Small Victories: Creating Intrinsic Motivation in Savings and Debt Reduction[*]

Alexander L. Brown[**]
Texas A&M University

and

Joanna N. Lahey[***]
Texas A&M University and NBER

February 28, 2013

Abstract: Saving when faced with the immediate option to spend is an unpleasant but not conceptually difficult task. The popular "debt snowball" approach contradicts traditional economic theory by suggesting that people in debt should pay off their debts from smallest size to largest regardless of interest rate, to realize quick motivational gains from eliminating debts. We discuss, model, and test alternative behavioral theories that might explain this approach. Using a laboratory computer task, we test the validity of these predictions, by breaking down this "debt snowball" approach into component parts and examining their efficacy. Consistent with the idea of the "debt snowball," we find that when a mildly unpleasant computer task is broken down into parts of unequal size, subjects complete these tasks faster when they are arranged in ascending order (i.e, from smallest to largest) rather than descending order (i.e., from largest to smallest). Yet when subjects are given the choice over three different orderings, subjects choose the ascending order least often. Of the subjects that choose the ascending order, performance increases are strongest for participants with high self-control and better critical reasoning skills. Given the magnitude of our results, we briefly discuss the possible efficacy of these alternative methods in actual debt repayment scenarios.

---

[*] This paper benefitted from helpful comments at the 2012 North American Economic Science Association Meetings, especially Martin Dufwenberg and John Kagel. We also received helpful comments from Pablo Brañas-Garza and Gary Charness. We especially thank José Gabriel Castillo, Gregory Cohen, Luke Franz, Matthew Liu, Laura Lombardo, Daniel Stephenson, Britnee Warmerdam, J. Forrest Williams, and Xiaoyuan Wang for help running, designing and transcribing data from experiments. We thank the International Foundation for Research in Experimental Economics for financial support for subject payments under their Small Grants Program.
[**] Contact author. Alex Brown can be contacted at abrown@econmail.tamu.edu.
[***] Joanna Lahey can be contacted at jlahey@nber.org.

I. Introduction

Savings provides for consumption in retirement, helps households smooth consumption after unexpected job loss, and lowers the utilization of public assistance programs. Despite its importance over the lifecycle, the accumulation of sufficient savings is far from universal. According to Bureau of Economic Analysis estimates, personal saving as a percent of disposable personal income dropped to a low of 1.4% in 2005, increasing to 5.9% in 2009 (Bureau of Economic Analysis 2010). This lack of sufficient savings will have profound effects on the well-being of future retirees, especially those who end up cutting their work lives short because of unexpected negative health or employment shocks. Consumer debt compounds this problem; before many households can make progress on retirement savings, they must first reduce or eliminate personal debt. According to the Survey of Consumer Finances, in 2007 the mean net worth of the lowest quintile of the population was negative $2,100, meaning that after accounting for debt, these households have no savings at all (Federal Reserve Board 2010). Because accumulating savings is intertwined with debt-reduction, any future policy concerning savings must also focus on reducing debt. With lower debt, people can build wealth and experience an undiminished quality of life during retirement. Additionally, techniques helpful in debt reduction may be applied to build up savings and grow wealth, thus insuring retirement income.

Regardless of debts accrued, optimal retirement saving is not easy for most consumers. It requires individuals to understand consumption, investment and labor markets, as well as to master dynamic programming with uncertainty. This required knowledge is often described as "financial literacy."[1] Yet, even for the financially literate, time-inconsistent behavior can derail retirement savings as the short-term, salient, desire to consume overpowers the long-term, peripheral plan to save. Experimental analysis suggests even when subjects are capable of understanding the complexity of a savings problem, the temptation of immediate rewards can cause them to make sub-optimal longer-term decisions (Brown et al. 2009). Thus, people with low levels of savings may require behavioral techniques as well as financial training to overcome their short-term impulses.

Because savings behavior can feature time-inconsistent preferences and thus self-

[1] A burgeoning literature documents the relationship between literacy and savings behavior and the use of matching grants to encourage retirement savings (e.g. Bernheim and Garrett 2003, Bernheim et al. 2001, Lusardi and Mitchell 2007a, Lusardi and Mitchell 2007b, Martin 2007, Schreiner, Clancy, and Sheradden 2002).

regulation problems, it differs from traditional economic theory, and may be an area in which behavioral, rather than rational, solutions are most effective. We focus on a phenomenon we term "small victories," the idea that people can motivate themselves to greater task completion by first completing an easier related task. That is, a larger project is not only broken up into smaller tasks, but the tasks are ordered to become progressively larger or more difficult. In relation to debt-reduction, this principle suggests there may be an additional motivational benefit for a person paying off his or her smallest debt first, and then paying the rest of his or her debts from smallest to largest. In comparison, standard economic models advocate paying off debts in order from highest to lowest interest rates. Indeed, Amar et al. (2011) suggest that, when given a choice, individuals prefer to follow the economically sub-optimal strategy, paying off their small debts first regardless of interest rate and then progressing to larger debts, even though doing so means that they pay more money in interest. This economically sub-optimal strategy has been advocated by self-help books for debt-reduction, including those by radio personality and author Dave Ramsey who terms this process the "debt snowball" (1998, 2009).

> "The reason we list [debts from] smallest to largest is to have some quick wins…When you start the Debt Snowball and in the first few days pay off a couple of little debts, trust me, it lights your fire…When you pay off a nagging $52 medical bill or that $122 cell-phone bill from eight months ago, your life is not changed that much mathematically yet. You have however, begun a process that works, and you have seen it work, and you will keep doing it because you will be fired up about the fact that it works." (Ramsey, 1998, p. 114-117)

Rather than demonstrating that people are making mistakes, we hypothesize that debt-reduction strategies that utilize "small victories" are more effective at reducing debt and increasing savings than are strategies dictated by traditional economic theory in some situations. While this process has not been studied in relation to savings until recently, it is similar to "exposure therapy" for specific anxieties and the use of "flow" in videogame development (Richard and Lauterbach 2006; Schell 2008). The psychological literature most similar to "small victories" is the subject of goal setting and task motivation. One predominant theory proposes that as the "discrepancy" between one's actual performance and goal shrinks, individual motivation increases (Hull 1932; Heilizer 1977). A competing theory advocates that successful past task completion provides further motivation for the future (Bandura, 1977; 1986). Both theories suggest completing a smaller task first would increase motivation to complete a similar larger task. Further, for complex tasks, evidence suggests that completing a small proximal goal before a large distal one can aid people by providing feedback about their current performance (Lantham and Seijts, 1999). These psychological theories suggest several motivations for why small victories may work. Numerous experiments have supported the predictions of these theories (e.g. Bandura and Simon, 1977; Bandura and Schunk, 1981; Morgan, 1985; Stock and Cervone, 1990; Latham and Seijts, 1999; Kivetz, Urminsky and Zheng, 2006; Nunes and Dreze, 2006).

We find subjects complete a tedious task faster when it is broken up into parts in order of ascending length compared to descending or equal lengths. Our theoretical framework shows this result is consistent with predictions derived from the psychological literature on task motivation of Bandura (1977; 1986), but is not consistent with the competing discrepancy theory (Hull 1932; Heilizer 1977). Further analysis—which shows subjects speed up as they approach the end of columns and slow down at the beginning of columns—provides some support for discrepancy theory (Hull 1932; Heilizer 1977). A second study finds when subjects are given the opportunity to choose over all three treatments they choose the ascending order *least* often. Aggregate performance increases over all orderings suggesting subject heterogeneity and a general benefit to choice. Additionally, those with higher self-control and better critical reasoning skills, as measured by the Tangney-Baumeister-Boone thirteen question, short-form measure of self-control (Tangney et al. 2004) and the Cognitive Reflection Test (CRT) (Frederick, 2005), benefit more from having chosen ascending.

Taken at face value, our results suggest there is some benefit in the form of intrinsic motivation in taking the small victories approach to debt-reduction. While it will take substantial investigation to determine the actual magnitude of this benefit in field debt-reduction situations, we caution readers that *even if this benefit has the identical effect as in the lab* it will only be useful to borrowers in specific cases of debt-reduction where interest rates between loans do not differ greatly. In the event of large differences in interest rates on loans, it will be best for consumers to pay off debts from largest interest rate to smallest, despite the additional motivational benefit from the debt-snowball approach.

The remainder of the paper is organized as follows: Section II maps out simple theory explaining the small victories phenomenon. Section III describes the laboratory experiment. Section IV applies our theoretical predictions to the laboratory experiment. Section V provides results, Section VI adds greater context to our main result, and Section VII discusses and concludes.

II. Theory

We wish to apply the psychological findings mentioned in the preceding section to a formalized, theoretical model of task-competition. We will examine how dividing a task up may aid one's progression in that task. This framework will allow us to derive careful conclusions about the implications of the psychological literature on both debt-repayment and other abstract tasks.

Let us define a task, X, that consists of individual discrete elements $x \in X$. Each task X can be framed into subtasks using a partition α.[2]

Definition. *The* <u>*subtask partition*</u> *$\alpha \in A(X)$ is a list of m ordered sets $\alpha=(\alpha_1,\ldots,\alpha_k,\ldots, \alpha_m)$ where $m \leq |X|$. Define $L_\alpha(k)=|\alpha_k|$. For each $1 \leq k \leq m$, $\alpha_k=(\alpha_{kl})$* for *$1 \leq l \leq L_\alpha(k)$, such that*

$$\sum_{k=1}^{m} L_\alpha(k) = |X| \quad and \quad \bigcup_{k=1}^{m} \bigcup_{l=1}^{L_\alpha(k)} \alpha_{kl} = X.$$

Note this implies that no two x's are repeated in α.

