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To encourage worker productivity offices prohibit Internet use. Consequently, many employees delay Internet activity to the end of the workday. Recent work in social psychology, however, suggests that using willpower to delay gratification can negatively impact performance. We report data from an experiment where subjects in a Willpower Treatment are asked to resist the temptation to join others in watching a humorous video for 10 minutes. In relation to a baseline treatment that does not require willpower, we show that resisting this temptation detrimentally impacts economic productivity on a subsequent task.

Keywords: temptation; willpower; lab experiment.

JEL-codes: C93; D01.

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1 Introduction

The office place is filled with tempting distractions from one's work, including everything from socialization with colleagues to napping. Perhaps the most prominent temptation, however, is the Internet. Indeed, a widely cited survey conducted in 2005 by America Online and Salary.com ranked personal Internet use as the number one way people waste time at work (Salary.com, 2007.)¹ To encourage worker productivity, offices adopt policies prohibiting Internet use during work hours, with some even monitoring employees' Internet activities. As a result, many employees delay gratification and wait until the end of the workday to use the Internet. However, recent work in social psychology suggests that using willpower to delay gratification, whether from the Internet or any of many other temptations, can detrimentally impact performance on subsequent tasks (see, e.g., Vohs and Heatherton, 2000).

Our goal is to understand whether exposure to a prohibited tempting item reduces *work productivity* on a subsequent task. To the best of our knowledge, the relation between temptation and productivity has been addressed only by Bucciol et al (2011) in a field experiment with children. That paper reports data suggesting the productivity of children is reduced after they are exposed to temptation.

2 The experiment

Our experiment was conducted in 3 sessions at the Laboratory for Experimental Economics (LEE) of the University of Copenhagen. In total 61 subjects from different fields of study participated, all recruited using ORSEE (Greiner, 2004). The experiment was programmed using the software *z-tree* (Fischbacher, 2007). On average, subjects spent 75 minutes in the experiment and earned 125 Danish crowns (DKK, about 22 USD).

Each treatment consists of three phases plus a final questionnaire about subjects' backgrounds. In Phase one, subjects perform three counting tasks; in Phase two they have the possibility to watch a funny video; in Phase three they perform ten counting tasks. Subjects in each session are randomly assigned in two treatments: No Willpower Treatment (NWT) and Willpower treatment (WT). The only difference between treatments occurs in Phase 2. In NWT the video starts automatically whereas in WT subjects just see a red button on their screen. They are aware that the video will start if they press the red button, but a text message warns them not to do so. Subjects are not monitored in that no experimenter is visibly present during this phase. The temptation is made salient by ensuring all subjects could hear the sounds of the video.

¹ Time is wasted also by socializing with co-workers and, to a less extent, running errands off-premises, spacing out, making personal phone calls, arriving late or leaving early.

In phases 1 and 3 subjects earn points according to the precision of their answer. Subjects earn 100 points if they report precisely the correct answer, 65 points if the difference between their guess and the correct answer is 1 (either from above or below), 50 if the difference is 2 and 0 points if the difference is bigger than 2. At the end of the experiments points are converted in Danish crowns (DKK): 10 points = 1 DKK. More details about the experiment, instructions and screenshots are available in the online Appendix.

Figure 1 reports the average number of mistakes (measured as the difference between the guess and the correct answer in each task) in the NWT and WT samples, in Phase 1 and in Phase 3. It is clear that mistakes occur more frequently in Phase 1 of the WT than NWT (mean mistakes are 1.40 and 2.013 in WT and NWT, respectively); the reverse is true in Phase 3 (mean mistakes are 1.18 and 0.91 in WT and NWT, respectively).

Table 1 reports statistics describing the composition of our sample.² In the next section, we aim to estimate the effect of temptation on productivity after controlling for subjects' characteristics.

