On the value(s) of time: Workers' value of their time depends on mode of valuation

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In this paper, we investigate how individuals make time–money tradeoffs in labor contexts in which they are either asked to work to earn money or to pay money to avoid work. Theory predicts that exchange rates between time and money are invariant to the elicitation method. Results from our experiments, however, show otherwise, highlighting inconsistencies in how individuals consider their time. In the first two experiments, participants work to earn money, and we compare two incentivized elicitation methods. In the first, "Fixed-Time mode," we fix the amount of time participants need to work and elicit the minimum dollar amount they require to do the job. In the second, "Fixed-Money mode," we fix the amount of money we pay participants and ask for the maximum amount of time they are willing to work for that pay. We similarly vary elicitation procedures in Experiment 3 for paying money to avoid work. Translating the results into pay per hour, we find that in Fixed-Time mode, valuation of time is stable across durations, based on an analytical approach. By contrast, in Fixed-Money mode, participants increase their pay-per-hour demand when the amount of money increases, indicating a less calculated and more emotional view of time. Our results demonstrate that individuals' value of their time of labor can be fluid and dependent on the compensation structure. Our findings have implications for theories of time valuation in the labor market.

time | money | valuation | elicitation method

Time and money are both limited resources, and people frequently make trade-off decisions regarding these resources. Economic theory assumes that agents have an inherent exchange rate between the resources that is independent of the way they are asked about it: If we ask a person "How much money do we have to pay you to work X hours," and one answers $Y, then we expect that one's answer to the question "how much time are you willing to work for $Y," will be X. As Becker (1) argued, as long as individuals can use their time freely both to produce and to consume, the allocation of time and the allocation of money problems should be equivalent.

At the same time, there are also large differences between time and money. One cannot go to the automated teller machine and withdraw time. Time that passed cannot be gained back. Time is less fungible than money (2). The evaluation of time is also more ambiguous—the value of time fluctuates depending on immediate situations, whereas the value of money, which is a more common currency, is fairly constant across situations (3). It is argued that because people are more accustomed to making decisions with money than with time, they use heuristics to a greater extent when deciding how to spend their time (4). When individuals are asked to donate time rather than money, they become more emotionally affected and donate more (5). Relatedly, consideration of money activates a more analytical mode of processing, whereas consideration of time activates a more affective mode of processing (6). People also discount time and money differently, with steeper discounting for the future cost of time versus that of money, which is consistent with the belief that one will have more spare time in the future but similar wealth (7, 8). Overall, it is easier to use analytical reasoning to consider money than time, and evaluations of time are more ambiguous and affect driven.

In this paper, we ask whether the psychological differences in the valuation of time and money affect the subjective exchange rate between them, such that different elicitation methods would result in systematically different values. When investigating the exchange rate, past research often chose one elicitation method, either eliciting time for a given amount of money (3, 9) or money for a given amount of time (10, 11). However, their equivalence is unclear. Framing effects in value elicitation, whereby decision-makers are influenced by the way values are presented and questions are posed despite their logical equivalence, have been well-documented in domains such as risk and product attributes [e.g., probability framing (12), gain-loss framing (13), attribute framing (14), and goal framing (15)]. In this paper, we investigate whether and how elicitation frame matters in the domain of time–money exchange. This question is important for methodological reasons as well as for understanding the psychology of the valuation of time and price determination in labor markets.

We compare two elicitation approaches. In the first, "Fixed-Time mode," we fix the amount of time participants need to work and elicit the minimum dollar amount they require to do the job. This elicitation method corresponds to situations in which the task is defined by its duration (e.g., babysitting for 5 h; the sitter considers what is the minimum that he or she wants to be paid for this job). In the second, "Fixed-Money mode," we fix the amount of money we pay participants and ask for the maximum amount of time they are willing to work for that pay. This elicitation method corresponds to labor markets with a fixed compensation (e.g., a cab ride to the airport for $50; the driver considers what is the longest distance he or she is willing to drive for this pay). In our experiments, the workers are Mechanical Turk participants who

Significance

We show that people are inconsistent in the way they assign monetary value to their time in a labor context. In theory, the exchange rate between time and money is invariant to the elicitation method. In contrast to this prediction, we find that individuals' valuation of their time directly depends on whether they are stating a price in time for a fixed amount of money or a price in money for a fixed amount of time. This insight has implications for workers' demand for wages in labor markets. Our research is relevant for researchers, individuals, and firms who seek to gain a deeper understanding of how individuals value and manage their effort.

