

# Lawrence Berkeley National Laboratory

## LBL Publications

### Title

Enabling behavior through personal commitment statements: why do they work?

### Permalink

<https://escholarship.org/uc/item/1vh9x468>

### Authors

Spurlock, C Anna  
Belal, Saika  
Fujita, K Sydney  
[et al.](#)

### Publication Date

2020-12-15

Peer reviewed

# Enabling behavior through personal commitment statements: why do they work?

Authors:

**C. Anna Spurlock<sup>1</sup>, Saika Belal<sup>1,2</sup>, K. Sydney Fujita<sup>1</sup>, Nikhil Sawe<sup>1,3</sup>**

<sup>1</sup>Lawrence Berkeley National Laboratory

<sup>2</sup>University of California at Berkeley

<sup>3</sup>Stanford University

Energy Analysis and Environmental Impacts Division  
Lawrence Berkeley National Laboratory

December 2020



This work was supported by the Laboratory Directed Research and Development Program of Lawrence Berkeley National Laboratory under U.S. Department of Energy Contract No. DE-AC02-05CH11231. The authors would like to thank Ming Hsu for early brainstorming of study concepts, advice, guidance, and facilitating access to resources to implement the study. The authors would also like to thank Morgan Faulkner and Annika Todd-Blick for support in field study implementation.

## **Disclaimer**

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor The Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or The Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof, or The Regents of the University of California.

Ernest Orlando Lawrence Berkeley National Laboratory is an equal opportunity employer.

## **Copyright Notice**

This manuscript has been authored by an author at Lawrence Berkeley National Laboratory under Contract No. DE-AC02-05CH11231 with the U.S. Department of Energy. The U.S. Government retains, and the publisher, by accepting the article for publication, acknowledges, that the U.S. Government retains a non-exclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this manuscript, or allow others to do so, for U.S. Government purposes.

## Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
<b>2</b>	<b>Field Experiment Design .....</b>	<b>3</b>
<b>3</b>	<b>Hypotheses and Analysis Approach.....</b>	<b>6</b>
3.1	<i>Future-self continuity.....</i>	7
3.2	<i>Disappointment/Regret Aversion.....</i>	8
3.3	<i>Present-Biased Preferences .....</i>	8
3.3.1	<i>Sophistication .....</i>	9
3.3.2	<i>Implementation Intention.....</i>	10
<b>4</b>	<b>Data.....</b>	<b>11</b>
<b>5</b>	<b>Results .....</b>	<b>17</b>
5.1	<i>Future-Self Continuity (FSC).....</i>	17
5.2	<i>Disappointment or regret aversion.....</i>	18
5.3	<i>Present-biased preferences.....</i>	18
5.4	<i>Implementation Intention Correlated with Preference for Commitment.....</i>	20
5.5	<i>Signing Commitment Statement Correlated with Implementation Intention.....</i>	21
<b>6</b>	<b>Discussion and Conclusions .....</b>	<b>21</b>
	<b>References .....</b>	<b>23</b>
	<b>Appendices .....</b>	<b>25</b>
	<i>Appendix A Sequence of Experimental Events.....</i>	25
	<i>Appendix B Survey 1: “Choice Task Questionnaire”.....</i>	30
	<i>Appendix C Survey 2: “Commitment and Outcome Task Questionnaire”.....</i>	36
	<i>Appendix D Survey 2: “Study Questionnaire” .....</i>	41

**Abstract:**

We define and test three main hypotheses each examining a mechanism by which personal commitment statements may influence behavior: future-self continuity, disappointment or regret aversion, and present-biased preferences coupled with sophistication. A set of additional analyses are conducted exploring a personal commitment statement's role as an enabling device that either increases, or is correlated with, intent to implement the desired behavior. Hypotheses are tested using data from a field experiment regarding public transit ridership. Results indicate that the strongest candidate mechanism for the effectiveness of a commitment statement to induce behavior change is the presence of present-biased preferences coupled with sophistication, or self-awareness of one's own limitations in following through with effortful behaviors. In addition, results suggest that the preference for one commitment mechanism could indicate a general preference for commitment mechanisms, but the presence of one commitment mechanism may crowd out perceived need for or interest in other enabling steps.

## **1 Introduction**

In the literature studying the effectiveness of different behavior change interventions, many types of interventions, such as increased monetary incentives, different types of emotionally or informationally salient messaging, or social norming, have a mechanism that is well understood. People respond to monetary incentives because of the law of demand; they respond to emotionally or informationally salient messaging because of limited attention, among other things, and they respond to social norming because of social psychological dynamics. However, the mechanisms that underlie the efficacy of some other interventions are less well understood. The focus of this study is one such intervention: personal commitment statements. We aim to utilize these statements to encourage public transit usage, and so the study relates most closely to research on interventions to facilitate pro-environmental behaviors.

In this paper, we investigate the mechanism for non-binding commitment devices, referred to as personal commitment statements, and how a respondent might perceive or engage with such a statement. We do this in the context of a field experiment in which study participants who had not taken a particular form of public transportation in the past six months for their commute (riding Bay Area Rapid Transit [BART]) were encouraged to do so. Participants were asked to respond to a series of choices in which the number of days and incentive payment per day they would agree to ride BART during the performance period varied. The participant knew that one of their choices would be selected as binding when responding to the choices. They were then presented with this binding offer and their follow-through behavior was tracked and the incentive payment, contingent on their following through with riding BART, was tendered as promised. Critically, there were three different treatment groups, which introduced randomization into whether the participant was also asked to sign a commitment statement indicating that they would commit to follow through with the binding offer. The presence of this commitment statement was known at the time the participant choice trial was decided on.

Commitment devices can take a variety of forms (binding or non-binding; written, signed, or implied), and aim to positively impact follow-through on particular tasks or behaviors. Explored in a variety of contexts (e.g., Himmler et al. 2019), personal commitment statements are an example of a behavioral “nudge,” meant to influence behavior while remaining free of any tangible external benefit or cost. Many behavioral field studies have demonstrated evidence that written commitments can increase the probability of following through on new pro-environmental behaviors such as recycling (Werner et al. 1995; Katzev and Pardini 1988; De Leon and Fuqua 1995; Wang and Katzev 1990; Burn and Oskamp 1986), towel reuse in hotels (Terrier and Marfaing 2015), or taking public transportation (Matthies, Klöckner and Preißner 2006), despite there being no penalty for commitment-breaking. Notably, these environmental behavior contexts where commitment statements have shown success are all highly habitual. The habitual nature of these behaviors provides a contextual challenge to induce behavior change, as the automaticity or lack of conscious thought about such behaviors presents an intrinsic barrier to encouraging or implementing sustained, daily change.

The field of behavioral economics has explored the role of binding commitments extensively. While neoclassical economic models assume individuals’ preferences to be time-consistent,

unrelated to decision frames, and affected only by reward magnitudes, models that allow for present-biased preferences acknowledge a more empirically consistent and less stable implementation of behavior. Present-biased preferences models account for the importance of immediate gratification in frequent empirical observations. In experimental and observational settings, individuals are patient and make plans to exercise, stop smoking, or look for a better job, when evaluating these outcomes in the distant future. However, as the future becomes the present, individuals go back on their plans. This type of behavior is referred to as time-inconsistency (Della Vigna 2009). Researchers have documented in both experimental and field studies that those with present-biased, or time-inconsistent, preferences are often willing to take on costly commitment devices to counteract these tendencies. This is especially true of individuals who are “sophisticated” or self-aware of those biases within themselves. However, the personal commitment statements we employ in this study have no binding constraints or penalties. The mechanism for their effectiveness, while possibly related, may not be the same as in the case where the commitment has a binding consequence.

The mechanisms by which personal commitments effectively induce behavior change are not yet fully understood. Berzonsky (2003) suggests that “stable personal commitments” play a role in promoting “personal functioning and well-being.” By abiding by and reinforcing personal commitments, individuals increase strength or clarity of their standards, goals, convictions, or beliefs. This armors individuals against personally undesirable behaviors; Berzonsky (2003) references Brickman (1987), who observed that a personal commitment “stabilizes individual behavior under circumstances where the individual would be otherwise tempted to change.” However, these descriptions lack specificity on the behavior mechanism or experience that motivates the behavior change as a result of these personal commitment statements. Why would more clarity in standards, goals, convictions or beliefs necessarily result in behavior change?

In this paper we define and test three main hypotheses, identified based on a review of the literature, each examining a mechanism by which personal commitment statements may influence behavior.

**Hypothesis 1:** Personal commitment statements act to increase individuals’ sense of connection and similarity with their future selves, enhancing a sense of future self-continuity (Hershfield 2011) which makes more salient the costs or benefits the future self would experience as a result of current choices.

**Hypothesis 2:** Personal commitment statements induce guilt, disappointment, or regret (Inman, Dyer & Jia 1997) in oneself for lack of follow-through, achieving efficacy because individuals wish to avoid experiencing those negative feelings.

**Hypothesis 3:** Similar to binding commitment devices, personal commitment statements may simply be viewed by individuals as a reinforcing nudge for an already-desirable behavior, which they would like to follow through on. In this framework, personal commitment devices would function as an attractive tool for those with self-control or

procrastination problems, and would be especially sought after by those who were self-aware about such issues (Ariely & Wertenbroch 2002; Bisin & Hyndman 2020).

A set of additional analyses are conducted relating to corollaries of this final hypothesis, exploring a personal commitment statement's role as an enabling device that either increases, or is correlated with, intent to implement the desired behavior. The underlying insight to be gained from these final analyses is the extent to which demand for one type of commitment device is positively correlated with demand for other types of commitment devices, or whether the presence of one commitment device crowds out demand for other potential enabling devices.

The remainder of this report is organized as follows. In Section 2 the field experiment design is described in detail; in Section 3 we outline the hypotheses we test and the analysis approach used; in Section 4 we describe the data used for the analysis in and provide some summary statistics; in Section 5 we present the results; and in Section 6 we conclude.

## **2 Field Experiment Design**

The data for this study were collected as part of a field experiment that was launched in early July of 2019 and ended in January of 2020. The study was focused on incentivizing participants to ride BART for their commute. The study was administered via Qualtrics questionnaires, and included a smartphone app designed to provide an objective confirmation of the extent to which the participant engaged in the target behavior. Participants were recruited to participate through four different venues: (1) UC Berkeley's Xlab and Behavioral Lab SONA system; (2) Craigslist job listings; (3) Facebook ad; and (4) fliers at UC Village (student housing for graduate students). The study design is described here, and more detail is provided in the Appendices.

Recruited participants first completed an initial online screening questionnaire to verify that they met the participation criteria. The critical criteria to participate required participants to have an email address, a smartphone on which they would be willing to install the study app, to have a commute for which they could feasibly take BART, but for which they had not taken BART in the past six months, and some willingness to consider taking BART for their commute. Participants who met the criteria were randomized into one of four treatment groups or a control group and sent a link to provide their consent to participate via another online survey. While there were four original treatment groups plus the control group, the analyses presented here rely on data from three of the treatment groups: (1) the Commitment Only group; (2) the Choice Only group; and (3) the Trial-by-Trial group.<sup>1</sup> For the Commitment Only group, these repeated choice trials

---

<sup>1</sup> The fourth treatment group was the same as the Commitment Only group only they were additionally asked to ride BART one time prior to responding to the first study questionnaire in which the choice trial offers of incentive to ride BART were undertaken. Recruitment to this treatment group stopped relatively early in the field experiment as it was apparent that this treatment group would be of limited value, as any follow-on behavior would be highly affected by participation bias for this group. The control group was not given any choice trials or incentive offers, and was not told anything about, nor signed, a commitment statement. In referring to more detail on the study design in Appendix A, the Commitment Only group is



were framed in the context of a commitment statement. Specifically, they were told that when offered their binding outcome, they would be asked to sign a personal commitment statement in which they would commit to follow through with that outcome. In contrast, for the Choice Only group, these repeated choice trials were framed only as choices, without a commitment statement component. For the Trial-by-Trial group it was made clear that some of the offers, if selected as binding, would be coupled with a request that they sign a personal commitment statement, and for some the offer would simply be provided and no commitment statement would be requested. Each trial was clearly marked as being associated with a commitment statement or not. The control group was not given any choice trials or incentive offers, and was not told anything about, nor did they sign, a commitment statement.

After providing their informed consent, participants were given instructions to install the smartphone app, which provided GPS location information to the researchers. The first questionnaire for the study was administered to the participant one week after they installed the app, to allow some pre-treatment data on commute patterns and BART ridership to be collected. This initial questionnaire consisted of three parts: (1) a series of questions about level of agreement with a list of “identity statements” (e.g., “I see myself as someone who is always prepared”). These statements were related to the characteristics of conscientiousness, openness to new experience, pro-environmental attitudes, habit, commitment follow-through, and BART/driving identity; and (2) the series of trials with potential options describing changes to their commute behavior in the ensuing month. Based on their treatment group, as described above, for some participants trial options might be “commitment”-cued, while some might just be offers that did not involve a commitment statement step. Subjects that saw both framings were informed ahead of time about the distinction between these two types of choice frames. The trials consisted of varying combinations of how many days they would alter their commute to use BART instead of their own car (varying from 1 to 4 days over the ensuing month), and the amount that they would be paid per BART commuting day as a monetary incentive (varying from \$0 to \$20 per day).

