ABSTRACT

THE ASSESSMENT OF AN INTERNET-BASED GROUP-ORIENTED CONTINGENCY TO DECREASE MILES DRIVEN DAILY

Past research that has focused on decreasing mileage consumption has used incentive procedures with individualized contingencies. The present study aimed to extend this line of research in sustainability by utilizing an interdependent group-oriented contingency where every member of a specified group met the predetermined mileage reduction criteria. In addition to the group-oriented contingency, a social media platform was incorporated to help facilitate communication between group members. Although all three groups that participated in the study failed to meet the group-oriented contingency for 2 consecutive weeks, results of group weekly mileage consumption indicated that all three groups reduced mileage after the interdependent group-oriented contingency component was added. Implications of the current study on group social interactions, CO2 emissions, and future research are discussed.

Martha Cecilia Cisneros
August 2018

THE ASSESSMENT OF AN INTERNET-BASED GROUP-ORIENTED CONTINGENCY TO DECREASE MILES DRIVEN DAILY

by

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APPROVED

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CHAPTER 1: INTRODUCTION

Human contribution of CO gasses in the atmosphere caused partially by the overuse of motorized vehicles is resulting in long lasting harmful effects on the environment, humans, and animals. According to the United States Environmental Protection Agency (EPA), combustion of fossil fuels was the second largest source of CO emissions in 2015, accounting for about 32% of total U.S. CO^2 emissions and 26% of total U.S. greenhouse gas emissions (EPA, 2015). This source includes highway vehicles and other forms of transportation such as air travel and marine transportation. A surplus of CO^2 gasses in the atmosphere is problematic because it leads to climate change. Climate change distorts the natural pace of climate patterns and results in extreme weather conditions such as increased coastal flooding, disruptions to food supplies, frequent and intense heat waves, and costly growing health impacts. EPA trend reports (2015) show that as the U.S. economy continues to grow and as population and energy use increase, Americans drive more miles daily. Specifically, trend reports show that the number of vehicle miles traveled (VMT) by light-duty motor vehicles increased by approximately 40% from 1990 to 2015.

Climate change due to global warming is a time sensitive issue that jeopardizes the future of our planet and therefore has become one of the most relevant issues of our time. Several efforts have been made to target the decrease of CO^2 gasses in the atmosphere. Technology, one of the most substantial efforts, has been used to address this issue through the development of battery and fuel cell electric vehicles. Although effective in decreasing CO^2 contribution to the atmosphere, these ironically also result in damage to the environment through the release of harmful gases during their production (Bauer et al., 2015). Because

technical efforts alone have not been sufficient in decreasing the surplus of CO^2 in the atmosphere, human practices should be targeted to make changes in behavior that maintain over time and can result in meaningful impact on the environment. In addition, behavior analytic strategies can be used to teach and increase engagement in alternative behavior practices that serve the same function while decreasing CO^2 emissions that threaten human and planet wellbeing.

CHAPTER 2: LITERATURE REVIEW

Behavior analytic interventions may be used to target driving behavior effectively by measuring behavior change directly and by using empirical methods to identify the variables that are responsible for behavior change. Past research has looked at increasing sustainable behavior in the areas such as recycling and carpooling as well as decreasing common behavior practices that harm the environment such as littering and energy consumption (Burgess, Clark, & Hendee, 1971; Foxx & Schaeffer, 13 driving behavior as it relates to climate change. Both studies used incentive procedures to decrease the mileage consumption of individuals in the experimental group and compared these to the miles consumed by those in the control group. Foxx and Hake (1977) divided college students into two groups in which the experimental group was offered incentives for meeting specific mileage reduction goals and the control group was offered no incentives for meeting the same goals. Subjects in the experimental group reduced their average daily mileage by 20% relative to baseline averages whereas the control group showed no reductions. Foxx and Schaeffer (1981) implemented a company-based lottery to reduce the number of nonessential miles employees drove using their personal cars each day. Those in the experimental group who were compensated for decreasing their percentage of average daily miles relative to their initial baseline reduced their average driving by 11.6% while those in the control group instead increased their average daily miles by 21.2%. Although these studies were successful in decreasing mileage consumption in the experimental groups by utilizing an incentive procedure, these interventions may be seen as lacking social significance. An intervention that is maintained only by the delivery of tangible reinforcers may be impractical to implement in an applied

setting where maintenance of sustainable behavior is contingent only on the consistent delivery of such incentive. An intervention that is comprised of additional conditioned reinforcers, such as social reinforcement may result in a more practical alternative, especially when funds are limited.

Individualized Contingencies for Sustainable Behavior

Other behavior analytic research in sustainability has combined alternative methods with incentive delivery to evaluate their combined effectiveness in the designing of socially valid interventions. The following studies identified the importance of combining incentive delivery with various forms of direct feedback and prompts to support sustainable behavior. Witmer and Geller (2013) investigated the effects of prompts and reinforcement to increase paper recycling in college dormitories by using flyers that promoted recycling for ecological reasons, for inclusion in a raffle, or to win a contest. Female and male dorm rooms were divided equally into three groups. One group received prompting only, the second group received a raffle contingency, and a third group received a contest contingency. Results of the study showed that the flyers promoting a contest had the most significant increase in paper recycling, raffle flyers had somewhat of an effect on paper recycling, and the flyers promoting recycling for ecological reasons had the least significant effect.

Burgess et al. (1971) used instruction and feedback-based interventions to evaluate the difference in effectiveness of six different anti-litter procedures designed to increase individual participation of picking up litter at a movie theater. The six procedures included providing litter-bags with instructions for use, providing extra trash cans, showing an “anti-litter film” before the movie, and providing incentives for proper disposal of litter. The experimental method used

was a reversal design in which the independent variable changed after each return to baseline. The first independent variable condition included providing litterbags alone, the second included litterbags with an intermission film, in the third guests were offered a monetary incentive when they delivered a full bag of trash at the end of the film, and in the last condition a free film ticket admission was offered upon delivery of a litterbag at the end of the film. Results suggested that although some of the interventions were able to increase litterbag delivery independently, litter bag delivery increased to 94% only once multiple interventions were combined and a monetary incentive was in place.

Abrahamse, Steg, Vlek, Rothengatter, and Rothengatter, (2007) decreased energy consumption in households by utilizing goal setting, tailored information, and tailored feedback. Tailored information included energy saving options that were relevant for each household and tailored feedback informed participants of the percentage change in energy use, the extent to which their energy saving behavior contributed to their energy consumption, and the amount of money saved though energy conservation. Changes in energy consumption were tracked for both experimental and control groups and results showed that households exposed to the combination of interventions saved 5.1% energy while the control group instead used 0.7% more energy. Although the previous behavior analytic studies in sustainability mentioned have assessed the combination of various different procedures their group methods could benefit from a contingency that will facilitate the effective delivery of incentives, and maintenance of behavior change when targeting group samples.

Group Oriented Contingencies

A consequence-based strategy that past research in behavior analysis has shown to be an effective way of managing the behavior of multiple individuals is group-oriented contingencies. Group-oriented contingencies vary in that delivery of a consequence can be contingent on the performance of one individual, a group of individuals, or the entire group. These can be catered to specific group qualities and arranged to facilitate behavior change for large groups of individuals. The three types of group-oriented contingencies often employed in research are independent, dependent, and interdependent group-oriented contingencies. As originally defined by Litoe and Pumroy (1975), independent contingencies are "established when the same response contingencies are simultaneously in effect for all group members, but are applied to performances on individual basis" (Litoe & Pumroy, 1975, p. 341). Dependent contingencies are "established when the same response contingencies are simultaneously in effect for all group members, but are applied only to the performances of one or more selected group members. It is the performance of the selected group members that results in consequences for the whole group" (Litoe & Pumroy, 1975, p. 341). Lastly, an interdependent contingency is "established when the same response contingencies are simultaneously in effect for all group members but are applied to a level of group performance" (Litoe & Pumroy, 1975, p. 341). Programs based on group-oriented contingencies can save time in administration because separate records of each individual's responding are not necessary. In addition, group-oriented contingencies can more efficiently modify group behavior than individual contingency systems (Gresham & Gresham, 1982). All three group-oriented contingencies have shown to be effective in increasing academic performance,

pro-social behavior, and in decreasing disruptive behavior in school settings (e.g., Skinner, Skinner, & Cashwell, 1999).

Possible limitations of each group-oriented contingency should be considered when selecting the ideal group contingency to implement. An independent group contingency, although effective, can be difficult to implement, as it requires the management and tracking of individual contingencies and performance. For example, this contingency can be hard to implement in a school setting when only one single instructor is available (Litoe & Pumroy, 1975). In addition, when one student is more likely to gain access to reinforcement compared to their peers, social disputes may occur (Davis & Blankenship, 1996). In a similar way, a dependent contingency can lead to social problems because one student or small group of students might be made responsible for reinforcement delivery for the entire group.

