

PROCRASTINATION, DEADLINES AND PERFORMANCE

by

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Procrastination, Deadlines, and Performance

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Abstract

Procrastination is all too familiar to many people. Yet, people also sometimes try to control their procrastination by setting deadlines for themselves. We empirically examine how sophisticated people are in dealing with their own procrastination behavior in effortful tasks, in which the cost of procrastination is likely performance deterioration. Do people intuit that they need to exercise self-control in these tasks? Do they self-impose meaningful (i.e., costly) deadlines? Would they procrastinate without these deadlines? Are these deadlines as effective in improving task performance as externally imposed deadlines? Two field studies and one laboratory study show that people recognize their self-control problems because they self-impose deadlines on their behavior that are costly to miss. But these self-imposed deadlines are not as effective as some externally imposed deadlines in improving task performance. People are sophisticated enough to recognize their own tendencies to procrastinate, but if left to their own devices they solve this self-control problem only partially.

(Key words: Procrastination, self-control, intertemporal choice)

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“If once a man indulges himself in murder, very soon he comes to think little of robbing; and from robbing he next comes to drinking and Sabbath-breaking, and from that to incivility and procrastination.”

Thomas De Quincey (1785-1859), from “Murder Considered as One of the Fine Arts,”
Blackwood’s Magazine, February 1827.

Self-control problems arise when preferences are inconsistent across time or context (Ainslie, 1975; Loewenstein, 1996; Thaler & Shefrin, 1981; Wertenbroch, 1998). For example, we often plan in the morning to have fresh fruit for dessert during lunch instead of chocolate cake. But at lunchtime we order the chocolate cake after all. After lunch, we then wish we had eaten the fresh fruit instead. The issue is not whether our choice of chocolate cake is right or wrong but rather that our preference for chocolate cake versus fresh fruit (implying a tradeoff between immediate taste and delayed health benefits) changes as a function of temporal distance from the decision (Figure 1, cf. Ainslie 1975). Such intertemporal preference reversals prevent people from having coherent, utility maximizing preferences (Strotz 1956), keeping them from following optimal plans of action such as eating a healthy dessert. Examples of self-control problems include lack of exercise, scratching itches, nail biting, smoking, unsafe sex, drug abuse, dissaving, etc.

••• Insert Figure 1 about here •••

To overcome these, people can bind their behavior, by precommitting ahead of time to a constrained set of options at the time of decision. In the dessert example, we may commit in advance to go to a restaurant with a less tempting menu. Examples of binding behaviors include frequenting health retreats where some food types are not available, saving in Christmas clubs, or buying vices like chocolate chip cookies or potato chips only in small packages, even at premium prices (Wertenbroch, 1998). At the most extreme level, dieters may put braces on their teeth to prevent themselves from eating solids, and drug addicts send self-incriminating letters to be held in trust, in case they relapse into drug use (Schelling, 1992). What these binding behaviors have in common is that, to prevent themselves from giving in to temptation, people voluntarily impose constraints on their own

future choices that are costly to overcome and they sometimes even pay a premium for binding themselves (Wertenbroch 1998). The defining characteristic of effective binding behaviors is that a lapse triggers the automatic self-imposition of costs (i.e., a penalty).

This paper focuses on procrastination as one class of self-control problems and on how to overcome it. One of the causes for the apparent changes in preferences for performing a task on time is attributed to changes over time in the saliency of costs and benefits of the activity in question (Akerlof, 1991). For example, well in advance, we may agree to give a conference presentation because the benefits of presenting loom large, while the costs seem small. But as the deadline draws closer, the salience of the costs and benefits changes and we become increasingly aware of the time needed for preparing the presentation, more and more dwarfing its benefits. So we postpone preparing it until we're running out of time.

Organizations often impose deadlines with penalties on their members to mitigate such procrastination. These deadlines increase, and boost the salience of, the costs of putting off a task (O'Donoghue & Rabin 1999a). But in the absence of external deadlines, are people sophisticated enough to strategically self-impose costly deadlines — as much well-meaning advice would suggest? To better understand how people deal with procrastination, and with self-control problems in general, we empirically examine two specific questions regarding procrastination and self-control:

- Q1. Do people intuit that they need to exercise self-control to overcome procrastination?
- Q2. Do people self-impose meaningful (i.e., costly) deadlines in order to overcome procrastination in performing tasks, in which the cost of procrastination is likely performance deterioration?
- Q3. Would people procrastinate without self-imposed, costly deadlines?
- Q4. Are self-imposed costly deadlines as effective in improving ultimate task performance as externally imposed costly deadlines? Is self-control as effective as external sanctioning?

