shows that among subjects with previous promotion subscriptions that BT group members visited the gym .36 times per week more than control group members and that this difference is statistically significant (p. = 0.5%) in the Seemingly Unrelated Regressions. Specification (6) shows analogously among promotion group members a statistically (p. = 0.6%) elevated proportion purchasing a subscription post-treatment for BT members relative to control group members (although specification (9) indicates that the increase in euros has only marginal significance (p. = 7.8%)). Specifications (11) and (12) suggest that the overall statistical increase in post-treatment grades comes from the promotion users who display a 1.2 point grade BT treatment effect.

Panels (B) and (C) to Figure 7 analogously report markedly differences between new and promotional users in their predicted week by week gym users. None of the new user weekly treatment effects are even marginally significant, while for the promotional users 7 of 16 weekly treatment effects are statistically significant at at least the 5% level (weeks 4-7, 10-11, and 14).

Finally, Table 7 tests for heterogeneous treatment effects with regard to sex, age, national origin and the length of the treatment gap. The table reports substantially BT treatment effects for women than for men. In regressions with uninteracted and interacted controls for gender, we find that BT group women are statistically (p. < .05) more likely than control group women to visit the gym, to spend more on a post-treatment subscription, and to earn higher grades.

In an analogous regression concerning national origin, the table reports more significant treatment effects for native (Dutch-born) subject than non-native subjects. We find that BT native-born subjects are statistically (p. < .05) more likely than control native-born subjects to visit the gym and to earn higher grades.

With regard to age, we find that the BT treatment seems to operate more through older students. In regressions with uninteracted and interacted controls for whether a subject was older than the median age of 23, we find that older BT group subjects are statistically (p. < .05) more likely than older control group to earn higher grades.

Finally, we explored whether the length of treatment gaps was associated with the size of the treatment effect. Subjects varied in how long they waited before return to the gym for their second visit. Some new subscribers visited the gym a second time the very next day after subscribing, while other waited a full week before returning for a second visit. We used the length of this gap between initial purchase and returning for a second time (when treatment occurred) as a proxy for the subject's likely initial enthusiasm. Table 7 suggests that subjects with a shorter treatment gap (with greater initial enthusiasm) displayed greater BT treatment effects with regard to average weekly visits while subjects with longer treatment gaps (i.e., with lower posited initial enthusiasm) displayed greater BT treatment effects with regard to post-treatment grades.

CONCLUSION

[forthcoming]

Figure 1: Screenshot of Bonus Temptation Treatment, First Screen (English)

Dear [First Name],

Thank you for using your USC membership.

Our records indicate that this is your second visit, and we want to make sure that you are satisfied with your membership. You have been randomly selected to receive a one-time offer. If you act now, we will cancel your membership and we will refund to you the entire sum you paid plus an additional 10%. If you choose to cancel, you will be prohibited from buying another USC membership in the next 3 months. Again, we emphasize that to receive this refund, you must act now.

We hope that you enjoyed your first visit, and that you will remain a member of the USC community.

I want to keep my subscription

I want to cancel my subscription and receive the refund

Figure 2: Screenshot of Money Back Temptation Treatment, First Screen (English)

Dear [First Name],

Thank you for using your USC membership.

Our records indicate that this is your second visit, and we want to make sure that you are satisfied with your membership. You have been randomly selected to receive a one-time offer. If you act now, we will cancel your membership and we will refund to you the entire sum you paid. If you choose to cancel, you will be prohibited from buying another USC membership in the next 3 months. Again, we emphasize that to receive this refund, you must act now.

We hope that you enjoyed your first visit, and that you will remain a member of the USC community.

I want to keep my subscription

I want to cancel my subscription and receive the refund

Figure 3: Screenshot of Control, First Screen (English)

Dear [First Name],

Thank you for using your USC membership.

Our records indicate that this is your second visit, and we want to make sure that you are satisfied with your membership.

We hope that you enjoyed your first visit, and that you will remain a member of the USC community.

