

Research Article

PROCRASTINATION, DEADLINES, AND PERFORMANCE: Self-Control by Precommitment

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Abstract—Procrastination is all too familiar to most people. People delay writing up their research (so we hear!), repeatedly declare they will start their diets tomorrow, or postpone until next week doing odd jobs around the house. Yet people also sometimes attempt to control their procrastination by setting deadlines for themselves. In this article, we pose three questions: (a) Are people willing to self-impose meaningful (i.e., costly) deadlines to overcome procrastination? (b) Are self-imposed deadlines effective in improving task performance? (c) When self-imposing deadlines, do people set them optimally, for maximum performance enhancement? A set of studies examined these issues experimentally, showing that the answer is “yes” to the first two questions, and “no” to the third. People have self-control problems, they recognize them, and they try to control them by self-imposing costly deadlines. These deadlines help people control procrastination, but they are not as effective as some externally imposed deadlines in improving task performance.

Good resolutions are useless attempts to interfere with scientific laws. Their origin is pure vanity. Their result is absolutely nil.

—Oscar Wilde, *The Picture of Dorian Gray*

Self-control problems arise when preferences are inconsistent across time or context (e.g., Ainslie, 1975; Loewenstein, 1996). For example, before going to a restaurant dieters may choose not to have crème brûlée, but when the time comes to have dessert they may give in to the temptation and order it after all, only to regret having eaten it after the meal is over. The issue is not whether having crème brûlée is right or wrong, but that ordering it is inconsistent with the decision makers' preferences both before and after the event. One way to think about these issues is that individuals have a set of preferences, X, at some point in time (or under a certain set of environmental conditions) and a different set of preferences, Y, at some other point in time. In the case of the crème brûlée, dieters may prefer not to consume it (Y) before going to the restaurant, prefer to eat it (X) when ordering dessert and consuming it at the restaurant, and prefer not to have eaten it after the meal is over (Y). This type of systematic preference reversal is often described by hyperbolic time discounting (e.g., Ainslie, 1975; Kirby, 1997; Laibson, 1997), under which immediately available rewards have a disproportionate effect on preferences relative to more delayed rewards, causing a time-inconsistent taste for immediate gratification. Crème brûlée poses but a minor self-control problem. Examples of more important self-control problems include not exercising enough, scratching a rash, nail biting, smoking, engaging in unsafe sex, abusing drugs, overspending, procrastination, and so forth.

One of the causes for the apparent changes in preferences over time is changes in the saliency of the costs and benefits of the activity in question (Akerlof, 1991). For example, well in advance of actually taking on the responsibility of writing a book, the benefits of completing such a task loom large, and the costs seem small. Consequently, authors take on such tasks. But as the deadline draws closer, the saliency of the costs and benefits changes. Authors become increasingly aware of the costs (the time needed for completing the task), while the benefits become increasingly less clear.

Although such time-inconsistent preferences may form serious obstacles to following a planned course of action, they can be overcome. In addition to exercising willpower to resist temptation (Hoch & Loewenstein, 1991; Muraven & Baumeister, 2000), people can bind, or precommit, their own behavior (Prelec, 1989; Schelling, 1992; Strotz, 1956; Thaler & Shefrin, 1981; Wertenbroch, 1998). For example, people who want to diet, but recognize that crème brûlée will tempt them to deviate from their plan, can preempt temptation by going to a restaurant with a less tempting menu. A wealth of anecdotes describes examples of binding behaviors, including frequenting health retreats where some food types are not available, saving in non-interest-bearing Christmas clubs, or buying small packages of cigarettes in order to reduce consumption (Wertenbroch, 1998). An extreme example was provided by Schelling (1992), who described drug addicts sending self-incriminating letters to be held in trust (and mailed to the person they fear the most will find out about their addiction) in the event of a relapse into drug use. What characterizes binding behavior is the voluntary imposition of constraints (that are costly to overcome) on one's future choices in a strategic attempt to resist future temptations.

