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**CARLINK: A SMART CARSHARING SYSTEM—
A STUDY OF BEHAVIORAL ADAPTATION**

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ABSTRACT

Most trips in U.S. metropolitan regions are drive-alone car trips, an expensive and inefficient transportation form. A more efficient, but often less convenient, system allows drivers to share cars. Carsharing organizations are becoming common throughout Europe and North America. Shared-use vehicles offer a modal alternative that can make metropolitan regions more livable.

A shared-use system aims to reduce traffic by reducing the number of cars needed by households and encouraging commuters to walk, bike, and use transit, at least for part of their trips. Further, carsharing could help air quality by incorporating low-emission vehicles into shared-use fleets, further reducing traffic and vehicle miles traveled. For commuters, shared-use vehicles could offer a low-cost, low-hassle alternative to private vehicles.

This paper describes the CarLink study approach; presents market results from a longitudinal survey on the CarLink concept, conducted in 1998; and describes an early CarLink adopter profile for the East San Francisco Bay region. This study found that willingness to use CarLink was dependent on the amount and type of exposure. Specifically, participants who read only a CarLink brochure lost interest over time, while nearly 78% of those who read a brochure, watched a video, and participated in a drive clinic declared they would use CarLink.

Key Words: Carsharing, smart technology, market survey.

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INTRODUCTION

Carsharing organizations are becoming more common throughout Europe and North America. Sharing vehicles might lead to less traffic congestion, air pollution, and government spending. For commuters especially, shared-use vehicles offer a low-cost, low-hassle alternative to getting to and from their destinations. Carsharing fleets might also consist of ultra-low emission, energy-efficient cars. Further, shared-use vehicles might reduce government spending on arterial street systems and mass transit by increasing ridership through added reverse commuters and midday, evening, and weekend riders. By serving multiple users each day, vehicles would spend less time parked and reduce the demand for parking spaces. Moreover, sharing could reduce the need for additional vehicles to support a household's travel needs. Travelers could benefit by gaining the mobility of a car without carrying the full costs of ownership; transit operators might benefit by tapping a much larger potential market; and society might benefit by diverting travelers from single-occupant vehicles to transit for part of their trips.

The Institute of Transportation Studies at the University of California, Davis (UC Davis), and its partners the California Department of Transportation, the Bay Area Rapid Transit (BART) District; American Honda Motor Company, UC's Lawrence Livermore National Laboratory (LLNL), and INVERS are studying the use of intelligent communication and reservation technologies to reduce the inconvenience of carsharing, and to identify market segments where smart carsharing (what the project partners call "CarLink") would be attractive. The CarLink project included a longitudinal survey and a ten-month field test of carsharing and intelligent communication and reservation technologies to facilitate shared-vehicle access at transit stations and other activity centers throughout the Dublin/Pleasanton region of northern California for tripmaking.

In Europe, the prevalent carsharing model is one in which the vehicles are used intensively by customers who drive little individually (Shaheen *et al.*, 1998). While these organizations require high usage rates to keep per-use costs low, they are most economically attractive to less intense vehicle drivers. In contrast, CarLink focuses on reducing daily vehicle use by facilitating transit access (i.e., frequent versus occasional carsharing usage). CarLink also increases the efficiency of business fleets at employment centers, by facilitating the use of vehicles by several different users. Furthermore, employer-based carsharing promotes commuting via alternative modes, including vanpool, carpool, transit, and bicycles, by providing access to a shared-vehicle fleet for personal and business trips that arise during the day.

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The following scenario exemplifies the CarLink model (i.e., a commuter-based carsharing approach). While returning from work, Homeside Users pick up a shared-use vehicle upon arriving at a BART station close to home on their return from work. They drive the CarLink vehicle home, and perhaps to other places during the evening; then drop it off at the station in the morning. After riding BART for their morning commute, Workside Commuters pick up a CarLink vehicle at their destination station, drive a short distance to work. During the day, other workers (i.e., Day Users) employ the CarLink vehicles for tripmaking. At the end of the day, Workside Commuters use the vehicles to return to the BART station for their evening commute.

The field test was deployed in the Dublin/Pleasanton region (or the East San Francisco Bay area) from January to November 1999. Close to 50 program participants used the CarLink vehicles at several locations throughout the demonstration. Using advanced communication and reservation system technologies, vehicles were reserved in advance or rented automatically upon arrival at a CarLink lot.