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complete online tasks for money. The task we used is counting the number of zeros on a page of numbers, repeated for a number of pages (*SI Appendix*, Fig. S1).

To allow for comparisons, we converted the results in both elicitation approaches into pay-per-hour. This conversion allows us to compare the requests in the two methods. We find that the two methods result in similar exchange rates for short (10-min) tasks. For longer tasks, the Fixed-Time mode elicits a relatively constant pay-per-hour demand. However, the Fixed-Money mode elicits hourly rates that were multifold higher. Thus, we find that the value of time greatly depends on the elicitation method.

We argue that one reason this discrepancy occurs is that people use different inputs and heuristics for their time valuation: in Fixed-Time mode, when focusing on stating a dollar value, people elicit the economic value of their time, resulting in a constant wage rate with respect to scale. On the other hand, in Fixed-Money mode, when focusing on stating a time value, people evoke the experience they anticipate in spending their time. As a result, the anticipated pain becomes an important driver of that evaluation. Because people anticipate tedious work to become increasingly painful with scale, their value of time increases with scale in the Fixed-Money mode.

Results

In Experiment 1, for the Fixed-Time mode, we presented participants with a fixed duration of time (10, 20. 30, 60, 120, or 240 min) in a between-subjects design. We asked participants to specify the minimum dollar amount they require to do the job.

In the Fixed-Money mode, we fixed the amount of money we pay participants and asked for the maximum amount of time they were willing to work for that pay. We used the median requested pay for each duration in the Fixed-Time mode as the fixed monetary payments. For example, the median participant asked for a $1.5 compensation to work on a 10-min task in the Fixed-Time mode, so we asked participants in the Fixed-Money mode how long they would be willing to work for $1.5. This method resulted in the following amounts of fixed payments: $1.5, $3, $5, $10, $20, and $40, presented between subjects.

Translating all response values to hourly wages (dollar-per-hour), the results are presented in Fig. 1 (*SI Appendix*, Table S1). We find a main effect of elicitation method [F (1, 1144) = 67.74, $P < 0.001$] and a significant interaction between elicitation method and duration [F (5, 1144) = 17.25, $P < 0.001$] to qualify the main effect.

In the Fixed-Time mode, there was no significant difference in the requested hourly rate across the six durations ($P = 0.85$), with participants asking for $10.76/h on average. In contrast, in the Fixed-Money mode, there was a significant ($P < 0.001$) difference among the six payment amounts (matched to the six durations), with an increasing hourly rate for larger payments. For the smallest payment amount ($1.50), the hourly rate between the Fixed-Time and Fixed-Money modes was similar ($M_{\text{Fixed-Time mode}}$ = $10.08/h; $M_{\text{Fixed-Money mode}}$ = $9.06/h; $P = 0.27$). For the largest payment amount ($40), we found a large difference, with higher valuations of time in the Fixed-Money mode ($M_{\text{Fixed-Time mode}}$ = $10.8/h; $M_{\text{Fixed-Money mode}}$ = $35.45/h; $P < 0.001$). Additional analysis examining differential variances across elicitation methods shows similar results (*SI Appendix*, Table S2). Whereas for the smallest payment amount ($1.5), the variance was similar between modes ($\sigma^2_{\text{Fixed-Time mode}} = 44.36$; $\sigma^2_{\text{Fixed-Money mode}} = 37.33$; $P = 0.41$), for the largest payment amount ($40), we found a large difference, with variance in the Fixed-Time mode significantly smaller than that in the Fixed-Money mode ($\sigma^2_{\text{Fixed-Time mode}} = 50.84$; $\sigma^2_{\text{Fixed-Money mode}} = 1{,}709$; $P < 0.001$).