Continue
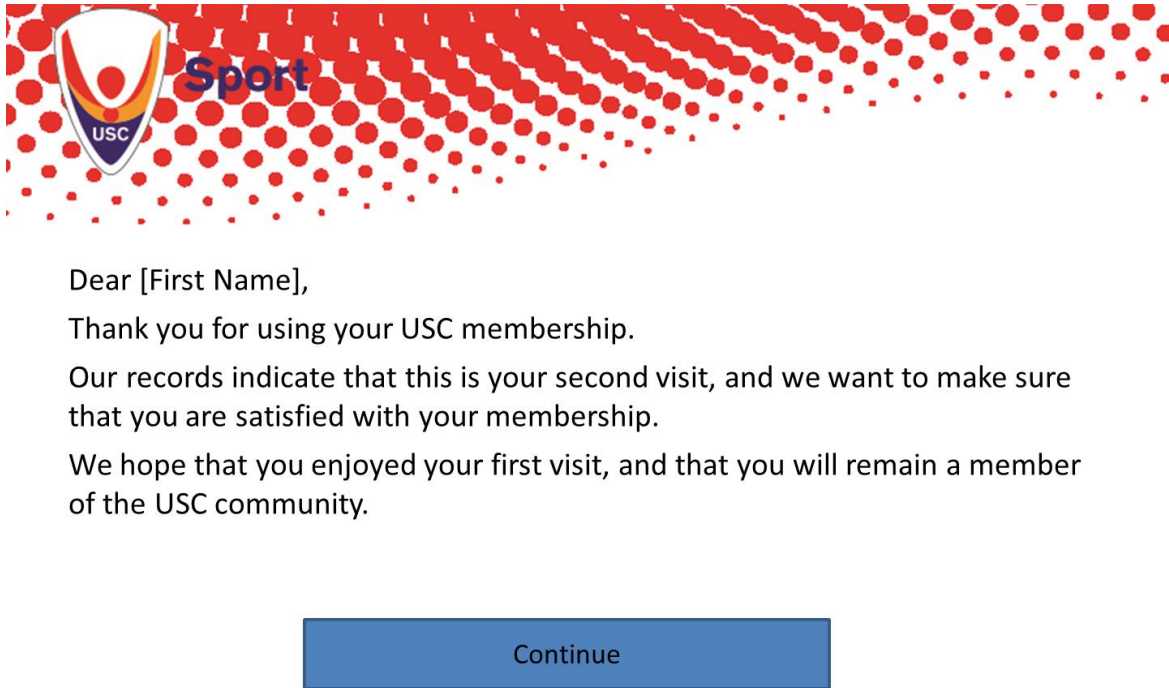
Figure 4: Second Screen, if not keeping subscription (English)

Please rate your satisfaction with USC:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| low | | | | | | | | high |