Program components included: a fleet of twelve 1998 Honda compressed natural gas (CNG) vehicles, a smart key manager (i.e., INVERS' key dispenser and reservation system, called Car-sharing Organization and Communication System (COCOS)); a fleet management system (i.e., INVERS' software system, called COCOS Universal Communication Manager (CUCUM)); and contactless smart cards. Reservations were made via COCOS and an Internet web page operated at the LLNL, and vehicles were monitored using in-vehicle trip diaries. COCOS provided a two-way flow of information between a central control computer and the key manager.

Since carsharing is becoming more common throughout Europe and North America, it is important to understand the response to this emerging alternative in the U.S. This paper describes the CarLink research approach; presents results from the longitudinal survey, conducted in 1998; and describes an early adopter profile for the East San Francisco Bay region.

RESEARCH APPROACH

The CarLink study has three components. First, it included a review of relevant technical and institutional literature. Second, the study employed a longitudinal market survey of 302 individuals in the Bay Area, including focus groups with survey participants (approximately 40 individuals). Third, it included a ten-month field test of the CarLink system. Many field test participants were drawn from the longitudinal market survey. Both the survey and focus groups evaluated participants' willingness to participate and pay for these innovations. Study data were used to create and test a user-centered model of smart carsharing in the Bay Area. This paper focuses on results from the longitudinal survey.

Social learning and social marketing theories were used in this study to explain the processes by which travelers can and might accept or adapt to a transportation innovation. "An innovation is an idea perceived as new by those who are confronted with it as an option in choice...Reaction to an idea is quite different when one encounters it for the first time, than

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when it has become routine” (Rogers, 1972, p. 86). Researchers focused on methods of presentation and learning to examine dynamics in target adopter response. Social learning and marketing theory are described in more detail below.

To explain the CarLink system, researchers developed and examined several informational media, including a brochure, video, and “trial” clinic. According to Magill *et al.* (1981), a strategy should be established to accomplish the innovation communication (or diffusion) objectives. In the longitudinal survey, communication objectives emphasized the disadvantages of current modes, the advantages and disadvantages of smart carsharing, and how the system works.

Researchers also integrated the human activity analysis approach into the design of study instruments, including the questionnaires, a drive clinic, and focus groups. Activity analysis examines the daily patterns of households and their members to capture and explain travel behavior and choices. This methodology, integrating principles of sociology, focuses on understanding behavior and lifestyle choices of study participants and their households. Examples of the activity analysis approach in this study include survey questions, such as how do you accomplish your weekly activities and how many trips are taken by activity type per week.

The longitudinal survey provided the attitudinal and belief data needed to evaluate the social learning and marketing methodologies employed in this study. Researchers used these data to assess dynamics in an individual’s learning and valuing response to a social innovation over time (i.e., CarLink). This paper provides results to the “dynamic” innovation response hypothesis:

An individual's response to a social innovation will be positively altered by informational media (i.e., video, brochure, and drive clinic). Furthermore, individuals who are not exposed to additional information about the innovation will become increasingly negative toward it over time.

Social Learning Theory

Social learning theory emphasizes a continuous interaction among behavior, personal factors, and environmental determinants. The relative influence of each factor is different for various settings and behaviors. Social learning theory bridges the gap between cognitively oriented rational decisionmaking models and behavioral theory. In this framework, individuals are “...neither driven by inner forces nor buffeted by environmental stimuli” (Bandura, 1977, p. 11). Rather, psychological processes are explained in terms of a dynamic and continuous interaction of personal, behavioral, and environmental factors. The environment can influence behavior by making it easier for individuals to act. For instance, situational factors in the environment can influence behavior (e.g., the close proximity of carsharing vehicles to a transit station could make it easier for users to select this transportation option). A distinguishing feature of social learning theory is that “symbolic, vicarious, and self-regulatory processes

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assume a prominent role” (Bandura, 1977, p. 12). For instance, an individual might observe another person’s behavior, reproduce it, and in replicating it, reinforce the modeled behavior.

More traditional behavioral theorists have advocated a different learning framework. From the behavioral perspective, learning can only occur after an individual performs an activity and experiences its effects (i.e., trial-and-error learning) (Polley and Ven, 1996).