In Experiment 2, we provide additional evidence for our hypothesis that the valuation of time depends on the elicitation method. First, in addition to the boring task of counting 0's, we added a task that pretesting indicated is more fun for participants—viewing pictures of faces and identifying six basic emotions from the facial expressions (*SI Appendix*, Fig. S2). Second, while Experiment 1 was a hypothetical setting, Experiment 2 replicated this effect in an incentivized design, with five durations between subjects (10, 30, 60, 90, and 120 min, matched to pay $1.5, $5, $10, $15, and $20 in the Fixed-Money mode).

The results are presented in Fig. 2 (*SI Appendix*, Table S3). Replicating the results of Experiment 1, there was a significant main effect of elicitation method, such that time valuation was higher in the Fixed-Money mode versus Fixed-Time mode [F (1,914) = 75.92, $P < 0.001$]. In addition, there was a main effect of task type, as expected. The demanded wage rate was higher when the task was boring than when it was fun [F (1, 914) = 44.48, $P < 0.001$].

We observed a three-way interaction between elicitation method, duration, and task type [F (4,914) = 3.58, $P < 0.001$]. In the boring condition, replicating Experiment 1, there was a significant interaction between elicitation method and duration

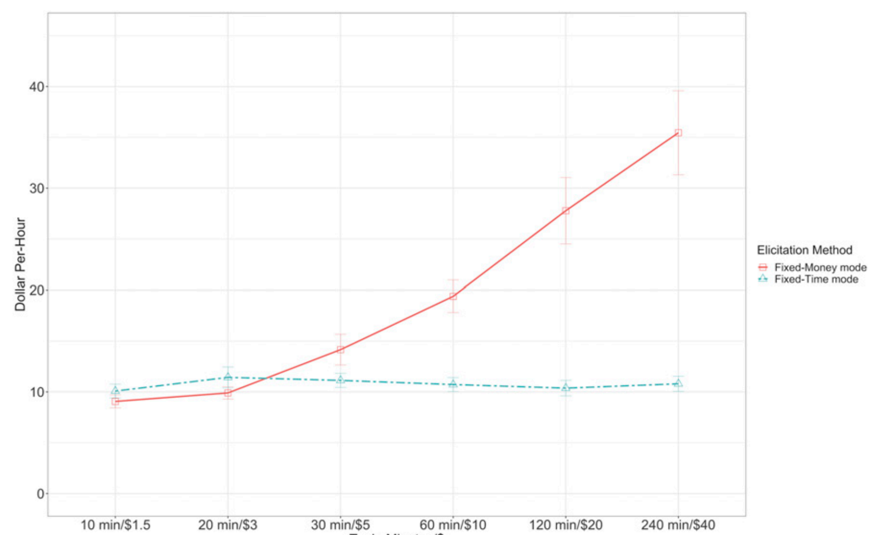

Fig. 1. Average dollar-per-hour valuation across time durations and elicitation methods. Error bars indicate the SEM.

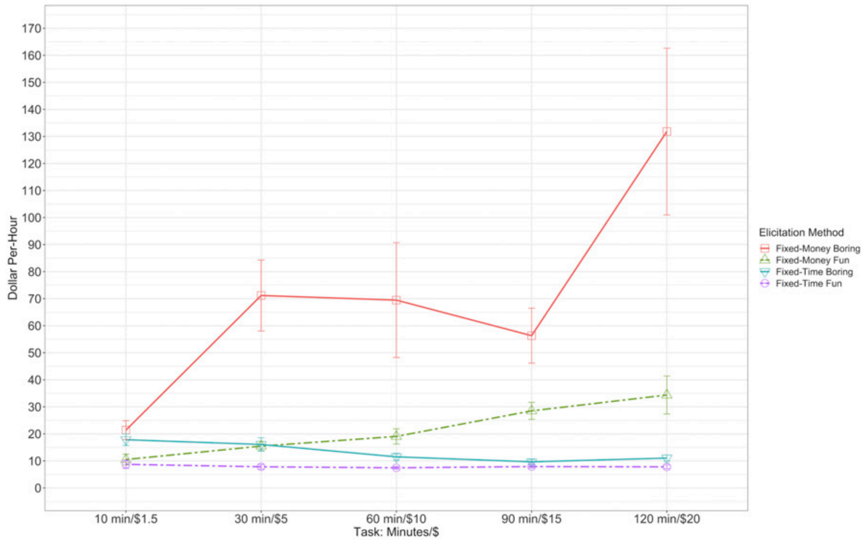

Fig. 2. Average dollar-per-hour valuation across time durations, elicitation methods, and task types. Error bars indicate the SEM.