3 Results

Table 2 shows the output of four regression models where the dependent variable is the mistake, measured as the absolute difference between the correct answer and the answer reported in each task by each subject. Positive estimates mean that the subject is more likely to make mistakes. Our benchmark is the panel Poisson model with random effects shown in Column (1). To account for the possibility that participants in WT and NWT may have different mean productivity, we adopt a difference-in-difference strategy. We include three dummy variables: one indicates the treatment to capture any between-treatment differences in "skill", one is the Phase (3 as opposed to 1), to capture any "learning", and one the interaction between the group and the phase, to capture the "temptation effect" of primary interest.

We also include one control variable for task complexity, video difficulty (measured as the ratio between the correct answer and the video length in seconds). In addition, we include controls for age, gender, nationality, field of studies (science or humanities, as opposed to social sciences), number of household members (apart from the subject), and personal budget. All the control variables are also interacted with WT to capture any between-treatment heterogeneity in participants' characteristics.

We find a significant effect of our three key variables:

² Although chosen randomly, the two samples are quite different with respect to some variables such as age and gender (see the last column of Table 1, reporting the Wilcoxon rank-sum test statistic).

- *Skill effect*: The group variable “WT” is negative, suggesting that the WT sample is more skilled than the NWT sample.
- *Learning effect*: The phase variable “Phase 3” is negative, suggesting that learning occurs.
- *Temptation effect*: The interaction variable “WT × Phase 3” is positive. This suggests that, on average, the WT sample is more likely to make mistakes than the NWT sample, after exposure to temptation in Phase 2.

Estimates in Column (1) imply a subject with average characteristics will make 1.93 times the overall average mistakes during Phase 1.³ In contrast, the same individual in Phase 3 would make just 0.43 times the average mistakes if not exposed to temptation, and 1.26 times the average mistakes if exposed to temptation.⁴ Thus, all else equal, mistakes subsequent to temptation exposure occur nearly three times as often in the absence of temptation exposure.

Column (2) reports a pooled Poisson regression model with fixed individual effects.⁵ The results are virtually unchanged from above. Column (3) reports a panel GLS with random individual effects, and Column (4) details a pooled OLS regression with fixed individual effects. The qualitative findings reported above are confirmed.

4 Discussion

In this paper we find that subjects required to resist temptation made significantly more mistakes on a subsequent counting task. This result is consistent with findings from social psychology (Vohs and Heatherton, 2000) as well as economics (Buccioli et al, 2011).

This finding has many practical implications. An important one is that employers should not prohibit the Internet and yet leave it available. Instead, employers should either remove it entirely or, when doing this is impractical, allow employees a certain amount of time – maybe even as often as several minutes per hour – for personal Internet activity. Perhaps lunch-breaks can be somewhat shortened to accommodate “surf-time”. Alternatively, employers might consider allowing regular Internet breaks, in the same way that many currently accommodate short but not infrequent cigarette or coffee breaks.

³ This is derived as the exponential of the linear specification in Column (1), using the sample averages of the explanatory variables, and imposing that Phase 3 = 0.

⁴ Derived as above. In this case, we impose Phase 3 = 1 and Phase 3 × WT = 0 if the individual is not subject to temptation, and Phase 3 × WT = 1 otherwise.

⁵ In this case the variable WT is absent, as it is fixed for each subject and it is therefore incorporated in the individual dummy variables.

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Table 1. Average sample statistics

	Whole sample	NWT	WT	Rank-sum test
N. observations	$60 \times 13 = 780$	$25 \times 13 = 325$	$35 \times 13 = 455$	
Payoff (DKK)	7.444	7.639	7.304	1.261
Age	25.650	26.200	25.257	2.753***
Female	0.333	0.200	0.429	-6.672***
Danish	0.567	0.600	0.543	1.587
Field: Science	0.350	0.320	0.371	-1.484
Field: Humanities	0.167	0.200	0.143	2.110**
N. household members	3.133	3.440	2.914	7.093***
Personal budget (k DKK)	3.707	4.032	3.474	1.679*