Comparative studies have looked at the three group contingencies to examine effectiveness of one over another in regards to decreasing problem behavior and increasing desired behavior. Lloyd, Eberhardt, and Drake (1996) showed that interdependent group-oriented contingencies were as effective as independent group oriented contingencies in increasing quiz scores; similarly, Lynch, Theodore, Bray, Kehle, (2009) found that when all three group-oriented contingencies were compared for differential treatment effects, all three contingencies were successful in increasing homework completion and accuracy for fifth grade children in a special education class. Contrary to their findings, Speltz, Shimamura, and McReynolds (1982) found that when they compared independent, dependent and interdependent group-oriented contingencies, interdependent and dependent contingencies were more effective in increasing quiz scores among children with learning disabilities than independent group-

oriented contingencies. In addition, results showed that contingencies' that were not individualized to each member of the group resulted in high positive social interactions for three of the four participants. Alexander, Corbett, and Smigel (1976) targeted the decrease of problem behavior and also found that interdependent group-oriented contingencies were superior to independent group contingencies in their effectiveness to reduce curfew hour violations in pre-delinquent adolescents. Lastly, when Payne, Dozier, Briggs, and Newquist (2016) compared group-oriented contingencies they found mixed results as to which contingencies were the most effective in decreasing problem behavior or increasing on task behavior. Nonetheless, all group-oriented contingencies were found to be effective in changing both behaviors. Although previous research has only established the effectiveness of interdependent group-oriented contingencies over independent group-oriented contingencies and not over dependent group-oriented contingencies, advantageous side effects of interdependent group-oriented contingencies may support their use over the remaining group contingencies.

The effectiveness and efficiency of interdependent group-oriented contingencies make them an ideal consequence intervention to implement in applied settings when time and resources are limited. According to Skinner et al. (1999) an interdependent group-oriented contingency should be utilized when measuring group-oriented criteria because it may be easier than measuring criteria at the individual level. Since every individual receives reinforcement based on the group's overall ability to meet a specified criterion, delivery of reinforcement is placed on an "all or nothing" basis and therefore tends to require less resources than those needed in other contingencies. For the same reason management of criteria and delivery of reinforcement is facilitated through the use of this contingency (Skinner et al., 1991). Interdependent group contingencies can be

used to help target the decrease of driving behavior of groups of people by facilitating incentive delivery and promoting maintenance of behavior change. Yet, these can only be effective if feedback for driving behavior is delivered frequently.

A limitation of previous research that has targeted driving behavior has been the lack of immediate feedback on number of miles decreased. While, past studies informed participants of their mileage reduction goals during the reinforcement condition (e.g., Foxx & Hake, 1977), feedback on their actual mile reduction was not provided throughout the condition. By only providing feedback at the end of the study previous studies have missed the opportunity of providing ongoing feedback throughout the experiment.

Technology can facilitate the delivery of immediate feedback and reinforcement by communicating progress towards common goal and thereby facilitating the implementation of a group-oriented contingency through feedback delivery. The use of technology in research has shown to be effective in tracking individual behavior and delivery of reinforcement. The following studies have implemented the use of technology in behavior analytic interventions with typically developing populations. Dallery, Meredith, Jarvis, Nuzzo, & Evans, (2015) used internet-based group-oriented contingencies to decrease cigar smoking. During the intervention, all group members were able to communicate with each other through internet-based discussion forums. When the intervention was in place, 41.3% of video-recorded breath carbon monoxide (CO) samples were negative compared to the 3.3% that were negative during baseline when the discussion forums were not in place. Graham, Koo, and Wilson, (2011) used technology to reduce the driving of college students by implementing an Internet-based intervention where students reported the number of miles they avoided

driving every other day. The intervention consisted of receiving daily feedback on the amount of pollution avoided and money saved in gas every day. Participants who received Internet-based feedback reported driving less than those who received none. Likewise, Abrahamse et al. (2007) used technology to promote sustainable behavior by encouraging households to reduce their electricity and fuel use. The intervention consisted of Internet-delivered goal setting and tailored feedback. Households exposed to the intervention saved more direct energy than those in the control group who did not have access to internet delivered feedback.

Future research can benefit from the integration of both technology and interdependent group-oriented group contingencies since both have indicated that they can facilitate the implementation of a group based procedure. Specifically, an interdependent group contingency when combined with an internet-based social media platform could facilitate the maintenance of a sustainable practice by creating an intervention that would be practical to implement by an organization aiming to change behavior at a group level.

The present study aimed to use an interdependent group-oriented contingency facilitated through an internet based social media platform to reduce the number of miles driven weekly by undergraduate students. In addition, we attempted to determine if group-oriented contingencies facilitated social interaction during the intervention. Finally, we assessed the environmental impact of the intervention.

CHAPTER 3: METHOD

Participants

Criteria for Participant Selection

Undergraduate college students from 4 lower division psychology classes were recruited to participate in this study through brief invitation announcements that took place at the beginning of their class. Those interested in participating in the month-long study were contacted via email and provided with a questionnaire to complete (see Appendix A). Similar to Foxx and Hake (1977), potential participants were asked to (1) list all the cars they drove (2) estimate how many miles they drove per day and (3) estimate percentage of driving done by someone else for their car. Only participants whose questionnaire responses met the following criteria were selected to participate in the study: those who report that 100% of their driving is done with one car, if they drive on average more than 20 miles a day, and if 5% or less of their vehicle driving was done by another person. Additionally, potential participants were asked to show that they possess a valid driver's license and car insurance in order to participate in the study.

Final Participant Selection

A total of 12 students were selected to participate in this study. Individuals were selected to participate in the study based on having met the previously stated criteria. They were all college students from lower-division psychology courses that included 10 females and 2 males. Participants were assigned to a group based on being 1 of the first 4 to meet participant selection criteria after each recruitment. The three groups developed (A, B, C) of 4 participants each, were used to create the social media groups that the participants would be part of for the

remainder of the study. One of the participants assigned to group C dropped out of the study shortly after the first meeting after learning that daily mileage reporting was a component of the study. Therefore, the final number of individuals who participated in the study was 11. Groups A and B consisted of 4 individuals, and 3 participants made up group C (see Figure 1 for additional participant characteristics).

Group	Participant	Gender	Age	Make/Model	Vehicle Year
A	P201	F	18	Chevrolet/Cruze	2012
	P202	F	24	Honda/Accord	2016
	P203	M	18	Nissan/Altima	2002
	P204	F	18	Ford/Fusion	2014
B	P001	F	21	Hyundai/ Elantra	2013
	P002	F	21	Chevrolet/Malibu	2010
	P003	F	23	Nissan/Versa	2009
	P004	F	22	Toyota/Corolla	2013
C	P101	F	23	Honda/Accord	2014
	P102	M	23	Honda/Accord	2003
	P104	F	23	Volkswagen/Jetta	2007

Figure 1. Participant group, number, gender, age, vehicle make and model, and year.

Setting

The participant meetings took place in a shared lab room space at the university science building where participants met with the experimenter at designated times. Data collection and group contingency implementation were conducted through the social media platform.

Response Measurement and Interobserver Agreement

The dependent measure in the study was the number of miles driven. Vehicle mileage was tracked using the participants' car odometers at the end of

every day during each condition. Reported mileage was accessed through image products that were uploaded and posted on to the social media platform on a daily basis over the course of the study. Odometer image checks included two procedures. The first procedure involved recording the number of miles that the odometer read in the image post, and the second procedure was to compare the dashboard to the dashboard in the template image. The template images were taken by the experimenter or a research assistant the morning of the beginning of the study for each participant to ensure that the daily uploaded reading was allocated to the participant's assigned vehicle. The number of miles driven daily were calculated by subtracting the miles in the odometer reading for any given day to the previous day's odometer reading reported in the image upload (see Appendix B). When a post was not uploaded, daily mileage consumption was calculated by dividing the mileage consumed the next day by 2 and reporting half of the mileage for each day. This occurred 6 times across all groups over the course of the study. Lastly, participant social media activity in each condition was tracked weekly through the frequency of Comments and Likes.

Interobserver agreement (IOA) was assessed by assigning an independent observer to report on data uploaded on to the social media platform for all conditions. Exact agreement IOA was calculated for miles reported and miles consumed daily for each participant by calculating the percentage of days in which both observers were in exact agreement for every week. IOA was calculated for miles reported and miles consumed for every group for each condition of the study. Exact agreement IOA was calculated by comparing the number of reported and consumed miles that both observers that were in exact agreement for every week. This score was then divided by the number of total opportunities available for any given week (total opportunities were 56 most weeks). The result was then

multiplied by 100 and a percentage of agreement was generated for every week (see Appendix B). Each groups' total IOA was calculated by adding the percentage of agreements for every week of the group's participation and then dividing by number of weeks. For group B, mean IOA was 98.75% (range 95%-100%). Mean IOA for group C was 97.32% (Range 91.4%-100%). Lastly, mean IOA for group A was 96.8% (Range 94.6%-100%).

Experimental Design

A non-concurrent multiple baseline across groups design was used to investigate the effect the intervention on the target behavior for each group. The A component of the design was the application of the social media platform alone. The B component included the implementation of the interdependent group contingency intervention facilitated though the social media platform. Group B was non-concurrent with the other two groups, while groups A and C went through the intervention concurrently.

Procedure

At the start of the study for each group, the experimenter and a research assistant met with each individual participant for about 30 minutes to go over the informed consent form and explain the purpose of the study. Participants were informed that the purpose of the study was to motivate students to reduce or eliminate unnecessary driving by engaging in alternative choices in an attempt to decrease their weekly mileage consumption and were then given Guide A (see Appendix C) explaining the goal, posting directions, and incentives available for the first week of the study. At this time, participants were also added on to their private social media group (either A, B or C) while the experimenter or research assistant covered Facebook® privacy settings with them. They were informed that

they were not required to add other members of their social media private group as ‘friends’ on Facebook ® and that because of the private nature of the group, no one on the social media platform would have access to the images posted in the private group other than their group members and the two experimenters (who were non-active members of every group over the course of the study).

During the initial meeting the experimenter also inspected each individual’s license, car insurance, and finally car. Each participant escorted the experimenter or research assistant to their car where initial mileage was noted by taking an image of the vehicles dashboard that allowed for a clear reading of the odometer. This image served as a template to ensure that participants used the same vehicle throughout the study. In addition to the template image, the make and model of each vehicle was also identified during the initial inspection.