Cognitive theorists offer still another approach. They focus on rational processes and how individuals’ preferences change as they undertake a course of action. For instance, once an individual has decided to adopt an innovation they often reinforce this decision and, in turn, become even more positive about this choice (Polley and Ven, 1996). Social learning integrates these perspectives and advocates that “the capacity to learn by observation enables people to acquire large, integrated patterns of behaviors without having to form them gradually by tedious trial and error” (Bandura, 1977, p. 12). Furthermore, social learning theory argues that as individuals gradually decide to adopt a new behavior, they do not implement it instantly. “Among other effects, this slow adaptation allows individuals to manage their anxiety in dealing with the newness of the new behavior” (Andreasen, 1995, p. 268). This study tests the validity of social learning methods in presenting informational media to CarLink study participants.

Social Marketing Theory

Social marketing offers the second important framework relevant to this study. It is the application of concepts and techniques used in business to social behaviors. Social marketing theory has been applied to health, family planning, childcare, and the environment (Kotler and Roberto, 1989; Andreasen, 1995). These techniques can also be applied to transportation, as researchers have done in the CarLink study.

Social marketing begins with targeted customers. It focuses on understanding a target audience’s needs, wants, and perceptions and is directed at creating a “social” campaign or product (e.g., anti-smoking campaigns and carsharing) (Andreasen, 1995).

“Social marketing recognizes that influencing behavior—especially behavior change—cannot come about simply by promoting the benefits of some new course of action. Careful attention must be paid to the nature of the behavior to be promoted (the product), the ways in which it will be delivered (the place), and the costs that consumers perceive they will have to pay to undertake it (the price)” (Andreasen, 1995).

Other key features of social marketing include an emphasis on program cost effectiveness; the use of market research to design, pretest, and evaluate new programs; careful market segmentation; and a recognition of competition (e.g., traditional auto ownership and leasing are competition to carsharing).

Not surprisingly, social marketing builds upon other theoretical frameworks, including traditional education, persuasion, social influence, behavior modification, and social learning ap-

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proaches by focusing on target adopters. Social marketing integrates and improves upon those other approaches by addressing many of their weaknesses and focusing on target adopters. Indeed, “[i]t often attempts to educate. It does seek to motivate individuals to act. It does introduce group pressure when appropriate and it often employs modeling and rewards to ensure the longer term success of its programs” (Andreasen, 1995, p. 13).

Each of the building block frameworks for social marketing theory is reviewed below. The traditional education approach emphasizes teaching and learning. Further, it assumes that individuals will alter their behavior if they are educated on what needs to be done and how to implement it. Andreasen (1995) points out several problems with the educational approach. First, it assumes that if beliefs can be changed, then behavioral change will result as well. Social marketing does not make this assumption; rather it focuses on making a behavioral change occur and be sustained. Second, this approach ignores the effects of social pressure. In contrast, social marketing recognizes that many individuals engage in behaviors that they are not personally interested in or perhaps are even opposed to (e.g., teenagers smoking due to peer pressure). Third, it assumes that facts will have an intended impact. In many cases, however, a campaign may have contrary effects. For instance, a breast cancer campaign, which emphasized that women with family histories of cancer had a higher risk for this disease actually discouraged women without cancer histories from conducting breast self-examinations.

The persuasion approach builds upon the educational framework. This model holds that behavioral change will only occur when an individual is sufficiently motivated. The main problem with this approach is convincing individuals to adopt this worldview. In contrast, social marketing promotes a user-centered approach to behavioral change, which recognizes that a marketing campaign must begin with the customer’s perceptions, needs, and wants (Andreasen, 1995).

In the social influence approach, public campaigns focus their attention on influencing targeted community groups and collective behaviors. This framework addresses the cost concerns of the behavior modification approach; yet, it has a few limitations. For instance, this framework may be effective only in the following situations: 1) social issues and norms of the targeted group are well understood; 2) pressures within the group are influential; and 3) the behavior is socially important and visible (Andreasen, 1995). An example of an effective social influence campaign might be an anti-smoking or anti-drug campaign deployed in a secondary school.