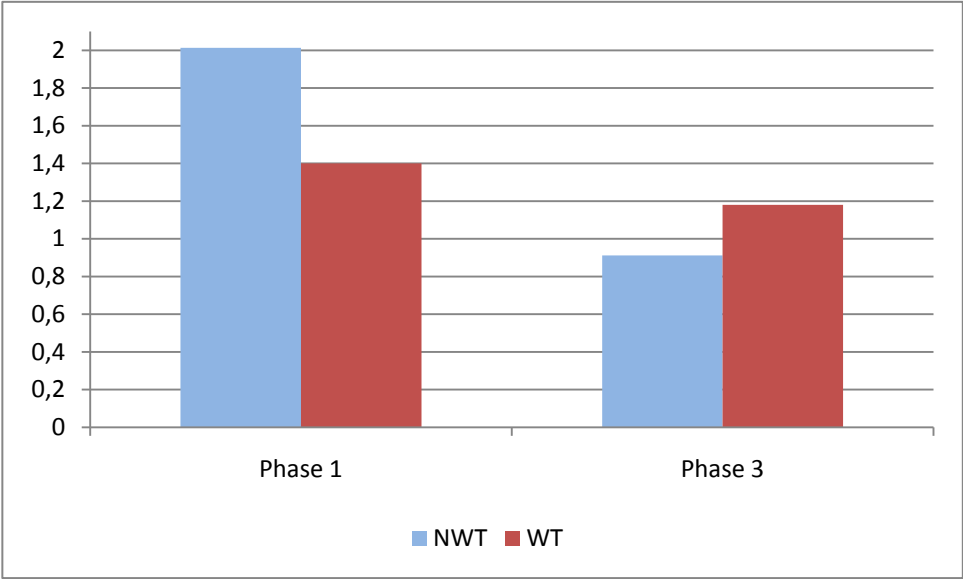
Note: the last column reports the non-parametric Wilcoxon rank-sum test statistic (also known as Mann-Whitney test), under the null hypothesis that the two independent samples (NWT and WT) are from populations with the same distribution. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Table 2. Partial correlates of productivity

Method	(1) Panel Poisson	(2) Pooled Poisson	(3) Panel GLS	(4) Pooled OLS
WT	-3.555* (1.953)	-	-5.926* (3.258)	-
Phase 3	-1.499*** (0.149)	-1.499*** (0.149)	-1.805*** (0.444)	-1.802*** (0.445)
WT × Phase 3	1.076*** (0.193)	1.075*** (0.193)	1.290** (0.582)	1.282** (0.583)
Difficulty (correct answer/video length)	2.541*** (0.344)	2.541*** (0.344)	2.764*** (1.010)	2.753*** (1.013)
Age	-0.021 (0.041)	-0.101*** (0.032)	-0.018 (0.069)	-0.119 (0.092)
Female	0.582* (0.315)	0.283 (0.466)	1.016* (0.602)	1.300 (1.291)
Danish	-0.663 (0.406)	-0.799* (0.458)	-0.316 (0.621)	-0.230 (1.195)
Field: Science	-0.248 (0.302)	1.492*** (0.343)	-0.224 (0.525)	1.948** (0.857)
Field: Humanities	-0.800** (0.339)	0.358 (0.564)	-0.857 (0.564)	0.492 (1.314)
N. household members	-0.220 (0.167)	-0.099 (0.115)	-0.113 (0.244)	0.190 (0.257)
Personal budget (k DKK)	0.070 (0.061)	0.079 (0.069)	0.090 (0.096)	0.083 (0.177)
WT × Difficulty (correct answer/video length)	-1.586*** (0.442)	-1.582*** (0.442)	-1.608 (1.323)	-1.578 (1.326)
WT × Age	0.133** (0.061)	0.101*** (0.020)	0.242** (0.105)	0.169*** (0.060)
WT × Female	-0.852** (0.389)	-1.289*** (0.421)	-1.065 (0.716)	-2.421* (1.241)
WT × Danish	-0.043 (0.484)	0.880* (0.455)	-0.690 (0.765)	0.318 (1.419)
WT × Field: Science	0.142 (0.385)	-1.745*** (0.488)	0.392 (0.670)	-2.336* (1.233)
WT × Field: Humanities	1.186*** (0.460)	-0.176 (0.591)	1.873** (0.798)	0.001 (1.603)
WT × N. household members	0.0780 (0.203)	-0.136 (0.149)	-0.152 (0.314)	-0.428 (0.348)
WT × Personal budget (k DKK)	0.054 (0.090)	-0.225** (0.100)	0.137 (0.148)	-0.264 (0.271)
Constant	0.937 (1.492)	1.373 (1.047)	1.472 (2.348)	1.466 (2.943)
Individual effects	NO	YES	NO	YES
Number of observations	780	780	780	780
Number of individuals	60	60	60	60
R ²	-	0.209	-	0.167
Wald Chi ² test	158.620	-	51.110	-
P-value	[0.000]	-	[0.000]	-
Hausman test	0.100	-	0.140	-
P-value	[0.999]	-	[0.998]	-