At the end of the initial meeting with each participant, the experimenter explained that over the course of the study (about a month) they were required to attend weekly meetings with the experimenter. During these meetings, they would receive the incentive they had earned the previous week as well as go over the Mileage Conservation Guide (see Appendix C) that would be effective that week. Guides were made up of three components. They included a description of participant mileage-reduction goal for the given week, specific directions for posting odometer reading images in the social media platform, and a description of the incentive available for that week.

After the first initial meeting, daily odometer checks continued to occur for the remainder of the study through images posted on to the social media private group. Weekly participant meetings took place at the start of every week (either Monday morning or Tuesday morning for each participant). Participants who met with the experimenter on Tuesdays because they did not have availability Monday

mornings were emailed the guide every Monday morning at 9 a.m. and asked to confirm when they had read over it via email. This was done in an effort to ensure that the entire group was informed of their mileage reduction goal for that week at the same time (between 8-9 a.m.). Participants who received the guide via email were still expected to attend the weekly meeting the following day (Tuesday) to receive their incentive and so that the experimenter could clarify the components of that week's guide in person. Every week at the end of the meeting participants were given a copy of their Conservation Guide to take home.

Social Media Platform (Control)

During the social media intervention participants were assigned Mileage Conservation Guide A (see Appendix C). During this condition, participants were asked to attempt to decrease their mileage consumption by engaging in alternative choices and no specific mileage reduction goals were assigned. Posting directions during this condition asked participants to share daily images of their odometer reading after 8pm every evening with the other participants in their group. In their image upload they were asked to include a caption stating the alternative behavior they engaged in that day to decrease their mileage. If they did not engage in an alternative behavior, they were asked to state that in the caption as well. On the site, during this condition in addition to posting their odometer/dashboard images, participants were told that they could interact with other members of their group by Liking, Commenting, or replying on other people's image uploads. During this condition of the study participants were offered one dollar for every daily post made on the social media group during the designated times giving them the opportunity to earn a total of $7 at the end of the week during this condition.

Interdependent Group-Oriented Contingency and Social Media Platform.

After 1 week (group A), 1.5 weeks (group B) or 2.5 weeks (group C) of the social media condition, an interdependent group-oriented contingency facilitated through the social media platform was introduced to each group for two consecutive weeks. During this condition, participants were given Mileage Conservation Guide B (see appendix C). This guide included the same components as Guide A and instructed them to maintain the use of the social media platform as previously instructed and to continue daily odometer image uploads. As opposed to Guide A, Mileage Conservation Guide B gave participants a specific goal: to reduce their mileage consumption that week by 20% by engaging in alternative behaviors of their choice to reduce their driving. If this goal was met, in addition to earning their weekly incentive for posting daily, participants had the opportunity to obtain an additional $15 incentive during this condition. In order to earn this additional incentive at the end of the week, every single member of their assigned social media private group would have to meet a 20%-mile reduction goal at the end of the week.

Individual 20% mileage reduction goals were generated for each participant from their reported mile consumption the previous week in the social media condition. For groups that were exposed to more than 1 week of social media, goals were generated from the week prior to the start of the intervention. Their 7-day consumption was then multiplied by 20% and the outcome subtracted from the total 7-day mile consumption. A 20% reduction weekly mile consumption goal was identified for each specific participant. Every participant received the exact number of miles that a 20% weekly mileage reduction goal represented for them individually in their Mileage Conservation Guide. Participants were also given the

number of average daily miles they should attempt to expend in order to meet the 20% reduction goal at the end of the week.

Participants were informed that if everyone in their assigned group meet their reduction criteria at the end of the week (Sunday), each individual would be given the additional monetary incentive the following day (Monday). If someone in the assigned group failed to meet criteria, even if this only applied to one individual in the group, the incentive was no longer available for the other participants even if they were to meet the criteria.

To ensure that group members were aware of each other's progress towards their mileage reduction goals, "odometer reading goals" were developed and posted on to the announcement section of the private group for each week of intervention (see Appendix D). This odometer reading was developed by each participants' weekly mileage consumption goal (20% reduction from miles consumed the previous week) and adding it to the mileage reported the previous night (Sunday). This "odometer reading goal" was posted in the announcement section of the private group for every participant in the group so that it would be visible to all members. This was an effort to facilitate participant tracking of each other's progress towards the reduction goal.

During the second week of intervention the same weekly consumption goal was used. Again, consumption goals were added to the mileage reported the night prior to the start of the intervention week to inform participants of what their odometer should read at the end of the week to meet reduction criteria.

Social Validity

Social validity was assessed by asking participants to complete a five-question post study survey that asked participants to report on the aspects of the study that they found most important and helpful (see Appendix E).

Carbon Emissions

Following the completion of the study, we determined the mean reduction in carbon emissions for each participant from the social media platform to the interdependent group-oriented contingency and social media platform. To calculate this, we determined the EPA estimated average miles per gallon (mpg) of the vehicles each participant used (United States Department of Energy & United States Environmental Protection Agency, 2018). We next determined the mean miles driven per day during each condition. We calculated the carbon emissions during each condition using the following formula, using the EPA estimated CO3 production from burning 1 gallon of gas (8.887kg; United States Environmental Protection Agency, 2018).

$$\text{Daily Carbon Emissions} = \frac{\text{Mean Miles Driven}}{\text{MPG}} \times 8.887\text{kg CO2}$$

We then subtracted the daily carbon emissions of the interdependent group-oriented contingency and social media platform from the social media platform condition to determine the amount of carbon prevented from entering the atmosphere.

CHAPTER 4: RESULTS

Group Goals

Every group that participated in the study was exposed to two consecutive weeks of intervention conditions in which they were asked to attempt to meet a 20% mileage reduction goal from their mileage consumption during the social media condition. Only if every member of the group meet their personal reduction goal, would group members have the opportunity to receive a $15 incentive at the end of the intervention week. None of the three groups that participated in the present study met the interdependent group-oriented contingency over the course of the study. From group B, 1/4 of the members met their personal reduction goal the first week of intervention (P004) and 1/4 again met their personal goal the second week (P002) (see Figure 2). From group C, 1/3 of participants met the goal the first week of intervention (P101) and 2/3 met the goal the second week (P101 and P104) (see Figure 3). Finally, in group A, 3/4 of participants met the reduction goal the first week of intervention (P201, P202, P204) and the same 3/4 participants met the goal the second week making group C the group that came closest to meeting the interdependent group-oriented contingency both weeks of intervention (see Figure 4).

Average Daily Mile Consumption

A non-concurrent multiple baseline design across groups was conducted to track daily average mileage consumption in attempt to observe daily changes in mileage variability and trend after introduction of the interdependent group-oriented contingency for all three groups (see Figure 5). Daily average mile consumption for Group B was highly variable during baseline and remained highly variable after the intervention was added. High mileage days of the

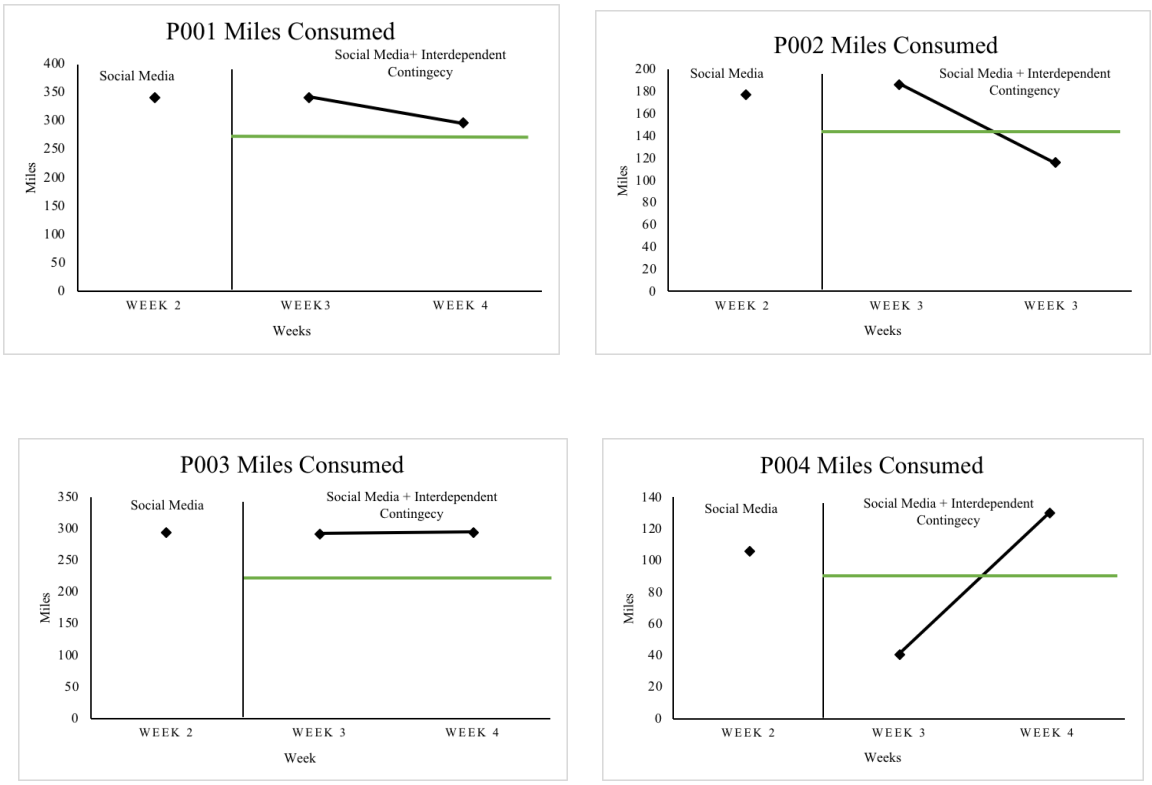

Figure 2. Miles consumed weekly for Group B (P001, P002, P003, P004). Horizontal lines represent individual participant goals