Thank you,
please go to the desk to collect your refund.
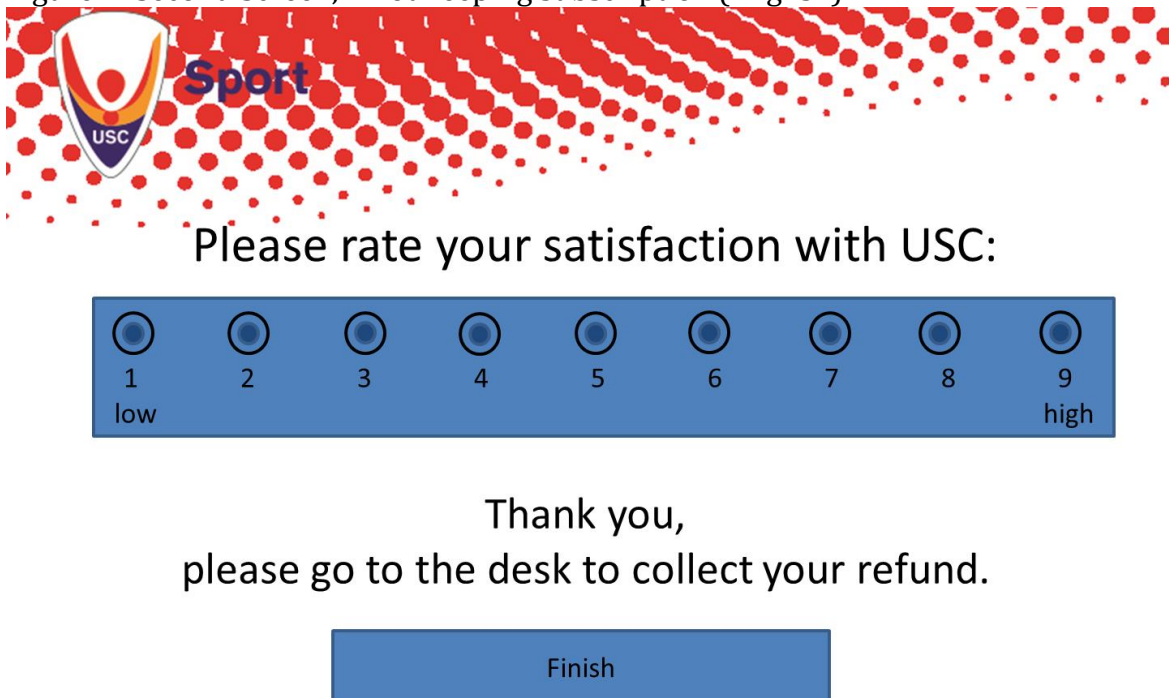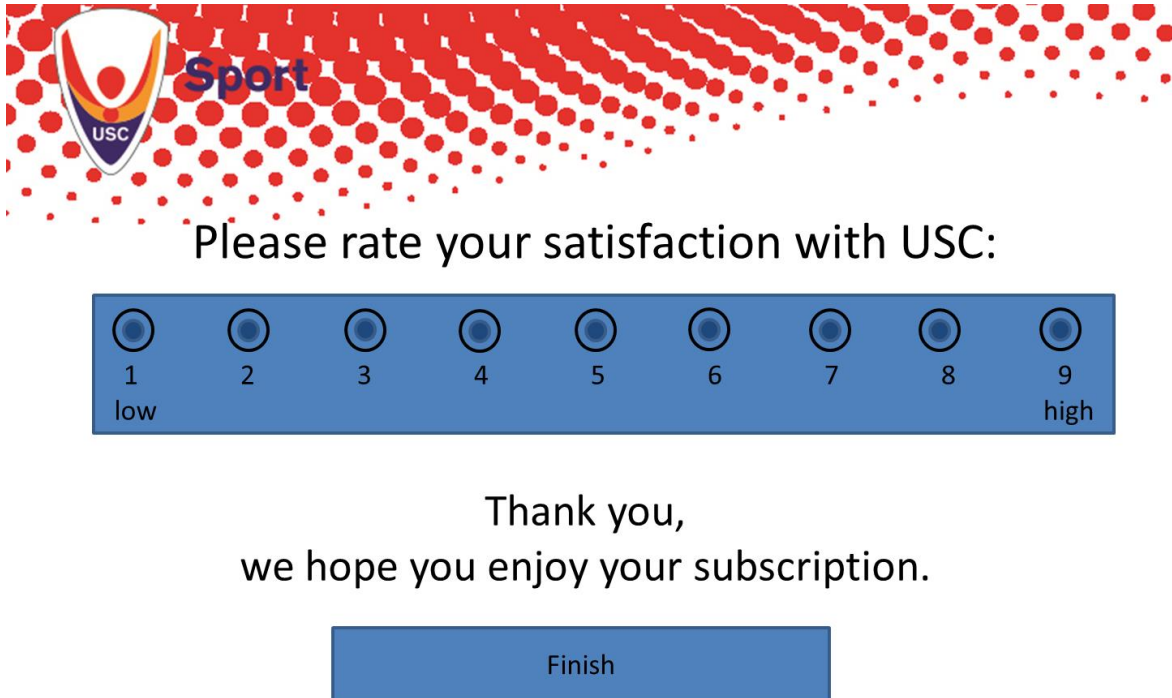
Finish

Figure 5: Screenshot of Second Screen, if keeping subscription (English)

Please rate your satisfaction with USC:

1	2	3	4	5	6	7	8	9
low								high

Thank you,
we hope you enjoy your subscription.