The behavior modification framework is focused on two simple principles of learning theory: first, individuals execute behaviors because they have been learned; and second, these behaviors result in a positive outcome or reward. Until the early 1960s, a majority of psychological learning theory assumed that individuals had to execute behaviors and be rewarded to learn a new one. The main problem with this approach is that it is costly. It typically must be implemented on an individual level rather than to a targeted group of customers. “Social marketers recognize that, to have maximum social effectiveness in a world of very limited budgets, one must focus on changing groups of consumers—not individuals and not mass markets, but carefully selected segments” (Andreasen, 1995, p. 12).

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In the early 1960s, Bandura and Walters (1963) contributed to learning theory when they realized that children could learn new skills by simply watching other children. From this finding, Bandura developed the social learning theory approach described earlier (Bandura, 1977). Social marketing builds upon and employs several social learning theory principles. For instance, media (e.g., modeling videos and articles) can be used to stimulate learning by targeted groups, and modeling can help develop an individual's sense that they can perform a new behavior. Nevertheless, the social marketing approach generally prefers in-person training (e.g., drive clinics) to media devices, such as videos and brochures.

Behavioral Adoption Process

Similar to social learning theory, social marketing supports a gradual or dynamic approach to behavioral adoption of a new product, concept, or service. Individuals move through definable stages in adopting a new product (Maibach and Cotton, 1995). There are four stages in Andreasen's social marketing behavioral adoption process: 1) precontemplation, 2) contemplation, 3) action, and 4) maintenance.

Precontemplation is the first stage in the behavioral adoption process during which a target population is introduced to the social product as a possible alternative to their current behavior. The goal of this stage is to generate awareness and interest in the target group. The appropriate tools for this phase are education and media.

In the second phase, contemplation, individuals consider adopting a social product. Individuals first consider the impacts of adopting the social product (e.g., reduced congestion time from using CarLink). This evaluation includes an assessment of the benefits and costs of adoption. Next, they consider what others (e.g., a spouse) might want them to do with respect to the new product. "Behavior change does not take place in a social vacuum. The broader society and its cultural norms and values have important roles to play, as do individual co-workers, friends, and family...Others are almost always involved, playing several roles—providing information about the potential benefits and cost of taking action, serving as role models, and bringing direct pressure to act in the desired way" (Andreasen, 1995, p. 253).

Target users typically evaluate potential satisfaction with a social product on a small subset of attributes. These attributes are important for researchers to understand, particularly in planning product development, communication, and promotion (Kotler and Roberto, 1989). In this study, two household members were invited to participate due to the influence these individuals are likely to have on each other, particularly in response to the CarLink innovation. Then, they contemplate whether or not they can adopt a new behavior. Clearly, if they want to develop an effective marketing program, marketers must document potential influences, including competing alternatives, on the target market's decision to adopt a social product (Andreasen, 1995).

The third stage is action. During this phase, individuals decide whether they can actually produce the new behavior (e.g., join CarLink). Related to this decision, potential customers

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evaluate the role of the environment (e.g., location of the carsharing system) and other individuals (e.g., a husband or wife) in adopting the new product and/or behavior. In the CarLink market study, the longitudinal survey stopped before the beginning of the action stage. However, the subsequent CarLink field test permitted study participants (in applicable user environments) to join the program. Hence, researchers were able to document behavior during the action stage.

Finally, there is the maintenance phase. This is a key stage because marketers can help consumers conclude that adopting a social product was the right decision (i.e., cognitive dissonance or anxiety that the right choice was made). Marketers should pay close attention to rewards that follow from a new behavior. Essentially, individuals tend to repeat behaviors that are rewarding. “Here, many of the principles of learning theory are especially relevant. Individuals need to be rewarded for what they do—their behavior must be reinforced. Further, they need to be helped to resolve the cognitive dissonance they go through when they undertake something that they once were uncertain was a good idea. Social marketers must work effectively on both mechanisms if their programs are to have permanent influence” (Andreasen, 1995, p. 169).

Although case studies of social marketing have been widely documented (e.g., Fox and Kotler, 1980; Kotler and Roberto, 1989; Andreasen, 1995), there is a paucity of experimental research published on this topic. Researchers found few studies that incorporate experimental design methodologies to test the impacts of social marketing campaigns (Winett *et al.*, 1982; Aronson and O’Leary, 1982-1983; Winett *et al.*, 1983; Winett *et al.*, 1985; Lefebvre and Flora, 1988; Pechmann and Ratneshwar, 1993). Very few have been conducted since the mid-1980s. In addition, only a few of these studies actually looked at the social marketing stages of action and maintenance. Although the CarLink study does not provide a “full” social marketing framework evaluation either, it does contribute to this body of research by addressing Andreasen’s first two stages of behavioral change. Moreover, the CarLink field test has aided researchers in further exploring the third and fourth stages of this model.