For each subtask partition, α, we can now define a function that maps each x to its position in α. Let $\phi(x, \alpha)=(k,l)$ where $x= \alpha_{kl}$. Then we may write $\phi_1(x, \alpha)=k$ and $\phi_2(x, \alpha)=l$ where $x= \alpha_{kl}$. Each individual $i \in N$ will complete each task based on the sum of the times it takes to complete each element (or alternatively pay a cost in time for each task based on the sum of the costs of each discrete element) given its position in the subtask partition. The two factors that may matter in the subtask partition are number of remaining elements in the subtask, and the number of previously completed subtasks. These factors will additively affect time performance

[2] In debt-repayment, one could think of each x as a monthly payment, and each subtask as an individual debt. The task X would be the removal of all debt. In our experiment each element is a cell, a subtask is a column, and X is a session.

for each individual. The function $\tau_i(x,\alpha)$ gives the time it takes individual i to complete element x under subtask partition α.

$$\tau_i(x,\alpha) = \mu_i + h\Big(L_\alpha\big(\phi_1(x,\alpha)\big) - \phi_2(x,\alpha)\Big) + v\Big(\phi_1(x,\alpha)\Big) + \varepsilon_{ix}$$

Thus the time to complete an element depends on an individual's characteristics μ_i and personal idiosyncratic error with element x, ε_{ix}. But it also depends on the element's position in subtask partition α. Function h expresses how the position of an element within a subtask affects performance, specifically its position from the end of a subtask. Function v expresses how previously completed subtasks affect performance. Note that the total time it takes individual i to complete a task under subtask partition α is given by

$$\mathrm{T}_i(\alpha) = \sum_{x\in X} \tau_i(x,\alpha).$$

Using the previously mentioned psychological literature as our guide, we will impose restrictions on functions h and v.

Assumption 1(a) (Bandura). *After completing a subtask, individual performance increases. Formally, v is decreasing.*

Often subtasks may be already defined, and one may be concerned with the question of how to order the subtasks in a way that will increase performance. For instance, a consumer may have multiple debts owed, and can choose in which order to repay them, but cannot restructure the debts. To fit such cases, we define a *class* of subtask partitions, or all subtask partitions that have the same structure of elements in each subtask, but the order of the subtasks has been changed.

Definition. *For any given X, the subtask partitions α' and α'' are said to be in the same <u>class of subtask partitions</u>,* $\beta \subseteq A(X)$*, if and only if* $|\alpha'|=|\alpha''|=m$ *and for all k,* $1\leq k\leq m$*, there exists a k' such that* $\alpha_k'=\alpha_{k'}''$*. That is, β is the set of all subtask partitions that differ by at most the ordering of subtasks.*

Under assumption 1(a) we can deduce a general results about the aggregate performance of tasks under subtask partitions of the same class.

Proposition 1. *For any i, for a given <u>class of subtask partitions</u>,* $\beta \subseteq A(X)$*. There exist α' and α'' such that*

$$\mathrm{T}_i(x,\alpha') \leq \mathrm{T}_i(x,\alpha) \leq \mathrm{T}_i(x,\alpha'') \;\forall\, \alpha \in \beta$$

and

$$|\alpha_1'| \leq \ldots \leq |\alpha_k'| \leq \ldots \leq |\alpha_m'|,\; |\alpha_1''| \geq \ldots \geq |\alpha_k''| \geq \ldots \geq |\alpha_m''|.$$

If v is non-constant, and α'≠α'', $T_i(x,\alpha') < T_i(x,\alpha'')$*.*

Proof: See Appendix.

Proposition 1 states that if people perform better after completing a subtask, and only the ordering of subtasks can be changed, putting subtasks in ascending order leads to optimal performance and minimal costs, while descending order leads to the worst performance and maximal costs. As long as all subtasks are not of equal length there should be a difference between these two extremes.

Note that Proposition 1 requires no structure on function *h*, the function that concerns performance relative to the end of the subtask. Thus, the findings of Bandura (1977; 1986), when applied to our model, suggest an optimal debt-repayment (or any general task-completion strategy) that is consistent with the debt snowball.

However, there is an alternate view of task completion that suggests distance to the end of a subtask, not subtasks completed, affects motivation.

Assumption 1(b) (Hull-Heilizer). *As individuals near the end of a subtask, their performance increases. Formally, h is increasing.*

If we instead use Assumption 1(b), and assume that the Bandura term *v* is constant (effectively zero), we find a much different result about the structure of subtasks.

Proposition 2. *For any X and i, if there exists an α'∈A(X) such that* $L_{\alpha'}(k)=c$ *for all* $1 \leq k \leq m$*. Then if v is constant,*

$$\mathrm{T}(x,\alpha') \leq \mathrm{T}(x,\alpha) \quad \forall\, \alpha \in \mathrm{A}(X) \text{ where } |\alpha'|=|\alpha|=m.$$

Further, if α'≠α and f is strictly increasing, $\mathrm{T}(x,\alpha') < \mathrm{T}(x,\alpha)$.

Thus under these assumptions, for any given number of subtasks, the optimal arrangement is to have subtasks of equal length. This will assure the average distance to the end of subtasks is the lowest on average.

For econometric considerations we also make assumptions on ε_{ix}.

Assumption 2 (Independence of errors). *The error terms ε_{ix} are independently identically distributed $N(0,\sigma)$* and $E(\varepsilon_{ix})=0$.

To conclude, Propositions 1 and 2 lead to very different results. If previous completion of subtasks aid future performance, as in Bandura (1977; 1986), then ascending orders are optimal for task completion and descending orders are the worst possible. This result holds regardless of the conditions imposed on *h*, the Hull-Heilizer function. If instead, completion of past subtasks does not matter, as in Hull (1932) and Heilizer (1977), and only distance to the end of those subtasks matters, then having a constant length of each subtask is ideal. In such case the even ordering will feature better subject performance than either ascending or descending orderings. Our experiments will compare ascending, descending, and even-length treatments to test these predictions.

III. Procedures

In order to simulate a series of debt repayments, we chose a computer task that was mildly unpleasant but not conceptually difficult. The experiments primarily consisted of subjects sitting at a computer terminal and copying ten-character lines of text in a Microsoft Excel worksheet. Subjects would copy a line of code and then click a button on their worksheet. If they had copied the line correctly, they would move to the next cell; if they copied incorrectly, nothing would happen until they copied the line of text correctly. The lines of text included upper and lower case letters, numbers and their shifts[3] (e.g., !#) and had been randomly constructed before so that each subject encountered the same order and same lines of text in cells.

The experiment had two main parts: a practice session, and one large copying task. Subjects would either complete their tasks or reach the time limits.[4] The practice session had a 5-minute time limit, and the large copying task had a 30-minute time limit. The practice task was the same for all subjects. It consisted of each subject typing ten lines of text. It was designed to familiarize subjects with the experimental procedures as well as to get an estimate of their general skill in these tasks.

[3] To avoid confusion the characters "I" and "l" were excluded. The sign "@", which produces a hyperlink in Excel, was also excluded.

[4] After the copying tasks, subjects had a ten-minute break and then participated in various pilots of future copying tasks. Subjects were aware of this second 30-minute session at the beginning of their experiments. The results of the pilot sessions are not presented here and are not relevant to the data analysis or conclusions of this paper.

The larger, 30-minute, tasks varied depending on the environment, but all tasks started with subjects encountering 150 cells to copy divided into 5 columns. In the baseline study, subjects were randomly assigned to three treatments. In the "ascending" treatment, the columns increased in size. The columns had 10, 20, 30, 40, and 50 cells respectively. In the "descending" treatment, the columns decreased in size and had the reverse ordering of the ascending (50, 40, 30, 20, and 10). In the "even" treatment all columns had 30 cells. Figures 1(a-c) provide screenshots of the initial worksheet under each of the three treatments.

Subjects completed their columns in order, left to right. Unless completing a column, every time a subject finished a cell he or she would move down to the next cell below the current cell. To frame column completion as a distinct event, the experimental interface would open a message box every time a subject completed a column. For all columns but the last column, the message said "You have completed X columns. Only 5-X to go!" When subjects finished the last column, they were given a congratulatory message. Once subjects clicked ok on that message, they moved to the cell at the top of the next column to the right.

Ninety-one subjects participated between December 6, 2011 and March 7, 2012. The session took place at the Economic Research Laboratory at Texas A&M University. Subjects were recruited from the econdollars website (econdollars.tamu.edu) that uses ORSEE software (Greiner, 2004).

For each task subjects were paid $10 if they could complete the task in under 30 minutes, plus an additional $0.50 for every minute they finished early, rounded up to the nearest minute. Subjects that did not complete the task were paid $10 minus $0.05 for every cell they left uncompleted. Because this structure guarantees a minimum payment for subjects, there were no additional payments given to subjects (i.e., show up fees). Subject earnings averaged $10.89 for the 35-minute session.[5] Subjects completed a demographic survey (from Eckel and Grossman, 2008), the Barratt Impulsivity Test (BIS 11) (Patton et al., 1995), the Zuckerman Sensation-Seeking Scale (SSS-V) (Zuckerman, 1994) and a five-factor personality assessment (John et al., 2008).[6]

[5] Including the second pilot task, subject earnings averaged $20.01 for 75 minutes.
[6] None of these three personality tests in the baseline condition were correlated with any subject performance measures (see Appendix, Table 1). We will not discuss these tests in relation to our results. In retrospect, it would have been preferable to replace these surveys with the surveys used in the choice condition (see below).

After examining the results of the first set of subjects, one remaining question was how subjects might have chosen among the treatments if given that choice. To answer this question a second "choice" study was run with 70 subjects between January 30 2013 and January 31, 2013. The study featured the same task and procedures as the first, except that before the experiments began, subjects were allowed to choose whether they would encounter the ascending, descending or even treatment. The experimenter showed pictures of each treatment on a screen with randomized names (i.e., "a", "b" and "c") and subjects would click on any of three icons corresponding to those names. After the subjects clicked on the icon, they would have a five-minute practice session and a 30-minute typing task. The second half of the experiments was again used for piloting other effort tasks. Subjects completed a demographic survey and non-incentivized risk-preference choice to elicit risk attitudes (both from Eckel and Grossman, 2008), financial literacy questions from the Health and Retirement Survey (Lusardi and Mitchell 2007b), the Tangney-Baumeister-Boone Scale (Tangney et al. 2004), and the Cognitive Reflection Task (Frederick, 2005).

IV. Theoretical Predictions

Propositions 1 and 2 give us two different predictions about the ordering of each task.