After completing this initial questionnaire, the study administrator assigned a binding outcome to the participant from their responses to offer trials. The outcome was randomly selected from all those offers accepted by the respondent in the trials. For those with some commitment-framed and some non-commitment-framed offers, the offer was selected at random from those commitment-framed offers accepted, unless none were accepted in which case the binding outcome was selected at random from any offers accepted. The assigning of the binding outcome triggered an invitation for the participant to complete the second questionnaire for the study. The second questionnaire consisted of five elements. First, for those assigned a commitment-framed outcome, participants were asked to sign the personal commitment statement: “I personally commit to taking BART for my commute to work, school or other primary destination [Number] day(s) over the course of 4 weeks for a compensation of \$[Incentive] per day that I take BART for this commute.” In this statement “Number” varied from 1 to 4 based on the binding outcome selected, and “Incentive” varied from \$0-\$20 based on the

---

referred to as “B2”, the Choice Only group is referred to as “B3”, the Trial-by-Trial group is referred to as “B1”, and the discontinued pre-ride treatment group is referred to as “B4.”

binding outcome selected. The participant had to type “I commit” in order to commit to this statement. They were allowed to decline to commit at that point, though almost no one declined. For those with no binding commitment outcome, the binding offer (simply consisting of information about the number of ride days and incentive level of the offer, without a personal commitment statement, was provided. Second, once subjects were informed of their binding choice, and after signing the personal commitment statement, if applicable, subjects were provided with an opportunity to plan their BART commute. They were provided with links to Google Maps, bart.gov, actransit.org, and 511.org as resources to inform themselves about their options. If they chose to undertake this step, they indicated as much by reporting the BART station they would use to depart for their commute and the BART station at which they would disembark at their destination. They could do this for all or some of the primary destinations they reported regularly traveling to. They were told they were free to skip this step if they choose. Third, participants were then offered an option to have all or a portion of their \$30 participation payment (which they would receive for completing these first three study questionnaires, regardless of follow-through BART ridership behavior) provided to them in the form of a Clipper card (the Bay Area public transit card), pre-loaded with that portion of funds to be usable on BART. This was a voluntary choice, and any or all of the participant payment not tendered in the form of a Clipper card was paid in the form of a VISA gift card. Fourth, participants were asked to rate how likely they believed it was that they would follow through with the agreed-to BART ridership behavior, given the agreed-to compensation level. Finally, participants responded to a variety of questions, which covered individual characteristics such as their transit habits and preferences, demographic and household information, environmental attitudes, and personality and psychological characteristic measures, including questions designed to identify their degree of future-self continuity, and their degree of present-biasedness.

After completing the second questionnaire, participants were told they were then free to proceed with the four-week period over which they could undertake to follow-through with the agreed upon, or committed to, BART ridership. They were sent three reminder emails over these four weeks reminding them of what they agreed/committed to and by what date they would need to follow through. At the end of the four week period, they were sent a link to the final questionnaire which consisted of three elements: (1) a repetition of the questions regarding identity statement from the first questionnaire; (2) a request for them to report how many times they rode BART over the course of the month since completing the initial study tasks (with a reminder that we were independently verifying this through the app data); and (3) questions about their attitudes and preferences for different commute transportation mode options. After completing this final questionnaire, their reported BART ridership was verified using the app data, they were paid their earned incentive, and were paid an additional \$10 for completing that third and final questionnaire.

The app was designed to track participants’ GPS locations throughout the duration of the study. The location data were compared with BART system routes to confirm participant reported BART ridership behavior in the study. The main purpose of the app was to provide participants with a sense that their behavior was being observed so they were more likely to be truthful in their response to the final study questionnaire, and would answer thoughtfully and realistically to

the choice trial offers in the first survey. The app was designed to work on both Apple and Android devices. The app worked correctly for most participants when installed correctly on a phone with cell service and the proper settings selected. There were some difficulties in some instances receiving data, and there was an interruption when Apple updated their iPhones midway through the study. However, in instances where data was not being reported from participants, this lapse in transmission was not obvious to participants, and so many were likely still under the impression their rides would be verified. Certainly, at the time they responded to the choice trial offers, which is the primary focus of the analysis for this paper, they were fully under the impression that their behavior regarding BART ridership in the study would be verified in this way, and so their responses to the offers were incentive compatible.

### 3 Hypotheses and Analysis Approach

In this section we outline the three competing hypotheses regarding the mechanism through which personal commitment affects behavior and choices. The general form the test of these hypotheses take is to assess the extent to which different characteristics mediate the premium participants required in order to accept a choice offer associated with a commitment frame (i.e., in which they knew, if chosen as binding, that offer would come with a request to sign a personal commitment statement) compared to an offer without a commitment frame. This required premium to accept the personal commitment can be framed in terms of a measure of the willingness to accept (WTA) for a personal commitment offer. The tests for all these hypotheses take the following general form where a given characteristic “X” is hypothesized to be associated with a relatively higher or lower WTA for commitment versus non-commitment offer, relative to someone without characteristic X. First a logit model is run of the form presented in Equation (1).

$$Accept[Y/N]_{it} = \alpha + \beta Pay_{it} + \gamma Commit_{it} + \eta X_i + \zeta(Commit_{it} * X_i) + \theta Rides_{it} + \varepsilon_{it} \quad (1)$$

From this the following elements can be defined:

$$A = WTA(Commit = 1|X = 1) = (\alpha + \gamma + \eta + \zeta + \theta mean(Rides_{it}))/\beta$$

$$B = WTA(Commit = 1|X = 0) = (\alpha + \gamma + \theta mean(Rides_{it}))/\beta$$

$$C = WTA(Commit = 0|X = 1) = (\alpha + \eta + \theta mean(Rides_{it}))/\beta$$

$$D = WTA(Commit = 0|X = 0) = (\alpha + \theta mean(Rides_{it}))/\beta$$

The hypothesis itself then takes the form presented in Equation (2).

$$\text{Hypothesis: } \Delta WTA(Commit|X = 1) > \text{ or } < \Delta WTA(Commit|X = 0) \quad (2)$$

Where:

$$\Delta WTA(Commit|X = 1) = WTA(Commit = 1|X = 1) - WTA(Commit = 0|X = 1) = A - C$$

$$\Delta WTA(Commit|X = 0) = WTA(Commit = 1|X = 0) - WTA(Commit = 0|X = 0) = B - D$$

Finally, the hypothesis test takes the form presented in Equation (3).

$$\text{Hypothesis Test: } A - C - (B - D) > \text{ or } < 0 \Rightarrow \zeta/\beta > \text{ or } < 0 \quad (3)$$

In one case, the hypothesis involves a particular form of interaction between two characteristics “X” and “Y”, where the hypothesis is posed to be true for those with characteristics X only if they also have characteristic Y; the test for this hypothesis takes a slightly different form from the previous. The logit estimation is presented in Equation (4).

$$\begin{aligned} \text{Accept}[Y/N]_{it} = & \alpha + \beta \text{Pay}_{it} + \gamma \text{Commit}_{it} + \eta X_i + \zeta (\text{Commit}_{it} * X_i) \\ & + \phi (X_i * Y_i) + \mu (\text{Commit}_{it} * X_i * Y_i) + \theta \text{Rides}_{it} + \varepsilon_{it} \end{aligned} \quad (4)$$

From this the following elements can be defined:

$$A = WTA(\text{Commit} = 1|X = 1 \& Y = 1) = (\alpha + \gamma + \eta + \zeta + \phi + \mu + \theta \text{mean}(\text{Rides}_{it}))/\beta$$

$$B = WTA(\text{Commit} = 1|X = 1 \& Y = 0) = (\alpha + \gamma + \eta + \zeta + \theta \text{mean}(\text{Rides}_{it}))/\beta$$

$$C = WTA(\text{Commit} = 0|X = 1 \& Y = 1) = (\alpha + \eta + \phi + \theta \text{mean}(\text{Rides}_{it}))/\beta$$

$$D = WTA(\text{Commit} = 0|X = 1 \& Y = 0) = (\alpha + \eta + \theta \text{mean}(\text{Rides}_{it}))/\beta$$

The hypothesis itself then takes the form presented in Equation (5).

$$\text{Hypothesis: } \Delta WTA(\text{Commit}|X = 1 \& Y = 1) > \text{ or } < \Delta WTA(\text{Commit}|X = 1 \& Y = 0) \quad (5)$$

Where:

$$\Delta WTA(\text{Commit}|X = 1 \& Y = 1) =$$

$$WTA(\text{Commit} = 1|X = 1 \& Y = 1) - WTA(\text{Commit} = 0|X = 1 \& Y = 1) = A - C$$

$$\Delta WTA(\text{Commit}|X = 1 \& Y = 0) =$$

$$WTA(\text{Commit} = 1|X = 1 \& Y = 0) - WTA(\text{Commit} = 0|X = 1 \& Y = 0) = B - D$$

Finally, the hypothesis test in this case takes the form presented in Equation (6).

$$\text{Hypothesis Test: } A - C - (B - D) > \text{ or } < 0 \Rightarrow \mu/\beta > \text{ or } < 0 \quad (6)$$

Following a review of the literature we define and test three main hypotheses: (1) future-self continuity; (2) disappointment/regret aversion; and (3) present-biased preferences. More detail on each of these are presented here.

### 3.1 Future-self continuity

Failure to follow through on a desired behavior could stem from making plans under a context of low future self-continuity, wherein participants do not feel strongly connected to their future self and thus do not necessarily act in their own future self-interest (Hershfield 2011). The commitment frame focuses a participant’s attention on the future action associated with the study; they are making a binding commitment that will be acted upon by their future self, which could temporarily strengthen the individual’s sense of future self-continuity in the context of actions to be taken for the study. The commitment frame may increase connection to the future self, so when framed in terms of a personal commitment statement, a participant may more thoroughly consider what is acceptable/doable for their future self in order to increase the

likelihood of following through with the desired behavior. This more serious reflection may result in requiring a higher incentive payment to accept a commitment-framed choice trial compared to a commitment-free trial.

Table 1 summarizes the different specific hypotheses, based on the analytical framework presented in Equations (1) through (6), including the specific tests conducted. The hypothesis pertaining to future-self continuity (FSC) tests whether those with high FSC require a higher premium for accepting an offer with a commitment frame as opposed to choice frame, relative to those with low FSC.

### **3.2 Disappointment/Regret Aversion**

Regret aversion is often tested in the literature by offering participants a chance to switch their choice from a status quo, resulting in a higher or lower reward. A regret-averse individual who anticipates the possibility of accidentally making a choice that reduces their reward from the status quo may choose to maintain that status quo simply to avoid experiencing regret (e.g., Inman, Dyer & Jia 1997). While our choices are structured somewhat differently, this cognitive process still has bearing on participants' choices on each trial, as well as the impact of the commitment frame.

For participants who self-report a tendency to procrastinate or a general lack of follow-through, the commitment frame may present the threat of higher future regret or disappointment. This could be external disappointment (as the participant considers the researchers' reaction) or internal (as the participant expresses regret when assessing their own behavior), should they fail to complete the tasks of the study. Under such conditions, the commitment frame may be perceived as undesirable, presenting a perceived future emotional cost to the participant. This might then lead to the requirement of a relatively higher incentive payment in order to accept a choice trial offer which comes with a personal commitment statement.

In Table 1 the hypothesis pertaining to disappointment or regret aversion tests whether those with relatively high disappointment risk (DisRisk) require a relatively higher premium for accepting an offer with a commitment frame as opposed to choice frame, relative to those with low DisRisk.

### **3.3 Present-Biased Preferences**

In cases where participants have an intrinsic desire to engage in the targeted behavior, but have difficulties with procrastination or follow-through, present-biased preferences (e.g., Ariely & Wertenbroch 2002, Bisin & Hyndman 2020) may play a role. Two factors could additionally relate to the role of the personal commitment statement through this mechanism: sophistication about the degree of present-biased preferences and implementation intention.

### 3.3.1 Sophistication

The first related factor, which may mediate the role of the personal commitment statement in the context of present-biased preferences, is the participants' level of sophistication about the extent and relevance of their own self-control problems in this decision context. In the present-biased preference model, commitment devices are only appealing to those with some self-awareness about the extent to which they are likely to continue to procrastinate absent a commitment device. The same may be true in the case of a non-binding commitment device, like the personal commitment statements used in our study.

*Table 1 Hypothesis Tests*

Mediating Factor	Question	Hypothesis	Test
Future-self continuity (FSC) (H1)	Do those with high future-self continuity (FSC=1) require a relatively higher premium to accept a commitment frame offer than those with a lower future-self continuity (FSC=0)?	$\Delta WTA(Commit FSC = 1) > \Delta WTA(Commit FSC = 0)$	$\zeta/\beta > 0^*$
Disappointment or regret aversion (H2)	Do those with a higher disappointment risk (DisRisk=1) require a relatively higher premium to accept a commitment frame offer than those with a lower risk of disappointment (DisRisk=0)?	$\Delta WTA(Commit DisRisk = 1) > \Delta WTA(Commit DisRisk = 0)$	$\zeta/\beta > 0^*$
Present-biased preferences (H3.1)	Do those who are more present-biased (PB=1) require a relatively lower premium to accept a commitment frame offer than those who are not present biased (PB=0)?	$\Delta WTA(Commit PB = 1) < \Delta WTA(Commit PB = 0)$	$\zeta/\beta < 0^*$
Present-biased preferences (H3.2)	Do those who are more present-biased and also sophisticated (PB=1 & Soph=1) require a relatively lower premium to accept a commitment frame offer than those who are present-biased and not sophisticated (PB=1 & Soph=0)?	$\Delta WTA(Commit   PB = 1 \& Soph = 0) < \Delta WTA(Commit PB = 1 \& Soph = 0)$	$\mu/\beta < 0^\dagger$

\* Derived from Equations (1) - (3)

† Derived from Equations (4) - (6)

In Table 1 there are two hypotheses associated with the present-biased preference explanation. The first tests whether those who have a higher degree of present-biasedness (PB) require a relatively lower premium for accepting an offer with a commitment frame as opposed to choice frame relative to those with low PB. The second tests whether those who have a higher degree of present-biasedness and are sophisticated (Soph) about their issues with self-control or follow-through require a relatively lower premium for accepting an offer with a commitment frame as opposed to choice frame relative to those who are also more present-biased but are not sophisticated.