Finish

Figure 6: Analysis of Waves
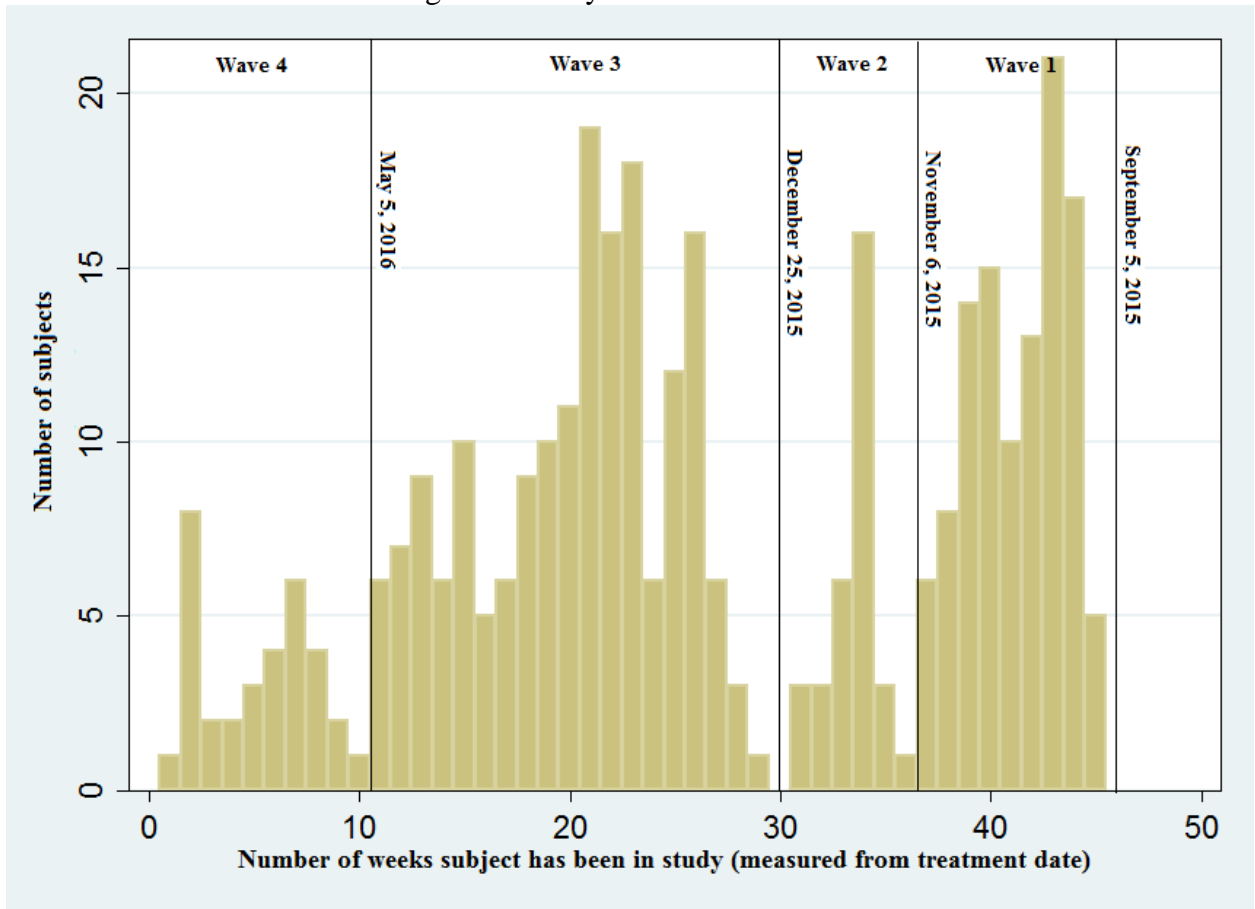
Note: The histogram below shows the number of people that were treated in each week in the weeks before the last observation in the dataset. There are four distinguishable "waves" – 1-10 weeks in study, 11-29 weeks in study, 30-37 weeks in study, and 37-45 weeks in study.