Prediction 1a (Bandura). Subjects in the ascending orders should finish faster than those in the descending orders, and be more likely to complete their tasks in the time allowed. Formally,

$$t_A < t_D, \qquad p_A > p_D$$

where t is the time to completion and p is the probability of completion.

Prediction 1b (Hull-Heilizer). Subjects in the even orders should finish faster than those in the ascending and descending orders, and be more likely to complete their tasks in the time allowed. Formally,

$$t_E < t_A, t_D, \qquad p_E > p_A, p_D.$$

Note that although Propositions 1 and 2 require contradictory assumptions, their respective predictions could be both correct if $t_E < t_A < t_D$ and $p_E > p_A > p_D$ and both incorrect if $t_E > t_A > t_D$ and $p_E < p_A < p_D$.

Because the debt-snowball approach (Ramsey, 1998, 2009) advocates ordering debts in ascending order to create a debt snowball, his advice is most consistent with the work of Bandura

(1977; 1986), Assumption 1a, Proposition 1 and Prediction 1a. Thus to test Ramsey's advice we will look for the conditions in (1a).

Our underlying psychological theories also make predictions about subject performance in specific columns throughout the experiment. If the theories underlying assumption 1a are valid, we should see subjects speed up as they complete more columns. If the theories underlying assumption 1b are valid, subjects should perform faster as they reach the end of each column. Recall from Proposition 1 that only assumption 1a is necessary for prediction 1a, for the ascending order to be faster than the descending. However, Proposition 2 requires assumption 1a not to hold and assumption 1b to hold, for prediction 1b to be valid, and subjects in the even treatment to perform the fastest.

V. Results

a. Time to Completion and Probability of Completion (Predictions 1a and 1b)

In the baseline environment, *consistent with Prediction 1a and Ramsey's debt-snowball approach*, subjects performed in the ascending treatment 1.42 seconds per cell faster on average than in the descending treatment, significant at the 5% level), as shown in Table 1 (Panel I). This relationship does not substantially change when ascending is compared to the pooled results of both descending and even treatments (1.23 seconds per cell faster on average, two-sided p-value: 0.019). Even subject performance falls between ascending and descending, which is inconsistent with Prediction 1b. A Kruskal-Wallis test indicates the differences for all three treatments are significant at the 10% level (two-tailed p-value: 0.084). As a robustness check, a regression (see Table 3) which controls for subject practice time does not appreciably change results. Additionally, practice time in seconds is strongly correlated with actual time in seconds with a coefficient of 0.133 and a standard error of 0.045 (results not tabled).

Table 1 (Panel II) shows the number of subjects that completed the full task, that is, those who copied all 150 cells in the 30-minute limit. A higher percentage of subjects (71%, 22 of 31) complete the task in ascending than descending (48%, 14 of 29) or even (58%, 18 of 31). A Pearson's chi-square test reveals this difference is meaningful at the 10% level. As before, this result is consistent with Prediction 1a, and the theories of Bandura, but not consistent with Prediction 1b.

b. Relative cell speed during task completion

A crucial assumption behind both predictions 1a and 1b is that subjects complete cells at different speeds depending on their position within the columns that make up the general task. The validity of this assumption can be examined directly. Figure 2 shows subject performance for each treatment relative to average performance. Consistent with Hull (1932) and Heilizer's (1977) discrepancy theories, subjects complete cells at a faster rate as they near the completion of a column. While subjects do not appear to start columns immediately faster, their time per cell greatly decrease over the course of completing columns, which is consistent with the theories of Bandura (1977; 1986). Further, note that this decrease is inconsistent with fatigue; subjects are speeding up over time.

To test whether this apparent speed-up shown in the figures is mathematically significant, we first control for a linear time trend consistent with speeding up through learning by using the residuals from a corrected equation on time. Thus, our coefficients indicate distance from the population mean for each environment across all treatments. Next, we created a new variable that indicated a "1" if the cell completed was in the first five cells of a column and a "0" if in the last five cells of a column. Cells that were neither in the first nor last five of any column were coded as missing. These results are presented in Table 2.

As shown in Table 2, participants complete the last five cells of each column on average 1.11 seconds faster than they complete the first five cells of each column. The pattern is similar for descending, but not significant, and attenuated for equal. To bound for a non-linear effect of learning, we repeated these t-tests with the first five and last five cells over-all removed from the analysis, thus starting with the last five cells of the first column and ending with the first five cells of the last column. Results, though attenuated compared to the bound in the other direction, were same signed and still significant and are available from the authors.[7]

Additionally, there may be some concerns that we are over-stating our power, depending on the assumptions of independence of columns or individuals. Therefore, we also present more conservative t-tests and regressions that assume that each set of five cells should be treated as one observation, assume that the first 5 cells across all columns should be treated as one observation per person as should the last 5 cells, or group all treatments together. Even the most

[7] A related worry is that some participants do not finish the experiment and thus these slower participants may be completing fewer "last" cells than "first" cells depending on where in the sheet they stop. A robustness check that cuts first and last cells until there are an even number of cells on either end (or as close as possible to an even number of cells) finds remarkably similar results to our main results.

conservative t-tests only reduce previously significant results from 5% to 10% with magnitudes largely unchanged, as shown in Table 4. We also provide regression results in Table 5 with clustering at the subject, cell, and subject*column levels, allowing for different assumptions about the standard errors. Again, these results are consistent with our t-test results.

As an overall trend, the results presented here are consistent with both sets of psychological theories. While the results supported prediction 1a and not prediction 1b, the former prediction only required the theories of Bandura (1977, 1986) to hold to be correct. Whether the discrepancy theories held was of little consequence. Prediction 1b needed the discrepancy theories to hold, *and* no effect from the theories of Bandura (1977, 1986). Our separate results on speeding up at the end of columns provide support for the validity of these discrepancy theories. The support of prediction 1a gives credence to the idea of the small victories strategy in generalized task completion environments.

c. Choice Study

In a second study, 70 subjects were given the opportunity to choose their treatment. Table 6 shows the results of this choice. Of the 70 subjects, 16 chose ascending, 31 chose even and 23 chose descending. A Pearson's chi-square test reveals these results are different from a random distribution at the 10% level. Strikingly, the ascending treatment—the method that follows the small-victories theory and is shown to lead to the best performance among subjects in the baseline study—is the least preferred. Less than one fourth of all subjects (22%) choose that method. This result is in stark contrast to Amar et al. (2011), who find that subjects prefer to pay debts from smallest to largest without considering interests rates. Their result, however, is in a much more stylized environment—one which much more transparently resembles actual debt-repayment—in which some popular culture gurus suggest that exact treatment.

There is little ability difference among subjects who choose different treatments in the choice study. Subjects that choose ascending tend to tend to be more proficient at the typing task in practice, but that difference is only significant at the 10% level when compared to those who choose descending. We present regression results controlling for practice time average. With the exception of our risk aversion measure, which may predict the choice of ascending over equal at the 10% level in a multinomial logit, there is no significant difference between those who choose ascending and those who choose other treatments. That is, choice is not predicted by the short-form Tangney-Baumeister-Boone self-control score, financial literacy, critical reasoning scores, or any standard demographic characteristics.

One surprising difference is that subjects complete cells faster in the choice study than with random assignment, shown in Table 6, Panel II. This difference suggests certain types of people may perform better with different types of treatments and may have some ability to select the treatment where they will perform better. The choice of ascending helps some participants more than others. Table 7 explores the effects of treatment on performance in the choice study for participants interacted with their answers to survey questions on self-control, critical reasoning skills, and risk aversion.[8] Participants with higher measures of self-control benefit more from ascending than from equal with a one point increase in the self-control scale leading to a 0.139 second decrease in average cell time compared to those who chose equal, as shown in column (1). Similarly, participants with higher critical reasoning skills benefit more from the ascending choice than do other participants; a one-point increase in critical reasoning skills leads to a one second decrease in average cell time, with significance at the 10% level in column (2). Finally, the interaction between risk aversion and the choice of ascending is also negative; a one-point increase in risk aversion leads to a drop of 0.71 seconds on average cell time, also significant at the 10% level in column (3).

VI. Extension to Field Debt-Reduction Environments

Our main result is that individuals increase their performance in tedious tasks when those tasks are broken down and put in ascending rather than descending order. When directly applied to the field, this suggests there is some benefit in using the small victories approach to debt reduction. While it will take substantial investigation to determine the actual magnitude of this benefit in the field, we can project in what types of debt situations the small victories approach would be effective using the estimated benefit from our experiments.

Table 1 shows that subjects in the ascending order complete a cell in 11.08 seconds on average compared to 12.50 seconds on average in the baseline study. Converted to rates, these values are 325 and 288 cells/hour, respectively for ascending and descending. Thus, in terms of total performance, our results suggest subjects in the ascending treatment are about 13% more productive than descending.

[8] Six people with random survey malfunctions were not included in these regressions.

While we caution that these results should not be used to make definitive conclusions about debt-reduction situations without further analysis, the 13% figure can be easily applied in an illustrative example to show clear bounds to the small victories approach.

Suppose an individual has two $10,000 outstanding loans. The first loan is at 10%, and the second has a rate between 10% and 20%. She may make monthly repayments of $300[9] on either loan. Suppose repaying the first loan first triggers the psychological motivations of small victories, and this individual is able to come up with 13% more on each payment, for a total payment of $369.

Figure 3 shows that in this example for all interest rates 16% and below, this individual would pay back both loans faster following the small victories method than the conventional economic method. But for rates 17% and higher, the conventional economic method of paying down debts with a higher rate of interest still produces faster debt repayment even though one is paying less per month.

Figure 4 shows the total amount spent on loans in both these cases. For rates 12% and lower, the additional psychological boost of the small victories and subsequent increase in debt repayment leads to a lower amount spent on loans than under the standard economic strategy. For rates between 13% and 16% inclusive, more is spent in total using the small victory method, but that is only when one includes the $69 boost each month from following that method. Depending on whether one believes that money would have been wasted or put to good use, the small victories method may or may not achieve a greater benefit for this individual. For values 17% and above, it is clear the individual is spending more following the small victories method than the conventional method.