### 3.3.2 Implementation Intention

The second related factor is “implementation intention” (e.g., Arbuthnott 2009). In this study implementation intention could be represented by the use of the BART trip planner, or the choice to apply some or all of their participation payment to a Clipper card (which is payment earmarked to the targeted behavior), or their self-reported likelihood of following through with the agreed-upon behavior. According to Arbuthnott (2009), the memory cueing and problem solving involved in making concrete plans regarding how and when to take an intended action can strengthen the link between attitude and behavior, requiring memory elicitation and problem solving. This concept is also related to other indicators of intention to follow through, such as a binding commitment device.

There are two sets of analyses conducted to further explore the relationship between preferences for personal commitment statements and preferences for other commitment devices or opportunities to exhibit behaviors consistent with increased implementation intention. The first (C1), is summarized in Table 2, while the second (C2) is outlined below in Equations (7) through (9). Here we use the term “implementation intention” to capture a characteristic proxied for by three factors, one of which is uptake of an actual binding commitment mechanism, one is engagement in a time-consuming (and optional) trip-planning exercise, and one is rating the likelihood of following through on the agreed-to behavior. The corollary outlined in Table 2 tests whether those who end up exhibiting a higher implementation intention (Impl) have a relatively lower premium for accepting an offer with a commitment frame as opposed to choice frame relative to those who end up exhibiting lower implementation intention.

*Table 2 Preference for personal commitment and implementation intention*

Implement- ation Intention (C1)	Do those who end up exhibiting a higher implementation intention (Impl=1) show evidence of requiring a relatively lower premium to accept commitment frame offers than those who end up exhibiting lower implementation intention (Impl=0)?	$\Delta WTA(Commit Impl = 1) < \Delta WTA(Commit Impl = 0)$	$\zeta/\beta < 0$
--	---	---	-------------------

In addition to the above summarized correlation regarding implementation intention, one additional related corollary (C2) is “are those who are assigned a binding outcome that is commitment framed more likely to exhibit higher implementation intention, or utilize other commitment devices, relative to those not assigned a binding commitment frame”? This corollary is tested in the following way:

$$Impl[Y/N]_i = \alpha + \beta BindingCommit_i + \gamma BindingPay_i + \theta BindingRides_i + \varepsilon_i \quad (7)$$

**Corollary C2**

$$Prob(Impl = 1 | BindingCommit = 1) > Prob(Impl = 1 | BindingCommit = 0) \quad (8)$$

**Test:**  $\beta > 0$  (9)

**4 Data**

The field experiment started recruiting participants in July 2019 and closed data collection in January 2020. A total of 184 participants who took the screening survey met the criteria for participation in the study. Of those, 137 formally joined the study by signing the informed consent. There was a large amount of attrition from this study. Only 107 participants installed the app for the study and moved to the next phase. The majority of the data used in the analysis for this report comes from responses from the first two study surveys; a total of 86 participants completed survey 1 while 81 completed survey 2. Finally, 77 participants completed the entire study all the way to the final follow-up survey which was administered a month after the preceding two surveys.<sup>2</sup> Table 3 summarizes the number of participants that completed the first, second, and final survey for the study by treatment group used in this analysis.<sup>3</sup> The

---

<sup>2</sup> This field study was originally designed as a preliminary study intended to guide the design and implementation of a final neuroeconomics study using fMRI imaging to analyze neurological patterns in the context of the 68 offers with varying numbers of BART ride days, incentive payments per day riding BART, and presence of the commitment frame. That is why the number of participants is relatively low; the main purpose of the study was to assess the presence of behavioral responses differentiated by the commitment frame in the choice trials, not in identifying the treatment-specific differences in follow-through behavior. Indeed, there are no statistically significant differences across treatment groups regarding follow-through BART ridership behavior that can be identified given the limited sample size. However, COVID-19 shelter-in-place came into effect just following closing data collection for this field experiment, and given restrictions of the timeline of the funding for this study, and the fact that the COVID-19 pandemic completely altered the way people were engaging in and perceiving public transit ridership, it was impossible to proceed with the original study as intended. As a result, this report takes advantage of the field experiment data already collected and attempts to make use of it to learn as much as possible given the limitations inherent in the relatively small sample size. Our intention is to provide a framework, and some suggestive evidence pointing to the likely explanation for the behavioral mechanism behind the effectiveness of personal commitment statements to facilitate behavior change. Our hope is that this report can be used as a building block for others to someday conduct a more robust and comprehensive follow-up experiment to more thoroughly study this.

<sup>3</sup> Participants in the control group and the “B4” pre-ride treatment group were not used in this analysis. The control group did not respond to the survey 1 choice trial questions upon which this analysis is based, and the “B4” treatment group was discontinued early on as it was determined that the selection effect for this group made it so that it could not be compared to any of the other treatment groups.



randomization was designed to result in more participants in the “Trial-by-Trial Commitment Treatment Group” compared to the other two.

**Table 3 Number of respondents that completed each of the study surveys**

	Completed Survey 1	Completed Survey 2	Completed Survey 3
Commitment Only Treatment Group	15	14	14
Choice Only Treatment Group	17	16	15
Trial-by-Trial Commitment Treatment Group	27	25	23

The specific variables used in the analysis are listed in Table 4 along with their role in each of the analyses conducted. Definitions and derivations of these variables are provided below.

**Table 4 Variables used and role in each analysis**

Variable	Hypothesis 1	Hypothesis 2	Hypothesis 3	Corollary 1	Corollary 2
FSC similar	FSC				
FSC average	FSC				
Inv followthru		DisRisk	Soph		
Inv persevere		DisRisk	Soph		
Lazy		DisRisk			
Shirks duty		DisRisk			
DisRisk Index		DisRisk			
Beta1 (>median)			PB		
Beta2 (>median)			PB		
Sophistication index			Soph		
Plan at least 1 BART				Impl	Outcome
Clipper allocate some				Impl	Outcome
Likely followthru				Impl	Outcome
Accept	Outcome	Outcome	Outcome		
Pay	Var. of interest	Var. of interest	Var. of interest		
Commit	Var. of interest	Var. of interest	Var. of interest		
BindingCommit					Var. of interest
BindingPay					Control
BindingRides					Control
Rides	Control	Control	Control	Control	
proxBART	Control	Control	Control	Control	Control

The two variables *FSC similar* and *FSC average* are derived from a set of questions asked in the second study survey designed to capture future-self continuity (see question 9 in the “Study Questionnaire” portion of Survey 2 shown in Appendix D) (Hershfield et al. 2009). The *FSC*

*similar* measure was derived from the response value, on a scale of 1 to 7, to question 9b, while the *FSC average* was derived from the responses to 9a and 9b. In both cases the *FSC similar* and *FSC average* variables were defined to be binary indicators equal to one if the value of either measure is greater than four (indicating a relatively strong connection to future self), zero otherwise.

Disappointment risk is proxied for using responses to four identity statements which are indicative of a respondent's likelihood of not completing tasks (and therefore potential likelihood of being disappointed with themselves). The wording for the statements is as follows: "I am someone who..." (1) "...makes plans and follows through with them", (2) "...perseveres until the task is finished," (3) "... tends to be lazy," and (4) "...shirks my duty." Participants responded using a 5-point scale ranging from "Strongly disagree" to "Strongly agree" (see question 8 in the "Choice Task Questionnaire" in Appendix B). These questions were derived from the Big Five Inventory measure (John and Srivastava 1999). The variable *Inv followthru* is derived from the inverse coding of (1) and *Inv persevere* is derived from the inverse coding of (2). The variables *Lazy* and *Shirks duty* are each derived from the direct coding of (3) and (4), respectively. The binary indicators for *Inv followthru* and *Inv persevere* equal one for anyone who did not indicate that they "somewhat agree" or "strongly agree" with statements (1) and (2), respectively, zero otherwise. For *Lazy* and *Shirks duty* the binary variables equal one if respondents indicated that they "somewhat agree" or "strongly agree" with statements (3) and (4), respectively, and zero otherwise. The combined index is derived by summing the raw inverse-coded responses to (1) and (2) and the direct coded responses to (3) and (4). The binary for the disappointment risk index (*DisRisk index*) equals one if respondent's score is above the sample median, and zero otherwise.

The variables *Beta1* and *Beta2* were derived by estimating a quasi-hyperbolic ( $\beta, \delta$ ) model of intertemporal preferences:

$$U_t = u(x_0) + \beta \sum_{k=1} \delta^k u(x_k) \quad (10)$$

We make the assumption that  $u(x)$  is approximately linear over the relevant range of payments. We then have:

$$U_t = x_0 + \beta \sum_{k=1} \delta^k x_k \quad (11)$$

We estimate  $\beta$  and  $\delta$  using respondents' choices over hypothetical sets of sooner-smaller and later-larger payments, the same as those used in Burks et al. (2012) (see questions 1 through 4 in the "Study Questionnaire" portion of Survey 2 in Appendix D). Respondents were presented with 7 binary choices in 4 separate time frames (28 choices total): today-tomorrow, today-5days, 2days-9days and 2days-30days. In all 4 frames, the later-larger payment was fixed at \$80 while the sooner-small payment ranged from \$75 to \$45 in decrements of \$5.

To estimate  $\beta$  and  $\delta$ , we first identify the point at which the respondent  $i$  is indifferent between receiving  $x_{(k-s),i}$  in  $s$  days (the soonest period) and \$80 in  $k$  days. For the case where  $s = 0$ , i.e., the soonest period is "today", indifference can be represented as:

$$x_{(k-s),i} = \beta \delta^{(k-s)} 80 \quad (12)$$

For the choice sets where  $s > 0$ , the indifference can be represented as:

$$x_{(k-s),i} = \delta^{k-s} 80 \quad (13)$$

Given the time increments in the question posed to respondents we end up with a system of equations as follows:

$$x_{1,i} = \delta 80 \quad (14)$$

$$x_{5,i} = \delta^5 80 \quad (15)$$

$$x_{7,i} = \beta \delta^{(9-2)} 80 \quad (16)$$

$$x_{28,i} = \beta \delta^{(30-2)} 80 \quad (17)$$

Where each of the values for  $x_{j,i}$  represents the minimum payoff the respondent indicated they were willing to accept in the sooner period,  $s$ , rather than \$80 in the later period,  $k$ . We solve for  $\delta$  first by combining Equation (14) and (15) and solving, then separately by combining Equation (16) and (17) and solving. This gives us two candidate values of  $\delta$ . We generate  $\beta$  two different ways. First, to generate *Beta1*, we take the mean of the two candidate  $\delta$  values generated in the previous step. We then use this average  $\delta$  estimate to solve for  $\beta$  in Equations (16) and (17), to get two values of  $\beta$  and again take the average across these two. We then define a binary variable such that *Beta1* is equal to one if the respondent's average  $\beta$  value using this method is greater than the sample median of this average  $\beta$ , zero otherwise. The second approach we use, for robustness, is to use the  $\delta$  derived from combining Equations (16) and (17) only (without averaging it with the  $\delta$  derived from Equations (14) and (15)). We then plug this  $\delta$  back in to Equations (16) and (17) to solve for two  $\beta$  values, take the average again, and define *Beta2* to be equal to one if the respondent's  $\beta$  value using this second method is greater than the median value from the sample of respondents, zero otherwise.

We proxy for sophistication (i.e., awareness of one's own present bias) to define the *Soph* feature in Table 4 using data on two self-reported identity statements that indicate respondents' self-perception as one who does not see tasks through to their completion. These proxies are chosen to be the same variables defined above, *Inv persevere* and *Inv followthru*. A combined index score (*Soph index*) is also employed defined in the same way as for the disappointment risk measures, but summing only the *Inv persevere* and *Inv followthru* inputs and then set equal to one if the value is over the sample median, zero otherwise.

Implementation intention is proxied for by three separate measures. First, it is proxied for using a binary variable that equals one if the respondent opted to plan their BART route (by identifying which stations they would need to depart from and arrive at) for at least one primary destination, zero otherwise (*Plan at least 1 BART trip*). Second, it is proxied for by a binary measure that equals one if respondent allocates any amount of their participation payment to a Clipper card

(i.e., committing money to the future use of BART), zero otherwise (*Clipper allocate some \$*). The third proxy for implementation intention uses their self-reported likelihood of following through after being assigned a binding BART-riding task and equals one if they indicate that they are either “Somewhat likely” or “Very likely” to follow through with the agreed-upon number of days riding BART for the study, zero otherwise (*Likely followthru*). All of these responses were elicited in the “Commitment and Outcome Task Questionnaire” portion of Survey 2 (see Appendix C).