Although time-inconsistent preferences and self-control have been the subject of much theoretical analysis in psychology and economics (Ainslie, 1975; Bargh & Gollwitzer, 1994; Hoch & Loewenstein, 1991; Muraven & Baumeister, 2000; O'Donoghue & Rabin, 1999, 2000; Prelec, 1989; Strotz, 1956; Thaler & Shefrin, 1981; Tversky & Shafir, 1992), controlled empirical evidence of self-control strategies is scarce. The few studies that have looked at self-control show that people do attempt to impose costly restrictions on themselves. In the domain of consumer choice, Wertenbroch (1998) showed with experimental and field data that people are willing to forgo quantity discounts on goods that they may be tempted to overconsume, effectively paying a “self-control premium” to implement a precommitment strategy of rationing their own consumption of such “vices.” Similarly, Read, Loewenstein, and Kalyanaraman (1999) asked participants to pick three rental movies either simultaneously (for later consumption) or sequentially (for more immediate consumption). Their results showed that participants used the simultaneous choices to precommit to watching more “high-brow” (as opposed to more tempting “low-brow”) movies. In the domain of medical testing, Trope and Fishbach (2000) allowed participants to set the magnitude of self-imposed penalties for failing to undergo small, unpleasant medical procedures. Their results showed that participants used these

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penalties strategically as precommitment devices, setting higher penalties for more aversive procedures.

What remains unclear from the studies that have documented such self-control behavior is the extent to which attempts to impose restrictions on oneself are successful. The work we report here examined self-control empirically, with a focus on procrastination. In particular, we were interested in the effectiveness of setting potentially costly deadlines as a way to overcome procrastination. To address this issue, we looked at tasks on which performance could be evaluated objectively. Using performance measures, we could test not only whether people use self-imposed deadlines as precommitment mechanisms, but also whether or not these mechanisms improve performance. We asked three questions regarding procrastination, self-control, and performance:

- Do people self-impose costly deadlines on tasks in which procrastination may impede performance?
- Are people correct in imposing deadlines on themselves? In other words, are self-imposed deadlines effective in improving task performance?
- Do people set their deadlines optimally, for maximum performance enhancement?

PILOT STUDIES

The two pilot studies took place within the context of a semester-long course (14 weeks) at the Massachusetts Institute of Technology (MIT). Participants were students in the class, and as part of their course requirement had to write either three short papers (Pilot Study 1) or one short paper (Pilot Study 2). The instructor explained that each student was free to choose the dates by which he or she committed to hand in the short papers, but that the deadlines had to be announced in advance and were binding.

Each of the deadlines was scored by taking its distance (number of days) from the last day of class. Thus, a score of zero implies a planned submission on the last day of class (as would be predicted in the absence of self-control problems). Any other response indicates a more severe deadline than necessary. In the first pilot study, the mean deadline across all three papers was 21.2 days before the end of the course, and significantly earlier than the last possible deadline, $t(83) = 8.05, p < .001$. The mean deadline was 32.8 days before the end of the course for the first paper, $t(27) = 5.72, p < .001$; 20.4 days before the end for the second paper, $t(27) = 5.04, p < .001$; and 10.4 days before the end for the third paper, $t(27) = 4.45, p < .001$. These results show that the students set themselves deadlines well before the last day of class.

To rule out the possibility that students self-impose deadlines because of a preference for distributing events evenly over time (Loewenstein & Prelec, 1993), in Pilot Study 2 we gave the students a single task. The mean self-imposed deadline in this case was 41.59 days before the end of the course, $t(21) = 15.44, p < .001$, suggesting that setting early deadlines is strategic, and not an outcome of a desire to space tasks evenly.

STUDY 1: THE FREE-CHOICE/NO-CHOICE STUDY

Method

Participants

Study 1 took place during a semester-long executive-education course at MIT. Participants were 99 professionals, most of whom par-

ticipated in the class via interactive video. The two sections of the course (which, based on records provided by the executive-education program, did not differ in overall academic performance) were each assigned to a different condition (so there was no random assignment of individuals to treatments but rather a random assignment of sections to treatments).