LONGITUDINAL SURVEY RESULTS

In evaluating a new technology, it is critical to document the processes of response and preference formation (Kurani *et al.*, 1996). Since research into consumer responsiveness to innovations (especially those embodying new values and performance attributes) must be attentive to the evolution of these processes, researchers used a longitudinal approach to evaluate concept response.

The four-month longitudinal survey assessed dynamics in an individual’s learning and valuing response to CarLink over time. The survey consisted of four questionnaires: a baseline (or initial survey) and three identical questionnaires that followed each of the informational media. After the survey was completed, four focus groups were held with study participants in October 1998, to further gauge participant perceptions and overall response to the CarLink concept.

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From June to October 1998, researchers collected user evaluations of the CarLink system from individuals in the Bay Area to measure user acceptance of this new form of transportation and to learn how CarLink could affect the overall travel of households. Participating households, for both the longitudinal survey and field test, included four groups: current BART commuters, individuals who might use BART when carsharing becomes available, people who do not usually take transit but could take it to work, and people who live in neighborhoods with substantial BART ridership. These groups represent potential CarLink participants.

In the longitudinal survey, the final sample population consisted of 207 experimental participants (154 households) and 95 control group participants (58 households). A total of 488 individuals (i.e., both experimental and control) received the initial questionnaire. Throughout this study, there were 186 dropouts (58 did not return the first questionnaire, and 128 individuals dropped out after returning the second questionnaire). To assist in evaluation and interpretation, researchers conducted four focus groups, consisting of three experimental groups with a total of 28 participants and one control group session with nine participants.

Several ways to explain CarLink were used: an informational brochure; a video; and an interactive drive clinic with the Honda Civics, smart cards, and the COCOS smart key manager kiosk. An experimental and control group was recruited for the study to evaluate the informational media.

At the drive clinic, held in September 1998, participants used a smart card to access a CarLink vehicle, release the immobilizer, which blocks unauthorized users from starting the car, and took a test drive, accompanied by a researcher who documented their observations, questions, and concerns. The drive clinic offered participants a chance to see and try these new technologies, as well as to interact with study researchers. Each participant completed a 20-minute exit interview with a researcher on his or her response to the CarLink system and willingness to participate in such a service. At the end of the clinic, participants received a final questionnaire and travel diary to take home and complete over the next several days, giving them time to reflect on their observations from the clinic and to answer questions about CarLink within the context of their own travel.

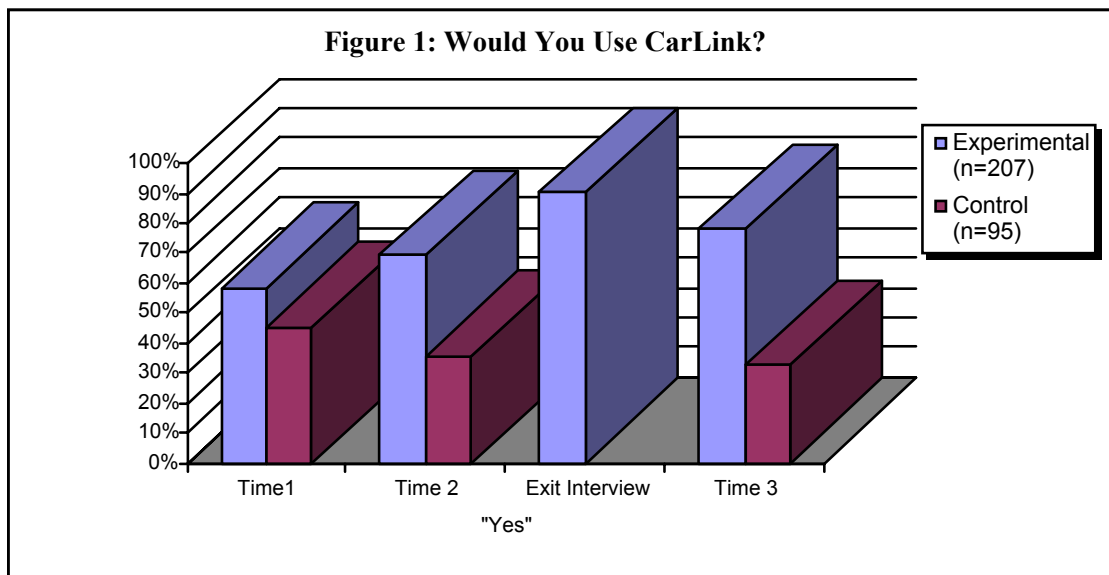
Dynamic Innovation Response Hypothesis Findings