Dependent variable: absolute difference between correct and reported answer in each task. Estimation methods: (1): Panel Poisson regression with random effects; (2) Pooled Poisson regression with individual effects; (3) Panel GLS regression with random effects; (4) Pooled OLS regression with individual effects. In the line of R²s, pseudo- R² is computed in model (2). Robust standard errors in round parentheses; p-values in squared parentheses. * = significant at 10%; ** = significant at 5%; *** = significant at 1%.

Figure 1. Average number of mistakes



Online Appendix: Experimental details

The counting task (Phase 1 and Phase 3)

In phase 1 and 3 we measure subjects' productivity through respectively three and ten counting tasks. In each task subjects watch a video where eight individuals are passing each other one or more balls (of different colors). Subjects have to count the exact number of times a specific ball moves from one player to another one. When the video is over, subjects have to indicate their answer. The level of complexity varies from task to task with the number of ball passes subjects are asked to count. At the end of each counting task they receive a feedback with the correct answer, their guess and the points earned.

Notice that: i) each question is presented before the video starts; ii) the questions and videos change in each period but are identical for all subjects in a given period. Videos have a length comprised between 39 and 93 seconds, with an average of 60 seconds. The correct answers range from a minimum of 16 to a maximum of 69 ball passes. Therefore, the complexity of each task may vary due to the video length and the number of balls that are present at the same time in the video.

In phases 1 and 3 subjects earn points according to the precision of their answer. Subjects earn 100 points if they precisely report the correct answer, 65 points if the (absolute) difference between their guess and the correct answer is 1, 50 if the difference is 2 and 0 points if the difference is bigger than 2. At the end of the experiments points are converted in Danish crowns (DKK) according to the following exchange rate: 10 points = 1 DKK (1 DKK roughly corresponds to 0.18 USD).

The temptation task (Phase 2)

In Phase two subjects in NWT watch a funny video for ten minutes while subjects in WT are exposed to temptation. Temptation is represented by a big red button labeled "VIDEO". Subjects know that the video will start if they press the button, but they are asked not to do so. Subjects, however, hear the sound (mainly people laughing) from the loudspeakers of the laboratory. Therefore, subjects understand that the video is funny⁶, but they cannot see what is going on and why people are laughing. This makes temptation strong. Moreover, subjects know that other people in the room have the possibility to watch this video and they are probably enjoying it.

If subjects in WT press the red button, a text message appears on their screen, warning that they should not have pressed the button. This is meant to recognize that pressure may be accidental. If

⁶ We used an episode of the Mister Bean series.

subjects press the button one more time, pressure is no longer considered accidental, and the video appears.

All the subjects (both in NWT and WT groups) earn 250 points from this task, disregarding the pressure of the red button. This setting tries to mimic what happens everyday in some workplaces. Workers are exposed to a large variety of temptations; employers may ask them to resist or they may let them succumb. Often there are no consequences if they do not follow employer's directions.

Only one out of the 36 subjects in the WT group pressed the button twice and eventually watched the video. We disregard this observation from the analysis as we cannot use it to measure the effect of a prohibited temptation (in fact, the subject showed not to resist temptation).

Instructions

Welcome!