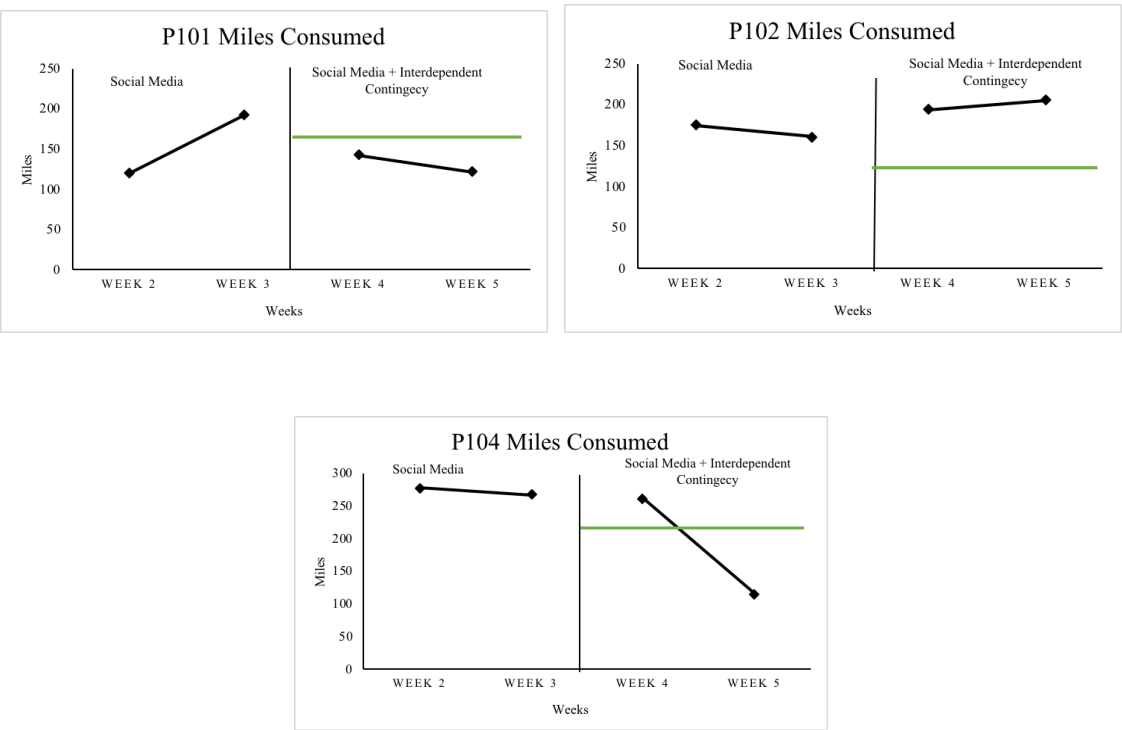

Figure 3. Miles consumed weekly for Group C (P101, P102, P104). Horizontal lines represent individual participant goals.

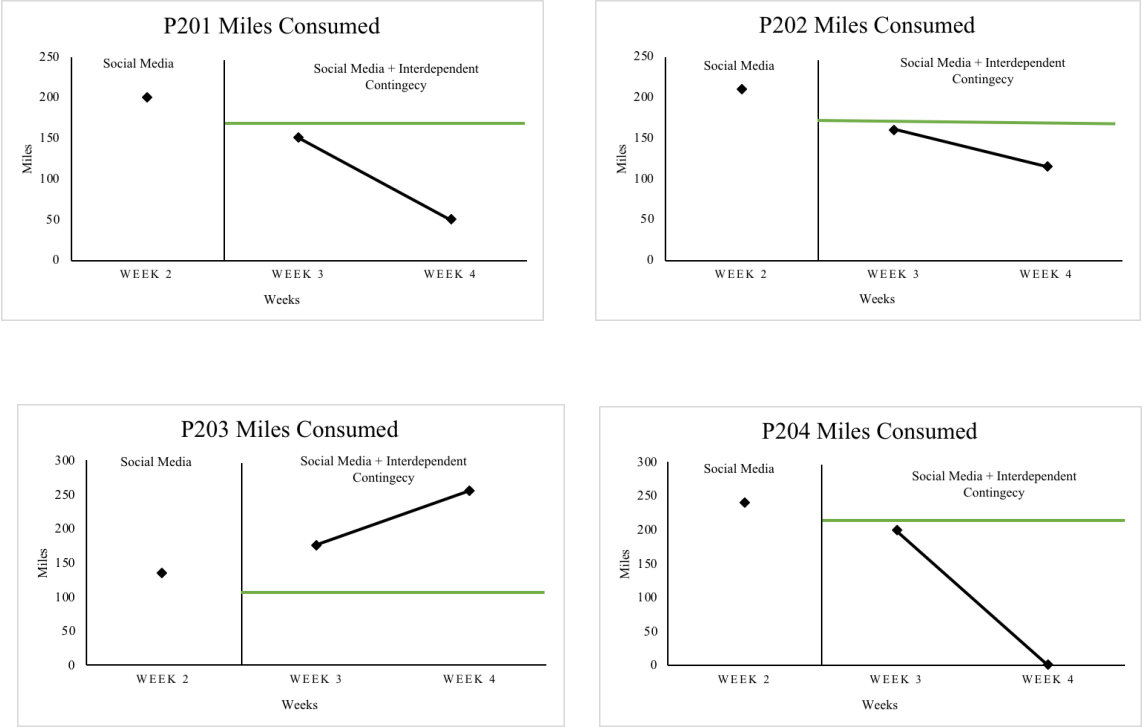

Figure 4. Miles consumed weekly for Group A (P201, P202, P203, P204). Horizontal lines represent individual participant goals.

week were not consistent across the study for group B but weekends were consistently the lowest mileage consumption days. Although a clear change in variability and trend is not evident for group B's average daily mileage consumption, a decrease in mileage consumption can be observed for Fridays and weekends. After the intervention was added, average mileage during weekends decreased as low as 1.3 miles a day (see Figure 5). For Group C, no clear change in variability and trend was observed for average daily miles after the intervention was added. Contrary to the immediate decrease in mileage predicted at the start of intervention, mileage instead returned to baseline levels the first day of intervention (Monday). Although a clear change in trend and variability is not evident, a decrease in high mileage week days can be observed from baseline to intervention for group C. During the social media condition, Monday, Tuesday,

Wednesday, Thursday, and Friday were all high average mileage consumption days (over 40 miles). After the intervention was introduced, mileage consumption was over 40 miles for only weekdays (Monday and Friday). Of the three groups that participated, group A had the clearest change in variability the first week of intervention. During the week of the social media condition the highest average daily mileage consumption for group A was 46 miles this decreased to 31 miles the first week of intervention. Finally, apart from a sudden increase in average daily mile consumption on day 18 (Thursday) a change in overall level of mileage consumption can be observed during the last week of intervention for group A (see Figure 5).

Weekly Group Mile Consumption

Weekly group mileage consumption was also tracked over the course of the study. Although the amount of data for weekly mileage consumption during the social media condition is limited because only group C was exposed to 2 complete weeks of social media only, a clear decline in weekly consumption is evident for all three groups after the introduction of the interdependent group-oriented contingency. Group B consumed 921 miles during their week of social media. After the group contingency was introduced, weekly mileage consumption dropped to 862 miles the first week of intervention and to 837 miles the second week (see Figure 6). Individual data for group B (see Figure 2) show a decrease in mileage consumption for P001 and P002 until the second week of intervention, and a slight mileage increase for P003 the second week of intervention. P004 met the weekly reduction goal the first week of intervention but not the second, this is reflected in the increase in mileage consumption the last week of intervention.