Finally, the other primary variables used in the analysis as listed in Table 4 are defined as follows. The variables *Accept*, *Commit*, *Pay*, and *Rides* are all specific to the 68 repeated choice offers in question 7 of the “Choice Task Questionnaire” of Survey 1 (see Appendix B). The variable *Accept* is a binary variable equal to one if the respondent indicated that they would accept the given offer, zero otherwise. The variable *Pay* is the payment offered per day riding BART in that choice task trial (taking values between \$0 and \$20). The variable *Rides* is the number of days riding BART associated with that choice task trial offer (1 through 4). Finally, *Commit* is a binary variable equal to one if that choice task trial was with a “commitment frame,” (i.e., the respondent knew that if selected as binding they would be asked to provide a personal commitment statement), zero otherwise. The variables *BindingCommit*, *BindingPay*, and *BindingRides* take a single value per study participant and are the values of the accepted choice trial selected as the binding offer for the participant to respond to as the offered incentive to ride BART during the performance period of the study, with *BindingCommit* being an indicator variable equal to one if that binding outcome was “commitment framed,” zero otherwise. Finally, the variable *proxBART* is the proximity, in miles, of the respondent’s first-listed primary destination to the nearest BART station.

Table 5 presents summary statistics of demographics and responses for all participants included in this analysis. Between 54 and 58 participants’ responses are used in the hypothesis and corollary tests. The difference is due to the fact that 58 completed the first survey while only 54 completed the second. Some of the analyses require responses to questions from the second survey and some do not. In addition, some respondents declined to answer some of the demographic questions. The majority of the sample is female and the average age of the sample of respondents is 30, with participants ranging from 19 to 54 years old. Close to a third of respondents are white while 45% are Asian and 30% are either Black or Hispanic. About 40% of the sample has a college degree and a third lives in a household with annual income over \$100,000. The first-listed primary commute destination for respondents was on average two miles from the nearest BART station.

*Table 5 Summary Statistics*

	N	Mean	Std. Dev.	Min	Max
Female	52	0.65	0.48	0	1
Age	53	30	10	19	54
Black	51	0.12	0.33	0	1
Hispanic	51	0.18	0.39	0	1
Asian	51	0.45	0.5	0	1
White	51	0.31	0.47	0	1
College graduate	54	0.39	0.49	0	1
Household income > \$100K	58	0.33	0.47	0	1
proxBART	58	1.95	5.69	0.04	39.72
FSC similar	54	0.37	0.49	0	1
FSC average	54	0.43	0.5	0	1
Inv followthru	58	0.10	0.31	0	1
Inv persevere	58	0.16	0.37	0	1
Lazy	58	0.28	0.45	0	1
Shirks duty	58	0.19	0.4	0	1
Index for disappointment risk (>median)	58	0.48	0.5	0	1
Index for sophistication (>median)	58	0.57	0.5	0	1
Beta1 (>median)	54	0.67	0.48	0	1
Beta2 (>median)	54	0.76	0.43	0	1
Plan at least 1 BART trip	54	0.67	0.48	0	1
Clipper allocate some \$	54	0.17	0.38	0	1
Likely followthru	54	4.59	0.77	1	5
BindingCommit	58	0.59	0.5	0	1
BindingPay	58	13.9	4.98	0	20
BindingRides	58	1.93	1.12	0	4
Rides	3,944	2.49	1.12	1	4
Rides x Accept	3,944	1.29	1.46	0	4
Pay	3,944	11.76	5.35	0	20
Pay x Accept	3,944	7.14	7.57	0	20
Commit	3,944	0.47	0.5	0	1
Commit x Accept	3,944	0.24	0.43	0	1
Accept	3,944	0.53	0.5	0	1

With respect to the primary measures used for the analysis, between 37% and 43% of respondents were categorized as having relatively higher future-self continuity, while fewer, between 10% and 30%, exhibited relatively higher values of the proxies for disappointment risk. The indices for disappointment risk and sophistication are derived from the median value within the sample, so those categorized as relatively higher or lower based on those binary indices are more evenly split in the sample. Between 67% and 76% of the sample have a value of  $\beta$  greater than the sample median, which was 0.9375 for both derivations of  $\beta$ . The majority of

respondents planned at least one BART trip when given the opportunity to do so, and almost all indicated a high likelihood of following through with the agreed-upon BART ridership behavior, though only 17% allocated any of their participation payment to a Clipper card. Approximately 60% of respondents had a binding outcome that was commitment framed. The average binding number of days they were to ride BART in the month-long performance period was two at an average binding pay of \$14 per day they did so. In the 68 choice trials per participant (resulting in 3,944 choice trial observations) offers with lower numbers of rides were more likely to be accepted than offers with higher numbers of rides. This tended to supersede the price effect, meaning that the average pay offer of accepted offers was lower than the overall average for all offers, likely because some offers with fewer ride days were accepted even for relatively lower pre-ride pay. Overall, 53% of offers were accepted and 51% of commitment-framed offers were accepted.

## 5 Results

Here we present the results from testing the hypotheses summarized in Section 3. All analyses used a binary logit specification. In all cases where the 3,944 choice trials were used in the analysis, standard errors were clustered at the respondent level. The hypothesis tests were conducted using the Delta Method.

### 5.1 Future-Self Continuity (FSC)

This hypothesis predicted that those with a higher future-self continuity would require a higher premium in order to accept an offer with a commitment frame, relatively speaking. The posited mechanism is that the commitment framing would potentially create a closer connection between the future and present selves, making the trade-offs associated with the future self (monetary incentive versus effort to undertake the behavior) more salient and thereby increasing the required monetary incentive to accept the offer. The results of the hypothesis tests are presented in Table 6. We find that we cannot reject the null hypothesis. The point estimates of the test value take the opposite sign of that hypothesized, but in neither case is the result statistically significantly different from zero.

*Table 6 H1: Future-self continuity (FSC)*

hypothesis:	$\Delta WTA(\text{Commit}   FSC=0)$	<	$\Delta WTA(\text{Commit}   FSC=1)$	$\zeta/\beta > 0$	p
FSC similar	0.931		0.278	-0.653	0.660
FSC average	1.157		-0.128	-1.285	0.392

Notes: the analysis controls for proxBart and Rides.  $\Delta WTA(\text{Commit} | FSC=z)$  is short for:  $WTA(\text{Commit}=1 | FSC=z) - WTA(\text{Commit}=0 | FSC=z)$ .

Significance levels are + for  $p < 0.20$ ; ++ for  $p < 0.10$ ; \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; \*\*\* for  $p < 0.001$ .

## 5.2 Disappointment or regret aversion

Results for the hypothesis tests for disappointment or regret aversion are presented in Table 7. The results are largely not consistent with the disappointment aversion hypothesis. In fact, the findings that are statistically significant all contradict the hypothesis. For all but one proxy for disappointment risk, the first difference for those with a higher disappointment risk is negative, meaning that for those with a higher risk of disappointment, commitment is more desirable than no commitment. The opposite is true for those with low disappointment risk. The difference-in-differences hypothesis test values ( $\zeta/\beta$ ) for these proxies are negative and statistically significant; it appears that those who are at greater risk of experiencing disappointment (i.e., those less likely to indicate they tend to persevere on a task, or are more likely to see themselves as lazy or as someone who shirks their duties) value commitment rather than being averse to it. Drawing strong conclusions from this is difficult, as the concept of disappointment risk is being proxied for here by attributes that may not precisely capture the desired concept. These same responses regarding these particular personality attributes could be indicative of other motivations or traits. Reporting that one is less likely to persevere or follow through may indicate a risk factor for later disappointment, may indicate someone who isn't easily disappointed about one's own behavior (i.e., doesn't actually care about following through and therefore not likely to be disappointed), or someone who is aware of this feature in themselves and seeks ways to mitigate it. This latter point regarding these measures will re-emerge below in the discussion of the results for Hypothesis 3.2, in the context of sophisticated present-biased preferences.

**Table 7 H2: Disappointment or regret aversion**

hypothesis:	$\Delta WTA(\text{Commit} \mid \text{DisRisk}=0)$	<	$\Delta WTA(\text{Commit} \mid \text{DisRisk}=1)$	$\zeta/\beta > 0$	p
Inv followthru	0.519		2.486	1.968	0.205
Inv persevere	0.782		-3.019	-3.801	0.002 **
Lazy	1.217		-0.882	-2.099	0.130 +
Shirks duty	1.346		-2.765	-4.110	0.001 **
Index disRisk (>median)	1.722		-0.714	-2.436	0.091 +

Notes: the analysis controls for proxBart and Rides.  $\Delta WTA(\text{Commit} \mid \text{DisRisk}=z)$  is short for:  $WTA(\text{Commitment} \mid \text{DisRisk}=z) - WTA(\text{No Commitment} \mid \text{DisRisk}=z)$ .

Significance levels are + for  $p < 0.20$ ; ++ for  $p < 0.10$ ; \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; \*\*\* for  $p < 0.001$ .

## 5.3 Present-biased preferences

When testing for whether those with present-biased preferences on average might have a preference for commitment (Table 8), we cannot reject the null hypothesis in favor of the hypothesis that those who are present biased will value commitment more than the no-commitment frame at a level greater than those who are less present biased. The sign of the

difference-in-difference test measure ( $\zeta/\beta$ ) contradicts the hypothesized relationship and the standard errors are too large to be conclusive.

**Table 8 H3.1: Present-biased preferences (without accounting for sophistication)**

hypothesis:	$\Delta$ WTA(Commit   PB=0)	>	$\Delta$ WTA(Commit   PB=1)	$\zeta/\beta < 0$	p
beta1 (>median)	0.104		1.020	0.915	0.488
beta2 (>median)	0.633		0.750	0.117	0.922

Notes: the analysis controls for proxBart and Rides.  $\Delta$ WTA(Commit | PB=z) is short for: WTA(Commitment | PB=z) - WTA(No Commitment | PB=z).

Significance levels are + for  $p < 0.20$ ; ++ for  $p < 0.10$ ; \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; \*\*\* for  $p < 0.001$ .

However, when we look at the subset of those with present-biased preferences who also exhibit traits consistent with sophistication about being present-biased (Table 9), we see results in line with the hypothesis. Recall that being sophisticated about being present-biased means being self-aware of one's limitations or tendencies to have self-control issues, procrastinate, etc. There is some evidence that higher levels of sophistication can be attributed to a greater demand for commitment among those with present-biased preferences. When sophistication is proxied for using lower self-reported likelihood of persevering until a task is finished, those with higher levels of sophistication using this proxy show evidence of a willingness to accept a lower incentive payment for commitment framed offers compared to non-commitment framed offers, and a difference-in-differences test value ( $\mu/\beta$ ) relative to non-sophisticated present-biased preference participants that is negative (as hypothesized) and statistically significant. Therefore, those who self-identify as being unlikely to persevere with a task (and are also present biased) will value commitment more than those who are present biased and do not identify this trait within themselves. The results are less clear when sophistication is proxied for using greater self-reported likelihood of being unlikely to follow through after making a plan. The direction of the test measure contradicts the hypothesis, but is not statistically significantly different from zero. The index measure combining the perseverance and follow-through scores result in similarly inconclusive estimates due to large standard errors.



**Table 9 H3.2: Present-biased preferences (with sophistication)**

hypothesis:	$\Delta WTA(\text{Commit}   \text{PB}=1 \ \& \ \text{Soph}=0)$	$>$	$\Delta WTA(\text{Commit}   \text{PB}=1 \ \& \ \text{Soph}=1)$	$\mu/\beta < 0$	$p$
<i>(A) Sophistication: inverse of makes plans and follows through with them</i>					
beta1 (>median)	0.904		1.788	0.884	0.497
beta2 (>median)	0.651		1.802	1.152	0.306
<i>(B) Sophistication: inverse of perseveres until the task is finished</i>					
beta1 (>median)	1.012		-4.702	-5.714	0.000 ***
beta2 (>median)	0.941		-2.446	-3.387	0.003 **
<i>(C) Sophistication: index combining (A) and (B)</i>					
beta1 (>median)	0.669		1.230	0.561	0.810
beta2 (>median)	0.967		0.531	-0.435	0.834

Notes: the analysis controls for proxBart and Rides.  $\Delta WTA(\text{Commit} | \text{PB}=1 \ \& \ \text{Soph}=z)$  is short for:  $WTA(\text{Commitment} | \text{PB}=1 \ \& \ \text{Soph}=z) - WTA(\text{No Commitment} | \text{PB}=1 \ \& \ \text{Soph}=z)$ . Significance levels are + for  $p < 0.20$ ; ++ for  $p < 0.10$ ; \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; \*\*\* for  $p < 0.001$ .

#### 5.4 Implementation Intention Correlated with Preference for Commitment

There is some limited evidence that those who end up exhibiting greater levels of implementation intention after being assigned binding outcomes also show a lower willingness to accept for the commitment frame (versus the no-commitment frame) when compared to those who demonstrate a lower level of implementation intention (Table 10). Specifically, those who choose to allocate some amount of their survey earnings to a Clipper card or report a greater likelihood of following through on their assigned task are likely to have valued the commitment frame more than the no-commitment frame relative to those who demonstrate a lower level of intention to implement. These results are marginally statistically significant at  $p < 0.20$ . Meanwhile planning at least 1 BART route does not have a clear relationship with willingness to accept for the commitment frame.