To test and monitor participant response to the carsharing concept over time, researchers developed a question, administered in all three survey phases to measure this response. Essentially, "Do you think that you would use the CarLink system?" served as the dependent variable in the CarLink longitudinal survey. This paper presents the results to dynamic innovation response hypothesis and response/interest to participate in the CarLink field test. These data were used to create an early adopter profile.

In the first phase, researchers presented the carsharing concept in an informational brochure. Researchers asked respondents to review the brochure and complete a questionnaire. Approximately 58.2% of the experimental respondents said "Yes." It is interesting to note that

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45.3% of the control group individuals responded “Yes.” In the initial phase, a significant difference was found between the responses of the experimental and control groups ($\chi^2 = 5.38$, p -value = .002). See Figure 1 below.



In the second phase, researchers presented the carsharing concept in a modeling video, which explained and demonstrated how CarLink could work for two households. Researchers asked experimental participants to review the video and complete a questionnaire. Over 69% of the participants said “Yes.” In contrast, only 35.8% of control respondents said “Yes.” In this phase, a significant difference was found between the responses of the experimental and control group ($\chi^2 = 32.99$, p -value = .000).

These findings support the study hypothesis: experimental participants will become more positive to the concept in response to educational media, and the control’s response will become more negative or remain stable over time. In this study, the experimental group became more positive and the control more negative. The experimental group only showed an 11-percentage point increase between the first and second phases; in contrast, the control group revealed a 9.5 percentage point decrease between these two phases. Consequently, it appears that the video was an effective tool for increasing CarLink positive awareness. This stimulus may also have assisted many participants in moving from the precontemplation phase into the contemplation phase of the behavioral adoption process.

After attending the drive clinic, researchers again asked participants about CarLink use in an exit interview. Over 90% of the participants said “Yes.” The positive response change revealed during this phase is most significant. Indeed, there was a 21.2 percentage point increase in the “Yes” response category during the clinic. Since control group respondents did not participate in the clinic, there is no corresponding data for them.

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It appears that the drive clinic is an effective tool for increasing positive awareness of the CarLink concept. Nevertheless, this response appears to be overstated (i.e., the Social Desirability Effect). Indeed, there was a 12.5 percentage point decrease in the experimental group's response during the final questionnaire. In addition, this stimulus may have helped move many participants from precontemplation into the contemplation phase and, for some, into the "action" phase of the behavioral adoption process.

During the final phase, researchers asked experimental participants to reflect on the clinic and complete a questionnaire. Again, respondents were asked whether or not they thought they would use CarLink. Nearly 78% of the experimental group said "Yes," whereas only 32.6% of the control responded positively (i.e., a 3.2 percentage point decrease from the previous phase). As mentioned, however, there was a significant decrease in the experimental group's positive response in the final phase. This change in response supports this assessment of the social desirability effect, indicating an overstated response from the clinic. During this phase, a significant difference was found between the responses of the experimental and control group ($\chi^2 = 58.65$, $p\text{-value} = .000$).

The overall data gathered from the longitudinal survey supports the study hypothesis and validates the behavioral adoption process. The only exception to this hypothesis is the drop in positive responses between the drive clinic and final phase for the experimental group. In contrast, the control group behaved as predicted. Over time, the control group became less positive toward CarLink use. Researchers attribute this effect to the lack of educational media and feedback needed to move an individual through the behavioral adoption process described by social marketing theorists.

In summary, control group participants did not receive the information and feedback needed to move from precontemplation into the contemplation phase. In contrast, the experimental group received educational media throughout, which allowed them to assess the benefits and costs of CarLink for their lifestyle and fostered a positive response among many toward this transportation alternative. In fact, many indicated in their final questionnaire that they would be interested in joining the CarLink field test (i.e., 77.9% of the experimental group in contrast to 32.6% of the control).