[F (4, 448) = 5.47, P < 0.001]. Compared to Experiment 1, in which hourly rate stayed constant in the Fixed-Time mode, here, hourly rate decreased with duration (10 min: \$17.85/h; 120 min: \$11.05/h, P = 0.007), perhaps accounting for some start-up cost. In contrast and consistent with Experiment 1, in the Fixed-Money mode, hourly rate increased as payment increased (\$1.5: \$21.38/h; \$20: \$131.81/h, P < 0.001; median values show a similar sixfold increase).

In the fun condition, there was also a similar pattern of significant interaction between elicitation method and duration [F (4, 466) = 6.8, P < 0.001], except the difference between the Fixed-Time and Fixed-Money modes became less pronounced (though still significant). In the Fixed-Time mode, a long-duration fun task elicited a similar hourly rate as a short-duration fun task (10 min: \$8.74/h; 120 min: \$7.8/h, P = 0.58). In contrast, in the Fixed-Money mode, a large-pay fun task elicited a higher hourly rate than a small-pay fun task (\$1.5: \$10.51/h; \$20: \$34.37/h, P = 0.002). In addition, analysis examining differential variances across elicitation methods finds similar results to that of Experiment 1 (*SI Appendix*, Table S4).

Notably, for the fun task in Fixed-Money mode, the difference in hourly rate between the largest- versus smallest-pay task was about a threefold increase, while that difference for the boring task was over sixfold. This is consistent with our theory that in the Fixed-Money mode, when considering amounts of time, people focus on the anticipated experience of the time spent, and the anticipated compounding of pain over a long duration is less severe for fun tasks than for boring tasks. In contrast, in Fixed-Time mode, in which people focus on considering amounts of money, they elicit the economic value of their time. Thus, the fun versus boring tasks as well as short versus long tasks all had more similar time valuations.

So far, we examined participants' valuation of their time in a selling labor context (i.e., work to gain money). In Experiment 3, we provide additional evidence for our hypothesis in a different context: buying out of labor (i.e., pay money to avoid work). This context allows us to test whether the patterns found would

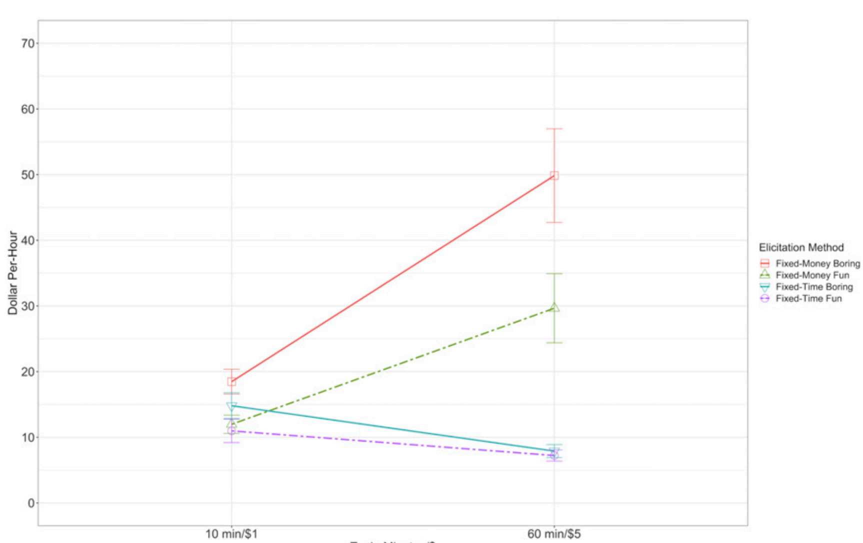

Fig. 3. Average dollar-per-hour valuation across time durations, elicitation methods, and task types. Error bars indicate the SEM.