We describe three studies, a field survey, a field experiment, and an experiment, that address the first two questions. Studies 2 and 3 address the fourth, Study 3 the third.

STUDY 1

Study 1 occurred during an undergraduate course at MIT. About 2/3 of the 28 students in the class were from MIT and 1/3 from Harvard University. At the beginning of the course, the instructor went over the syllabus, which included the instructions for the study. One part of the course requirements was to write three short papers. The instructor explained that each student was free to choose the dates, by which he or she wanted to hand in each of the three papers. Four external constraints were set regarding the dates: first, students had to hand in the papers no later than the last lecture; second, students had to announce the date for each paper prior to the second lecture; third, the dates were final and could not be changed; fourth, the dates were binding so that missing a deadline would cause a reduction of 1% in the grading score for each day of delay. Thus, students who chose dates prior to the last day of class would self-impose costly deadlines. It was also explained clearly that being early had no consequences, because the instructor would not provide grades or feedback on the assignments before the end of the course. Thus, there were no incentives for students to hand papers in early in order to get feedback, with which to improve subsequent papers.

In fact, the instructor encouraged the students to submit all three papers on the last possible day. The instructor explained that this way (a) they would have the most time to work on the papers; (b) they would have the highest flexibility in arranging their workload; (c) they would learn the most about the topic before submitting the papers; and (d) the penalty would be applied to late submissions independently of when the respective deadline was set. If any students had wanted to submit assignments early, they could have done so without committing to it in advance. Moreover, students who wanted to commit to early deadlines could have privately committed to an earlier deadline without declaring it publicly and thus would not have risked lowering their grades for being late.

If the students were not afraid of procrastinating and behaved normatively, they would choose the last day of class as the deadline. That is, they would not impose constraints on their own future behavior. However, if they used self-imposed deadlines strategically as self-control mechanisms, they would pick dates more spread out throughout the semester.

Results

First, we examined the declared deadlines for each of the three papers. We scored each of these deadlines by taking its distance (number of days) from the last day of class. A score of zero means a planned submission on the last day of class (perfectly normative), while non-zero responses indicate the severity of the deadlines the students imposed on themselves. The mean deadline was 32.8 days before the end of class [$t(27) = 5.72, p < 0.001$] for the first paper, 20.4 days [$t(27) = 5.04, p < 0.001$] for the second paper, and 10.4 days [$t(27) = 4.45, p < 0.001$] for the third paper. Figure 2 shows a frequency distribution of the deadlines. While 35 deadlines (42%) were set for the final week of class, the majority of the deadlines was set prior to the last lecture as expected. In fact, only eight students (29%) chose to submit all three papers on the last day, and only 27 of the deadlines (32%) were set at the last possible date.

•• Insert Figure 2 about here ••

We also examined how the chosen deadlines related to task performance. Note that because the students self-selected the deadlines for the three papers, one cannot draw a causal inference about this relationship. Nonetheless, suggestive evidence of performance differences between students who selected early versus late deadlines will invite further examination of the effects of deadlines on performance. We first divided the subjects into two groups. We placed the eight students who set all three deadlines for the last day of class in the **normative** group and the remaining 20 students who set any of the three deadlines prior to the last day in the **self-control** group. Table 1 shows the grades for the different aspects of the course; the grader knew neither by whom nor when an individual paper was handed in, a fact the students had been told on the first day of class. The self-control group directionally outperformed the normative group in all tasks except the first paper, although the normative group had more time to absorb the course material before writing their papers.

One interpretation is that imposing deadlines on oneself limits procrastination, provides more time to complete the tasks, and hence improves performance.

••• Insert Table 1 about here •••

Discussion

Our subjects impose restrictions on their schedules that are not prescribed by a standard interpretation of normative principles. Instead, they pick binding deadlines that are earlier than necessary. So they must be intuiting that they would otherwise procrastinate. Their willingness to impose these potentially costly deadlines on themselves implies that they are attempting to strategically control their own behavior. Interestingly, these subjects could have committed to deadlines privately, but instead they chose public deadlines that involved greater commitment due to the substantial grade penalty for being late. It seems that they were willing to take the risk of losing grade points in order to apply the more powerful self-control mechanism of public commitment.