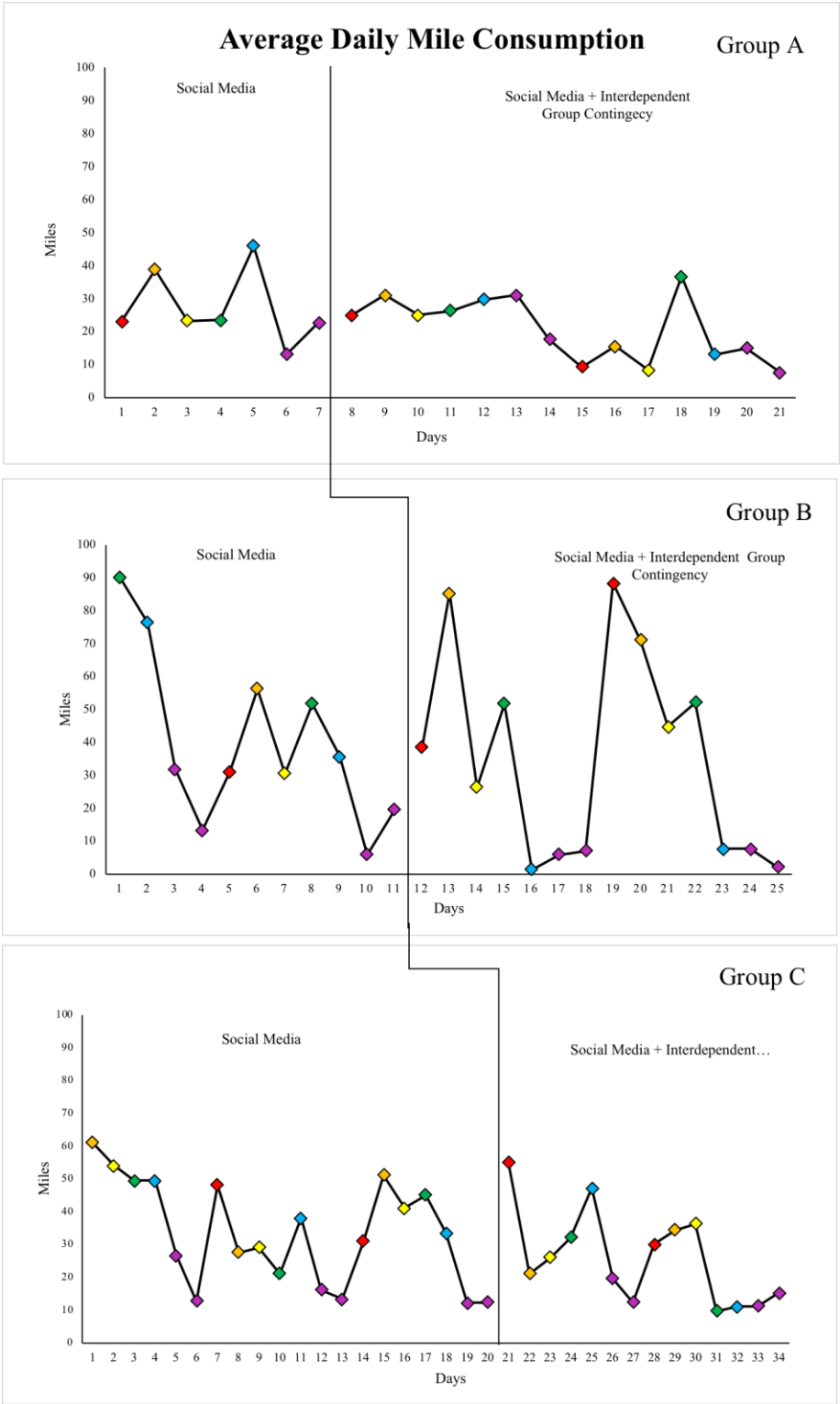

Figure 5. Average daily consumption for groups A, B, and C. Horizontal lines represent average mile consumption for each condition. Days of the week are represented by colors as follows:

M T W TH F SAT/SUN

Although group C had a slight increase in weekly consumption during the social media condition from 582 miles the first week to 681 miles the second week, mileage consumption quickly decreased after the group contingency was introduced to 598 miles the first week to 444 miles the second week of intervention (see Figure 7). Individual data for group C (see Figure 3) show a decrease in consumption after the intervention was added for P101 even though mileage increased the second week of the social media condition. For P104, there is a slight decrease in mileage can be seen the first week of intervention and a more significant decrease the second week when the mileage reduction goal was met. Conversely, P102 increased mileage both weeks of intervention and as a result failed to meet the reduction goals both opportunities.

Finally, Group A consumed 807 miles during the social media condition. After the group contingency was introduced mileage reduced to 688 miles the first week and 421 the second week (see Figure 8). Participant data for group A reflects a decrease in mileage consumption the first and second week of intervention for P201, P202, and P204 who all met consumption goals both weeks (see Figure 4). As opposed to the rest of the group, P203 increased mileage consumption every week of intervention and was also the only group member who didn't meet criteria both weeks. P204 consumed 0 miles the last week of intervention due to being ill.

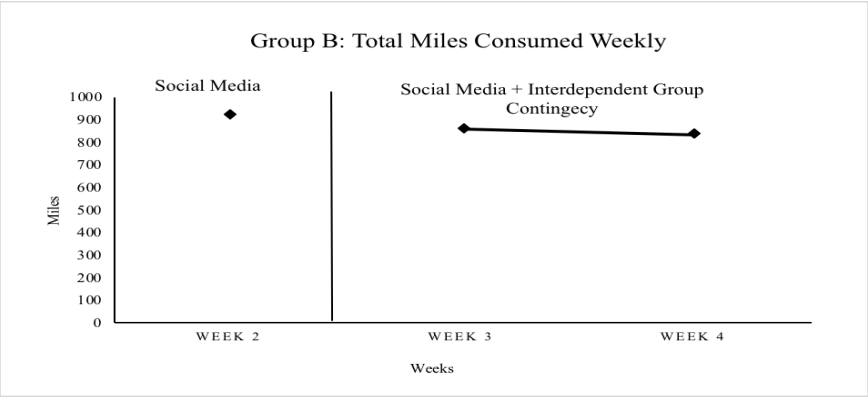

Figure 6. Total miles consumed weekly for Group B.

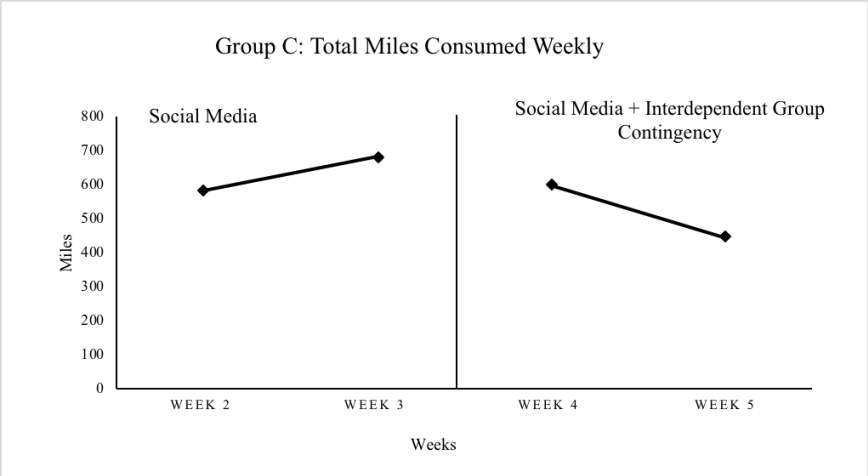

Figure 7. Total miles consumed weekly for Group C.

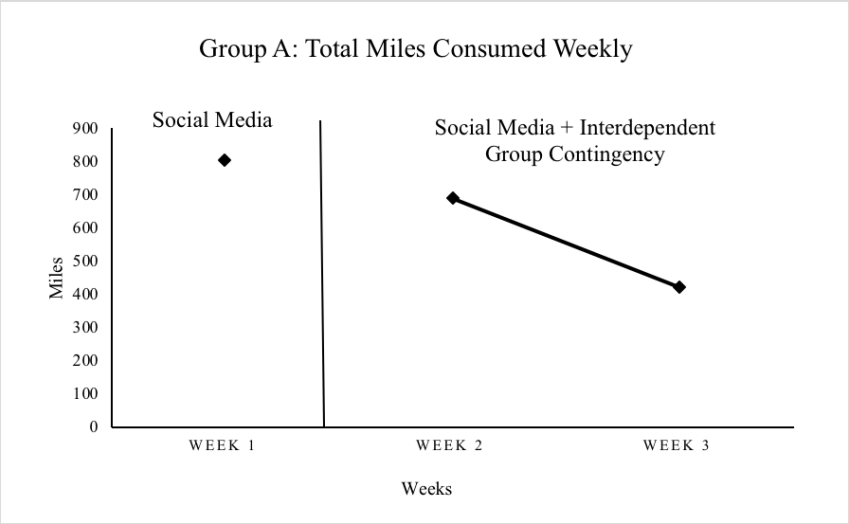

Figure 8. Total miles consumed weekly for Group A.

Social Interactions

Frequency of social interactions in the form of Comments and Likes on the social media platform were tracked weekly during every condition of the study to evaluate changes in social interactions after integrating the interdependent group-oriented contingency. A total of 4 Comments and 4 Likes were identified for Group B during the social media condition and 0 social interactions during the two intervention weeks. Group C had 0 instances of both Likes and Comments in the social media condition and only 1 Like during intervention. Finally, Group A also had 0 social interactions in the social media condition and a total of 2 Comments and 2 Likes during intervention. Overall frequency of interactions was too low throughout both conditions of the study across all groups to make inferences about possible changes in social interactions as a result of the interdependent group-oriented contingency. An example of a comment observed in the initial social media condition was as a reply to a caption stating: "Only necessary trips…okay, maybe not the one to Starbucks ☺" was "As a Starbucks employee, I approve that coffee run Haha" (Between P004 and P003, Group B, first week of social media condition). One of the comments observed after the interdependent group-oriented contingency was added was "I will most definitely try to make this goal. I just want to let you all know that my work is 20+ miles round trip, and I was scheduled to work four days this week. Since I only worked one day last week and carpooled a ton, decreasing my mileage by 20% will be difficult, but I will try so we can all meet our goal ☺" (P203, Group A, first week of intervention). Opposed to predictions of increased social interactions, cooperation between group members, and increased conversations during the interdependent group-oriented contingency as reported by Gresham and Gresham (1982), no clear increase of social interactions was observed for either of the three groups (see Figure 9).

	Group A		Group B		Group C	
Condition	**Comments**	**Likes**	**Comments**	**Likes**	**Comments**	**Likes**
Social Media Week 1	0	0	4	3	0	0
Social Media Week 2	N/A	N/A	0	1	0	0
Group Contingency Week 1	2	1	0	0	0	0
Group Contingency Week 2	0	1	0	0	0	1

Figure 9. Frequency of social interactions in the form of Comments and Likes during each condition of the study for Groups A, B and C.