**Table 10 C1: Implementation Intention Correlated with Preference for Commitment**

hypothesis:	$\Delta WTA(\text{Commit}   \text{implInt}=0)$	$>$	$\Delta WTA(\text{Commit}   \text{implInt}=1)$	$\zeta/\beta < 0$	$p$
Plan at least 1 BART trip	0.379		0.977	0.599	0.681
Clipper allocate some \$	1.192		-0.983	-2.174	0.141 +
Likely followthru BART	4.885		-0.053	-4.938	0.163 +

Notes: the analysis controls for proxBart and Rides. Significance levels are + for  $p < 0.20$ ; ++ for  $p < 0.10$ ; \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; \*\*\* for  $p < 0.001$ .

## 5.5 Signing Commitment Statement Correlated with Implementation Intention

Overall, the results do not provide strong support for the potential corollary that being assigned to a commitment frame binding outcome and therefore signing the commitment statement will increase implementation intention (Table 11). Only one measure of implementation intention, assigning some money to Clipper card, had an odds ratio greater than 1, however the standard error is too large to reject the null hypothesis. On the other hand, when implementation intention is proxied for using an indicator variable of whether participants planned their BART route to at least one primary destination, we find a statistically significant effect in the opposite direction of what was hypothesized. It appears that being assigned to a commitment frame binding outcome lowers the probability of planning out one's BART route.

*Table 11 C2: Signing Commitment Statement Correlated with Implementation Intention*

hypothesis: Odds ratio coeff(commit)>1	Odds ratio coeff(commit)	p-value
Plan at least 1 BART trip	0.185 *	0.027
Clipper allocate some \$	2.883	0.245
Likely followthru BART	0.560	0.635

Notes: the analysis controls for proxBart. The term coeff(commit) refers to the coefficient on the BindingCommit variable from an estimation of Equation (7).

Significance levels are \* for  $p < 0.05$ ; \*\* for  $p < 0.01$ ; \*\*\* for  $p < 0.001$ .

The results from C1 and C2 together suggest that the preference for one commitment mechanism (the commitment statement) could indicate a general preference for commitment mechanisms (the Clipper Card allocation in particular is a binding commitment in which money is earmarked specifically for the desired behavior) (H4), but the presence of one commitment mechanism may crowd out perceived need for or interest in other enabling steps (e.g., planning the BART ride). This is only one possible interpretation of these results.

## 6 Discussion and Conclusions

We defined and tested three main hypotheses, identified based on a review of the literature, each examining a mechanism by which personal commitment statements may influence behavior.

**Hypothesis 1:** Personal commitment statements act to increase individuals' sense of connection and similarity with their future selves, enhancing a sense of future self-continuity (Hershfield 2011) which makes more salient the costs or benefits the future self would experience as a result of current choices.

**Hypothesis 2:** Personal commitment statements induce guilt, disappointment, or regret (Inman, Dyer & Jia 1997) in oneself for lack of follow-through, achieving efficacy because individuals wish to avoid experiencing those negative feelings.

**Hypothesis 3:** Similar to binding commitment devices, personal commitment statements may simply be viewed by individuals as a reinforcing nudge for an already-desirable behavior, which they would like to follow through on. In this framework, personal commitment devices would function as an attractive tool for those with self-control or procrastination problems, and would be especially sought after by those who were self-aware about such issues (Ariely & Wertenbroch 2002, Bisin & Hyndman 2020).

A set of additional analyses were conducted relating to corollaries of this final hypothesis, exploring a personal commitment statement's role as an enabling device that either increases, or is correlated with, intent to implement the desired behavior. The underlying insight to be gained from these final analyses is the extent to which demand for one type of commitment device is positively correlated with demand for other types of commitment devices, or whether the presence of one commitment device crowds out demand for other potential enabling devices.

Hypotheses were tested using data from a field experiment in which three different treatment groups were provided with different frameworks to decide upon whether or not they would accept a series of offers with differing numbers of days they would be asked to ride BART for their commute over a four-week period, and differing levels of incentive payment per day they followed through with this behavior. Some offers were "commitment framed," meaning if selected as the final binding offer the participant would be asked to sign a personal commitment statement indicating they would follow through with the agreed-upon behavior.

Results of the analysis indicate that the strongest candidate mechanism for the effectiveness of a commitment statement to induce behavior change is the presence of present-biased preferences coupled with sophistication, or self-awareness of one's own limitations in following through with effortful behaviors. In addition, results suggest that the preference for one commitment mechanism could indicate a general preference for commitment mechanisms, but the presence of one commitment mechanism may crowd out perceived need for, or interest in, other enabling steps.

Berzonsky (2003) suggested that by abiding by and reinforcing personal commitments, individuals increase strength or clarity of their standards, goals, convictions, or beliefs. In this study we have demonstrated that indeed, personal commitment statements, even absent a costly consequence for not following through, may function via a similar mechanism as a binding commitment with a tangible consequence. Those with self-awareness of their own limited capacity to follow through on a desired behavior are likely to seek out a mechanism to reinforce their ability to follow through. A personal commitment statement may be one such mechanism, similar to a binding commitment device.

## **References**

- Arbuthnott, K. D. (2009). Education for sustainable development beyond attitude change. *International Journal of Sustainability in Higher Education*, 10(2), 152-163.  
<https://doi.org/10.1108/14676370910945954>
- Ariely, D., & Wertenbroch, K. (2002). Procrastination, Deadlines, and Performance: Self-Control by Precommitment. *Psychological Science*, 13(3), 219-224.  
<https://doi.org/10.1111/1467-9280.00441>
- Berzonsky, M. D. (2003). Identity Style and Well-Being: Does Commitment Matter? *Identity*, 3(2), 131-142. <https://doi.org/10.1207/S1532706XID030203>
- Bisin, A., & Hyndman, K. (2020). Present-bias, procrastination and deadlines in a field experiment. *Games and Economic Behavior*, 119, 339-357.  
<https://doi.org/10.1016/j.geb.2019.11.010>
- Brickman, P. (1987). *Commitment, Conflict, and Caring*. Prentice-Hall.
- Burks, S., Carpenter, J., Götte, L., & Rustichini, A. (2012) Which measures of time preference best predict outcomes: Evidence from a large-scale field experiment. *Journal of Economic Behavior & Organization*, 84(1), 308–320.  
<http://dx.doi.org/10.1016/j.jebo.2012.03.012>
- Burn, S. M., & Oskamp, S. (1986). Increasing Community Recycling with Persuasive Communication and Public Commitment. *Journal of Applied Social Psychology*, 16(1), 29–41. <https://doi.org/10.1111/j.1559-1816.1986.tb02276.x>
- De Leon, I. G., & Fuqua, R. W. (1995). The Effects of Public Commitment and Group Feedback on Curbside Recycling. *Environment and Behavior*, 27(2), 233–250.  
<https://doi.org/10.1177/0013916595272007>
- Della Vigna, S. (2009). Psychology and Economics: Evidence from the Field. *Journal of Economic Literature*, 47(2), 315-372. <https://doi.org/10.1257/jel.47.2.315>
- Hershfield, H. E., Cohen, T. R., & Thompson, L. (2011). Short horizons and tempting situations: Lack of continuity to our future selves leads to unethical decision making and behavior. *Organizational Behavior and Human Decision Processes*, 117 (2012) 298–310.  
<https://doi.org/10.1016/j.obhdp.2011.11.002>
- Hershfield, H. E., Garton, M.T., Ballard, K., Samanez-Larkin, G.R. & Knutson, B., (2009). Don't stop thinking about tomorrow: Individual differences in future self-continuity account for saving. *Judgment and Decision Making*, 4(4), 280.
- Himmler, O., Jäckle, R., & Weinschenk, P. (2019). Soft Commitments, Reminders, and Academic Performance. *American Economic Journal: Applied Economics*, 11(2), 114–142. <https://doi.org/10.1257/app.20170288>
- Inman, J. J., Dyer, J. S., & Jia, J. (1997). A Generalized Utility Model of Disappointment and Regret Effects on Post-Choice Valuation. *Marketing Science*, 16(2), 97-111.  
<https://doi.org/10.1287/mksc.16.2.97>
- John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. *Handbook of personality: Theory and research*, 2(1999), 102-138.

- Katzev, R. D., & Pardini, A. U. (1988). The comparative effectiveness of reward and commitment approaches in motivating community recycling. *Journal of Environmental Systems*, 17(2), 93–113. <https://doi.org/10.2190/XV00-DD4B-EPEH-EN5R>
- Matthies, E., Klöckner, C. A., & Preißner, C. L. (2006). Applying a modified moral decision making model to change habitual car use: How can commitment be effective? *Applied Psychology*, 55(1), 91–106. <https://doi.org/10.1111/j.1464-0597.2006.00237.x>
- Terrier, L., & Marfaing, B. (2015). Using social norms and commitment to promote pro-environmental behavior among hotel guests. *Journal of Environmental Psychology*, 44, 10–15. <https://doi.org/10.1016/j.jenvp.2015.09.001>;
- Wang, T. H., & Katzev, R. D. (1990). Group Commitment and Resource Conservation: Two Field Experiments on Promoting Recycling. *Journal of Applied Social Psychology*, 20(4), 265–275. <https://doi.org/10.1111/j.1559-1816.1990.tb00411.x>
- Werner, C. M., Turner, J., Shipman, K., Shawn Twitchell, F., Dickson, B. R., Brusckke, G. V., & von Bismarck, W. B. (1995). Commitment, behavior, and attitude change: An analysis of voluntary recycling. *Journal of Environmental Psychology*, 15(3), 197–208. [https://doi.org/10.1016/0272-4944\(95\)90003-9](https://doi.org/10.1016/0272-4944(95)90003-9)

## **Appendices**

### **Appendix A Sequence of Experimental Events**

The sequence of experimental events is as follows. Depending on the treatment group and the phase of study some of these steps will not be applicable to some groups. A map of which of these steps will be applicable to which treatment groups is provided in the “Study Flow” Figure below. Each of the below-listed study event steps are described in more detail below.

Sequence of experimental event steps:

- Recruitment (Attachment: Behavioral Recruitment Language)
- Screening questionnaire (Attachment: Behavioral Screening Questionnaire)
- Randomization into Treatment/Control groups
- Informed Consent (Attachments: Behavioral Study Consent Form 1 & 2)
- Install Mode Choice Verification App (Attachment: Instructional Email Text)
- Pre-Ride Task
- **Survey 1:** Choice Task Questionnaire (Attachment: Choice Task Questionnaire)
  - Verification of BART ridership behavior since Consent
  - Identity Statement Agreement Task
  - Public Transit Choice Task
- **Survey 2:** Commitment & Outcome Task Questionnaire (Attachment: Commitment & Outcome Task Questionnaire)
  - Personal Commitment Statement Task
  - BART Commute Plan Task
  - Clipper Card Allocation Task
  - Self-Report Likelihood of Follow-through Task
- **Survey 2:** Study Questionnaire (Attachment: Study Questionnaire)
- BART Ride Verification & Follow-up
  - Mode Choice Verification App data analysis
  - **Survey 3:** Follow-up Questionnaire (Attachment: Follow-up Questionnaire)
- Study Completion Instructions (Attachment: Instructional Email Text)
  - Information on final payment timeline and status
  - Instructions for uninstalling the Mode Choice Verification App

#### **Recruitment:**

Healthy adult subjects that meet the recruitment criteria will be recruited from the UCB Xlab paid non-Cal, staff, alumni, and student pools, the Stanford research subject pool, and possibly via other online recruitment venues such as Craigslist or Facebook.

#### **Screening Questionnaire:**

If a potential participant indicates interest in participating in the study they will first complete an initial online screening questionnaire to verify that they meet the participation criteria. They will read a consent language for the screening, be provided with an overview description of the study, and be provided with contact information and encouraged to ask questions about the study if they have them.

### **Randomization into Treatment/Control groups & Informed Consent:**

Participants that meet the criteria and indicate continued interest will be randomized into one of four treatment groups or the control group. Having provided their email they will be sent an initial email with a Qualtrics survey link. The survey will provide them with the consent form appropriate to their treatment group. The consent forms for the study will all be the same except the B4 treatment group will have a slightly different consent form describing the requirement of the Pre-Ride Task, while the other treatment groups will be provided with consent forms that do not include this language.

### **Install Mode Choice Verification App:**

After completing the Informed Consent online, participants will be provided with instructions to install the smartphone app, which will provide GPS location information and mode use prediction to the researchers. These instructions will be sent via email. See the text of these instructions in the text of EMAIL 2 in the Instructional Email Text Attachment to this protocol.

### **Pre-Ride Task:**

Treatment group B4 will be asked to ride BART at least once prior to the Choice Task Questionnaire step, while all other treatment groups will be requested to not ride BART in that interim (the Control group will be given no specific instructions regarding mode choice). These instructions will be given via email.

### **Survey 1: Choice Task Questionnaire:**

For the Choice Task Questionnaire subjects will be instructed on the tasks that they need to perform (described in more detail below). This questionnaire will be able to be completed via web browser on the Qualtrics platform. An email with a link to the Qualtrics survey Choice Task Questionnaire will be sent to the participant with instructions for how to proceed.

### **Verification of Bart ridership behavior since Consent:**

Subjects will be asked to verify their BART ridership behavior since completing the consent form. Data from the app will be used to independently verify commute mode choice behavior both before and after the Choice Task Questionnaire through Study Questionnaire steps, so that this behavior can be compared to that of the control group (members of which will also install the app) and the other treatment groups. The data from the app will be used to verify mode choice behavior. The app will remain on all study participants' smartphones through the course of the study.