Did the students choose these early deadlines well, to improve their performance? The informal performance analysis above hints that choosing public deadlines might have been helpful, as it may have caused students to tackle the tasks more successfully. For example, students might know that they typically procrastinate working on a paper until a few days before the deadline, and hence they choose earlier deadlines in order to force themselves to spread out their work load. For those with a sophisticated understanding of their procrastination problems (see O'Donoghue & Rabin, 1999b), self-imposing deadlines may improve their performance as hinted by Study 1. However, perhaps it was simply the better students who chose early deadlines. Thus, better performance under self-selected deadlines might be confounded with better performance in general. We provide more controlled tests of the effect of self-imposed deadlines on performance in the next two studies.

STUDY 2

Study 2 took place during an executive education course at MIT with the same length as that in Study 1. The participants were professionals who were off-site during the course and participated once a week via interactive video. They were allocated randomly to two sections of the course, which represented different conditions. Prior academic performance did not differ between the sections. In the **free-choice** condition, the instructions and procedure were the same as in Study 1; participants chose their own deadlines for submitting three papers. In the **no-choice** condition, participants were given fixed, evenly spaced deadlines for the papers (a paper at the end of each third of the course). As in Study 1, the deadlines were binding so that missing a deadline would cause a reduction of 1% in the grading score for each day of delay. The design ensures that performance differences between deadline conditions cannot be explained by general performance differences between those who apply self-control strategies and those who don't. Moreover, better performance under external deadlines would imply that the self-selected deadlines are not as performance-enhancing as possible.

Results

The results in the free-choice condition replicate those of Study 1. The mean self-selected deadline for the first paper was 41.78 days before the end of class [$t(44) = 8.41$, $p < 0.001$]. For the second paper it was 26.07 days [$t(44) = 8.10$, $p < 0.001$], and for the third paper it was 9.84 days [$t(44) = 4.97$, $p < 0.001$].

Next, we compared the grades in the two sections to see if flexibility in setting deadlines affected grades. Again, the grader knew neither by whom nor when an individual paper was submitted. Flexibility in setting self-imposed deadlines, compared with externally imposed, evenly spaced deadlines, should not impede performance, unless people procrastinate, try to curb their procrastination by setting deadlines for themselves, but lack accurate calibration in how to set these deadlines. The results support this prediction.

Grades for the three papers were lower in the free-choice section ($M=85.67$) than in the no-choice section ($M=88.76$) [$t(95) = -2.92, p = 0.0044$].

In addition, one could ask how such deadlines influence other aspects of performance that also require the investment of time as a resource. In particular, a final project was due on the last day of class. Grades for the final project showed the same effect: Performance scores for the final project were lower in the free-choice section ($M=77$) than in the no-choice section ($M=86$), [$t(95) = 4.15, p < 0.001$]

Discussion

Study 2 replicated the findings of Study 1 (in the free-choice condition) and extended them by comparing the participants' grade performance in the free-choice condition and in the no-choice condition. Subjects wanted to self-impose early deadlines when they were given the option to do so, but they did not choose deadlines that maximized their performance, because subjects who faced externally imposed, evenly spaced deadlines performed better. These results show that our subjects do have self-control problems, that they try to overcome these when given an opportunity, but that they do not have perfect insight into how to set self-imposed deadlines.

In light of these results, we propose that when people self-impose deadlines they balance their impulsive tendency to procrastinate with the objective to space tasks optimally in order to maximize their performance. The results of Study 2 suggest that our subjects chose deadlines that were a compromise between the two objectives and thus did not maximally enhance either procrastination or performance. We will provide a more direct test of this idea in Study 3.

Interestingly, all participants submitted their papers on time and there were no requests for extensions. We speculate that this outstanding compliance with the deadlines occurred because these subjects were older, were sponsored by their companies, and were taking only

a few classes. They were extremely motivated to do well. To look more deeply into the issue of compliance with self-imposed deadlines, Study 3 will provide an environment that is more likely to promote delays in meeting deadlines.

STUDY 3

Studies 1 and 2 show that people use self-imposed deadlines as self-control mechanisms. Performance under these self-imposed deadlines is inferior to that under evenly spaced deadlines. Hence, we now revisit whether self-imposed deadlines help people improve their performance at all.