Figure 7: (with BT for 16)
Panel A: All Users, First 16 Weeks, Only those who have been in the study for 10 weeks or longer
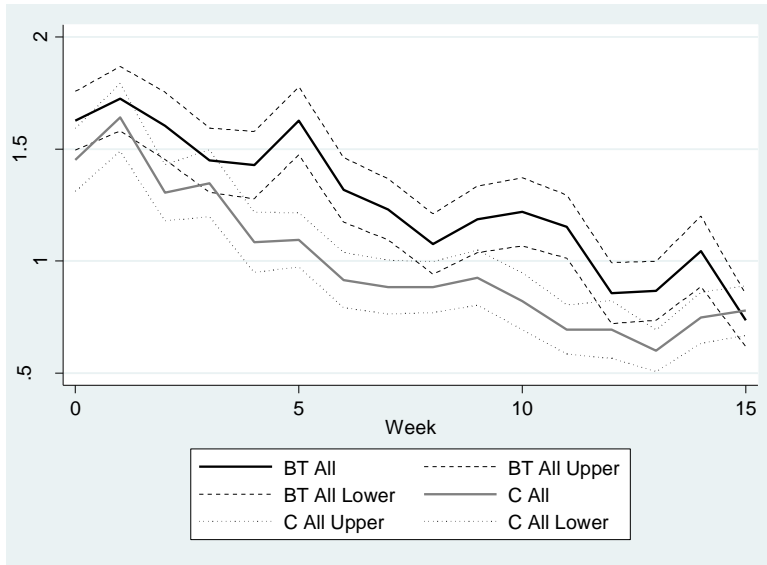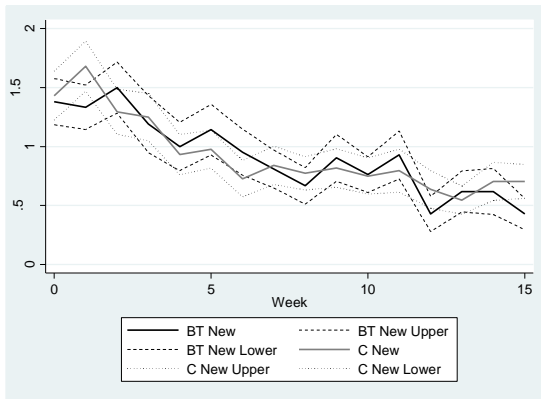
Panel B: New Users   Panel C: Promotional Users

Table 1: 4-Fold Typology of Compliance and Defiance Incentives

		Incentive Goal	
		Compliance Incentives	Defiance Disincentives
Baseline Incentive	Rewards	Carrot	Anti-Carrot
	Punishments	Stick	Anti-Stick

Table 2: Blocking Analysis

```
             (firstnm)
subscription_type_at_                 (firstnm) group
           treatment  |  Bonus T..   Control  Money B..  |    Total
----------------------+------------------------------------+----------
1 Maand Fitness Ope.. |       9        10         9       |       28
    Fitness / 10x 18+ |       2         2         2       |        6
    Fitness / 25x 18+ |       2         2         2       |        6
 Fitness / halfjaar.. |      11        11        10       |       32
  Fitness / jaar 18 + |      50        51        51       |      152
 Fitness / kwartaal.. |      17        17        18       |       52
   Fitness / maand 18+|      21        21        21       |       63
   Fitness ZOMER 18+  |       2         2         3       |        7
Fitness daluren / k.. |       2         1         1       |        4
----------------------+------------------------------------+----------
               Total  |     116       117       117       |      350
```

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Table 3: Descriptive Statistics of Pretreatment Variables

Pretreatment Variable	BT	MBT	C	All
N	116	117	117	350
Post-treatment weeks included in study	26.88	26.85	27.26	27.00
Pre-treatment weeks included in study	1.79	2.07	1.87	1.91
Average weekly visits pre-treatment	1.77	1.54	1.70	1.67
Total visits pre-treatment	3.58	3.37	3.43	3.46
Total visits before blocking	1.49	1.47	1.57	1.51
Number of visits between blocking and treatment	2.10	1.91	1.87	1.96
Subject treated within one week of blocking	0.75	0.68	0.73	0.72
Did not visit the gym before blocking	0.43	0.44	0.41	0.43
Number of days between blocking and treatment	5.88	5.71	5.26	5.61
Age	22.54	22.40	22.58	22.51
Age unknown	0.09	0.09	0.11	0.10
Female	0.47	0.47	0.54	0.49
Born outside the Netherlands	0.28	0.30	0.31	0.30
Birthplace unknown	0.29	0.29	0.37	0.32
Born in the Netherlands	0.42	0.41	0.32	0.39
University Employee	0.02	0.00	0.00	0.01
Student at Hogeschool van Amsterdam	0.09	0.20	0.08	0.12
Student at Universiteit van Amsterdam	0.81	0.68	0.79	0.76
Student at Vrije Universiteit	0.07	0.09	0.11	0.09
Student at other institution	0.02	0.04	0.02	0.03
Other institutional affiliation	0.00	0.00	0.01	0.00

Pretreatment Grades Variables	BT	MBT	C	All
N	60	56	55	171
Average exam grade pre-treatment	6.27	6.10	6.28	6.22
Number of pre-treatment exams with recorded grades	26.56	27.66	32.19	28.70
Number of pre-treatment exams with missing grades	29.40	27.63	32.58	29.81
Within-student variance of pre-treatment exam grades	2.91	3.25	3.62	3.25