### **Identity Statement Agreement Task:**

Subjects will read a series of statements framed as "identity statements" (e.g., "I see myself as someone who is always prepared"). These statements will be related to the characteristics of conscientiousness, openness to new experience, pro-environmental attitudes, habit, commitment follow-through, and BART/driving identity. Subjects will perform ratings on how strongly they agree on whether these traits describe them or not.

**Public Transit Choice Task:**

Subjects will be presented with a series of trials with potential options describing changes to their commute behavior in the ensuing month. Some of these options will be “commitment”-cued options, and some will just be offers that don’t involve a commitment statement step (subjects that will see both framings will be informed ahead of time about the distinction between these two types of choice frames). For treatment groups receiving commitment framing trials, as they proceed through the trials they will see a cue that means responding “Yes” to that offer includes a requirement to make a written commitment (or not), then an indication of how many days they would alter their commute to use BART instead of their own car (varying from 1 to 4 days over the next month), and finally an amount that they would be paid per BART commute as a monetary incentive to switch transit modes (varying from \$0 to \$20). They then make a voluntary agreement (Yes/No) to carrying through with the offer. For groups receiving choice frame only (no commitment) trials, the same choice sets will be presented (regarding number of BART rides and incentive level), but no written commitment will be required.

Commitment & Outcome Task Questionnaire (20-30 min. – not done by control group):

The Commitment & Outcome Task Questionnaire will also take place online using the Qualtrics platform. After they’ve completed the Choice Task Questionnaire, their responses will be processed and one of their choices from the Public Transit Choice Task will be determined to be “binding.” They will then be sent an email with instructions and a link to the Commitment & Outcome Task Questionnaire, which will inform them of their “binding” choice, and ask follow-up questions as described below.

**Survey 2: Commitment & Outcome Task Questionnaire:****Personal Commitment Statement Task:**

One trial from the Public Transit Choice Task is chosen to count as binding for each participant. If a written commitment was agreed to for the binding choice, the subject must then digitally sign a Personal Commitment Statement specifying that they commit to change their commute by going by BART the agreed-to number of days over the next month, for the agreed-to monetary incentive. Subjects are then tracked over the course of 1 month, to see whether they have followed through on their agreed commute change (see below). Note: signing the commitment statement does not negate the voluntary nature of the follow-through BART ridership behavior. A commitment statement is simply a behavioral “nudge” mechanism that has been shown to increase the probability that people follow through with a given behavior change. The effectiveness of this is part of what we’re testing in this study.

**BART Commute Plan Task:**

Once subjects have been informed of their binding choice, and after signing the Personal Commitment Statement, if applicable, subjects will be provided with an opportunity to plan their BART commute if they would like to. They can do so in whatever way they like, and will be provided with links to Google Maps, bart.gov, actransit.org, and 511.org as resources to do so. If they choose to undertake this step, they can indicate that they did so by reporting the BART station they would use to depart for their commute and the BART station at which they would disembark at their destination. They are told they are free to skip this step if they choose.



Response to this task is a metric of or proxy for their degree of motivation to follow through, and can potentially help boost the follow-through effect (as it has been shown that making a specific plan can also help reinforce behavior change follow-through).

### **Clipper Card Allocation Task:**

Subjects will also be offered an option to select to apply all or a portion of their Participation Payment (see below) to be provided to them in the form of a Clipper Card (the Bay Area public transit card) pre-loaded with that portion of funds to be usable on BART. This is a voluntary choice, and if they choose to apply none of their payment to a Clipper Card, they will receive the payment in full as a VISA gift card. Choices in this stage also provide a proxy indication of the level of motivation subjects have to follow through, as by applying a portion of their non-earmarked payment to a form earmarked for BART rides is a commitment mechanism the participants can choose for themselves or not.

### **Self-Report Likelihood of Follow-through Task:**

For this task participants will be asked to rate how likely they believe it will be that they follow through with the agreed-to BART ridership behavior, given the agreed-to compensation level.

### **Survey 2: Study Questionnaire:**

At this point participants will complete the Study Questionnaire, which covers individual characteristics such as their transit habits and preferences, demographic and household information, and environmental attitudes and personality and psychological characteristic measures.

### **BART Ride Verification & Follow-Up:**

Over the course of the ensuing month the smartphone app will remain on the subject's phone providing GPS location data and mode-prediction data to the researchers. These data will be used to independently verify BART ridership behavior throughout the study period. In addition, at the end of the month period the subject will be contacted via email to fill in a final online Follow-up Questionnaire.

### **Survey 3: Follow-up Questionnaire**

The Follow-up Questionnaire will include three elements: 1) a repetition of all or a subset of the same Identity Statement Agreement Task; 2) a request for them to report how many times they rode BART over the course of the month since completing the initial study tasks (with a reminder that we are independently verifying this through the app data); and 3) questions about their attitudes and preferences for different commute transportation mode options.

### **Instructions for uninstalling the Commute Verification App**

Once all the study tasks are completed a final email is sent with instructions to uninstall the app, and information about the timing of when to expect the final compensation payments.

The Control group will do all of the study steps (Consent Form, app installation, Study Questionnaire, and Follow-Up Questionnaire), except only the Identity Statement Agreement

Task within the Choice Task Questionnaire, and the Commitment & Outcome Task Questionnaire.

- Monetary payment for subjects are as follows:
- Participation Payment:
  - \$30 for completing all requested components of the Choice Task Questionnaire, Commitment & Outcome Task Questionnaire, and Study Questionnaire as well as installing the app. (Received by all treatment groups, including control group.)
  - Payment form: VISA Gift Card and/or Clipper Card based in Behavioral Outcome Task
  - Payment delivery: Emailed VISA and/or Mailed Clipper
- Incentive Payment:
  - \$0-\$20 per day taking BART in the follow-up month, depending on the incentive they agreed to in the chosen trial, and contingent with taking BART trips. The agreed upon amount will be paid for each day BART is taken for their primary commute up to the specified number agreed to, even if they don't take all of those they agree to. (Potentially available to all treatment groups; not offered to control group)
  - Payment form: VISA Gift Card
  - Payment delivery: Emailed
- Follow-up Questionnaire Payment:
  - \$10 for completing the follow-up questionnaire (Received by all treatment groups, including control group.)
  - Payment form: Visa Gift Card
  - Payment delivery: Emailed

Behavioral Field Experiment					
Treatment Group:	B1	B2	B3	B4	Control
Recruitment	✓	✓	✓	✓	✓
Phone Screen	✓	✓	✓	✓	✓
Randomization into Treatment/Control groups	✓	✓	✓	✓	✓
Informed Consent	Behavioral Study Consent Form 1	Behavioral Study Consent Form 1	Behavioral Study Consent Form 1	Behavioral Study Consent Form 2	Behavioral Study Consent Form 1
Install Mode Choice Verification App	✓	✓	✓	✓	✓
Pre-Ride Task					
Choice Task Questionnaire	✓	✓	✓	✓	
Verification of BART ridership behavior since Consent	✓	✓	✓	✓	
Identity Statement Agreement Task	✓	✓	✓	✓	✓
Public Transit Choice Task	Frame 1	Frame 2	Frame 3	Frame 2	
Commitment & Outcome Task Questionnaire	✓	✓	✓	✓	
Personal Commitment Statement Task	✓	✓		✓	
BART Commute Plan Task	✓	✓	✓	✓	
Clipper Card Allocation Task	✓	✓	✓	✓	
Self-Report Likelihood of Follow-through Task	✓	✓	✓	✓	
Study Questionnaire	✓	✓	✓	✓	✓
BART Ride Verification & Follow-up	✓	✓	✓	✓	✓
Mode Choice Verification App data analysis	✓	✓	✓	✓	✓
Follow-up Questionnaire	✓	✓	✓	✓	✓
Study Completion Instructions	✓	✓	✓	✓	✓
Information on final payment timeline and status	✓	✓	✓	✓	✓
Instructions for uninstalling the Commute Verification App	✓	✓	✓	✓	✓

Treatment Group Definitions:

	Choice Frame	Pre-Ride Treatment
B1	1	No
B2	2	No
B3	3	No
B4	2	Yes
Control	N/A	No

Choice Frame Definitions:

- Frame 1 Commitment and Choice Frame Varried Trial by Trial
- Frame 2 Commitment Frame Only
- Frame 3 Choice Frame Only (no commitment)

Figure 1 Study Flow

## Appendix B Survey 1: “Choice Task Questionnaire”

Thank you for participating in the study *Studying Decision Processes with Environmental and Energy Use Impacts*. This is the first of three questionnaires for this study. It may take you up to 45-60 minutes to complete in total. You can complete it on your own time, and if you want to stop part way through, you can return and complete it later. To start the questionnaire please enter the password provided in the box below and click “Next.”

[Password] [Next](#)

1. How many primary destinations (e.g., work, school) do you regularly commute to (2 or more times per week)? \_\_\_\_\_
2. Please provide the following information for each of the primary destinations (e.g., work, school) you commute to regularly (2 or more times per week).

Primary Destination 1:

- a. Which of the following best describes this primary destination?
  - My work
  - My school
  - The work or school of a household member
  - Other \_\_\_\_\_

- b. How many days per week on average do you commute to this destination?
- c. Please provide the address or intersection of this primary destination:

Address/Intersection \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

[Question 2 repeats for as many primary destinations as they indicated in question 1 ]

- 3. Have you taken BART at any point since you were recruited to participate in this study?

Yes  No

[If Yes]

- 4. What kind of trip did you take BART for? (select all that apply)

My regular commute to work, school or other primary commute destination

Entertainment or recreation

Other \_\_\_\_\_

[If responds with "For my regular commute to work, school or other primary destination"]

- 5. How many dates did you take BART? "For my regular commute to work, school or other primary destination" \_\_\_\_\_

- 6. On what dates did you take BART? "For my regular commute to work, school or other primary destination"

Date 1 of X [DATE ENTRY]

Date 2 of X [DATE ENTRY]

Etc. [for as many dates as they indicated in Q5]

[Q5 and Q6 repeat for each of the selected responses of Q4]

## 7. Public Transit Choice Task

For this task, you will see a series of trials with potential options. The options specify that you would take BART instead of your usual commute method for a certain number of days in the following month, with a certain \$ payment that you would receive as incentive per day. For instance, one trial could ask if you wanted to take BART for your commute 2 days in the coming month, with \$5 payment per day that you took BART. You can agree to these options or not. Please note that each of the questions pertain to your commute **to your primary destination(s)**, not just any destination.

You have listed the following primary destination(s):

[Destination 1]

[Destination 2]


Etc.

For these questions you will see a cue or wording that means you must also make a written commitment to engage in this behavior. This means you make a voluntary agreement (Yes/No) to commit to that choice with the understanding that it involves signing a formal personal commitment statement.

Example of a question that will be a **written commitment**:

**[Written commitment]** 

**Number of days riding BART in the following month: 1 day**  
**\$ Per day riding BART: 8**

**Commit?** 


Yes

No

Example of a question that will be a **choice** (not requiring a written commitment statement):

**[Choice]** 

**Number of days riding BART in the following month: 1 day**  
**\$ Per day riding BART: 12**

**Agree?** 

Yes

No

**One of these trials is chosen to count as binding. Any option you respond to with "no" will not be offered to you. And one of the options you respond to with "yes" will be offered to you, so that if you follow through on that option you will receive the stated payment.**

If a written commitment was not part of the choice, the binding trial simply consists of the number of days riding BART and monetary incentive level per day that you agreed to. If a written commitment was a part of the choice, you will be asked to formally sign a commitment statement to change your commute by going by BART the specified number of days over the next month, for the specified monetary incentive.

After 1 month, we will follow up to see whether you have followed through on the agreed commute change. You will be asked to report how many and on which days you took BART during that period. Data from the app you've installed on your smartphone for the purposes of our study will be used to independently verify these BART trips. We will then pay you the agreed-upon incentive for each verified day you took BART up to the agreed-upon number in your binding choice or commitment.

[This following basic question will be repeated up to 60-80 trials per respondent with different permutations varying whether or not it's a commitment or no commitment choice frame, the number of days riding BART being agreed to (between 1 and 4), and the level of the incentive payment per day riding BART (between \$0 and \$20 per day)].

Written commitment [Choice]

Number of days riding BART in the following month: [1 day, 2 days, 3 days, 4 days]

\$ Per day riding BART: [\$0-\$20]

Commit [Agree]?

Yes     No

You have now completed the first of three questionnaires for this study. You will receive an email with instructions for how to proceed to the next step of the study. If you have any questions, please email [ba\\_study@lbl.gov](mailto:ba_study@lbl.gov). Thank you for your participation.

#### **8. Identity Statement Agreement Task**

For this task you will make decisions about how strongly you agree (from “Strongly disagree” to “Strongly agree”) with a series of statements about yourself. Please be honest about how much you consciously identify with the statement.