Procedure

During the first lecture, the instructor went over the syllabus, which included instructions for the study. One part of the course requirements was to write three short papers. Students in the *no-choice* section (48 students) were given fixed, evenly spaced deadlines for the papers (a paper at the end of each third of the course). Students in the *free-choice* section (51 students) were given detailed instructions about setting their own deadlines (as in the pilot studies). These instructions indicated that each student was free to choose the dates by which he or she wanted to hand in the short papers. Four external constraints were set regarding the dates: First, students had to hand in their papers no later than the last lecture; second, students had to announce the deadlines for submission prior to the second lecture; third, the dates were final and could not be changed; and fourth, the dates were binding, such that each day of delay beyond the deadline would cause a 1% penalty in the paper's overall grade. Finally, it was explained clearly that there were no grade advantages for early submissions because the instructor would not provide grades or feedback on the assignments before the end of the course. Explaining to the students that there would be no feedback before the end of the course was important because it eliminated incentives for students to hand in papers early in order to get feedback that they could use to improve subsequent papers.

In fact, the external incentives for the students in the free-choice section encouraged submission of all three papers on the last possible day. By setting their deadlines as late as possible, the students would have the most time to work on the papers, the highest flexibility in arranging their workload, and the opportunity to learn the most about the topic before submitting the papers. Students also had an incentive to set submission dates late because the penalty would be applied only to late submissions and not to early ones. Finally, students who wanted to submit assignments early could privately plan to do so without precommitting to the instructor. Of course, such private deadlines might be less psychologically meaningful than the deadlines they set with the instructor, and hence more pliant and less effective.

Results and Discussion

First, we examined the declared deadlines for each of the three papers. Again, each deadline was scored by taking its distance (number of days) from the last day of class, so that a score of zero indicates a planned submission on the last day of class (perfectly normative). Other responses indicate the severity of the deadlines the students imposed on themselves. The mean deadlines were significantly earlier than the last possible deadline—41.78 days before the end of the course for the first paper, $t(44) = 8.41, p < .001$; 26.07 days before the end for the second paper, $t(44) = 8.10, p < .001$; and 9.84 days before the end for the third paper, $t(44) = 4.97, p < .001$. Figure 1 shows that only 43 deadlines (32%) were set for the final week of class. The majority of the deadlines were set prior to the last lecture,