You are now taking part in an economic experiment which has been financed by various research foundations. During the experiment you can earn money. It is therefore important that you **read carefully the following instructions.**

Instructions are solely for your private information. **Do not communicate with other participants or look at the others' screens during the experiment.** If you violate this rule, we will have to exclude you from the experiment and all the payments. If you have any questions, please raise your hand and **ask the experimenter or the assisting staff.**

During the experiment your earnings will be calculated in points. At the end of the experiment the points you earned will be converted into Danish crowns (*Danske kroner*) at the following rate:

$$10 \text{ points} = 1 \text{ DKK}$$

Your entire earnings will be paid in cash, privately, immediately after the experiment.

The experiment

The experiment consists of **3 phases** and will last **45 minutes** in total.

In the following page the rules of the three phases are explained.

Phase 1

In Phase 1 **three short videos** are about to be shown. In these videos there are some people passing each other a ball. You have to **count the exact number of passes**. At the end of the video, you have 10 seconds to **indicate in a box on the right the exact number of passes** you have seen.

The **number of points** you will earn depends on the (**absolute**) **difference between the correct answer and your guess** (see table below). For instance, if the correct answer was 10 and you have indicated 10 you will earn 100 points. If you have indicated 11, you will earn 65 points; similarly if you have indicated 9. If you have indicated 7 or 13 you will earn 0 points.

Correct answer – Your guess	Points
0	100
+ 1 - 1	65
+ 2 - 2	50
+ 3 (or greater) - 3 (or greater)	0

If you are ready please press OK. You will be asked some control questions to check if the rules and payoff structure are clear.

Phase 2

In Phase 2 you are randomly assigned to one of two groups, A or B. Subjects in group A will watch a funny video for few minutes. Subjects in group B will not watch the video but they will only hear the sound. At the beginning of Phase 2 you will be informed of whether you are in group A or B.

The video will start automatically only if you are in group A. If you are in **group B**, a red button labeled “VIDEO” will appear. **DO NOT PRESS THIS BUTTON**. If you are in group B and you press this button, you will receive a warning message. This will happen only the first time. If you press the button again the video will start.

At the end of Phase 2 you will earn 250 points.

Phase 3

Tasks in Phase 3 are identical to those in Phase 1. The only difference is that now you will see **ten short videos**. The payoff structure is the same as that of Phase 1.

If you are ready please press OK.

Sequence of screenshots.

A typical counting task in Phase 1 and 3

Question:



Counting task



Answer

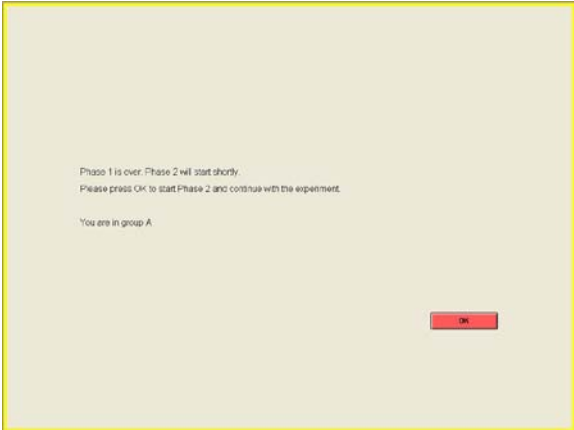


Feedback



Phase 2: No Willpower Treatment (NWT)

Welcome screen

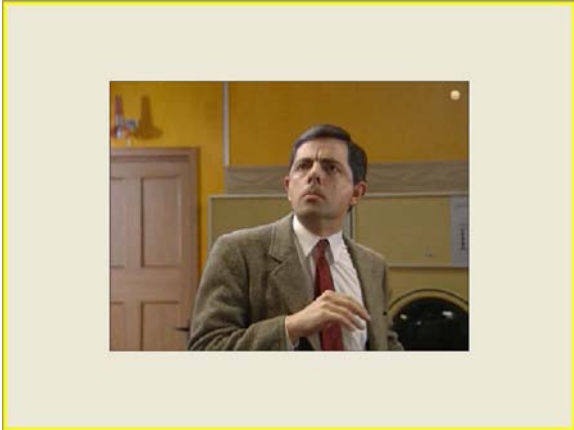


Phase 2: Willpower Treatment (WT)

Welcome screen



Video



Temptation