On the one hand, our subjects understood the normative reasons for setting deadlines as late as possible. But their behavior suggests that they also understood the value of binding themselves in order to overcome procrastination. We proposed that procrastinators combine these two perspectives and come up with a set of deadlines that is sub-optimal (as we saw in Study 2) but better than setting all deadlines on the last possible day. Thus, we now hypothesize that performance under self-imposed deadlines is lower than under externally imposed, evenly spaced deadlines but higher than under maximally delayed deadlines when all tasks are due simultaneously at the end of the period.

To look at this issue, Study 3 included three different conditions: In one condition, deadlines were evenly spaced, in another they were all set at the end of the period, and in the third they were flexibly set by the subjects themselves. The main goal of Study 3 was to examine whether self-imposed deadlines improve performance compared to when all deadlines are stacked at the end. At the same time, Study 3 attempted to replicate the results of Study 2, showing that the performance under self-imposed deadlines is lower than under evenly spaced deadlines. Finally, Study 3 examined the issues of procrastination and self-control in a more controlled, experimental setup, providing for a more sensitive test of the effect of deadlines on performance and for a more objective performance measure.

We wanted to create a task that people cared about yet whose outcome was not central to their lives (as course grades were likely to be for the participants in Studies 1 and 2). We also wanted the scoring of performance to be more objective so that we could pay subjects according to their performance. We designed a proofreading task by deliberately implanting spelling and grammatical mistakes in meaningless text that we had created with a post-modern text generator (<http://www.elsewhere.org/cgi-bin/postmodern/>). A short 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. D’Erlette[2] holds that we have to choose between premodern dialectic theory and subcultural feminism. It could be said that the main theme of the works of Pynchon is 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 100 grammatical and spelling errors. We placed an ad in a university newspaper and on bulletin boards, looking for native English speakers to help us proofread papers by other students in order to evaluate writing skills. Payment would be contingent on the quality of the proofreading, with 10¢ paid per correctly detected error. A total of 60 qualified respondents to our ad participated in the study, randomly divided among the three experimental conditions. In each condition, we clearly explained to the subjects that their payoffs would depend on how many errors they detected correctly and on when they submitted each of the three proofread texts. As in Study 1, subjects were told that submitting tasks early was permitted (without increasing their compensation) but that delay in submitting would reduce their payoffs by \$1 for each day of delay. The conditions were:

1. *Evenly spaced deadlines*: Subjects had to submit one text every seven days.
2. *End-of-period deadlines*: Subjects had to submit all three texts at the end of three weeks (27 days).
3. *Self-imposed deadlines*: Subjects had to choose their own deadline for each text within the three-week window.

Results and discussion

As in the previous studies, subjects in the self-imposed deadlines condition chose to space out their proofreading tasks. The average submission deadline for the first task was 13 days before the final day [$t(19) = 20.03$, $p < 0.001$], 8.3 days for the second task [$t(19) = 12.47$, $p < 0.001$], and 2.2 days for the third task [$t(19) = 2.80$, $p = 0.012$].

Next, we ran an ANOVA to examine the quality of the proofreading performance in the three conditions. The overall model was statistically significant [$F(2,57) = 20.93$, $p < 0.001$], indicating that performance differed across conditions. As predicted, the number of correctly detected errors under evenly spaced deadlines was the highest ($M=136.1$ errors), followed by the self-imposed deadlines condition ($M=103.5$ errors) [$t(118) = 2.83$, $p = 0.006$], with the lowest performance in the end-of-period deadlines condition ($M=69.6$ errors) [$t(118) = 3.84$, $p < 0.001$].

Similar results occurred for subjects' delays in submitting their proofreading tasks. We analyzed the total number of days of delay across the three tasks for each subject. The overall model was statistically significant [$F(2, 57) = 23.53$, $p < 0.001$]. Subjects in the end-of-period deadlines condition were the latest ($M=12$ days delay), followed by subjects in the self-imposed deadlines condition ($M=6.5$ days delay) [$t(118) = 3.32$, $p = 0.001$], while subjects in the evenly spaced deadlines condition were the least delayed ($M=0.5$ days delay) [$t(118) = 5.00$, $p < 0.001$].