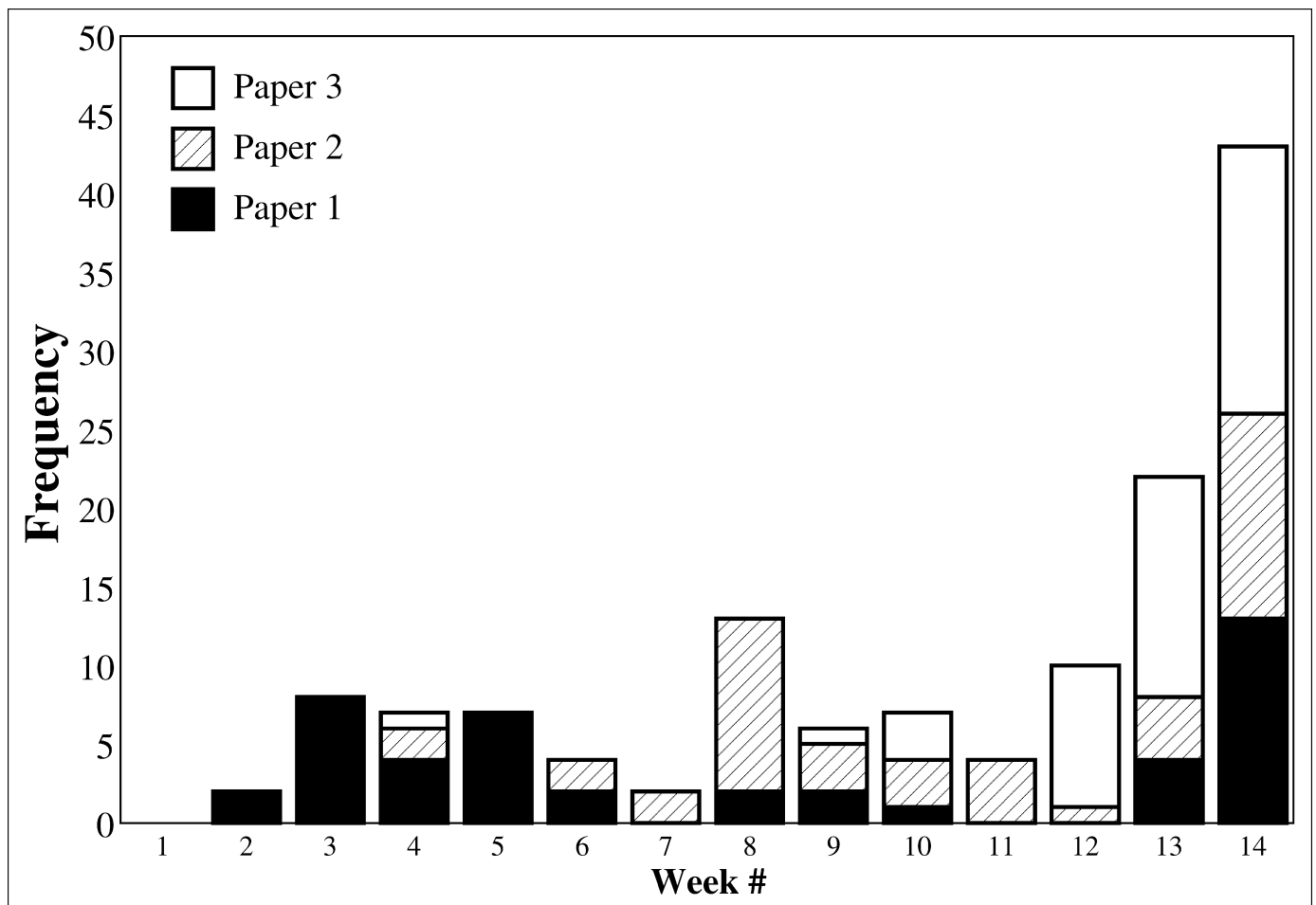


Fig. 1. Frequency distribution of the declared deadlines in Study 1 as a function of the week of class (Week 1 is the first week, and Week 14 the last week), plotted separately for the three papers.

and in fact, only 12 students (27%) chose to submit all three papers on the last day of class.¹

These results indicate that people are willing to self-impose deadlines to overcome procrastination, even when these deadlines are costly (our first question). The students could have chosen less binding private deadlines, but instead chose deadlines that involved more commitment and greater potential cost (a grade penalty for being late). It seems that they were willing to take the risk of losing grade points to apply the self-control mechanism of precommitment.

Next, we compared the grades in the two sections to see if flexibility in setting deadlines caused higher or lower grades compared with externally imposed, evenly spaced deadlines. There were three possible predictions: (a) If students do not have self-control problems, greater flexibility should lead to higher grades. (b) If students do have self-control problems, and if they both use deadlines to overcome these problems and set these deadlines optimally, greater flexibility should allow them to achieve higher grades. (c) If students do have

self-control problems, and they use deadlines to overcome these problems, but do not set these deadlines optimally, greater flexibility might lead to lower grades. In sum, flexibility, compared with evenly spaced deadlines, should lead to lower grades only if people have self-control problems yet do not set their own deadlines optimally.² The results supported the third prediction. The grades in the no-choice section ($M = 88.76$) were higher than the grades in the free-choice section ($M = 85.67$), $t(97) = 3.03$, $p = .003$.

In addition to having a direct effect on performance, deadlines can have a secondary effect on other aspects of performance that also require the investment of time as a resource. A natural candidate for this measure is the students' performance on a final project that was due on the last day of class. Grades for the final project showed the same effect: Scores were lower in the free-choice section ($M = 77$) than in the no-choice section ($M = 86$), $t(95) = 4.15$, $p < .001$, suggesting that students with late self-imposed deadlines for the three fo-

1. Because of missing data, the percentages do not fit with the total number of students in the class.

2. We use the term *optimally* relative to participants' performance under the evenly spaced deadlines in the no-choice section. If performance can be improved, it is suboptimal by definition.

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cal tasks might not have had sufficient time to dedicate to the final project.