While the proceeding is only an illustrative example—actual parameters in debt-repayment situations vary greatly—the general lesson should be clear. Even if the small victories method can give individuals the ability to save 13% more on average, this method should only be utilized when individuals have debts with similar interest rates. The motivation boost required to justify paying off a 10% loan ahead of a 20% or more loan is not observed in our experiments.

---

[9] While this number was chosen somewhat arbitrarily, note that values much smaller than this (e.g., $100) will never pay off either loan. Values much larger than this (e.g., $1000) pay off the loan too quickly for interest to make much of a difference.

VII. Discussion/Conclusion

We have examined a non-traditional approach to debt payment, advocated by personal finance gurus such as Dave Ramsey, by developing the psychological theories that underlie it into a formal model. We find that if one set of theories (Bandura 1977; 1986) has validity, ordering subtasks in ascending order of difficulty should produce optimal performance. If that set does not hold, but a competing theory (Hull 1932; Heilizer 1977) does, then dividing the task into equal lengths will produce optimal performance, an approach that Ramsey does not advocate (though it may not be possible in a debt-repayment situation). Our results support Ramsey's approach and the psychological theories that underlie it, specifically Bandura (1977; 1986). In the baseline study of this experiment, subjects, who are randomly assigned to the small victories approach, perform significantly faster and complete a higher percentage of tasks on average than in other treatments.

Further, we find evidence for both of sets of psychological theories by directly examining our data. Subjects speed up at the end of columns relative to their performance at the beginning of columns, consistent with Hull (1932) and Heilizer (1977). Additionally, our estimations find that past columns completed is positively correlated with performance, consistent with Bandura (1977; 1986). If both sets of theories hold, Proposition 1 shows that in our environment subjects in ascending treatment should outperform those in the descending treatment, which is exactly what we find.

Interestingly, when we allow a new set of subjects to choose which of the three treatments they prefer, the ascending treatment is chosen least often. Subject performance increases overall relative to the randomized study, suggesting that on average subjects improve performance with their choice. Further, our regression results indicate that the subjects who benefit most from the ascending order are subjects with the highest self-control and reasoning ability. This last finding may suggest a flaw with the Ramsey approach: the people who would benefit most from a small victories approach may be the ones least likely to be in debt. Obviously, future research will need to look at the issue more carefully, perhaps in more stylized debt repayment scenarios or with surveys and actual field data.

If we instead focus on the small victories approach as a universal effect (subjects in the ascending order, based on their speed of cell completion are roughly 13% more productive than those in the descending order), the strength of the effect in our environment should be strong enough to overcome small deviations in loan interest rates. If these results hold across different domains—and we have yet to provide evidence that they do—we must caution those who advocate the debt-snowball strategy. Our results appear to indicate that the “small victory” of paying off the smallest debt first may increase motivation in debt repayment, but this increase in motivation will not offset the loss of neglecting a high interest rate debt, if its rate is substantially higher than other debts.

Future research can determine the full effects of framing debt in these situations. Adding additional factors to our experimental design, commonly found in debt-repayment scenarios, such as interest rates, minimum payments, and actual cash values may aid in determining the appropriate bounds on the motivational improvement of the small victories method. Field experiments that randomly assign repayment strategies to consumers with debt may also be a promising future direction.

References

Amar, Moty, Dan Ariely, Shahar Ayal, Cynthia E. Cryder and Scott I. Rick. 2011 "Winning the Battle but Losing the War: The Psychology of Debt Management." *Journal of Marketing Research*, 48: S38-S50.

Bandura, Albert. 1986. *Social Foundations of Thought and Action*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, Albert. 1977. *Social Learning Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, Albert and Dale H. Schunk. 1981. "Cultivating Competence, Self-Efficacy, and Intrinsic Interest through Proximal Self-Motivation." *Journal of Personality and Social Psychology,* 41(3): 586-598.

Bandura, Albert and Karen M. Simon. 1977. "The Role of Proximal Intentions in Self-Regulation of Refractory Behavior." *Cognitive Therapy and Research*, 1(3): 177-193.

Bernheim, Douglas B. and Daniel M. Garrett. 2003. "The Effects of Financial Education in the Workplace: Evidence from a Survey of Households." *Journal of Public Economics,* 87(7/8): 1487-1519.

Bernheim, B. Douglas, Daniel M. Garrett, and Dean M. Maki. 2001. “Education and Saving: The Long-term Effects of High School Financial Curriculum Mandates." *Journal of Public Economics*, 80(3): 435-465.

Brown, Alexander L., Zhikang Eric Chua, and Colin F. Camerer. 2009. "Learning and Visceral Temptation in Dynamic Saving Experiments." *Quarterly Journal of Economics,* 124(1): 197-231.

Bureau of Economic Analysis, United States Department of Commerce. 2010. "Comparison of Personal Saving in the National Income and Product Accounts with Personal Saving in the Flow of Funds Accounts." Washington D.C.: http://www.bea.gov/national/nipaweb/Nipa-Frb.asp#Foot

Eckel, C. C. and P. J. Grossman (2008). "Forecasting risk attitudes: An experimental study using actual and forecast gamble choices." *Journal of Economic Behavior & Organization* 68(1): 1-17.

The Federal Reserve Board. 2010. Family net worth, by selected characteristics of families [Chart]. In *2007 Survey of Consumer Finances*. Washington D.C.: http://www.federalreserve.gov/pubs/oss/oss2/2007/bulletin.tables.pub.xls

Frederick, Shane. (2005) Cognitive Reflection and Decision Making. *Journal of Economic Perspectives*, 19(4): 25-42.

Greiner, Ben. 2004. “The Online Recruitment System ORSEE 2.0,” *Working Paper Series in Economics,* University of Cologne.

Heilizer, Fred. 1977. “A Review of Theory and Research on the Assumptions of Miller’s Response Competitions Models: Response Gradients.” *The Journal of General Psychology*, 97(1): 17–71

Hull, Clark L. 1932. “The Goal Gradient Hypothesis and Maze Learning,” *Psychological Review*, 39(1): 25-43.

John, Oliver P., Naumann, Laura. P., Soto, Christopher J., 2008. “Paradigm Shift to the Integrative Big-Five Trait Taxonomy: History, Measurement, and Conceptual Issues.” In: John, O. P., Robins R.W., Pervin, L. A. (Eds.), *Handbook of Personality: Theory and Research*. Guilford Press, New York, NY, pp. 114–158.

Kivetz, Ran, Oleg Urminsky, and Yuhuang Zheng. 2006. “The Goal-Gradient Hypothesis Resurrected: Purchase Acceleration, Illusionary Goal Progress, and Customer Retention.” *Journal of Marketing Research*, 43(1): 39-58.

Latham, Gary P. and Gerard H. Seijts. 1999. “The Effects of Proximal and Distal Goals on Performance on a Moderately Complex Task.” *Journal of Organizational Behavior,* 20(4): 421-429.

Lusardi, Annamaria and Olivia S. Mitchell. 2007a. “Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth.” *Journal of Monetary Economics*, 54(1): 205–24.

-------------. 2007b. “Financial Literacy and Retirement Preparedness: Evidence and Implications for Financial Education.” *Business Economics*, 42(1): 35–44.

Martin, Matthew. 2007. “A Literature Review on the Effectiveness of Financial Education.” *Federal Reserve Bank of Richmond Working Paper* No. 07-03.

Morgan, Mark. 1985. "Self-Monitoring of Attained Subgoals in a Private Study." *Journal of Educational Psychology,* 77(6): 623-630.

Nunes, Joseph C. and Xavier Drèze. 2006. “The Endowed Progress Effect: How Artificial Advancement Increases Effort.” *Journal of Consumer Research*, 32(4): 504-512.

Patton, J. H., M. S. Stanford, et al. (1995). "Factor structure of the Barratt impulsiveness scale." Journal Of Clinical Psychology 51(6): 768-774.

Ramsey, Dave. 2009. *The Total Money Makeover: A Proven Plan for Financial Fitness*. Nashville, TN: Thomas Nelson.

Ramsey, Dave. 1998. *The Financial Peace Planner: A Step-by-Step Guide to Restoring Your Family's Financial Health.* New York: Penguin Books.

Richard, David C. S. and Dean Lauterbach, Eds. 2006. *Handbook of Exposure Therapies*. San Diego: Elsevier.

Schell, Jesse. 2008. *The Art of Game Design: A Book of Lenses*. San Francisco: Morgan Kaufmann.

Schreiner, Mark, Margaret Clancy, and Michael Sherraden. 2002. *Saving Performance in the American Dream Demonstration: A National Demonstration of Individual Development Accounts*. Center for Social Development, Washington University.

Stock, Jennifer and Daniel Cervone. 1990. "Proximal Goal Setting and Self-Regulatory Processes." *Cognitive Therapy and Research,* 14(5): 483-489.

Tangney, June P, Roy F. Baumeister and Angie Luzio Boone. 2004 “High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades and Intrapersonal Success.” *Journal of Personality,* 72(2): 272-322.

Zuckerman, M. (1994). Behavioral Expressions and Biosocial Bases of Sensation Seeking. Cambridge, Cambridge, University Press.

Appendix: Proofs of Propositions

The section contains proofs of Propositions 1 and 2 found in the Theory section (section 2) of this paper. To prove these propositions a helpful lemma is necessary. The lemma is very similar to a standard result of expected utility theory involving first-order stochastic dominance. The proof follows the work of Hadar and Russell (1969), and the more well-known, Rothschild and Stiglitz (1970).

Lemma. Suppose there are a finite number of distinct values, $j=1,2,\ldots n$, $y_{j'} > y_j$ if and only if $j'>j$. Define functions f and g so $f(y_j)=a_j$ and $g(y_j)=b_j$, where $0\le a_j,b_j\le 1$ and $\sum_{j=1}^{n} f\left(y_j\right) = \sum_{j=1}^{n} g\left(y_j\right) = 1$.