Subjects' earnings as a measure of performance in the different conditions followed the same pattern (subjects received 10¢ for each error they correctly detected and a \$1 penalty for each day of delay). The overall model was significant [$F(2,57) = 32.55$, $p < 0.001$], showing that subjects under evenly spaced deadlines earned the most ($M=\$13.2$), followed by subjects in the self-imposed deadlines condition ($M=\$3.8$) [$t(38) = 5.6$, $p < 0.001$] and by subjects in the end-of-period deadlines condition ($M=-\$5$). In fact, some subjects in the end-of-period deadlines condition were so bad they would have earned negative amounts.

At the end of the study, after subjects submitted their final proofreading task and before we calculated their payments, we asked them to evaluate each text on five attributes and to estimate how much time they had spent on each of the three tasks. The evaluation questions were: How much did you like the text? How interesting did you find it? How was the writing quality? How was the grammatical quality? How effectively did the text communicate the ideas contained in it? Responses to all questions were on 100-point scales, with higher numbers representing higher quality ratings.

An analysis of the average subjective evaluation across the five questions and three texts for each subject revealed a significant main effect [$F(2,57) = 17.06, p < 0.001$], according to which the perceived text quality in the evenly spaced deadlines condition was lowest ($M=22.05$), followed by the self-imposed deadlines condition ($M=29.4$) [$t(198) = 3.29, p = 0.001$], with the highest perceived quality in the end-of-period deadlines condition ($M=37.9$) [$t(198) = 2.77, p = 0.006$]. That is, those subjects who performed better liked the texts less. This is not surprising as the texts were meaningless and the proofreading was boring if not annoying. The analysis of the time subjects reported spending on each of the tasks followed the same pattern. Overall, there was a significant difference between the conditions [$F(2,57) = 45.76, p < 0.001$], in which the time spent in the evenly spaced deadlines condition was the longest ($M=83.95$ min.), followed by the time spent in the self-imposed deadlines condition ($M=65.75$ min.) [$t(38) = 4.55, p < 0.001$], with the shortest time spent in the end-of-period deadlines condition ($M=50.8$ min.) [$t(38) = 5.57, p < 0.001$]. These results suggest that subjects procrastinated and eventually ran out of time when the deadlines were all stacked up at the end.

GENERAL DISCUSSION

Study 1 shows that people impose deadlines on themselves in tasks, in which performance may deteriorate with procrastination, even when missing these deadlines entails penalties. In a world without self-control problems such behavior would seem non-

normative. A rational decision maker with time-consistent preferences would not self-impose constraints on his or her choices. But if people impulsively procrastinate and if they are aware of their procrastination problems, self-imposing costly deadlines as a binding mechanism appears strategic and reasonable (O'Donoghue & Rabin 1999b; cf. Wertenbroch 1998). Study 2 replicates Study 1 and in addition demonstrates experimentally that self-imposed deadlines do not enhance performance as much as externally imposed, evenly spaced deadlines. Study 3 replicates this performance difference, yet it also demonstrates that performance is better under self-imposed early deadlines than under external late deadlines – which cause the highest degree of procrastination, measured by costly delays.

We can now return to the questions posed in the beginning. First, do people intuit that they need to exercise self-control to curb procrastination? Second, do they self-impose costly deadlines for that purpose? Third, would they otherwise procrastinate? Fourth, are self-imposed costly deadlines as effective in improving task performance as externally imposed ones? The answer is 'yes' to the first three questions and 'no' to the fourth. Our findings show that people are sophisticated enough to understand the value of binding themselves in order to overcome procrastination (O'Donoghue & Rabin, 1999b), in the face of strong normative reasons for setting deadlines as late as possible. Under self-imposed early deadlines people perform better than when deadlines are set at the last possible minute (Study 3). But they perform less well than under a benchmark of external, evenly spaced deadlines (Studies 2 and 3). Whether this 'imperfect' sophistication is just bad calibration in setting their own deadlines or due to a mixing strategy, under which people trade off the conflicting goals of flexibility and of controlling their tendency to procrastinate, is uncertain. What is clear from our empirical evidence is that procrastination is a real behavioral problem because people strategically try to curb it by using self-imposed costly deadlines as self-control mechanisms, albeit in a way that is not as effective as some external deadlines are in boosting task performance.