Social Validity

Participants were asked to complete a five-question post study survey on the last meeting date of the study in order to identify the aspects of the study that they found most important and helpful in decreasing mileage (see Appendix E). Results of the survey showed that carpooling, staying home to avoid driving, and walking were the most commonly used strategies to reduce daily mileage consumption across participants (see Figure 10). Only 27% or 3 out of 11 participants reported being able to decrease more than the 20% mile reduction goal assigned in the study (see Figure 11). 90% or 10 out of 11 participants reported that the implication of reducing mileage consumption they found most important was ecological as opposed to the 10% or 1out of 11 who selected monetary implications as being more important (see Figure 12). 81% or 9 out of 11 participants found group goals as the aspect of the study that motivated them the most to reduce mileage (see Figure 13) and 90% or 10 out of 11 participants found daily image uploads as the least motivating aspect of the study in reducing daily mile consumption throughout the study (see Figure 14).

Top 3 Strategies to Reduce Mileage	
Carpooling	100%
Staying Home	81%
Walking	41%

Figure 10. Top 3 answers to survey Q1: List the top 3 strategies you used to reduce daily mile consumption.

Able to reduce more than 20% Weekly Mileage	
Yes	27%
No	72%

Figure 11. Answers to survey Q2: Could you have reduced more than the 20% weekly mileage reduction goal?

Most Important Implication for Reducing Mileage	
Ecological	90%
Monetary	10%

Figure 13. Answers to survey Q3: What implication of reducing mile consumption do you think is more important?

Most Motivating to Reduce Mileage	
Group Goals	81%
Incentives	18%
Image Uploads	0%

Figure 12. Answers to survey Q4: What aspect of the study motivated you the MOST to reduce daily mile consumption?

Least Motivating to Reduce Mileage	
Group Goals	0%
Incentives	1%

Figure 14. Answers to survey Q5: What aspect of the study motivated you the LEAST to reduce daily mile consumption?

Carbon Reduction

An important final outcome of the present research study is that as a result of mileage reduction across all groups during the intervention condition emission of carbon dioxide gasses was also reduced (see Figure 15). Group B reduced on average 11.6kg of CO2 daily, group C reduced 9.0kg, and group A reduced 13.5kg (see Figure 15), for an overall mean reduction of 11.37kg CO2 daily.

Group	Participant #	Average Change in CO_2 kg Emissions Daily
A	P201	-4.210
	P202	-3.174
	P203	-0
	P204	-6.128
B	P001	-1.114
	P002	-0.183
	P003	-9.744
	P004	-0.567
C	P101	-4.992
	P102	-0
	P104	-4.010

Figure 15. Average change in CO2 kg emissions daily by each participant.

CHAPTER 5: DISCUSSION

The present study intended to investigate the effect of an interdependent group-oriented contingency facilitated through an Internet based social media platform to reduce the number of miles driven weekly by undergraduate students. Results gathered from this study have multiple implications. No clear change in trend and variability in daily average mile consumption was not evident for all three groups after the start of intervention (see Figure 5). In addition, although 4/11 participants met their personal reduction criteria the first week of intervention and 6/11 the second week, all three groups failed to meet the interdependent group-oriented contingency both intervention weeks. The lack of overall social interactions during both social media condition and intervention in the form of Likes and Comments could be perceived as a potential reason why groups failed to work collectively towards a common goal to complete the 'all or nothing' contingency. Regardless of not meeting group criteria, results of group weekly mileage consumption show an immediate decrease in mileage consumption following the introduction of the group contingency for all three groups (see Figures 6, 7, and 8). This decrease in overall weekly mileage suggests that although not all members of each group were able to meet criteria, each group overall reduced mileage after being presented with the interdependent group-oriented contingency and continued to decrease mileage the following week. These results imply that although the independent variable did not have an effect on all members of every group and did not decrease mileage to the extent predicted, it did overall result in a decrease in weekly consumption for all groups. Additionally, the reduction of 11.37 kg of CO2 each day was almost equivalent to removing one average car from the road each day that the group-oriented

contingencies were in place (12.5kg Co2/day; United States Environmental Protection Agency, 2018).

Reduction in mileage in total group consumption and for 9 out of 11 participants suggests that although the groups never contacted the consequence associated with the group-oriented interdependent contingency, additional components of the present study still had a positive effect on participant behavior. A possible component of the study that supported the consistent reduction in mileage across intervention weeks for most participants was public posting. When compared, posting of individual performance data has been shown to be more effective in consistently changing group performance than posting of collective group data (Guercio et al., 2005). Although the element of individual public posting of daily mileage was present in both conditions of the study through daily image uploads of odometer readings, an addition form of public posting was added during the intervention condition. At the beginning of every intervention week (Monday), each participant's weekly mileage consumption goal (20% reduction from miles consumed the previous week) was added to the mileage reported the previous night (Sunday). This "odometer reading goal" was posted in the announcement section of the private group for every participant in the group so that it would be visible to all members. The odometer reading goal allowed participants to track each other's progress towards the criteria during the intervention condition. It is possible that this additional pubic posting of progress maintained mileage reduction in the absence of contacting the group contingency consequence. In addition, it is possible that participants behaved according to the rule in place regardless of contacting direct contingencies associated with meeting their personal goals given that "instructional prompts can override or modify

control by the programmed contingencies" (Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986, p. 253).

Possible reasons why all groups failed to meet the interdependent group-oriented contingency should also be considered. As expressed by Skinner et al. (1999), "How one structures interdependent group contingency goals or criteria can impact the effectiveness of group contingencies" (Skinner, 1999, p. 816). It is possible that the mileage reduction goals generated from the social media condition did not reflect attainable reduction goals for some participants. Because mileage consumption prior to the social media condition was not tracked, it is impossible to know if mileage immediately decreased following the incorporation of this condition. Some participants may have reached a mileage reduction floor effect during the social media condition making it impossible to decrease mileage further after the group contingency was added. Another possible explanation for why all groups failed to meet the interdependent-group oriented contingency is that interdependent group oriented contingencies are more effective when group cooperation is in place (Gresham & Gresham, 1982). Low levels of social interactions were observed for all groups in both conditions of the study, it is possible that the absence of a requirement to Comment and Like encouraged individuals to not engage in social interactions and thereby restricted the element of cooperation in the groups.

The present study also posed multiple limitations that are worth noting. Weekly mileage consumption goals during intervention conditions were calculated from mileage consumed during 1 week of the social media condition for every individual. For groups who had more than 1 week of social media only consumption goals were generated from the week prior to the start of the intervention. Generating consumption goals from only 1 week of social media may

have not permitted the detection of variability in driving patterns across weeks. Likewise, not controlling for driving variability across weeks may have limited the ability of meeting weekly goals for some participants. For example, if during the social media week, a participant had a class canceled, and was scheduled for less work hours (most participants had part time jobs) his mileage consumption reported that week may not reflect a typical week.

Another limitation is that over the course of the study participants failed to post readings of their odometers a total of six times. When no post was uploaded, daily mileage consumption was calculated by dividing the mileage consumed the next day by 2 and reporting half of the mileage for each day. Data reported for the 2 days involved may not represent accurate mileage consumption for the given day. Equally, because daily mileage consumption was used to calculate group average daily mile consumption this too may have been inaccurately represented for the two days involved. It is important to consider however that because goals during the study were based on weekly mileage consumption, this may not have been an issue.

The number of essential miles (mileage consumed to travel to work and school) for each participant was not calculated or separated from the total amount of daily mileage consumption in the present study. If for some participants most of their driving involved necessary trips that could not be avoided and/or carpooled to, this may have limited the ability of some members to achieve their mileage reduction goals.

Variability in time of posting on the social media site was also a limitation in this study. At the start of the study, participants were informed that posting had to occur between 8-9 p.m. every night in order to receive the incentive available for posting. This rule was later changed because due to work schedules,

participants were not able to upload odometer readings at the designated time. As a result, posting instructions were opened to posting between 8 p.m.-12 a.m. every night. This larger posting interval lead to less consistency in posting times for participants and may have distorted the definition of daily mile consumption across participants. However, because each day's mileage was calculated based on the previous day's mileage and goals were based on weekly mileage, this may not have affected the overall usefulness of this data collection method for the purposes of this study.

The timing of the last week of intervention may also present a limitation to this study. The last week of intervention for groups C and A was also California State University, Fresno's Spring Break week and thereby no classes were held during this time. Although neither group met the group goal that week, the increase in individuals who met the goal in group C (2 out of 3) and the overall decrease in mileage in both groups may be a result of the absence of commuting to school.

Incentive delivery may have also posed a limitation to the study. Incentives were delivered weekly over the course of the study for posting daily. Every week each participant had the opportunity to earn up to $7 for posting. It is possible that having incentives available for both social media and intervention conditions of the study may have decreased the reinforcing value of the incentives associated with meeting the interdependent group-oriented contingency during the intervention condition. For some participants, earning $7 for simply posting every day of the week may have been a sufficient reinforcer and therefore been less likely to attempt to meet their mileage reduction goal.

Findings from this study suggest multiple implications for future studies in this line of research. According to the social validity post study survey, most

participants (8 out of 11) reported not being able to surpass than the 20% mileage reduction criteria used in this study (see Figure 11). Future studies should consider developing reduction goals that are easier to achieve and perhaps strategically increase them gradually throughout based on achievement in order to increase participant success in meeting weekly goals. Likewise, future studies may also consider generating reduction goals based on more than one week of social media condition data so that these can account for driving fluctuations across weeks especially when working with populations with highly variable work and school schedules. Finally, in an effort to isolate the effects of the social media platform alone, future studies may also consider collecting data on daily mile consumption before adding participants on a social media platform.

Findings of the present study may also contribute several recommendations to behavior analytic literature intervening on sustainable behavior. The first contribution is the identification of social media as an effective platform to enforce and maintain sustainable practices in groups. This is especially beneficial given that the use of a social media platform is typically free, user friendly, and may led to self-sustaining practices due to the social contingencies embedded in the design. Results of the study also support the use of technology to measure behavior outside of a clinical setting, specifically when direct observation is not feasible. Finally, this study further supports the use of technology in applied research where investigation of behaviors that are challenging to directly measure may be avoided.