Further define

$$F\left(y_j\right) = \sum_{r=1}^{j} f\left(y_r\right) \quad \text{and} \quad G\left(y_j\right) = \sum_{r=1}^{j} g\left(y_r\right).$$

For any non-decreasing function, $u\colon \mathbb{R}\to\mathbb{R}$, where u is continuous over $[y_1,y_n]$, and differentiable over all open intervals (y_j,y_{j+1}) for $1\le j\le n-1$. If $G(y_j)\le F(y_j)$ for $1\le j\le n$ then

$$\sum_{j=1}^{n} u\left(y_j\right) f\left(y_j\right) \le \sum_{j=1}^{n} u\left(y_j\right) g\left(y_j\right). \tag{A1}$$

The conditions, u is non-constant and $G(y_j)<F(y_j)$, or u is strictly increasing and g and f are different, both imply (A1) with strict inequality.

Proof. This proof is largely derived from Hadar and Russell (1969), Theorem 1 and is similar to many others involving first-stochastic dominance.

For every interval $[y_j,y_{j+1}]$ for $1\le j\le n-1$, the Mean Value Theorem shows there exists a ξj such that

$$u\left(y_j\right) = u\left(y_{j+1}\right) - u'\left(\xi_j\right)\Delta y_j \quad \textit{where} \quad \Delta y_j = y_{j+1} - y_j.$$

Then

$$\sum_{j=1}^{n} u\left(y_j\right) f\left(y_j\right) - \sum_{j=1}^{n} u\left(y_j\right) g\left(y_j\right) = \sum_{j=1}^{n} \left[u\left(y_n\right) - \sum_{r=j}^{n-1} u'(\xi_r)\Delta y_r \right]\left(f\left(y_j\right) - g\left(y_j\right)\right)$$

$$= \sum_{j=1}^{n} u\left(y_n\right)\left(f\left(y_j\right) - g\left(y_j\right)\right) - \sum_{j=1}^{n}\sum_{r=j}^{n-1} u'(\xi_r)\Delta y_r \left(f\left(y_j\right) - g\left(y_j\right)\right)$$

$$= u(y_n)\left[\sum_{j=1}^{n} f(y_j) - \sum_{j=1}^{n} g(y_j)\right] - \sum_{j=1}^{n}\big(f(y_j) - g(y_j)\big)\sum_{r=j}^{n-1} u'(\xi_r)\Delta y_r$$

$$= -\sum_{r=1}^{n-1} u'(\xi_r)\big[G(x_r) - F(x_r)\big]\Delta y_r \geq 0.$$

Non-decreasing implies $u'(\xi_r)\geq 0$, $\Delta y_r>0$ by definition, and $G(y_j)\leq F(y_j)$, so are final result is greater or equal to 0. Alternatively if u is increasing $u'(\xi_r)>0$, and if g and f are different there is some y_j where $G(y_j)<F(y_j)$, so we have strict inequality. Similarly, if u is non-constant and $G(y_j)<F(y_j)$, there is some y_j where $u'(\xi_r)>0$, and we also have strict inequality.

Proposition 1. *For any i, for a given* <u>*class of subtask partitions*</u>*, $\beta\subseteq A(X)$. There exist α' and α'' such that*

$$\mathrm{T}_i(x,\alpha') \leq \mathrm{T}_i(x,\alpha) \leq \mathrm{T}_i(x,\alpha'')\ \forall\, \alpha \in \beta$$

and

$$\left|\alpha_1^{'}\right| \leq \ldots \leq \left|\alpha_k^{'}\right| \leq \ldots \leq \left|\alpha_m^{'}\right|,\ \left|\alpha_1^{''}\right| \geq \ldots \geq \left|\alpha_k^{''}\right| \geq \ldots \geq \left|\alpha_m^{''}\right|.$$

If v is non-constant, and $\alpha'\neq\alpha''$, $T(x,\alpha')<T(x,\alpha'')$.

Proof. First we will show that for a <u>class of subtask partitions</u>, for any $\alpha\in\beta$ the value $\sum_{x\in X} h\Big(L_\alpha\big(\phi_1(x,\alpha)\big) - \phi_2(x,\alpha)\Big)$ is equal. Consider any $x'\in X$, let $k=\phi_1(x',\alpha)$, $k'=\phi_1(x',\alpha')$, and $k''=\phi_1(x',\alpha'')$. Since x' is unique in any partition, we must have $\alpha_k=\alpha_{k'}=\alpha_{k''}$. Trivially, $L_\alpha(k)=L_{\alpha'}(k)=L_{\alpha''}(k)$ and $=\phi_2(x',\alpha)=\phi_2(x',\alpha')=\phi_2(x',\alpha'')$. Thus,

$$\sum_{x\in X} h\Big(L_\alpha\big(\phi_1(x,\alpha)\big) - \phi_2(x,\alpha)\Big) = \sum_{x\in X} h\Big(L_\alpha\big(\phi_1(x,\alpha')\big) - \phi_2(x,\alpha')\Big) = \sum_{x\in X} h\Big(L_\alpha\big(\phi_1(x,\alpha'')\big) - \phi_2(x,\alpha'')\Big)$$

Next, we will define the following functions:

$$\overline{v}(y) = v\big(\lfloor y \rfloor\big) + \frac{v\big(\lceil y \rceil\big) - v\big(\lfloor y \rfloor\big)}{y - \lfloor y \rfloor}$$

$$f_\alpha(k) = \begin{cases} L_\alpha(k) \Big/ \sum_{j=1}^{m} L_\alpha(j) & if \quad k = 1,2,\ldots m \\ 0 & otherwise \end{cases}.$$

Note that $\bar{v}(y)$ is continuous. It is differentiable over every open interval between integers. It is also non-increasing by Assumption 1a. If we define F_α in the same way as in Lemma 1, we will find, $F_{\alpha''}(y) \geq F_\alpha(y) \geq F_{\alpha'}(y)$, as α' and α'' are ascending and descending orders of the same subtasks. By lemma 1,

$$\sum_{j=1}^{m} f_{\alpha'}\bar{v}(j) \leq \sum_{j=1}^{m} f_{\alpha}\bar{v}(j) \leq \sum_{j=1}^{m} f_{\alpha''}\bar{v}(j) \text{ which implies}$$

$$\sum_{x\in X} v\left(\phi_2(x,\alpha')\right) \leq \sum_{x\in X} v\left(\phi_2(x,\alpha)\right) \leq \sum_{x\in X} v\left(\phi_2(x,\alpha'')\right).$$

Since the other terms in T, are independent of partition or proven to be equal in summation we have,

$$\mathrm{T}_i(x,\alpha') \leq \mathrm{T}_i(x,\alpha) \leq \mathrm{T}_i(x,\alpha'').$$

If $\alpha' \neq \alpha''$, we would have $F_{\alpha''}(y) > F_{\alpha'}(y)$, so Lemma 1 implies $T(x,\alpha') < T(x,\alpha'')$.

Proposition 2. *For any X and i, if there exists an $\alpha' \in A(X)$ such that $L_{\alpha'}(k)=c$ for all $1 \leq k \leq m$. Then if v is constant,*

$$\mathrm{T}(x,\alpha') \leq \mathrm{T}(x,\alpha) \quad \forall \alpha \in \mathrm{A}(X) \text{ where } |\alpha'|=|\alpha|=m.$$

Further, if $\alpha' \neq \alpha$ and f is strictly increasing, $\mathrm{T}(x,\alpha') < \mathrm{T}(x,\alpha)$.

Proof. If v is constant, the only term that changes in T with α is h. We must show

$$\sum_{x\in X} h\left(L_\alpha\left(\phi_1(x,\alpha')\right) - \phi_2(x,\alpha')\right) \leq \sum_{x\in X} h\left(L_\alpha\left(\phi_1(x,\alpha)\right) - \phi_2(x,\alpha)\right).$$

Define the following functions:

$$\bar{h}(y) = h(\lfloor y \rfloor) + \frac{h(\lceil y \rceil) - h(\lfloor y \rfloor)}{y - \lfloor y \rfloor}$$

$$f_\alpha(y) = \left|\left\{x \in X : L_\alpha\left(\phi_1(x,\alpha')\right) - \phi_2(x,\alpha') = y\right\}\right|$$

Note that $\bar{h}(y)$ is continuous, and differentiable over every open interval between integers. It is also non-increasing by Assumption 2. If we define F_α in the same way as in Lemma 1, we will find, $F_{\alpha'}(y) \geq F_\alpha(y)$, as α' has columns of constant length and the lowest possible average distance to the end of a subtask per element.

By lemma 1,

$$\sum_{x\in X} h\left(L_\alpha\left(\phi_1\left(x,\alpha'\right)\right)-\phi_2\left(x,\alpha'\right)\right) \leq \sum_{x\in X} h\left(L_\alpha\left(\phi_1\left(x,\alpha\right)\right)-\phi_2\left(x,\alpha\right)\right).$$

Note that if $\alpha' \neq \alpha$, and f is strictly increasing, lemma 1 implies the above relation with strict inequality, therefore implying $T(x,\alpha')<T(x, \alpha'')$.

Table 1: Main Results

Panel I: Time to completion				
	Mean (in sec)	N	Mean-Asc	p (two-sided)
Ascending	11.08	31		
Not Ascending	12.31	60	1.23	0.019
Even	12.13	31	1.05	0.078
Descending	12.50	29	1.42	0.015
Kruskal Wallis				0.084

Panel II: Completion as an outcome	
Ascending	0.13248
	(0.1222)
Descending	-0.09628
	(0.1280)
Observations	91
Asc-desc chi squared p-value	0.08

Notes: Results in Panel I from separate t-tests on the time to complete each cell in seconds. Panel II provides marginal effects results from a probit regression on whether or not the participant completed the 150 cell task. In Panel II the omitted variable is even.

Table 2: Comparing first 5 cells in each column to last 5 cells

	Mean (residual)	N	Difference	p (two-sided)
Ascending				
In First Five Cells	-0.2660	775		
In Last Five Cells	-1.3763	730	-1.11	0.0000
Descending				
In First Five Cells	1.6540	635		
In Last Five Cells	0.3443	570	-1.31	0.2307
Equal				
In First Five Cells	0.2144	740		
In Last Five Cells	-0.1965	685	-0.41	0.1307

Notes: Magnitudes are measured as difference from the population average.