References

- Ainslie, G. (1975). Specious reward: A behavioral theory of impulsiveness and impulse control. *Psychological Bulletin*, 82, 463-496.
- Akerlof, G. A. (1991). Procrastination and obedience. *American Economic Review*, 81 (2), 1-19.
- Loewenstein, G. F. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes*, 3 (March), 272-292.
- O'Donoghue, T., and Rabin, M. (1999a). Incentives for procrastinators. *Quarterly Journal of Economics*, 114 (3), 769-816.
- O'Donoghue, T., and Rabin, M. (1999b). Doing it now or later. *American Economic Review*, 89 (1), 103-124.
- Schelling, T. (1992). Self-command: A new discipline. In: J. Elster, and G. Loewenstein (Eds.) *Choice over time*. New York: Russell Sage Foundation.
- Strotz, R. H. (1956). Myopia and inconsistency in dynamic utility maximization. *Review of Economic Studies*, 23, 165-180.
- Thaler, R. H. and H. M. Shefrin (1981). An economic theory of self-control. *Journal of Political Economy*, 89, 392-406.
- Wertenbroch, K. (1998). Consumption self-control by rationing purchase quantities of virtue and vice. *Marketing Science*, 17 (4), 317-337, 1998

Table Captions and Tables

Table 1.

Mean Performance in the Different Tasks in the Course

Task	normative group	self-control group	Difference
Grade for paper#1	77	76	-1
Grade for paper#2	70	76	6
Grade for paper#3	77	80	3
Final project	72	73	1
Final exam	71	79	8
Overall grade	67	73	6

Note. Performance is calculated separately for the students who set their deadline as the last day of class (the “normative” group) and the students who set at least one deadline prior to the last day of class (the “self-control” group). The column on the right indicates the differences between the two (self-control minus normative). Positive numbers indicate better performance in the self-control group and are marked in bold.