Although the students were instructed about the penalties associated with missing the deadlines, it is possible that students in the free-choice section, compared with those in the no-choice section, treated these deadlines as less binding because they were self-imposed.³ To demonstrate that the better performance in the no-choice section was caused by the timing of the deadlines and not by the perceived force of the externally imposed deadlines, we compared the performance of the students in the no-choice section with the performance of those students in the free-choice section who chose evenly spaced (or almost evenly spaced) dates for submission. This comparison isolates the effect of deadline type (self vs. external) on performance. If these two groups with similarly spaced deadlines differed in their performance, the overall difference between the sections could be attributed to the nature of the deadlines (self vs. external). However, if students who spaced their deadlines evenly showed similar performance regardless of the nature of the deadline, the overall difference between the sections was likely due to the timing of the deadlines. The results showed that the performance difference between the two sections decreased dramatically and became nonsignificant when only those students who had evenly spaced deadlines were included in the analysis (effect size reduced by 59%). This comparison suggests that the overall effect of self-imposing deadlines was due primarily to the timing of the deadlines, not just a weaker perceived potency of self-imposed deadlines.

STUDY 2: THE PROOFREADING STUDY

The combined results of the pilot studies and Study 1 suggest that decision makers who face situations in which they can self-impose deadlines recognize two conflicting forces. On the one hand, they realize the value of binding themselves to overcome procrastination; on the other hand, they understand the normative reasons to set the deadlines as late as possible. We propose that decision makers combine these two perspectives and come up with deadlines whose timing is suboptimal (as shown in Study 1) but better than delaying all deadlines to the last possible day. Thus, we hypothesize that performance under self-imposed deadlines is lower than performance under externally imposed, evenly spaced deadlines but higher than performance under maximally delayed deadlines (when all tasks are due simultaneously at the end of the period). To examine this hypothesis, we now focus on our second and third questions: whether self-imposed deadlines improve performance and, if so, whether people know how to set deadlines for maximum performance enhancement. Study 2 was designed to examine these questions in a controlled experimental setup, providing a more sensitive test of the effect of deadlines on performance than Study 1 did, coupled with a more objective performance measure.

Method

Participants

In MIT's newspaper and on bulletin boards, we placed an ad looking for "native English speakers to help us proofread papers by other students to evaluate writing skills." We also noted that payment would

be contingent on the quality of the proofreading, with 10¢ paid per correctly detected error and a \$1 penalty for each day of delay. A total of 60 students participated in the study, randomly assigned to the three experimental conditions.

Procedure

We chose a task that people cared about but one whose outcome was not central to their lives (in contrast to the course grades in the previous studies). We also wanted a task for which performance scores would be more objective and for which we could pay participants accordingly. We therefore designed a proofreading task in which we deliberately planted spelling and grammatical mistakes. We used a postmodern text generator⁴ to create text that was grammatically correct but not meaningful, as shown by the following sample:

"Sexual identity is intrinsically impossible," says Foucault; however, according to de Selby[1], it is not so much sexual identity that is intrinsically impossible, but rather the dialectic, and some would say the stasis, of sexual identity. Thus, D'Erlette[2] holds that we have to choose between premodern dialectic theory and subcultural feminism imputing the role of the observer as poet.

We created three such texts with a length of about 10 pages each, and inserted in each of them a total of 100 grammatical and spelling errors.

Study 2 included three different conditions. In each condition, we clearly explained to the participants that their payoffs would depend on how many errors they detected and on the time of submission of each proofread text. Participants were told that submitting their tasks early was permitted (without increasing their compensation), but that delay in submission would result in a penalty of \$1 for each day of delay. In the evenly-spaced-deadlines condition, participants had to submit one of the three texts every 7 days; in the end-deadline condition, they had to submit all three texts at the end of 3 weeks (21 days); and in the self-imposed-deadlines condition, they had to choose their own deadline for each of the three texts within the 3-week window (as in the previous studies).

Results and Discussion

First, we determined whether the self-imposed-deadlines condition replicated the results of the previous studies. The results showed that participants in this condition chose to space out their proofreading tasks, $F(2, 38) = 63.28, p < .001$, thus showing a preference for self-imposing costly deadlines.