Table 3

Average time to complete cells

	(1)	(2)
Ascending	-1.0522	-0.96397
	(0.5862)	(0.5518)
Descending	0.3718	0.0464
	(0.6496)	(0.5888)
Practice average		0.12656
		(0.0439)
Observations	91	90
Asc-desc F-test	0.01	0.05

Notes: Robust standard errors in parentheses. F-test value given is for the p-value of the F-statistic. Omitted treatment is equal. One student had technical difficulties with the practice session and is dropped from regressions that control for practice average.

Table 4: Comparing first 5 cells in each column to last 5 cells

	Mean (residual)	N	Difference	p (two-sided)
Panel I: Collapsed to First/Last				
Ascending				
In First Five Cells	-0.2660	155		
In Last Five Cells	-1.3763	146	-1.11	0.0011
Descending				
In First Five Cells	1.6705	128		
In Last Five Cells	0.3443	114	-1.33	0.2335
Equal				
In First Five Cells	0.2144	148		
In Last Five Cells	-0.1711	138	-0.39	0.2730
Panel II: Collapsed to Person				
Ascending				
In First Five Cells	-0.2660	31		
In Last Five Cells	-1.2599	31	-0.99	0.0699
Descending				
In First Five Cells	2.3895	29		
In Last Five Cells	0.7737	29	-1.62	0.2948
Equal				
In First Five Cells	0.4238	31		
In Last Five Cells	0.1144	31	-0.31	0.6242
Panel III: Collapsed all Firsts/Lasts Baseline				
Ascending				
In First Five Cells	0.8153	91		
In Last Five Cells	-0.1437	91	-0.96	0.0973

Notes: Panel III groups all firsts and lasts as one observation per person. Magnitudes are measured as difference from the population average for each environment.

Table 5: Baseline ascending regression results for residual cell time with clustering

	Cluster on subject	Cluster on cell	Cluster on column*subject
	(1)	(2)	(3)
In First Five Cells	1.11	1.11	1.11
	(0.30)	(0.46)	(0.25)
Observations	1505	1505	1505

Notes: Robust clustered standard errors in parentheses. Omitted treatment is "in last five cells".

Table 6: Choice

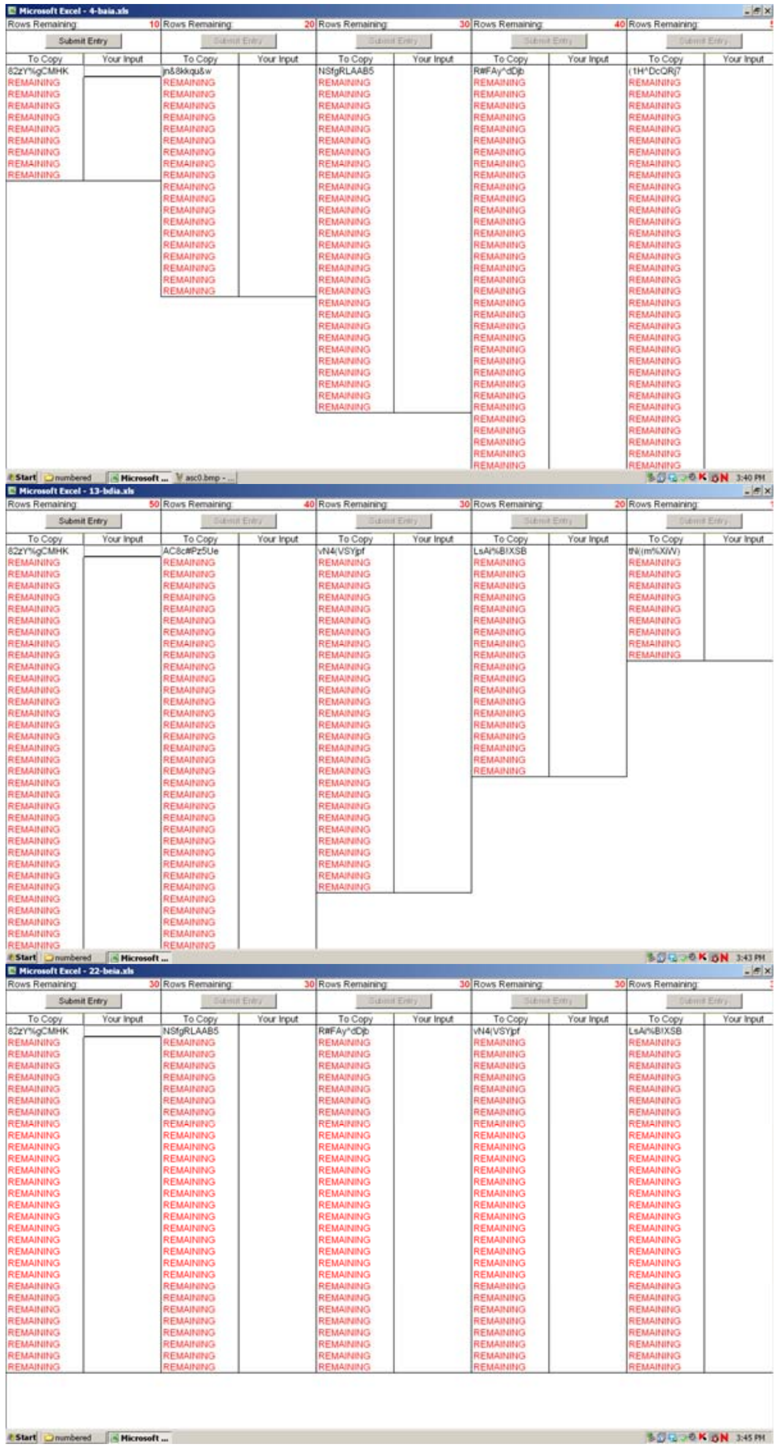
Panel I: What they chose		
	N	
Ascending	16	
Not Ascending	54	
Even	31	
Descending	23	
chi-squared p-value	0.0894	
Panel II: Choice vs. Baseline		
	N	Time per cell
Choice	70	11.12
Baseline	91	11.89
two-sided p-value	0.037	

Notes: Results from the choice condition.

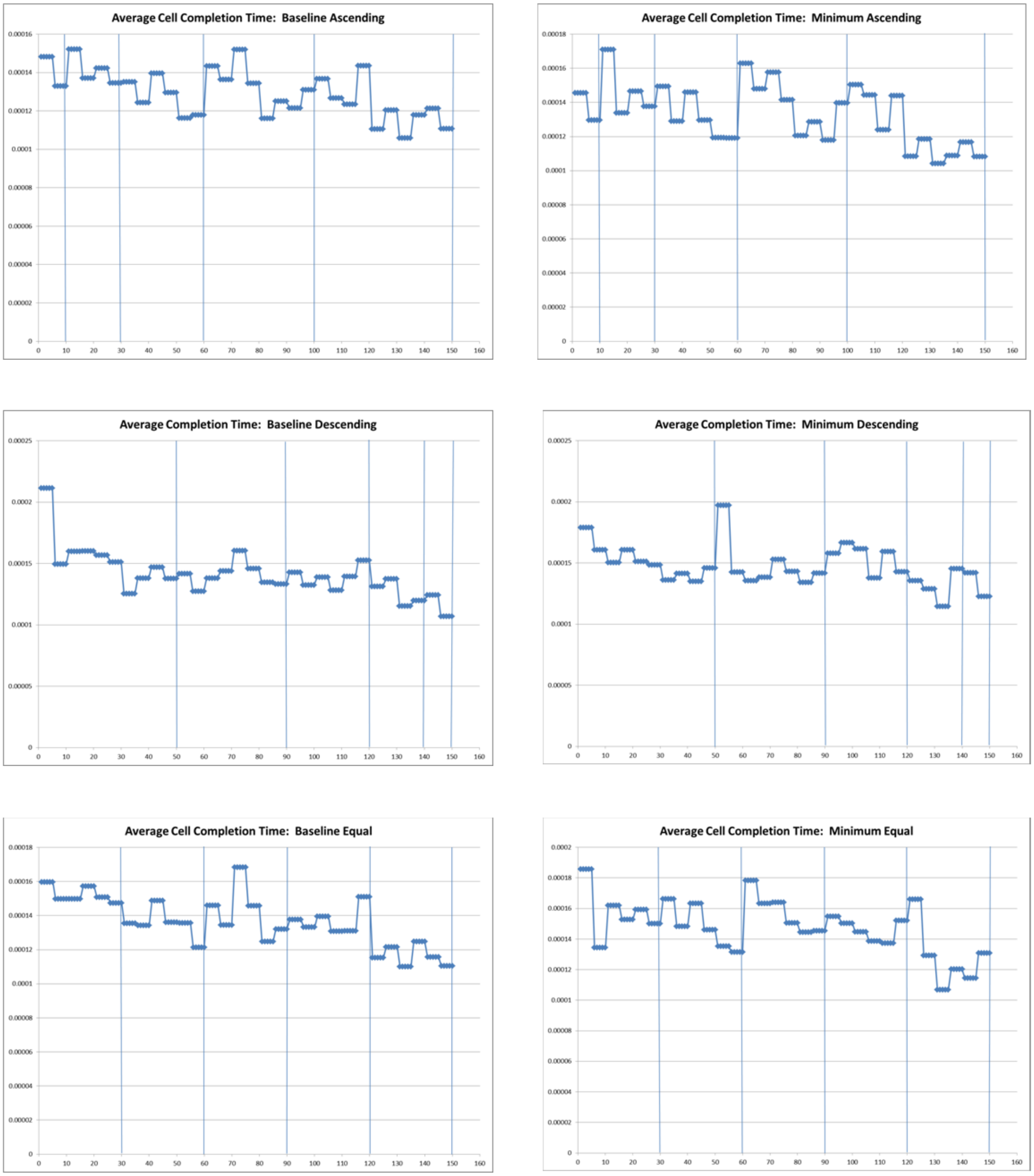
Table 7: Effect of choice interactions with survey data on average cell time

	Self-control	Critical Reasoning	Risk Aversion
	(1)	(2)	(3)
X*ascending	-0.139	-1.060	-0.710
	(0.070)	(0.586)	(0.390)
X*descending	-0.026	-0.735	-0.410
	(0.062)	(0.401)	(0.317)
ascending	6.333	0.825	2.495
	(3.280)	(0.793)	(1.599)
descending	1.241	0.935	1.178
	(2.600)	(0.663)	(1.013)
X	-0.011	0.073	0.188
	(0.046)	(0.231)	-0.174
practice average	0.257	0.253	0.274
	(0.068)	(0.070)	(0.069)
Observations	64	64	64

Notes: Outcome is average time to complete one cell in seconds. X is the Tangney-Baumeister measure of self-control in column (1) and the Cognitive Reflection Task in Column (2). Robust standard errors in parentheses. Omitted treatment is "equal". Six people with random survey malfunctions were eliminated from these regressions.