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APPENDICES

APPENDIX A: PARTICIPANT SELECTION SURVEY

Participant Selection

1. Please list the number of different vehicles you drive during a typical week.

2. On average, how many miles do you drive in a typical day?

3. On average, what percentage of driving is done by another individual with your vehicle in a typical week?

4. On average, how many times do you engage in alternative behavior in order to decrease your driving in a typical week?

APPENDIX B: WEEKLY GROUP DATA SHEET

Miles Consumed: Miles consumed for any given day will be calculated by subtracting the previous day's mileage report by the current day's mileage report.		Participant #_____	Participant #_____	Participant #_____	Participant #_____
Monday Date:	Mileage Reported:				
	Miles Consumed:				
Tuesday Date:	Mileage Reported:				
	Miles Consumed:				
Wednesday Date:	Mileage Reported:				
	Miles Consumed:				
Thursday Date:	Mileage Reported:				
	Miles Consumed:				
Friday Date:	Mileage Reported:				
	Miles Consumed				
Saturday Date:	Mileage Reported:				
	Miles Consumed:				
Sunday Date:	Mileage Reported:				
	Miles Consumed:				
Total Miles Consumed This Week:					
Week Mileage Consumption Goal: (20% reduction)					
Week Mile Reduction Goal Met: Yes/NO:					

APPENDIX C: MILEAGE CONSERVATION GUIDES A AND B

Personal Mileage Conservation Guide A

Effective Week: _____

Goal:

To reduce your average daily mile consumption.
You may use any strategies you want for reducing your miles per day (e.g., carpooling, eliminating unnecessary trips, walking) except for borrowing another person's car or tampering with your car.

Directions:

Every night between 8-9 pm upload an image of your vehicles odometer on to the_____ Facebook® private group.

- The image must include a clear view of your entire dashboard and a legible view of your odometer reading. (see Image 1)
- The image post, include a brief description of an alternative behavior you engaged in that day to reduce mileage consumption (see Image 2).
- During this week, you may access the _____ Facebook ® private group whenever you want to communicate with other team members by commenting on, or liking their progress uploads as you please.

Incentive:

You will be awarded $1 every day that you upload an image on to the _____ Facebook® private group following all the directions stated above.

Image 1. Car dashboard and odometer

Image 2. Facebook Image post and comment

Personal Mileage Conservation Guide B

Effective Week: _____

Goal:

To reduce your average daily mile consumption by 20%.

- Your daily average mile consumption goal is _____ or below.
- Your weekly mile consumption goal is _____or below.

You may use any strategies you want for reducing your miles per day (e.g., carpooling, eliminating unnecessary trips, walking) except for borrowing another person's car or tampering with your car.

Directions:

Every night between 8-9 pm upload an image of your vehicles odometer on to the_____ Facebook®

private group.

- The image must include a clear view of your entire dashboard and a legible view of your odometer reading. (see Image A)
- The image post must include a brief description of an alternative behavior you engaged in that given day to reduce mileage consumption (see Image B).
- During this week, you may access the _____ Facebook ® private group whenever you want to communicate with other team members by commenting on, or liking their progress uploads as you please.

Incentives:

- You will be awarded **$1** every day that you upload an image on to the _____ Facebook® private group following all the directions stated above.
- At the end of the week you also have the opportunity to earn an additional $15 dollars if you and every member of your _____ Facebook® private group are able to meet your individual **week** mile consumption goal at the end of the week (Sunday 9pm).
    - Every member of your group must meet criteria in order for you to receive the $15 incentive. If one member of the group fails to meet criteria the other members will automatically lose their opportunity to get incentive.

Image 1. Car dashboard and odometer

Image 2. Facebook Image post and comment

APPENDIX D: ODOMETER READING MILEAGE GOALS

Particpant	*Daily Consumption Goal*	***Week Goal***
[illegible]	22.8 Miles	**69235**
[illegible]	24 Miles	**17899**
[illegible]	15.3 Miles	**101980.2**
[illegible]	29.6 Miles	**21904.2**

APPENDIX E: POST STUDY SURVEY

Post Study Survey

1. **List the top 3 strategies you used to reduce daily mile consumption (*List from most commonly used to least commonly used)***

1.
2.
3.

2. **Could you have reduced more than the 20% weekly mileage reduction goal? (*Choose one)***

- Yes
- No

3. **What implication of reducing mile consumption do you think is more important? (*Choose one*)**

- Monetary (Saving Gas Money)
- Ecological (Helping The Environment)

4. **What aspect of the study motivated you the MOST to reduce daily mile consumption? (*Choose one*)**

- Weekly Group Goals
- Monetary Incentives
- Daily Image Uploads

5. **What aspect of the study motivated you the LEAST to reduce daily mile consumption? (*Choose one*)**

- Weekly Group Goals
- Monetary Incentives
- Daily Image Uploads

APPENDIX F: DEPARTMENTAL (UNIT) REVIEW FORM
COMMITTEE ON THE PROTECTION OF
HUMAN SUBJECTS

DEPARTMENTAL (UNIT) REVIEW FORM
COMMITTEE ON THE PROTECTION OF HUMAN SUBJECTS
CALIFORNIA STATE UNIVERSITY, FRESNO

Please type

PRINCIPAL INVESTIGATOR	Steven Payne	Psychology	ST11
	Name	Department	Mail Stop
	278 6397	278 2691	
	Telephone Number	Dept. Telephone Number	
If student or collaborative research	Martha Cisneros	Psychology	
	Name	Affiliation	
	520-383-4247		
	Telephone Number	Telephone Number	

TITLE OF STUDY: The Assessment of an Internet-Based Group Oriented Contingency to Decrease Miles Driven Daily

If funding is sought, from what agency? N/A

How did the Principal Investigator designate the research? Minimal risk ☐ At risk ☐

REVIEWER 1

Name

At risk ☐ Minimal Risk ☐

COMMENTS:

Place your signature in the category of your judgment

☐ APPROVED

☐ DISAPPROVED

REVIEWER 2

Name

At risk ☐ Minimal Risk ☐

COMMENTS:

Place your signature in the category of your judgment

☐ APPROVED

☐ DISAPPROVED

REVIEWER 3

Name

At risk ☐ Minimal Risk ☐

COMMENTS:

Place your signature in the category of your judgment

☐ APPROVED

☐ DISAPPROVED

The department may wish to route this form to the 3 reviewers or send each reviewer a form. If the review is done on three separate forms, the Chair ought to give each reviewer the comments of the other reviewers as well as the Principal Investigator. If all three reviewers judge the proposal as "minimal risk," the Department Chair notifies the Principal Investigator and keeps the form(s) for 5 years. If funding is sought for this study or it is "at risk," one (1) copy of the protocol and this form are forwarded to the university CPHS, Haak Administrative Center, 4th Floor Henry Madden Library, California State University, Fresno, M/S ML 54, Fresno, CA 93740-8014, with one additional copy to the dean's office. (See sections 3.7 or 3.8.)

"Exempt" Research.

If "exempt", see Section 3.5.2.

"Minimal Risk" Research.

Research IN WHICH THE RISKS OF HARM ANTICIPATED ARE NOT GREATER, PROBABILITY AND MAGNITUDE, THAN THOSE ORDINARILY ENCOUNTERED IN DAILY LIFE OR DURING THE PERFORMANCE OF ROUTINE PHYSICAL OR PSYCHOLOGICAL EXAMINATIONS OR TESTS. No research involving any item listed as being "at risk" can be determined to be minimal risk. A department or other unit review committee may determine that a research proposal submitted, in the judgment of the principal investigator as "minimal risk", is actually "AT RISK".

"At Risk" Research.

"A subject is considered to be 'at risk' if he/she is exposed to the possibility of harm- physical, psychological, sociological, or other as a consequence of any activity that goes beyond the application of those established and accepted methods necessary to meet his/her needs. The determination of when an individual is 'at risk' requires application of sound professional judgment of the activity in question and the ethical principles contained herein. Responsibility for this determination resides at all levels of institutional and departmental review." (***The Institutional Guide to DHEW Policy on Protection of Human Subjects***, Washington, D.C., 1971, p.2.)

An illustrative, but not inclusive, list of "at risk" procedures would include experiments involving any aspect, degree, quality, or amount of any of the following:

Deception, mental stress, including subjection to public embarrassment, humiliation, discomfort, irritation, or harassment, hypnosis, sensory deprivation, sleep deprivation, normally ingested or inhaled materials in excess or less than normal amounts, injection, ingestion or inhalation of toxic materials, including all drugs, alcohol or placebos; strenuous physical exertion; use of physical stimuli in abnormal amounts (e.g., noise, vibration, shock, heat, magnetic fields, radiation); violation of anonymity or confidentiality of subjects and data; OBSERVATIONS RECORDED ABOUT THE INDIVIDUAL WHICH, IF THEY BECAME KNOWN OUTSIDE THE RESEARCH, COULD MAKE THE SUBJECT LIABLE TO CRIMINAL OR CIVIL ACTION OR DAMAGE THE SUBJECTS FINANCIAL OR EMPLOYMENT STATUS; OR ABROGATION OF ANY CIVIL RIGHTS.