**I am someone who...**

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
... has a set routine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... is curious about many different things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... likes order	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... makes commitments that would result in negative environmental	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... makes plans and follows through with them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... cares about my impact on the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... pays attention to details	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... tends to be disorganized	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... is a car driver	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... dislikes trying new things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... perseveres until the task is finished	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... tends to be lazy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... prefers work that is routine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... will change my behavior if it helps the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... shirks my duties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... is a BART rider	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... has a clearly defined comfort zone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... avoids commitments because I dislike trying new things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... follows a schedule	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... has environmentally friendly habits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

... likes trying new things

... does a thorough job

... does things efficiently

... will commit to new behaviors if they help the environment

... makes commitments that mean changes to my routine

... is inventive



## Appendix C Survey 2: “Commitment and Outcome Task Questionnaire”

Thank you for participating in the study *Studying Decision Processes with Environmental and Energy Use Impacts*. This is the second of three questionnaires for this study. It may take you up to 30-50 minutes to complete in total. You can complete it on your own time, and if you want to stop part way through, you can return and complete it later. To start the questionnaire please enter the password provided in the box below and click “Next.”

[Password] [Next](#)

### Personal Commitment Statement

In the previous survey you answered a series of questions about whether you would agree or commit to taking the BART to your primary destination for a certain number of days for a certain payment per day. From the set of BART-riding days and payments you signaled your willingness to commit to, one has been selected as binding. On the next page you will be asked to sign a commitment statement to follow through on this combination of days and payments.

1. By typing “I commit” below I formally acknowledge the following:

I Personally commit to taking BART for my commute to work, school or other primary destination [X] day(s) over the course of 4 weeks for a compensation of [\$Y] per day that I take BART for this commute.

- Please type “I commit”: \_\_\_\_\_
- I do not commit

[If they do not commit in Q1]

You have chosen not to sign the personal commitment statement. However, your binding choice of BART rides and compensation amounts will still be honored.

You have therefore still agreed to riding BART for your regular commute on X days over the course of 4 weeks (specific end date will be provided in a follow-up email). You will be compensated \$X for each day you ride BART for your commute up to X days.

If you have changed your mind and want to sign the commitment statement, please click the "Back" button to change your response.

### Clipper Card Allocation Task

2. You have agreed to (committed to) take BART [X] day(s) over the course of 4 weeks (specific end date will be provided in a follow-up email) for a compensation of [\$Y] per day that you take BART for your commute to work, school or other primary destination up to [X] days. Note (for those assigned to more than 1 day of riding BART): Because payment is on a per day basis, even if you do not take BART all of your agreed-upon number of days, you will still be paid [\$Y] for

each day you ride the BART up to that number. Given your agreed-upon number of BART-ride days the maximum payment you can receive for taking the BART is  $X*Y = \$Z$ .

You now have an opportunity to help yourself follow through with this by allocating all or a portion of your \$30 initial participation payment to a Clipper Card, which you can use to ride BART.

Please note:

- BART now requires a Clipper Card to ride from several major BART stations and no longer provides paper tickets. If you do not have a Clipper Card you will have to purchase one for \$3 if riding BART from one of those stations. We will provide you with a Clipper Card for free if you choose that option.
- If you already have a Clipper Card Account we can only pay you with a VISA Gift Card.

If you choose to allocate any of your participation payment to a Clipper Card, an account would be set up in your name at [www.clippercard.com](http://www.clippercard.com). We would set up the account, order you a Clipper Card pre-loaded with the dollar amount you select below, and have the card mailed to your preferred mailing address. You would be free to then use or not use this Clipper Card as much or as little as you would like going forward, including setting up recharging of the card with funds from your own bank account or credit card. Any portion of your participation payment not allocated to a Clipper Card will be paid to you via an emailed VISA gift card.

Please choose below how much you would like allocated to a Clipper Card:

- \$30 on a Clipper Card, and nothing on a VISA Gift Card
- \$20 on a Clipper Card, and \$10 on a VISA Gift Card
- \$15 on a Clipper Card, and \$15 on a VISA Gift Card
- \$10 on a Clipper Card, and \$20 on a VISA Gift Card
- \$5 on a Clipper Card, and \$25 on a VISA Gift Card
- Nothing on a Clipper Card, and all \$30 on a VISA Gift Card

3. [If they choose NOT to allocate any to a Clipper Card]

Do you already own a Clipper Card?

- Yes
- No

4.

[If they choose NOT to allocate any to a Clipper Card – Note: while the control group will not complete this Questionnaire in it's entirety, they will be asked to provide this information in order to issue their participation payment]

In order to issue you your participation payment in the form of a VISA Gift Card, we need the following information:

- First Name \_\_\_\_\_
- Last Name \_\_\_\_\_
- Email Address \_\_\_\_\_

[If they choose to allocate any to a Clipper Card]

You have selected to allocate \$X of your participation payment to a Clipper Card. In order for us to set up an account for you at [www.clippercard.com](http://www.clippercard.com) and purchase you a Clipper Card pre-loaded with the amount you selected, we need your first and last name, email address, phone number, mailing address, and shipping address you prefer for the Clipper Card (if different from your mailing address).

If you would like to look at Clipper Card's privacy policy, click here:

<https://www.clippercard.com/ClipperWeb/privacy.do>

When setting up your account we will make the selection that does not give the Clipper program permission to send you communications by email or mail about products and services, surveys, or news about Clipper.

Once we send you your account information you can change your account password, security question, and preference setting regarding communications from the Clipper Program. Once you change your password we will no longer have any way of accessing your Clipper account and the account would be yours going forward.

If you have changed your mind and no longer want to allocate any of your funds to a Clipper Card, please select "I don't want a Clipper Card" below. If you make this selection all of your \$30 participant payment will be made to you in the form of a VISA Gift Card. If you select "I don't want a Clipper Card" you will still be asked for your first and last name in order to receive your VISA Gift Card payment. If you want to proceed with obtaining a Clipper Card pre-loaded with the amount you selected, please select "I want to proceed with Clipper Card setup"

- I don't want a Clipper Card
- I want to proceed with the Clipper Card setup

[If they select that they don't want a Clipper Card they will be taken back to the version of this question posed to those who did not allocation any to a Clipper Card (i.e., asking for just their name and email address)]

If you would like us to set up your Clipper Account, please provide the following information (Note: your VISA Gift Card payments for all other parts of your study compensation will be issued to this same first and last name):

- First Name \_\_\_\_\_
- Last Name \_\_\_\_\_
- Phone Number \_\_\_\_\_
- Email Address \_\_\_\_\_
- Mailing Address \_\_\_\_\_
  - Address line 1 \_\_\_\_\_
  - Address line 2 \_\_\_\_\_
  - City \_\_\_\_\_

- State \_\_\_\_\_
- Zip Code \_\_\_\_\_
- Shipping Address
  - Same as Mailing Address
  - Address line 1 \_\_\_\_\_
  - Address line 2 \_\_\_\_\_
  - City \_\_\_\_\_
  - State \_\_\_\_\_
  - Zip Code \_\_\_\_\_

5. Please confirm the information you provided for setting up your Clipper Card account (issuing your VISA Gift Card payment). If the information is correct, please select “Confirm” below. If any of the information is incorrect, please navigate back to the previous question and correct the information before you proceed.

[\[shows response from Q4\]](#)

Confirm

### **BART Commute Plan Task**

6. You have agreed to (committed to) take BART [X] days over the course of 4 weeks (specific end date will be provided in a follow-up email) for a compensation of [\$Y] per day that you take BART for your commute to work, school or other primary destination up to [X] days.

We would now like to give you an opportunity to plan out how taking BART will best work for you. Resources you can use to do this are the following:

- maps.google.com – to plan a trip and get directions using public transportation
- bart.gov – to look up information about BART and plan a trip
- actransit.org – to look up additional information about riding a bus to the BART station (if applicable)
- Uber or Lyft app installed on your phone - look up information about using Uber or Lyft to get to or from the BART station (if applicable)
- 511.org – to plan a trip

Once you have taken a look at your options, you have an opportunity to indicate that you did so by entering the BART stations you will use for your trip below.

If you prefer not to plan your trip at this time, please select "I prefer not to plan my trip right now" in each of the BART station drop-down menus below.

The BART stations I would use to get to my destination [Address/Cross street, city, state – as provided in the Choice Task Questionnaire]:

Departure from home station: [Dropdown menu of BART stations with “I prefer not to plan my commute as one of the dropdown options]

Arrival to destination station: [Dropdown menu of BART stations with “I prefer not to plan my commute as one of the dropdown options]

[Question 2 repeats for all the of specific primary destinations they provided in the Choice Task Questionnaire]

**Self-Report Likelihood of Follow-through Task**

7. Given what you know about yourself, your preferences and needs, and the number of BART rides and incentive payment you agreed to, how likely are you to follow through with all of the BART rides you agreed to (committed to)?

- Very Likely
- Somewhat Likely
- Neutral
- Somewhat Unlikely
- Very Unlikely
- Not sure

## Appendix D Survey 2: “Study Questionnaire”

1. In each of the following hypothetical choices, please indicate whether you would prefer a **prize amount today (Option A)**, or whether you would rather **wait for a higher prize amount tomorrow (Option B)**. These choices are purely hypothetical.

	Option A	Option B (These are all the same)
Choice 1	\$75 today	\$80 tomorrow
Choice 2	\$70 today	\$80 tomorrow
Choice 3	\$65 today	\$80 tomorrow
Choice 4	\$60 today	\$80 tomorrow
Choice 5	\$55 today	\$80 tomorrow
Choice 6	\$50 today	\$80 tomorrow
Choice 7	\$45 today	\$80 tomorrow

2. In each of the following hypothetical choices, please indicate whether you would prefer a **prize amount today (Option A)**, or whether you would rather **wait for a higher prize amount in 5 days (Option B)**. These choices are purely hypothetical.

	Option A	Option B (These are all the same)
Choice 1	\$75 today	\$80 in 5 days
Choice 2	\$70 today	\$80 in 5 days
Choice 3	\$65 today	\$80 in 5 days
Choice 4	\$60 today	\$80 in 5 days
Choice 5	\$55 today	\$80 in 5 days
Choice 6	\$50 today	\$80 in 5 days
Choice 7	\$45 today	\$80 in 5 days

3. In each of the following hypothetical choices, please indicate whether you would prefer a **prize amount in 2 days (Option A)**, or whether you would rather **wait for a higher prize amount in 9 days (Option B)**. These choices are purely hypothetical.

	Option A	Option B (These are all the same)
Choice 1	\$75 in 2 days	\$80 in 9 days
Choice 2	\$70 in 2 days	\$80 in 9 days
Choice 3	\$65 in 2 days	\$80 in 9 days
Choice 4	\$60 in 2 days	\$80 in 9 days
Choice 5	\$55 in 2 days	\$80 in 9 days
Choice 6	\$50 in 2 days	\$80 in 9 days
Choice 7	\$45 in 2 days	\$80 in 9 days

4. In each of the following hypothetical choices, please indicate whether you would prefer a **prize amount in 2 days (Option A)**, or whether you would rather **wait for a higher prize amount in 30 days (Option B)**. These choices are purely hypothetical.

	Option A	Option B (These are all the same)
_____		

Choice 1	\$75 in 2 days	\$80 in 30 days
Choice 2	\$70 in 2 days	\$80 in 30 days
Choice 3	\$65 in 2 days	\$80 in 30 days
Choice 4	\$60 in 2 days	\$80 in 30 days
Choice 5	\$55 in 2 days	\$80 in 30 days
Choice 6	\$50 in 2 days	\$80 in 30 days
Choice 7	\$45 in 2 days	\$80 in 30 days

5. In each of the following hypothetical choices, please indicate whether you would prefer a **certain prize amount for sure (Option A)**, or whether you would rather **take the 50-50 chance at getting a higher prize amount (Option B)**. These choices are purely hypothetical.

	Option A	Option B (These are all the same)
Choice 1	\$1 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 2	\$10 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 3	\$20 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 4	\$30 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 5	\$40 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 6	\$50 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 7	\$60 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 8	\$70 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 9	\$80 for sure	50% chance of winning \$100, 50% chance of winning \$0
Choice 10	\$90 for sure	50% chance of winning \$100, 50% chance of winning \$0

6. Please rate your level of agreement with each of the following statements.

	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
a. We are approaching the limit of the number of people the Earth can support	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Humans have the right to modify the natural environment to suit their needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. When humans interfere with nature it often produces disastrous consequences.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Human ingenuity will insure that we do not make the Earth unlivable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Humans are seriously abusing the environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. The Earth has plenty of natural resources if we just learn how to develop them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Plants and animals have as much right as humans to exist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

i.	Despite our special abilities, humans are still subject to the laws of nature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j.	The so-called “ecological crisis” facing humankind has been greatly exaggerated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k.	The Earth is like a spaceship with very limited room and resources.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l.	Humans were meant to rule over the rest of nature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m.	The balance of nature is very delicate and easily upset.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n.	Humans will eventually learn enough about how nature works to be able to control it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o.	If things continue on their present course, we will soon experience a major ecological catastrophe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Please rate your agreement with the following statements about your personality.

I see myself as someone who...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
a. ... is reserved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. ... is generally trusting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. ... tends to be lazy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. ... is relaxed, handles stress well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. ... has few artistic interests	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. ... is outgoing, sociable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. ... tends to find fault with others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. ... does a thorough job	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. ... gets nervous easily	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. ... has an active imagination	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. ... is considerate and kind to almost everyone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Answer each of the questions below to the best of your ability (and without using a calculator).