Table 4: Test of Balance with LHS Pre-treatment Regressors

	VARIABLES	N	BT		MBT		Constant		R-squared
(1)	post_treatment_weeks	350	-0.383	(0.811)	-0.413	(0.798)	27.262***	(0.000)	0.000
(2)	pre_treatment_weeks	350	-0.077	(0.725)	0.201	(0.382)	1.866***	(0.000)	0.005
(3)	avg_pre_weekly_visits	350	0.077	(0.490)	-0.157	(0.115)	1.698***	(0.000)	0.015
(4)	total_pre	350	0.150	(0.487)	-0.060	(0.772)	3.427***	(0.000)	0.003
(5)	preblocking_visits	350	-0.081	(0.657)	-0.103	(0.591)	1.573***	(0.000)	0.001
(6)	gap_visits	350	0.232*	(0.082)	0.043	(0.655)	1.872***	(0.000)	0.011
(7)	treatment_within_week	350	0.024	(0.685)	-0.043	(0.475)	0.726***	(0.000)	0.004
(8)	newuser	350	0.021	(0.749)	0.034	(0.599)	0.410***	(0.000)	0.001
(9)	treatment_gap	350	0.626	(0.385)	0.447	(0.404)	5.258***	(0.000)	0.003
(10)	stat_Fitness_jaar	350	-0.005	(0.941)	-0.000	(1.000)	0.436***	(0.000)	0.000
(11)	stat_Fitness_maand	350	0.002	(0.976)	-0.000	(1.000)	0.179***	(0.000)	0.000
(12)	stat_Fitness_kwartaal	350	0.001	(0.979)	0.009	(0.855)	0.145***	(0.000)	0.000
(13)	stat_Fitness_10x	350	0.000	(0.993)	-0.000	(1.000)	0.017	(0.156)	0.000
(14)	stat_Fitness_halfjaar	350	0.001	(0.983)	-0.009	(0.820)	0.094***	(0.001)	0.000
(15)	stat_1_Maand_F_OpenDag	350	-0.008	(0.827)	-0.009	(0.812)	0.085***	(0.001)	0.000
(16)	stat_F_daluren_kwartaal	350	0.009	(0.558)	-0.000	(1.000)	0.009	(0.318)	0.001
(17)	stat_Fitness_25x	350	0.000	(0.993)	0.000	(1.000)	0.017	(0.156)	0.000
(18)	stat_Fitness_ZOMER	350	0.000	(0.993)	0.009	(0.653)	0.017	(0.156)	0.001
(19)	est_PROEFABONNEMENT	350	-0.021	(0.749)	-0.026	(0.693)	0.590***	(0.000)	0.001
(20)	est_Fitness_jaar	350	-0.024	(0.636)	0.026	(0.631)	0.197***	(0.000)	0.003
(21)	est_Fitness_maand	350	0.009	(0.764)	0.017	(0.583)	0.051**	(0.013)	0.001
(22)	est_Fitness_kwartaal	350	-0.008	(0.745)	-0.000	(1.000)	0.043**	(0.023)	0.000
(23)	est_Fitness_10x	350	0.009	(0.318)	0.009	(0.318)	0.000	(.)	0.003
(24)	est_Fitness_halfjaar	350	0.009	(0.748)	-0.009	(0.735)	0.043**	(0.023)	0.001
(25)	est_1_Maand_F_OpenDag	350	0.009	(0.764)	-0.009	(0.759)	0.051**	(0.013)	0.001
(26)	est_Fitness_ZOMER	350	0.000	(0.995)	0.000	(1.000)	0.009	(0.318)	0.000
(27)	firstvisit_dow0	350	0.009	(0.748)	0.051	(0.121)	0.043**	(0.023)	0.009
(28)	firstvisit_dow1	350	-0.058	(0.311)	-0.026	(0.660)	0.282***	(0.000)	0.003
(29)	firstvisit_dow2	350	-0.050	(0.291)	0.017	(0.739)	0.179***	(0.000)	0.006
(30)	firstvisit_dow3	350	0.019	(0.715)	-0.034	(0.480)	0.179***	(0.000)	0.003
(31)	firstvisit_dow4	350	0.070	(0.140)	0.026	(0.565)	0.120***	(0.000)	0.006
(32)	firstvisit_dow5	350	0.036	(0.454)	-0.051	(0.213)	0.137***	(0.000)	0.011
(33)	firstvisit_dow6	350	-0.025	(0.363)	0.017	(0.606)	0.060***	(0.007)	0.006
(34)	treatment_dow0	350	0.026	(0.385)	0.034	(0.272)	0.043**	(0.023)	0.004
(35)	treatment_dow1	350	0.019	(0.722)	-0.034	(0.498)	0.197***	(0.000)	0.003
(36)	treatment_dow2	350	-0.024	(0.621)	0.043	(0.416)	0.179***	(0.000)	0.005
(37)	treatment_dow3	350	-0.033	(0.517)	0.009	(0.871)	0.197***	(0.000)	0.002
(38)	treatment_dow4	350	0.010	(0.834)	-0.000	(1.000)	0.145***	(0.000)	0.000
(39)	treatment_dow5	350	0.036	(0.478)	-0.043	(0.349)	0.162***	(0.000)	0.008
(40)	treatment_dow6	350	-0.034	(0.278)	-0.009	(0.802)	0.077***	(0.002)	0.003
(41)	birth_pre	350	-0.016	(0.684)	-0.026	(0.512)	0.111***	(0.000)	0.001
(42)	birth_1990	350	0.009	(0.797)	-0.017	(0.606)	0.077***	(0.002)	0.002
(43)	birth_1991	350	0.018	(0.627)	0.060	(0.139)	0.077***	(0.002)	0.007
(44)	birth_1992	350	-0.016	(0.732)	-0.060	(0.166)	0.154***	(0.000)	0.006
(45)	birth_1993	350	0.036	(0.444)	-0.009	(0.844)	0.128***	(0.000)	0.003
(46)	birth_1994	350	-0.102**	(0.023)	0.000	(1.000)	0.188***	(0.000)	0.018
(47)	birth_1995	350	0.036	(0.454)	-0.009	(0.848)	0.137***	(0.000)	0.003