Figures 1(a-c): The experiment interface featured a typing task of copying 150 cells in a Microsoft Excel Spreadsheet. Figures (a, top),(b, middle), and (c, bottom) show the task with five columns in ascending, descending, and even orderings, respectively.



Figures 2(a)-(f): Average Cell Completion Time by Cell. Note: each group of five cells has been given the average completion time for that group for legibility purposes.

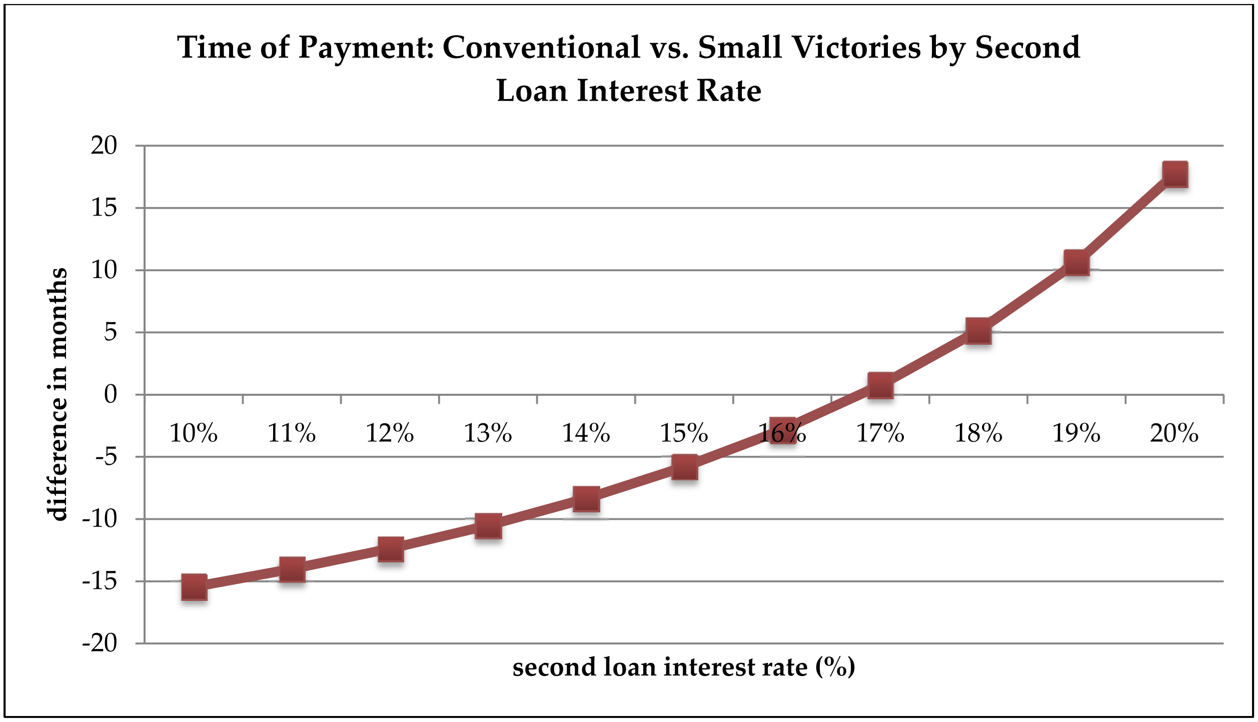


Figure 3: Total time to pay off two loans with one loan at 10% interest and the other at 10%-20%. The standard monthly payment is $300, but the small victories method produces a 13% boost corresponding to a $369 monthly payment.

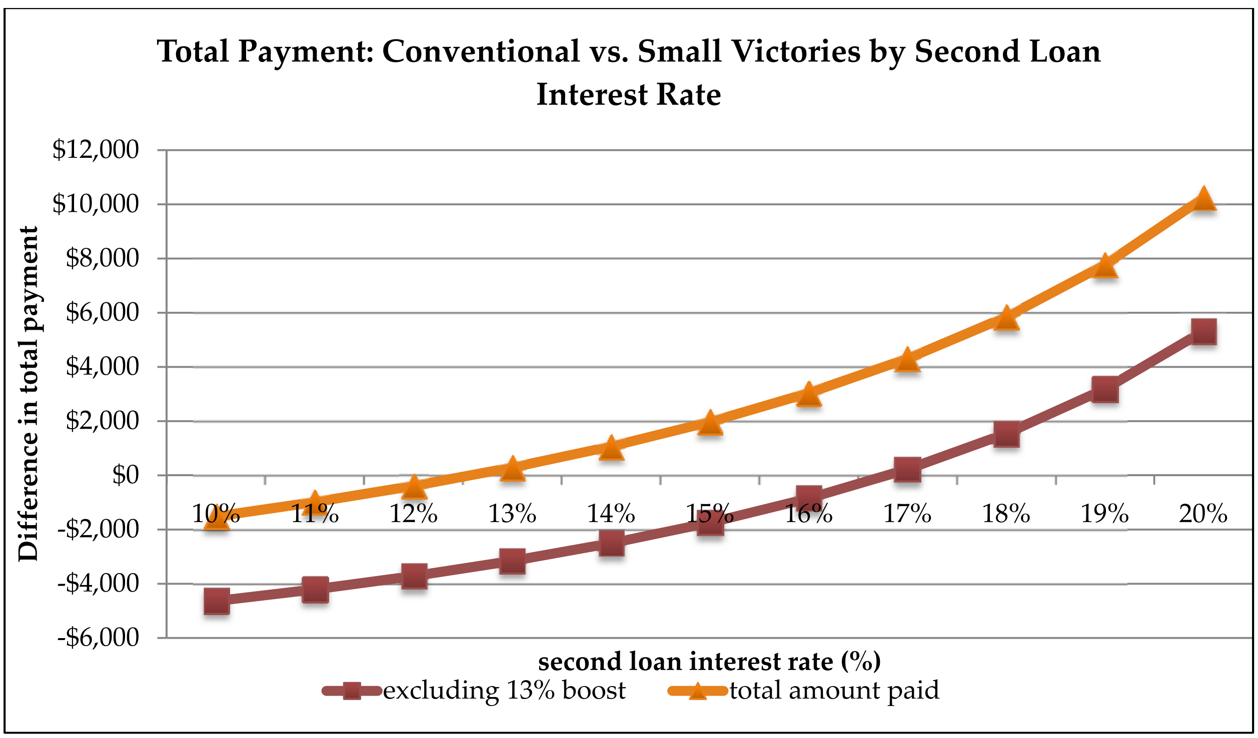


Figure 4: Total amount spent to pay off two loans with one loan at 10% interest and the second at 10%-20%. The standard monthly payment is $300, but the small victories method produces a 13% boost corresponding to a $369 monthly payment. One line shows the total amount spent on the loan, the other shows that amount without the 13% boost (i.e., the extra $69 each month.).

Appendix, Table 1: Effect of baseline treatment interactions with survey data on average cell time

	Barratt	High SSH	Extraversion	Agreeableness	Concientiousness	Openness	Neuroticism
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
X*ascending	0.1943	0.3027	0.1582	0.1429	0.1329	-0.03525	-0.2034*
	(1.2095)	(1.1629)	(0.1176)	(0.1354)	(0.1500)	(0.1070)	(0.1217)
X*descending	-1.1639	-0.6144	-0.06990	0.1686	0.1850	-0.05391	-0.2247*
	(1.3108)	(1.3043)	(0.1472)	(0.1647)	(0.1851)	(0.1341)	(0.1279)
ascending	-1.2418	-1.5411*	-1.2023*	-1.4210**	-1.2196*	-1.0727*	-2.1063**
	(0.8183)	(0.8609)	(0.6056)	(0.6874)	(0.6750)	(0.5807)	(0.9536)
descending	0.9077	0.7421	0.1653	-0.09740	-0.006695	0.4927	-0.8077
	(0.8651)	(0.9751)	(0.6668)	(0.7841)	(0.8339)	(0.6859)	(1.0452)
X	0.399	1.0843	-0.06937	-0.1215	-0.1226	0.1045	0.1408
	(0.9592)	(0.9070)	(0.0920)	(0.1194)	(0.1359)	(0.0634)	(0.1072)
Observations	91	91	91	91	91	91	91

Notes: Outcome is average time to complete one cell in seconds. X is the Barratt Impulsivity measure in column (1), high sensation seeking in Column (2), and columns (3)-(7) are the five factors from the Big Five Inventory. Robust standard errors in parentheses. Omitted treatment is "equal".

Experimental Instructions

Today, you will be participating in an economics experiment. The experiment tests how well people perform certain tasks. Your performance in this experiment will determine your earnings, which will be paid to you in to cash at the end of the session. You will participate in this task on the computer in front of you. Please pay attention to these instructions so you will understand how to make money.

During this experiment, it is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

This experiment consists of a typing exercise. You will sit at a computer and copy a number of columns of text (see Figure 1). You will begin at the top cell of the leftmost column and end at the bottom cell of the rightmost column. You will see that one cell is visible to the left of your cursor. You will type the characters exactly as they appear in the cell to your left in the current cell. You will only be asked to copy lower case and upper case letters, numbers and the symbols on number keys (!@#$%^&*()) into each cell. Each time you complete a cell you will click the "Submit Entry" button above your current column. If you have typed your cell exactly as it appears to your left, you will move to the next cell below. If you have typed your cell incorrectly, nothing will happen. You will need to edit your cell until it is correct. Once you have corrected your cell, you can click "Submit Entry" to proceed.