We analyzed three aspects of performance across the different conditions: number of errors detected, delays in submissions, and earnings (see Fig. 2). All differences were statistically significant (all $ps < .01$) in the expected direction. As predicted, the number of errors correctly detected was highest in the evenly-spaced-deadlines condition, followed by the self-imposed-deadlines condition, with the lowest performance in the end-deadline condition. Results were similar for participants' delays in submitting their proofreading work (in this case, shorter delays resulted in higher payoffs). Participants' earnings reflected a combination of error detection and delay and thus show the same pattern of results.

3. Evidence against this argument is that all students (in both sections) handed in their papers on or before the deadlines.

4. The text-generating engine is on the Web at <http://www.elsewhere.org/cgi-bin/postmodern/>.

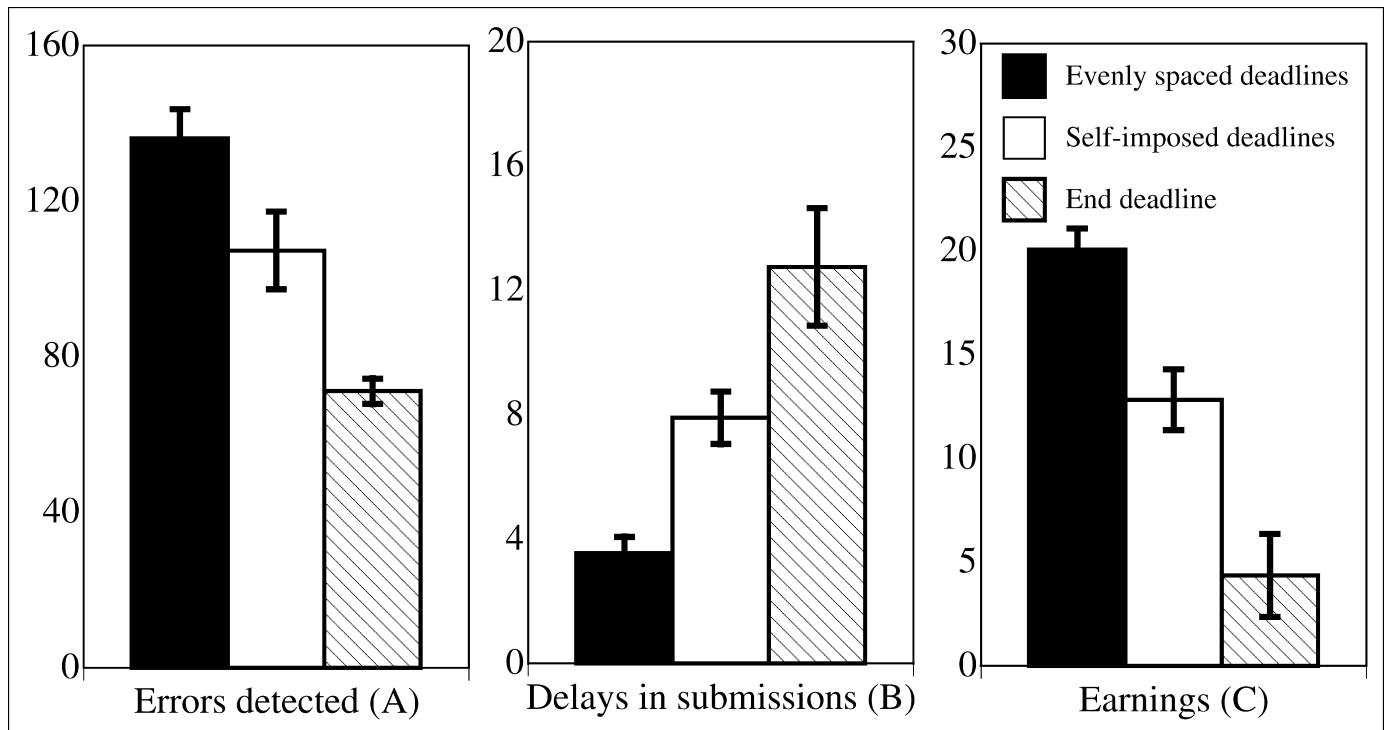


Fig. 2. Mean errors detected (a), delays in submissions (b), and earnings (c) in Study 2, compared across the three conditions (error bars are based on standard errors). Delays are measured in days, earnings in dollars.