(48)	birth_1996	350	0.018	(0.627)	0.034	(0.372)	0.077***	(0.002)	0.002
(49)	birth_1997	350	0.026	(0.349)	0.034	(0.237)	0.034**	(0.043)	0.004
(50)	birth_1998	350	-0.008	(0.567)	-0.009	(0.563)	0.017	(0.156)	0.001
(51)	land_foreign	350	-0.023	(0.699)	-0.009	(0.887)	0.308***	(0.000)	0.000
(52)	land_native	350	0.098	(0.124)	0.085	(0.176)	0.325***	(0.000)	0.008
(53)	land_missing	350	-0.074	(0.229)	-0.077	(0.212)	0.368***	(0.000)	0.006
(54)	uni_SHvA	350	0.009	(0.797)	0.120***	(0.007)	0.077***	(0.002)	0.028
(55)	uni_SUvA	350	0.024	(0.649)	-0.111*	(0.055)	0.786***	(0.000)	0.019
(56)	uni_SVU	350	-0.042	(0.262)	-0.026	(0.512)	0.111***	(0.000)	0.004
(57)	uni_Sotheruni	350	0.000	(0.993)	0.026	(0.251)	0.017	(0.156)	0.006
(58)	gender_f	350	-0.073	(0.267)	-0.068	(0.297)	0.538***	(0.000)	0.004
(59)	w1_sep5nov5	350	-0.023	(0.703)	0.009	(0.889)	0.316***	(0.000)	0.001
(60)	w2_nov5dec25	350	0.009	(0.810)	-0.017	(0.642)	0.094***	(0.001)	0.001
(61)	w3_dec25may5	350	0.039	(0.557)	0.009	(0.896)	0.487***	(0.000)	0.001
(62)	w4_may5sep5	350	-0.025	(0.507)	0.000	(1.000)	0.103***	(0.000)	0.002
(63)	cijfer_pre	171	-0.009	(0.974)	-0.185	(0.511)	6.281***	(0.000)	0.004
(64)	pre_grades_var	170	-0.716	(0.281)	-0.379	(0.583)	3.624***	(0.000)	0.007
(65)	grades_pre_count	235	-5.628	(0.312)	-4.531	(0.433)	32.189***	(0.000)	0.005
(66)	grades_pre_missing	235	-3.179	(0.353)	-4.948	(0.179)	32.581***	(0.000)	0.009

Note: The table shows balance analysis regressing pre-treatment variables on the treatment dummies BT and MBT.