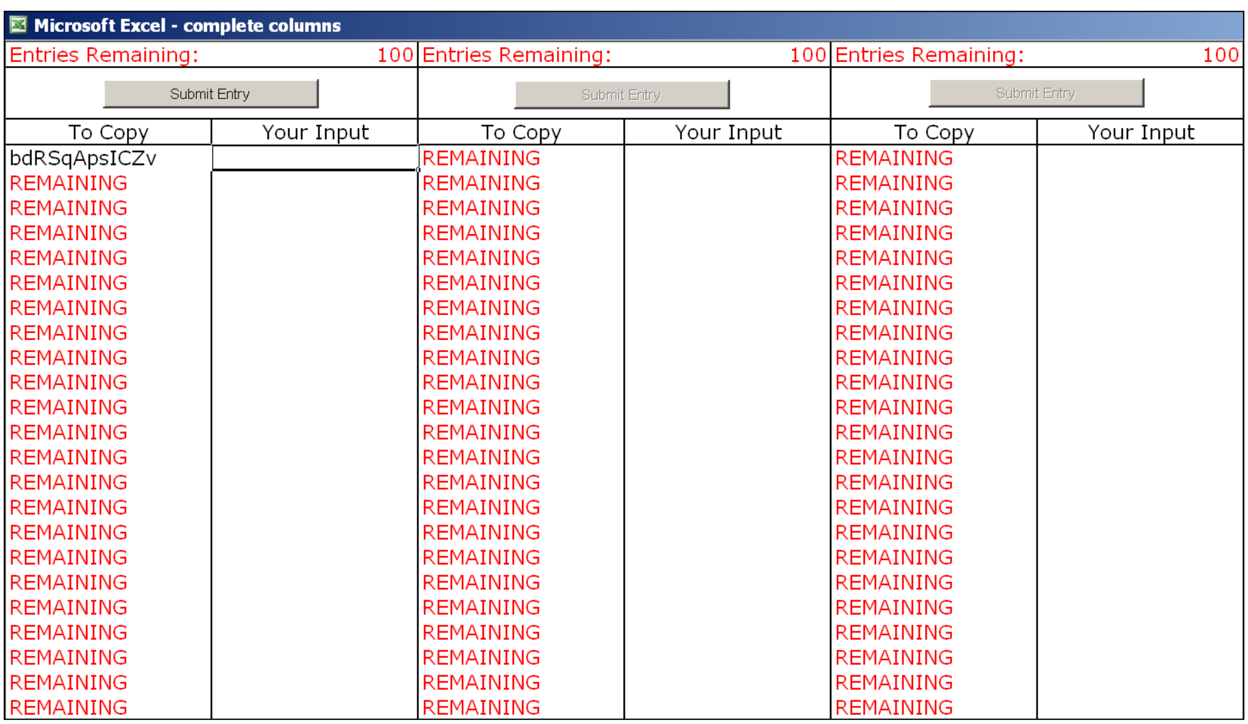


Figure 1: Three sample columns.

There will be some number of columns to type. You will have 30 minutes to copy all columns. If you complete this task you will receive a $10 payment plus 50 cents for every minute you finish early, rounded up to the nearest minute. For example, if you finish in 23:35, you will have finished 7 minutes early, and receive $13.50. If instead you don't finish the task, you will receive $10 minus $0.05 for any cell you haven't completed. So if after 30 minutes you have 85 cells remaining you will receive $5.75. This amount is $10 minus $0.05 x 85.

Before this experiment begins, you will be asked to type a practice column of 10 cells. You will not receive any payment for this task. You will have 5 minutes to complete this task. Once you complete this task, the experiment will begin. If you cannot complete the practice column in 5 minutes, the practice round will still end and the experiment will begin.

The experiment will last for 30 minutes. You may receive these instructions before the first or second task of this experiment. Both tasks will last 30 minutes each. If you finish the first task before the 30 minutes have elapsed, you may begin completing the written surveys that have been given to you. Once the second task begins, you should not return to your surveys until you complete the second task. If you complete your two tasks and two surveys before the 60 minutes has elapsed, you will be asked to wait quietly. Once the 60 minutes has elapsed, all subjects that have completed their surveys can receive their payments.

To summarize:

1. You will be copying a number of cells for 30 minutes to receive cash earnings.
2. After you copy a cell you must click the button above the column you are copying.
3. You must copy a cell exactly to receive credit and move to the next cell.
4. If you complete copying the columns earlier than the thirty minutes, you will receive a bonus based upon your remaining time. If you are unable to complete the columns in 30 minutes you will receive a penalty for any remaining cells.

Experimental Instructions

Today, you will be participating in an economics experiment. The experiment tests how well people perform certain tasks. Your performance in this experiment will determine your earnings, which will be paid to you in to cash at the end of the session. You will participate in this task on the computer in front of you. Please pay attention to these instructions so you will understand how to make money.

During this experiment, it is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

This experiment consists of two typing exercises. You will sit at a computer and copy some number of columns of text (see Figure 1). You will begin at the top cell of the leftmost column and end at the bottom cell of the rightmost column. You will see that one cell is visible to the left of your cursor. You will type the characters exactly as they appear in the cell to your left in the current cell. You will only be asked to copy lower case and upper case letters, numbers and the symbols on number keys (!@#$%^&*()) into each cell. Each time you complete a cell you will click the "Submit Entry" button above your current column. If you have typed your cell exactly as it appears to your left, you will move to the next cell below. If you have typed your cell incorrectly, nothing will happen. You will need to edit your cell until it is correct. Once you have corrected your cell, you can click "Submit Entry" to proceed.

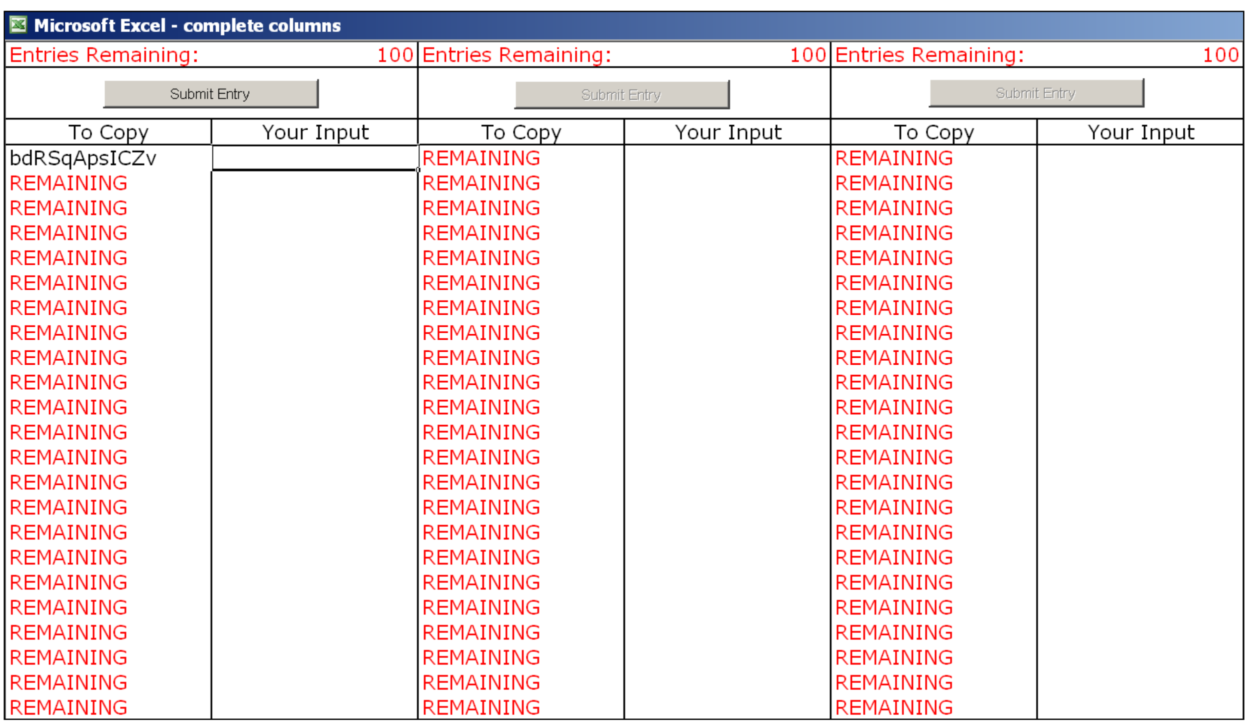


Figure 1: Three sample columns.

In each task there will be some number of columns to type. You will have 30 minutes to copy all columns. If you complete a task you will receive a $10 payment plus 50 cents for every minute you finish early, rounded up to the nearest minute. For example, if you finish in 23:35, you will have finished 7 minutes early, and receive $13.50. If instead you don't finish the task, you will receive $10 minus $0.05 for any cell you haven't completed. So if after 30 minutes you have 85 cells remaining you will receive $5.75. This amount is $10 minus $0.05 x 85.

Before this experiment begins, you will be asked to type a practice column of 10 cells. You will not receive any payment for this task. You will have 5 minutes to complete this task. Once you complete this task, the experiment will begin. If you cannot complete the practice column in 5 minutes, the practice round will still end and the experiment will begin.

After your practice session, you will be asked to choose among three different ways to fill out your columns of cells. Each choice will have columns of different length, but will have the same number of cells regardless of the ordering. Once you have made your choice, you may begin the task.

You may receive these instructions before the first or second task of this experiment. Both tasks will last 30 minutes each. If you finish the first task before the 30 minutes have elapsed, you may begin completing the written surveys that have been given to you. Once the second task begins, you should not return to your surveys until you complete the second task. If you complete your two tasks and two surveys before the 60 minutes has elapsed, you will be asked to wait quietly. Once the 60 minutes has elapsed, all subjects that have completed their surveys can receive their payments.

To summarize:

1. You will be copying some number of columns of cells for 30 minutes to receive cash earnings.
2. After you copy a cell you must click the button above the column you are copying.
3. You must copy a cell exactly to receive credit and move to the next cell.
4. If you complete the columns earlier than the thirty minutes, you will receive a bonus based upon your remaining time. If you are unable to complete the columns in 30 minutes you will receive a penalty for any remaining cells.