The Assessment of an Internet-Based Group Oriented Contingency to Decrease Miles Driven Daily

Steven W. Payne, Ph.D., BCBA-D

Background and Purpose: Human contribution of CO gasses in the atmosphere caused partially by the overuse of motorized vehicles is resulting in long lasting harmful effects on the environment, humans, and animals. A surplus of CO_2 gasses in the atmosphere is problematic because it leads to climate change. Climate change distorts the natural pace of climate patterns and results in extreme weather conditions such as increased coastal flooding, disruptions to food supplies, more frequent and intense heat waves, and costly and growing health impacts. Climate change due to global warming is a time sensitive issue that jeopardizes the future of our planet and therefore has become one of the most relevant issues of our time. Several efforts incorporating technology have been used to target the decrease of CO_2 gasses in the atmosphere, but these efforts alone have not been sufficient. Human practices should be targeted to encourage change in behavior that can maintain over time and can result in meaningful impact on the environment. In addition, behavior analytic strategies can be used to teach and reinforce alternative behavior practices that are less harmful to the environment and serve the same function thereby decreasing CO_2 emissions that threaten human and planet wellbeing. The present study seeks to extend this line of research in sustainability by utilizing an interdependent group oriented contingency where incentives will be delivered only if every member of a specified group has met the predetermined mileage reduction criteria. In addition to the

group-oriented contingency, a social media platform will be incorporated to help facilitate communication between group members.

Human Subjects: Eight college students from a lower division psychology course that will include both males and females will be selected to participate in the study. Individuals will participate in the study based on having met predetermined criteria gathered from a questionnaire. Those who report that 100% of their driving is done with one car, 5% or less of their vehicle driving is done by another person, and drive at least every day will be selected. Additionally, students must show that they possess a valid driver's license and insurance to participate.

Location The study will take place in a shared lab room at the university science building where participants will meet with the experimenter at designated dates and times. Data collection and group contingency implementation will take place on the social media platform.

Method: An ABAB reversal design will be used to investigate the effect the intervention on the target behavior. The A component of the design will be the application of the social media platform alone. The B component will include the implementation of the interdependent group contingency intervention facilitated though the social media platform.

Intervention 1

Social Media Platform: During the 7-day week long social media intervention participants will be asked to attempt to decrease their mileage consumption to reach daily mileage reduction parentage goals by engaging in alternative choices. During this time, they will be added to a social media private group where they will share a daily image of their odometer reading with other participants to show if they weather or not they were successful in meeting their mileage reduction goals. Prior to beginning the intervention participants will be given a Study Participation Guide that will include directions on uploading their odometer images to the social media private group. During the social media condition of the study participants will be offered one dollar for every daily post they make on the social media platform.

Intervention 2

Interdependent Group-Oriented Contingency and Social Media Platform After the Social Media Platform Phase, an interdependent group contingency facilitated through the social media platform will be introduced. In this condition in addition to maintaining the use of the social media platform to upload daily odometer images, participants will be informed of criteria for obtaining a monetary incentive. In order to earn their incentive (a $15-dollar gift card) at the end of the week, every single participant in the assigned social media group will be asked to meet a 20%-

mile reduction goal from their average daily mile consumption in the initial social media condition. This will be calculated by adding the total miles driven during the 7-day initial social media condition and dividing it by 7. Participants will receive the exact number of daily miles that the 20 % reduction goal represents for them individually. If everyone in the assigned group meets the reduction criteria, each individual will be given a gift card at the end of the week period. If someone in the assigned group fails to meet criteria, even if this only applies to one individual in the group, the incentive will not be available for the other participants even if they meet criteria.

Potential Benefits: There are several potential benefits of the current study. The most direct benefit is that reduction in daily average mileage consumption will inevitably result in a decrease in daily fuel consumption therefore posing a financial advantage for participants over the course of the study. An additional benefit of the current study is that participants will benefit from engaging in alternative transportation practices during the intervention conditions due to the ecological implications that decreasing daily mileage consumption will have on the environment.

Potential Risks: There is minimal potential risk for the human participants in this study. Although participants will not be asked to engage in specific alternative driving practices that could put them at any additional risk it is possible that in order to meet their mileage consumption goal, participants may avoid necessary driving that can result in a form of personal inconveniency. The risks involved should be no different than what they

encounter in their everyday lives. There is also a potential risk of a loss of privacy of information, through the use of the social media platform, although again these risks will be similar to the risks already encountered in their everyday lives, and the information from odometer readings is unlikely to be of concern.

Risk Management: In order to minimize potential risk all participants will be asked to show a valid driver's license and proof of their current car insurance. In addition, participants will not be asked to engage in specific practices to decrease mileage consumption that might put them at risk. Instead, they will have the freedom to engage in the alternative practices of their choice. Lastly, participants will be told that the study's guidelines should not be enforced or effective during emergency situations where driving is needed. Students will also be shown a guide to Facebook privacy (https://www.facebook.com/about/basics/usr1?gclid=EAIaIQobChMIoe_W-f7h1wIVBttkCh2zrQIcEAAYASAAEgKq7_D_BwE).

INFORMED CONSENT FORM

The Assessment of an Internet-Based Group Oriented Contingency to Decrease Miles Driven Daily
Steven W. Payne, Ph.D., BCBA-D
California State University, Fresno

This Informed Consent Form has Two Parts:

- Information Sheet (to share information about the study with you)
- Certificate of Consent (for signatures if you agree to participate

You will be given a copy of the full informed consent form

Pa**rt 1: Information Sheet**

Introduction

You are invited to participate in a research study conducted by Steven W. Payne, Ph.D., BCBA-D. The general purpose of this study is to figure out how we can help people make more sustainable choices in their driving habits by driving less per week. In this research, Dr. Payne and his associates will give you a participation guide that will describe weekly specific instructions for attempting to decreasing your daily average mile consumption and for reporting odometer measures daily on a Facebook® private social media group. The study will last a total of 4 weeks in which you will have the opportunity to earn $1 for every daily required social media post over the course of the entire study (4 weeks) and the opportunity to earn $15 dollars two out of the four weeks if you and your assigned team members meet specified mileage reduction criteria. The money will be given in the form of gasoline gift cards. We cannot guarantee however that you will receive any benefits from this study. Please take time to reflect and decide on whether you would like to participate in this study. If you do not understand any part of the study, I will take the time to answer any questions that you may have.

Purpose

Climate change due to human activity is one of the major threats to society. One of the contributing factors in climate change is the carbon monoxide produced through driving. In order to help combat climate change, it is important for individuals to decrease their overall driving. The current study will assess the use of a social-media platform for measuring driving behavior and will also assess the use of incentives to decrease driving based on a group-based goal.

Procedures

Prior to starting the study, you will be asked to provide proof of a driver's license and insurance to ensure that you can legally drive in the state of California. You will also be asked to provide some information on your driving habits, such as the amount of driving you do per week. We will also inspect your vehicle and take a photograph of your dashboard and odometer reading for comparison purposes. During the study, you will be asked to post a photograph of your odometer to a private Facebook group which can be viewed by other participants in the study as well as the researchers. You will be given instructions on how to do this. You will receive $1 for each successful submission to the group, regardless of the odometer reading. In addition, following the initial photograph submissions, we will set a goal for individuals in the Facebook group. Upon every member of the group reaching their goal for the week, you will each receive a $15 gas card. However, if one member does not reach the goal, no one in the group will receive the gas card. You will still receive compensation for submitting odometer photos regardless of the goal being met.

Duration

The study should take approximately 1 month.

Risks and Discomforts
There is minimal potential risk for the you as part of this study. You may avoid driving that can result in a form of personal inconveniency. The risks involved should be no different than what you encounter in your everyday lives. There is also a potential risk of a loss of privacy of information, through the use of the social media platform, although again these risks will be similar to the risks already encountered in normal social-media use.

Benefits
There are several potential benefits of the current study. The most direct benefit is that reduction in daily average mileage consumption will inevitably result in a decrease in daily fuel consumption therefore posing a financial advantage for you over the course of the study. An additional benefit of the current study is that you mal benefit from engaging in alternative transportation practices during the intervention conditions due to the ecological implications that decreasing daily mileage consumption will have on the environment.

Voluntary Participation
Participation in this study is completely voluntary. Your decision whether or not to participate will not prejudice your future relations with California State University, Fresno. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without penalty.

Reimbursement
Participation in this study will not be reimbursed outside of the rewards for meeting goals and submitting data as described above.

Confidentiality
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. It should be noted that the odometer readings posted on the Facebook page will be visible to others in your participant group. However, you will be given information on how to keep your other Facebook information private if you so choose.

Dissemination
If you give us your permission by signing this document, we plan to disseminate our findings at psychological conferences and through journal articles so that other interested people may learn from our research. Any identifying information will not be included in this dissemination.

Contact
If you have any questions prior to or during the study, you may contact the following:

Steven W. Payne, Ph.D., BCBA-D
spayne@csufresno.edu

Martha Cisneros
marthacisneros4@mail.fresnostate.edu

Approvals

The Committee on the Protection of Human Subjects at California State University, Fresno has reviewed and approved the present research.
If you have any questions, please ask us. If you have any additional questions later, Dr. Payne (T) 278 6937 will be happy to answer them. Questions regarding the rights of research subjects may be directed to Kris Clarke, Chair, CSU Fresno Committee on the Protection of Human Subjects, (559) 278-4468.

You will be given a copy of this form to keep.

Part 2: Certificate of Consent

I, _____, have been asked to consent to my participation in this research study which will involve the use of a social media group to collect data on my driving behavior, set goals for driving reduction, and provide incentives for meeting these goals. I have read the foregoing information. I have had the opportunity to ask questions about the information and any questions that I have asked have been answered to my satisfaction. I am aware that I may choose to not consent or withdraw consent at any time. I consent voluntarily to participate in the study.

_____ _____
Participant name Participant Signature

_____
Date

_____ _____
Witness name Witness Signature

_____
Date