- a. Imagine that we roll a fair, six-sided die 1,000 times. (That would mean that we roll one die from a pair of dice.) Out of 1,000 rolls, how many times do you think the die would come up as an even number? \_\_\_\_\_
- b. In the BIG BUCKS LOTTERY, the chances of winning a \$10.00 prize are 1%. What is your best guess about how many people would win a \$10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS? \_\_\_\_\_
- c. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car? Please do not include the



percent sign

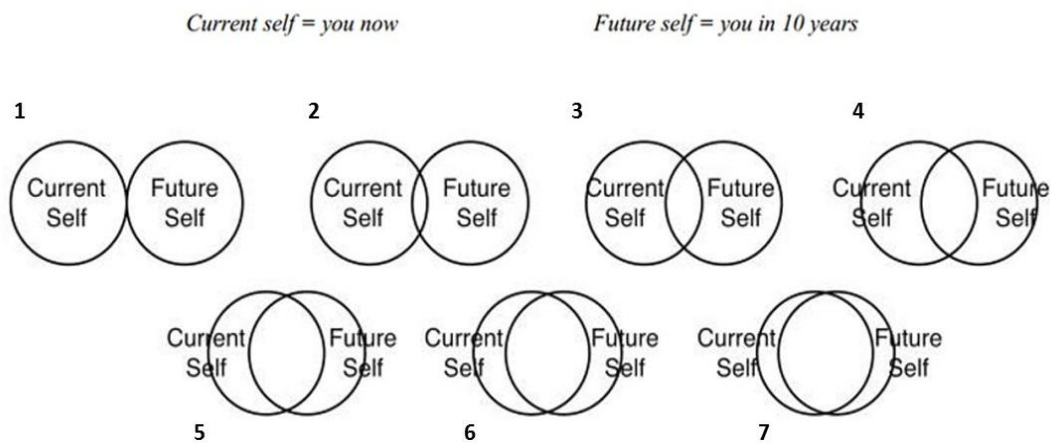
(%). \_\_\_\_\_

- d. Which of the following numbers represents the biggest risk of getting a disease?
- i. 1 in 100
  - ii. 1 in 1000
  - iii. 1 in 10
- e. Which of the following numbers represents the biggest risk of getting a disease?
- i. 1%
  - ii. 10%
  - iii. 5%
- f. If Person A's risk of getting a disease is 1% in ten years, and Person B's risk is double that of A, what is B's risk? Please do not include the percent sign (%). \_\_\_\_\_
- g. If Person A's chance of getting a disease is 1 in 100 in ten years, and Person B's risk is double that of A, what is B's risk? Please provide a response that completes this statement: Person B's chance of getting the same disease is \_\_\_ in 100 in ten years.
- h. If the chance of getting a disease is 10%, how many people would be expected to get the disease:
- i. Out of 100? \_\_\_\_\_
  - ii. Out of 1000? \_\_\_\_\_
- i. If the chance of getting a disease is 20 out of 100, this would be the same as having a \_\_\_\_ % chance of getting the disease. Please fill in the blank answer below.
- \_\_\_\_\_
- j. The chance of getting a viral infection is .0005. Out of 10,000 people, about how many of them are expected to get infected? Please enter your answer using digits (numbers only).
- \_\_\_\_\_
- k. Which of the following numbers represents the biggest risk of getting a disease?
- i. 1 chance in 12
  - ii. 1 chance in 37
- l. Suppose you have a close friend who has a lump in her breast and must have a mammogram. Of 100 women like her, 10 of them actually have a malignant tumor and 90 of them do not. Of the 10 women who actually have a tumor, the mammogram indicates correctly that 9 of them have a tumor and indicates incorrectly that 1 of them does not have a tumor. Of the 90 women who do not have a tumor, the mammogram indicates correctly that 81 of them do not have a tumor and indicates incorrectly that 9 of them do have a tumor. The table below summarizes all of this information. Imagine that your friend tests positive (as if she had a tumor), what is the likelihood that she actually has a tumor?

	Actually has a tumor	Does not have a tumor	Totals
Tested positive	9	9	18
Tested negative	1	81	82
Totals	10	90	100

Please enter your answer to complete the following statement: "The likelihood that she actually has a tumor is \_\_\_\_%."

- m. Imagine that you are taking a class and your chances of being asked a question in class are 1% during the first week of class and double each week thereafter (i.e., you would have a 2% chance in Week 2, a 4% chance in Week 3, an 8% chance in Week 4). What is the probability that you will be asked a question in class during Week 7? Please answer in PERCENT, but please do not include the '%' sign.
- n. Suppose that 1 out of every 10,000 doctors in a certain region is infected with the SARS virus; in the same region, 20 out of every 100 people in a particular at-risk population also are infected with the virus. A test for the virus gives a positive result in 99% of those who are infected and in 1% of those who are not infected. A randomly selected doctor and a randomly selected person in the at-risk population in this region both test positive for the disease. Who is more likely to actually have the disease?
- They both tested positive for SARS and therefore are equally likely to have the disease.
  - They both tested positive for SARS, and the doctor is more likely to have the disease.
  - They both tested positive for SARS, and the person in the at-risk population is more likely to have the disease.
9. Read the questions below, and please select the choice that best describes your current relationship with the specified person. There are no correct answers; we only care about your feelings and opinions.
10. Top row, going from left to right: Image 1, 2, 3, 4. Bottom row, going from left to right: Image 5 and 6

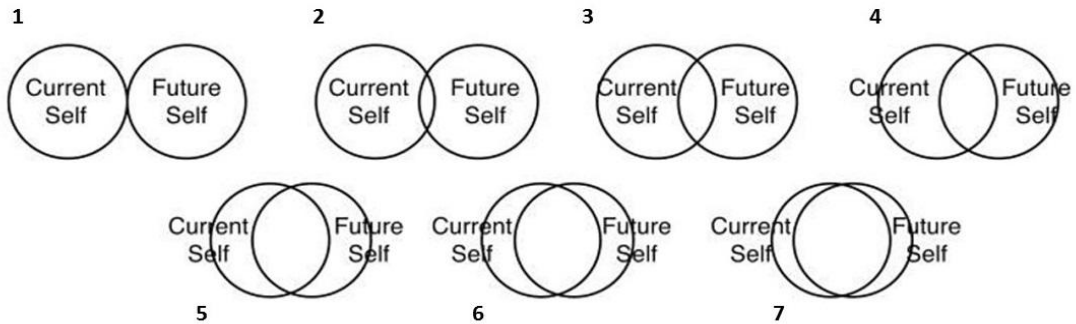


- a. Connected Select the picture above that best describes how **connected** you feel with your future self (you in 10 years).
- Image 1
  - Image 2
  - Image 3
  - Image 4 (4)
  - Image 5 (5)

- vi. Image 6 (6)
- vii. Image 7 (7)

*Current self = you now*

*Future self = you in 10 years*



- b. Similar Select the picture above that best describes how **similar** you feel to your future self (you in 10 years).
- i. Image 1
  - ii. Image 2
  - iii. Image 3
  - iv. Image 4 (4)
  - v. Image 5 (5)
  - vi. Image 6 (6)
  - vii. Image 7 (7)

11. In what year were you born? [\[dropdown with year options within the age range for this study\]](#)

12. What is your gender?

- Male
- Female
- Other \_\_\_\_\_
- Prefer not to answer

13. Which categories best describe you? Select one or more boxes.

- White
- Hispanic, Latino, or Spanish origin
- Black or African American
- Asian
- Middle Eastern or North African
- American Indian or Alaska Native
- Native Hawaiian or Other Pacific Islander
- Some other race or origin \_\_\_\_\_
- Prefer not to answer

14. What is the highest level of education you've completed?

- 12<sup>th</sup> grade or less, no diploma

- High school diploma/GED
- Some college
- Associate's degree
- Bachelor's degree
- Master's degree
- Professional degree (for example: MD, DDS, DVM, JD)
- Doctoral degree (for example: PhD, EdD)
- None of the above
- Prefer not to answer

15. What is your annual household income before taxes?

- Less than \$10,000
- \$10,000 to \$14,999
- \$15,000 to \$24,999
- \$25,000 to \$34,999
- \$35,000 to \$49,999
- \$50,000 to \$74,999
- \$75,000 to \$99,999
- \$100,000 to \$149,999
- \$150,000 to \$199,999
- \$200,000 to \$299,999
- \$300,000 to \$399,999
- \$400,000 or more
- Prefer not to answer

16. Do you speak another language other than or in addition to English at home?

- No
- Yes (please fill in): \_\_\_\_\_
- Prefer not to answer

17. Which of the following best describes your employment status? Please select all that apply.

- Employed for wages
- Self-employed
- Out of work and looking for work
- Out of work but not currently looking for work
- A homemaker
- A student
- Military
- Retired
- Unable to work
- Prefer not to answer

18. Including yourself, how many people (including all adults and children) currently live in your household?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or more

19. How many of the [\[response to Question 17\]](#) people that live in your household are children under 8 years of age?

- 1
- 2
- ...
- [\[response to Question 17 minus 1\]](#)

20. Which of the following transportation options did your **parent(s) or guardian(s)** use most frequently when you were in high school (14 – 18 years old). Select up to three.

- Telecommute
- By Bicycle or foot
- Public mass transit (e.g., train, tram, bus, ferry)
- Private mass transit (e.g., company bus or shuttle)
- Carpool with at least one other person (including another adult household member)
- Drive own vehicle (single occupant)
- Other

21. Please indicate the last time you used each of the following transportation options either alone or in combination for your current commutes to one or more of your X [\[filled in based on response to Choice task questionnaire\]](#) primary destinations.

		Today	In the past seven days	In the last month	In the last 12 months	At some point, but not in the last 12 months	Never	Note Applicable
a.	Your own vehicle (single occupant)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b.	Carpool with a friend, family member, colleague, or through Casual Carpool	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

c.	Public mass transit – city bus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d.	Public mass transit – other (e.g., BART, MUNI, train, ferry)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e.	Private mass transit (e.g., company bus or shuttle)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f.	Uber, Lyft, or similar app-based rideshare service (single passenger option)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g.	Uber Pool, Lyft Line, or similar app-based rideshare service (carpool option)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h.	Car-sharing services like Zipcar or Car2Go.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i.	Motorcycle, moped, or scooter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j.	Bicycle or foot	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k.	Telecommute	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l.	Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

22. Please indicate whether you would consider each of the items below to be a positive characteristic of a transportation option for you personally, or a negative characteristic.

- i. Ability to interact with people (other than close friends or family members)  
[Options: Positive; Negative]
- ii. Minimizing environmental impact [Options: Positive; Negative]

23. In this question think about how you decide which transportation option to use for your commute to your X [\[filled in based on response to Choice task questionnaire\]](#) primary destinations. Please rate how important each of the following characteristics of transportation options are in in this decision on a scale of 1=Not at all important, to 5=Very important.

	Not at all important	Slightly important	Moderately important	Important	Very important	Not Applicable
	1	2	3	4	5	
a. Low cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Predictable cost (e.g., cost doesn't vary like it does with Uber surge pricing)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Short travel time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Predictable arrival time (knowing when you will arrive at your destination)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

e.	Low hassle (e.g., not having to transfer multiple times)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f.	Minimize environmental impacts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g.	The ability to engage in activities while traveling (e.g., work, entertainment, reading)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h.	Ability to make more than one stop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i.	Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j.	Shelter from bad weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k.	Ability to safely and conveniently transport a child under 8 years of age	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l.	The ability to interact with people (other than close friends or family members)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[The above Q22.f and Q22.l are positively framed (and would be stated this way if they selected “Positive” for either of these questions in Q21. If they selected “Negative” for either in Q21, that option would be stated as follows in Q22.f and Q22.l: Not having to interact with people (other than close friends or family members); Maximizing environmental impact]

24. Based on your perception, how do you rate riding BART on the following:

- a. Safety relative to driving your own vehicle
  - i. Very safe
  - ii. Somewhat safe
  - iii. Neutral
  - iv. Somewhat unsafe
  - v. Not at all safe
- b. Cost effectiveness relative to driving your own vehicle
  - i. Very cost-effective
  - ii. Somewhat cost-effective
  - iii. Neutral
  - iv. Not that cost-effective
  - v. Not at all cost-effective
- c. Travel time relative to driving your own vehicle
  - i. Very short travel time

- ii. Somewhat short travel time
  - iii. Neutral
  - iv. Somewhat long travel time
  - v. Very long travel time
- d. Predictability of travel time relative to driving your own vehicle
  - i. Very predictable travel time
  - ii. Somewhat predictable travel time
  - iii. Neutral
  - iv. Somewhat unpredictable travel time
  - v. Very unpredictable travel time
- e. Hassel or effort relative to driving your own vehicle
  - i. Very low effort/hassle
  - ii. Somewhat low effort/hassle
  - iii. Neutral
  - iv. Somewhat high effort/hassle
  - v. Very high effort/hassle
- f. Environmental impact relative to driving your own vehicle
  - i. Very positive environmental impact
  - ii. Somewhat positive environmental impact
  - iii. Neutral
  - iv. Somewhat negative environmental impact
  - v. Very negative environmental impact
- g. Convenience relative to driving your own vehicle
  - i. Very convenient
  - ii. Somewhat convenient
  - iii. Neutral
  - iv. Somewhat inconvenient
  - v. Very inconvenient

You have now completed the second of three questionnaires for this study. You will receive an email with instructions for how to proceed to the next step of the study. If you have any questions, please email [ba\\_study@lbl.gov](mailto:ba_study@lbl.gov). Thank you for your participation.