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generalize when the endowment frames of money and time are reversed—from "gain money spend time" to "spend money gain time." We predict that in Fixed-Time mode, similar to the selling labor context, the exchange rate for buying out of labor will be stable with scale. We tested two competing hypotheses for the exchange rate in Fixed-Money mode. First, one's value of time might decrease with scale (unlike in Experiments 1 and 2) if participants are increasingly averse to losing larger amounts of money. Alternatively, dollar-per-hour valuation might still increase in Fixed-Money mode as scale increases if participants focus on the anticipated pain of doing the work, as they did in Experiments 1 and 2. We test these competing predictions using the same counting and emotion recognition tasks as in Experiment 2, with two durations between subjects (10 min or 60 min; matched to pay \$1 or \$5 in the Fixed-Money mode).

The results are presented in Fig. 3 (*SI Appendix*, Table S5). Replicating the results of the previous two experiments, there was a significant main effect of elicitation method, such that valuation was higher in the Fixed-Money mode versus Fixed-Time mode [F (1,737) = 51.76, $P < 0.001$]. In addition, as expected and replicating Experiment 2, there was a main effect of task type: the required wage rate was higher when the task was boring versus fun [F (1, 737) = 10.07, $P < 0.001$]. Moreover, we observed a marginal three-way interaction between elicitation method, duration, and task type [F (1,737) = 2.94, P = 0.09]. In the boring condition, there was a significant interaction between elicitation method and duration [F (1, 360) = 23.52, $P < 0.001$]. Similar to Experiment 2, Fixed-Time mode hourly rate decreased with duration (10 min: \$14.81/h; 60 min: \$7.9/h, P = 0.002), while in the Fixed-Money mode, hourly rate steeply increased as payment increased (10 min: \$18.47/h; 60 min: \$49.85/h, $P < 0.001$).

In the fun condition, there was also a significant interaction between elicitation method and duration [F (1, 377) = 12.93, $P <$ 0.001]. In a similar pattern to Experiment 2, the difference between the Fixed-Time mode and Fixed-Money mode became less pronounced in the fun condition. In the Fixed-Time mode, a long-duration fun task elicited a marginally lower hourly rate than a short-duration fun task (10 min: \$10.98/h; 60 min: \$7.22/h, P = 0.06). In contrast, in the Fixed-Money mode, a large-pay fun task elicited a higher hourly rate than a small-pay fun task (\$1: \$11.98/h; \$5: \$29.65/h, P = 0.002). Variance analysis finds results consistent with the first two experiments (*SI Appendix*, Table S6). Experiment 3 shows that the effect of elicitation method on time valuation is not dependent on endowment frames of money and time. When we changed the frame from spending time to make money to paying money to gain time, we obtained the same results as in Experiments 1 and 2.

The results of the first three experiments are in line with the conjecture that participants anticipate that the task will become more painful with time—even though this emotional utility is only used as an input in the Fixed-Money mode. In Experiment 4, we provide evidence for this anticipation by measuring participants' anticipated pain (per 10 min)* of doing a counting task over four durations between subjects (10, 30, 60, and 120 min). We find a positive significant main effect of duration on anticipated pain per 10 min [F (3,297) = 3.64, $P < 0.001$]. Post hoc comparisons using the Tukey's honestly significant difference test indicated that the mean anticipated pain in the 10-min condition (M = 61.09; SD = 26.96) was significantly lower than that in both the 60-min condition (M = 72.09; SD = 22.47) and 120-min condition (M = 75.26; SD = 23.69, $P < 0.001$). Moreover, none of the other pairwise comparisons were significant (*SI Appendix*, Table S7). Thus, hourly rate in the Fixed-Money mode but not Fixed-Time mode in previous studies matched the pattern of increasing anticipated marginal pain with scale.

Discussion

What compensation would workers demand for their labor? Results of this research suggest that it would depend on whether the compensation structure is fixed in time or fixed in money. We find that using a Fixed-Time mode results in a pay-per-hour demand that is independent of duration. However, using a Fixed-Money mode results in increasing pay-per-hour demand for longer jobs. Our findings contribute to theories of time valuation in labor markets (16–19) by showing that psychologically, individuals can think about their time as an economic resource or as an affective unit, resulting in systematically different valuations depending on how they construct the time–money exchange.