Table 5: Descriptive Statistics of Core Outcomes

Outcome Variable	BT	MBT	C	All
N	116	117	117	350
Satisfaction (1-9 Scale)	7.33	7.42	7.34	7.36
Average weekly visits post-treatment	0.99	0.95	0.86	0.93
Total visits to the gym post-treatment	27.02	23.37	22.44	24.27
Subject purchased a subscription post-treatment	0.29	0.25	0.21	0.25
Number of purchases made post-treatment	0.58	0.50	0.32	0.47
Total Euros spent post-treatment	20.50	15.85	13.39	16.57

Outcome Grades Variable	BT	MBT	C	All
N	74	68	69	211
Average exam grade post-treatment	6.66	6.34	5.98	6.34
Number of post-treatment exams with recorded grades	11.12	10.20	11.53	10.94
Number of post-treatment exams with missing grades	44.84	45.09	53.24	47.57
Within-student variance of post-treatment exam grades	3.16	3.48	4.25	3.62

Table 6: Treatment Effects on Average Weekly Post-treatment Visits, Whether there was a post-treatment sale, Total post-treatment subscription revenue, and Average subject post treatment grades

VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12
	Average Post-treatment Weekly Visits			Purchased Post-treatment Subscription			Total Post-treatment spending in Euros			Average Grades		
	All	New	Promo	All	New	Promo	All	New	Promo	All	New	Promo
BT	0.175*	-0.051	0.361***	0.110**	0.017	0.200***	8.893*	6.301	12.118*	0.725**	0.145	1.224***
	(0.067)	(0.696)	(0.005)	(0.041)	(0.822)	(0.006)	(0.063)	(0.315)	(0.078)	(0.019)	(0.728)	(0.006)
MBT	0.044	-0.070	0.169	0.026	0.060	0.017	2.328	4.495	1.848	0.424	-0.194	0.965**
	(0.647)	(0.588)	(0.193)	(0.624)	(0.418)	(0.824)	(0.626)	(0.463)	(0.792)	(0.219)	(0.709)	(0.039)
Constant	0.986***	0.888***	1.109***	0.101**	0.066	0.127**	0.815	-0.973	1.728	4.905***	4.688***	5.962***
	(0.000)	(0.000)	(0.000)	(0.022)	(0.268)	(0.038)	(0.834)	(0.844)	(0.764)	(0.000)	(0.000)	(0.000)
BT % Increase	0.177	-0.057	0.326	1.089	0.258	1.575	10.912	-6.476	7.013	0.148	0.031	0.205
BT Increase over constant standard err	2.244	-0.490	3.406	2.500	0.288	3.279	2.286	1.278	2.109	0.823	0.349	1.937
Observations	350	150	200	350	150	200	350	150	200	211	92	119
R-squared	0.080	0.078	0.142	0.104	0.095	0.173	0.162	0.132	0.208	0.040	0.035	0.100

Note: The results for post-treatment weekly visits, post-treatment subscription purchase, and post-treatment spending are from Seemingly Unrelated Regressions with each other. Post-treatment exam grades is standard OLS, due to a difference in the number of observations. All regressions were weighted by number of the subject's post-treatment weeks. New users had no subscriptions prior to their blocking subscription. Promotional users had a promotional subscription prior to their blocking subscription. P-values are displayed in parentheses; Asterisks signify significance as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

TABLE 7: HETEROGENEOUS BT TREATMENT EFFECTS

VARIABLES	Average Post-treatment Weekly visits	Sale (=1, if sale)	Post-treatment Subscription Revenues (Euros)	Post-treatment Grades
Male	-0.048	0.070	-0.704	0.107
Female	0.416***	0.148*	19.067**	1.395***
Native Born	0.301**	0.003	4.362	0.989**
Foreign Born	0.572*	-0.066	-9.664	1.615
age < 23	0.149	0.130	8.449	0.672
age > 23	0.208	0.086	9.476	0.804**
Treatment gap longer than median	0.126	0.140	9.437	1.146***
Treatment gap shorter than median	0.161**	0.085	7.854	0.237

Note: Table reports treatment effects from 4 regressions, which successively included uninteracted and interacted subgroup indicators for subjects being Female, Native Born, Under 23 and having a longer than Median treatment gap.