Next, we examined the same measures focusing on the participants in the self-imposed-deadlines condition who had spaced their tasks evenly, or approximately evenly ($n = 10$). Mirroring the results of Study 1, the differences between the evenly-spaced-deadlines condition and the (“sophisticated”) self-imposed-deadlines condition decreased dramatically and became nonsignificant for all dependent measures: delay in submissions (effect size reduced by 55%), errors detected (effect size reduced by 79%), and earnings (effect size reduced by 55%). This reduction in effect sizes provides additional evidence that a central cause of the lower performance in the self-imposed-deadlines condition compared with the evenly-spaced-deadlines condition was suboptimal spacing of the tasks.

Finally, we asked participants to evaluate their overall experience on five attributes: how much they liked the task, how interesting it was, how good the quality of the writing was, how good the grammatical quality was, and how effectively the text communicated the ideas contained in it. Responses to all questions were on a 100-point scale, on which higher numbers represented higher quality ratings. An analysis of the average subjective evaluation across the five questions revealed a pattern that was the opposite of the performance results, $F(2, 57) = 17.06$, $p < .001$. Participants in the evenly-spaced-deadlines condition liked the task the least ($M = 22.1$), followed by the participants in the self-imposed-deadlines condition ($M = 28.12$), followed by participants in the end-deadline condition, who liked the task the most, or disliked it the least ($M = 37.9$). These results are not surprising, as the texts were meaningless and the tasks were boring, if not annoying. We suggest that the pattern would have been reversed if the task had been inherently enjoyable; participants in the evenly-spaced-deadlines condition would have enjoyed it the most, followed by par-

ticipants in the self-imposed-deadlines condition, and finally by participants in the end-deadline condition.

In addition, we asked participants to estimate how much time they had spent on each of the three texts. The time estimates revealed a mirror image of the subjective evaluations, $F(2, 57) = 45.76$, $p < .001$, indicating that increased time spent on the task caused the evaluation to be more negative. Participants in the evenly-spaced-deadlines condition indicated they spent the most time on the task ($M = 84$ min), participants in the self-imposed-deadlines condition spent an intermediate amount of time on the task ($M = 69.9$ min), and participants in the end-deadline condition spent the least time on the task ($M = 50.8$ min). Taken together, the results show that when deadline constraints increased, performance improved, time spent on the task increased, and enjoyment of the task decreased (because of enhanced recognition of the true low quality of the texts). The effectiveness of the constraints themselves depended on the type of constraint—self-imposed deadlines improved performance, but not to the same degree as evenly spaced deadlines.

GENERAL DISCUSSION

The studies presented here show that people sometimes impose deadlines on themselves, even when missing these deadlines leads to penalties. In a world without self-control problems, such behavior would seem nonnormative. A rational decision maker with time-consistent preferences would not impose constraints on his or her choices. But if people impulsively procrastinate, and if they also are aware of their procrastination problems (e.g., Bénabou & Tirole, in press; O'Donoghue & Rabin, 1999), self-imposing costly deadlines can be strategic and reasonable. Study 1 demonstrated that self-imposed deadlines do

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not enhance performance as much as externally imposed, evenly spaced deadlines. The results from Study 2 show that performance under self-imposed deadlines is lower than performance under evenly spaced deadlines, but higher than performance under maximally delayed deadlines.

We can now return to the three questions posed earlier. (a) Do people self-impose costly deadlines to overcome procrastination? (b) Are self-imposed deadlines effective in improving task performance? (c) Do people set self-imposed deadlines optimally? The answer to the first two questions is "yes," and the answer to the last question is "no." Our findings demonstrate that people understand the value of binding themselves to overcome procrastination, even in the face of strong normative reasons for setting deadlines as late as possible. Our participants showed some sophistication in their understanding of their own procrastination problems, but many did not set their deadlines to bind themselves optimally. Whether our evidence of such "imperfect" sophistication (or "partial naiveté") reflects biased self-perception, cognitive limitations in calibrating deadlines, or a deliberate mixed strategy of balancing flexibility and self-control is a question for future research. What is clear from our empirical evidence is that procrastination is a real behavioral problem, that people strategically try to curb it by using costly self-imposed deadlines, and that self-imposed deadlines are not always as effective as some external deadlines in boosting task performance.

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