Our findings have policy implications. For example, for jobs that are unpleasant in nature, offering the job in a Fixed-Time mode (e.g., do this job for 40 h) might result in lower demanded salary (when converted to pay per hour) than using a Fixed-Money mode (e.g., offering \$500 for the job). From a workers' perspective, our results suggest that the common Fixed-Time contract might lead workers to exhibit some level of pain-neglect for long, painful tasks, whereby they are not taking their emotional cost into adequate consideration when evaluating their compensation.

Our findings add a dimension to the literature challenging procedure invariance (20), which shows that preferences are not simply "revealed" but "constructed" (21–23), and one should not simply find the "best elicitation method to reveal the true value" but rather strive to understand how and why different approaches result in different evaluations. The evaluation mode can determine the input and heuristics used, in particular, the extent to which analytical thinking versus emotions play a role in the evaluation (24).

We argued that in Fixed-Time mode, stating a monetary price focuses one's attention on the economic analysis of time, resulting in a constant stated exchange rate between time and money. An alternative for this constant wage is that calculating compensation based on hourly wage is common practice. Future research can test whether wage conventions in a population play a role in time valuation in Fixed-Time mode. Furthermore, in Fixed-Money mode, we posit that stating an amount of time evokes the anticipation of pain during the time spent in driving one's valuation of time. We found evidence for this mechanism by showing that the marginal anticipated pain increases with the scale of the task and that the increased wage over longer durations is particularly large for more painful tasks. There could also be other mechanisms simultaneously operating. For example, in addition to increased anticipated pain with scale, there could also be decreased anticipated utility from money with scale (although only in a Fixed-Money mode). The latter would also lead to increasing wage demand with increasing scale (albeit it would not explain the difference between fun versus tedious tasks). Future research can look into this possibility and generally into the subjective utility of different amounts of money in different evaluative contexts. More broadly, future research can examine more variations in elicitation modes, such as using a "price list" or choices among preset contract options, and identify factors of time valuation therein. Finally, we find the variance of time valuation to be much greater in Fixed-Money mode as the scale of the task increases. This increase in variance may suggest that the affect-based value of time becomes increasingly ambiguous, and it might be increasingly difficult to translate affect into monetary values as the affect intensifies. Future research is needed to examine this possibility and its implications for theories relating affective utility to monetary utility.

*Anticipated pain was rated on a self-report scale ranging from not at all (0) to extremely (100).

Materials and Methods

For all studies reported, written consent was obtained from participants prior to participation, and approval to conduct the studies was granted by the Human Subjects Committee Institutional Review Board at University of California San Diego.

Participants. A total of 3,335 US-based Amazon Mechanical Turk (MTurk) workers gave their consent to participate in this research. The MTurk participants were paid $0.25 in all experiments for show up (contingent payments were extra in Experiment 2). Prior to the main analysis, responses that were more than two SDs below or above the mean were dropped.

Across these studies, a total of 6% of the responses were excluded, leaving a total sample of 3,133 eligible participants overall. To confirm that these exclusions did not significantly bias results, we repeated all analyses using all completed survey responses. Across all studies, the findings remained significant and in line with those reported in the main text when all responses were included in the analyses.

Methods.

Experiment 1. A total of 1,156 eligible participants were randomly assigned to one of 12 between-subject conditions. First, 573 eligible participants (under a target of 600) were randomly assigned to one of six between-subject, Fixed-Time duration conditions (10, 20, 30, 60, 120, or 240 min). All participants were presented with a one-page example of a counting task. Specifically, they were told the following: "During the counting task, you will need to count the number of 0's that appear on the page and write down the total number on the bottom of each page. Once you complete a page, a new page will appear. You will have 60 seconds to complete each page, and you will need to reach a minimum threshold for accuracy."

Next, depending on the duration condition, participants were asked to report the minimum amount of money they were willing to accept in exchange for completing this counting task for that duration.

Subsequently, 583 eligible participants (under a target of 600) were randomly assigned to one of six between-subject, duration-equivalent, Fixed-Money payment conditions ($1.5, $3, $5, $10, $20, or $40). As in the previous study, all participants were first presented with a one-page example of a counting task. Then, depending on dollar amounts condition, participants were asked to report the maximum amount of time they were willing to work on this counting task for that dollar amount.