Figure Captions and Figures

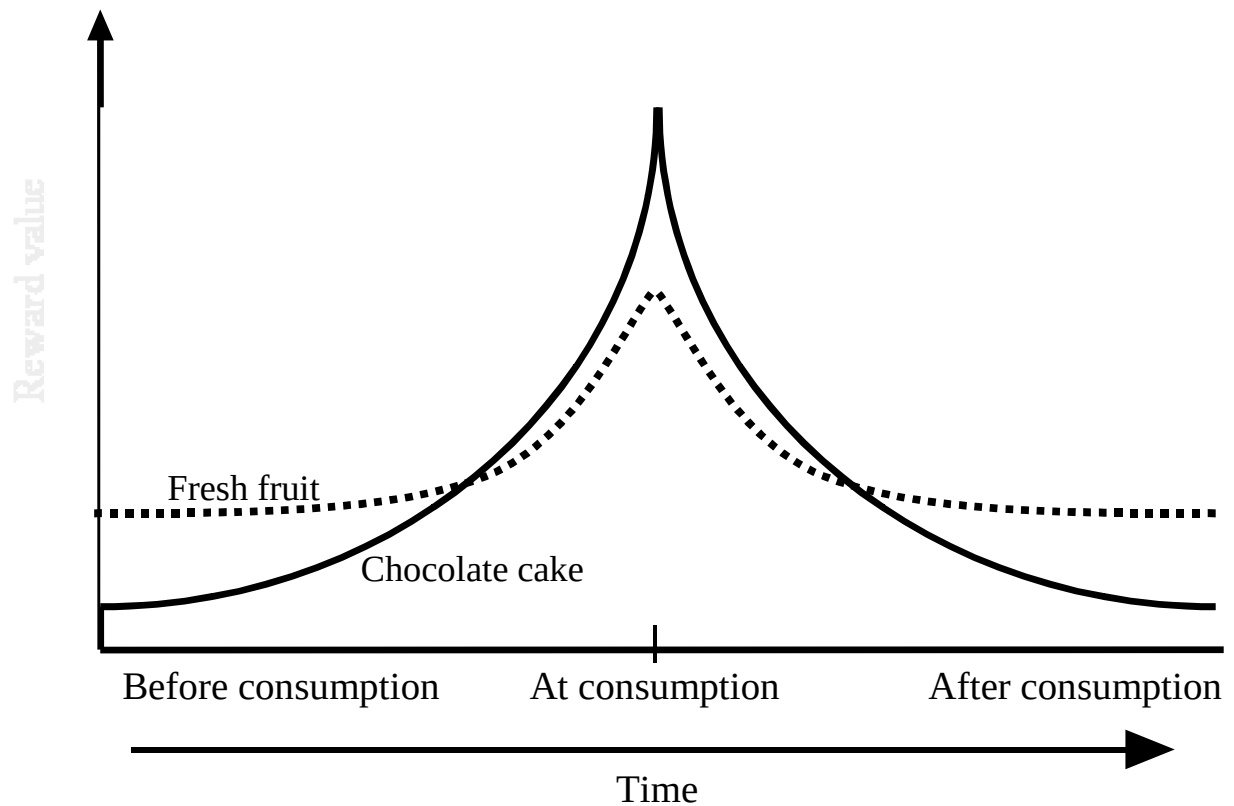


Figure 1: The evolution of time-inconsistent preferences. The decision maker is facing a decision between the “good option,” or virtue (fresh fruit), represented by the broken line and the “bad option,” or vice (chocolate), represented by the solid line. Ahead of the time of consumption, fresh fruit has a higher overall reward value (healthier and not contributing to weight gain). But with the time of consumption approaching, the chocolate cake becomes preferable. Finally, after consumption, the value of chocolate cake over fresh fruit diminishes and the choice of chocolate seems wrong in retrospect (cf. Ainslie 1975).

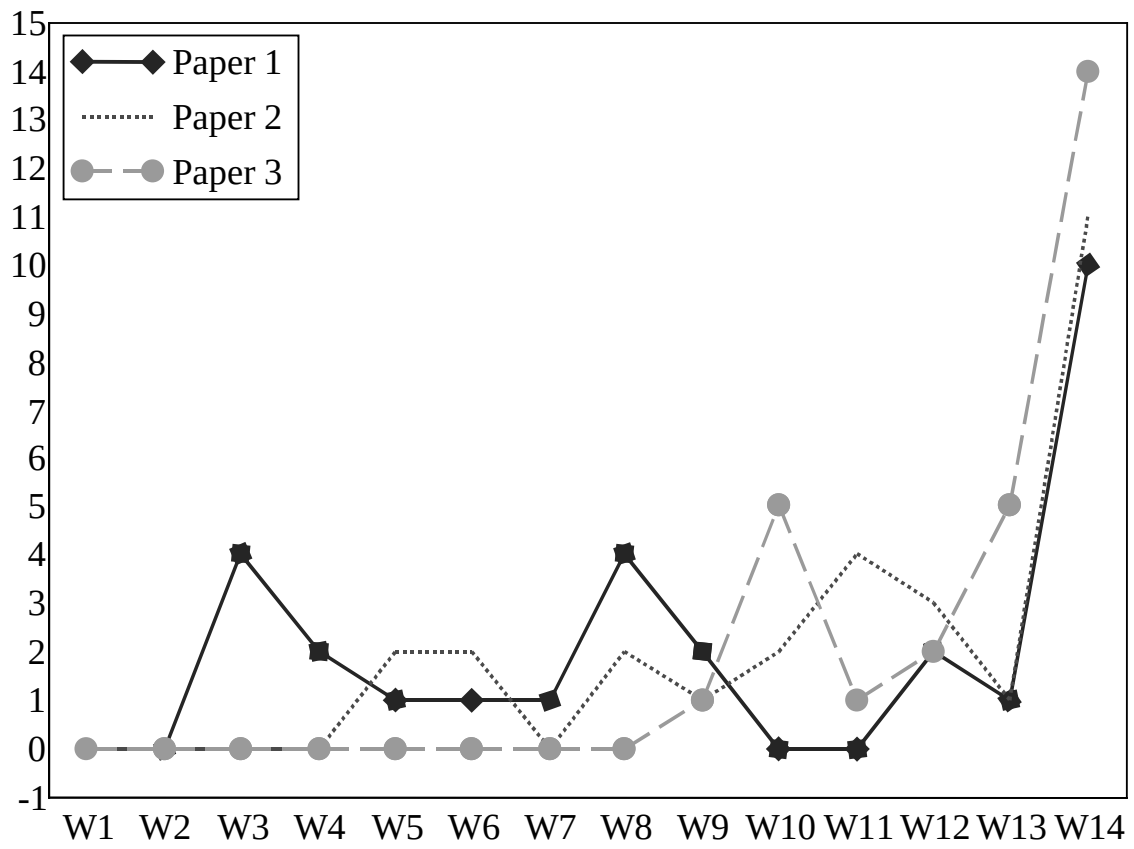


Figure 2. Frequency distribution of the declared deadlines in Study 1 as a function of the week of class (W1 is the first week and W14 the last week), plotted separately for the three papers.