Experiment 2. A total of 934 eligible participants (under a target of 1,000) were randomly assigned to one of 20 between-subject conditions in a 2 (elicitation method: Fixed-Time mode versus Fixed-Money mode) $\times$ 2 (task type: boring versus fun) $\times$ 5 (duration: 10, 30, 60, 90, or 120 min; or duration-equivalent payment: $1.5, $5, $10, $15, or $20). The general procedure was similar to that of the first experiment. Participants were shown an example of one page of either a fun or a boring task (*SI Appendix*; pretested to be relatively fun versus boring). For the fun task, participants were told they would view pictures of faces and be asked to identify six basic emotions from the facial expressions (sadness, happiness, fear, anger, disgust, or surprise). For the boring task, participants were told they would complete a counting task identical to the one in Experiment 1. Following these instructions, participants in the Fixed-Time mode were asked to report the minimum amount of money they would be willing to accept in exchange for completing the task. Participants in the Fixed-Money mode were asked to report the maximum amount of time they would be willing to do the task in exchange for money. We determined the duration-equivalent pay in the Fixed-Money mode based on a $10/h rate. This $10/h rate was directly informed by Experiment 1, in which we found that participants in the Fixed-Time mode valued their time at approximately $10/h across all time durations. For example, we calculated the 90-min duration-equivalent pay by multiplying the total time (1.5 h) by $10/h to yield a Fixed-Money pay of $15. To incentivize participants, in the Fixed-Time (money) mode, we informed them that the lowest (highest) five responses would be chosen to do the task for the amount of money (time) they indicated.

Experiment 3. A total of 745 eligible participants were randomly assigned to one of eight between-subject conditions. First, 371 eligible participants (under a target of 400) were randomly assigned to one of four Fixed-Time mode, between-subject conditions in a 2 (task type: boring versus fun) $\times$ 2 (duration: 10 or 60 min). All participants were presented with the following scenario: "Imagine you have worked full-time for the week, and your paycheck for the entire week will be coming later today. Before you get your paycheck, there is one more task you must complete, a 10-minute counting task (60-minute counting task / 10-minute emotion recognition task / 60-minute emotion recognition task). Your manager informed you that you can pay to avoid doing the 10-minute counting task (60-minute counting task / 10-minute emotion recognition task / 60-minute emotion recognition task), out of your current paycheck. In other words, you can pay money to get out of doing the counting task (emotion recognition task), and the money you pay will be directly taken from your paycheck."

Next, depending on the fun/boring condition, participants were presented with a one-page example of a counting task (emotion recognition task). Lastly, depending on duration condition, participants were asked to report the maximum amount of money they were willing to pay to avoid doing the counting task (emotion recognition task) for that duration.

Subsequently, a total of 374 eligible participants (under a target of 400) were randomly assigned to one of four Fixed-Money mode, between-subject conditions in a 2 (task type: boring versus fun) $\times$ 2 (duration-equivalent payment: $1 or $5). As in the previous study, all participants were first presented with the following scenario: "Imagine you have worked full-time for the week, and your paycheck for the entire week will be coming later today. Before you get your paycheck, there is one more task you must complete, a counting task / an emotion recognition task. Your manager informed you that you can pay $1 ($5) to avoid doing the counting task (emotion recognition task), out of your current paycheck. In other words, you can pay $1 ($5) to get out of doing the counting task (emotion recognition task), and the money you pay will be directly taken from your paycheck."

Next, depending on condition, participants were presented with a one-page example of a counting task (emotion recognition task). Lastly, depending on condition, participants were asked to report the minimum amount of time they would want to buy out with a $1 ($5) deduction from their pay.

Experiment 4. A total of 298 eligible participants (under a target of 300) were randomly assigned to one of four between-subject, time-duration conditions (10, 30, 60, or 120). As in previous experiments, all participants were presented with a one-page example of a counting task (the same one used in previous experiments). Next, depending on condition, participants were asked to report their anticipated pain of completing the task. Specifically, they were told the following: "Suppose you are doing this task for 10 (30, 60, or 120) minutes. In your anticipation, in these 10 (30, 60, or 120) minutes, how painful is each 10 minutes of the task on average? (0 = Not at all; 100 = Extremely)."

Data Availability. A web appendix and project data have been deposited in the Open Science Framework (https://osf.io/env2h/?view_only=f15e3530d1054010a43c08c61289a7d8) (25)

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