CarLink Early Adopter Profile

In the final questionnaire, researchers also asked participants if they would be interested in joining the CarLink field test in the Dublin/Pleasanton region. The field test provides an opportunity for individuals who participated in the longitudinal survey to move from the contemplation phase of the behavioral adoption process into the "action" stage.

In the final phase of the longitudinal survey, 77.9% of experimental ($n=161$) and 32.6% of control respondents ($n=31$) said they would use the CarLink system. In contrast, only 53.6% of experimental ($n=111$) and 17.8% of control participants ($n=17$) indicated that they would be interested in participating in the CarLink field test. Not surprisingly, the number interested in joining the field test was lower than that reflected by this study's main dependent variable.

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After the survey was completed, researchers contacted individuals who indicated they were interested. If they had a match with one or more of the program groups, individuals were able to enroll in CarLink:

- Homeside Users, those who use Carlink vehicles to drive from home to the Dublin/Pleasanton BART station and then take transit to work.
- Workside Commuters, individuals who commute between BART and LLNL using a CarLink car.
- Day Users, individuals who work at LLNL and use a CarLink vehicle during the day.

If an individual did not have a match with one of these groups, researchers were unable to enroll them in the field test. Many interested did not meet the criteria for program participation (e.g., they do not work at LLNL) or were unable to join the program due to costs. Nevertheless, participants who expressed interest in joining the field test (i.e., 42% of total survey population) can provide an early profile of potential target adopters among the study sample.

Interestingly, no one from the control group was able to join the field test. Twenty-three percent of participants, who requested that we contact them about field test participation, became members. Ten percent of the total survey population actually joined the field test, and 15% of experimental participants joined. It is likely that these percentages (i.e., 10 to 15%) provide a more accurate picture of the initial target adopter rates, given program eligibility and cost requirements. Since the sample is comprised of individuals who agreed to participate in this treatment, self-selection permits reasonable generalization to the target population (i.e., individuals that live and work in the Dublin/Pleasanton region) (Singleton *et al.*, 1993).

Longitudinal survey participants comprise 59% of the field test population. An additional 20 individuals later joined the field test (i.e., they did not participate in the survey), primarily as Homeside Users and Workside Commuters. They represent the other 41% of the field test population.

I examined many of the sociodemographic and psychographic characteristics of the individuals (i.e., n=139) who expressed interest in the field test and those who joined the program. Researchers compiled these data to create an early target profile for the CarLink system in the East Bay. This profile is as follows:

- Approximately 50% of those interested in participating in the CarLink field test belong to two- to three-member households.
- An equal number of men and women expressed interested in CarLink participation during the longitudinal survey. In the actual field test, however, 60% of participants are male and 40% are female.

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- A majority of those interested in CarLink participation are married (i.e., approximately 70%).
- The majority of participants (i.e., approximately 90%) are between the ages of 24 to 64. About 56% percent are 24 to 40 years of age, and 39% are between 41 to 64.
- Approximately 60% of those interested in CarLink participation have a Bachelor's or Master's degree.
- Approximately 50% of those interested in CarLink participation live in a large- or medium-sized city. (A large city is greater than 250,000 individuals and a medium city is greater than 50,000, but less than 250,000 individuals.)
- The majority of the individuals interested in CarLink participation (i.e., approximately 60%) have a household income over \$50,000 per year.
- Approximately 20% of participants interested in the CarLink program are currently dissatisfied with their current transportation modes. This result is contrary to what researchers would have expected. Researchers thought more would be dissatisfied with their current modes.
- Approximately 60% of individuals interested in CarLink participation agree or strongly agree that vehicle maintenance is a hassle.
- As expected, 20% of the participants interested in the CarLink program strongly agree or agree that vehicles are enjoyable.
- Approximately 60% of those interested in the CarLink program strongly agree or agree that congestion is a serious problem.
- Approximately 50% of those interested in CarLink participation agree or strongly agree that the environment is a concern.
- Approximately 80% of those interested in CarLink participation agree or strongly agree that they like to experiment with new ways of doing things.

It is interesting to note that many of the above profile characteristics are comparable to those of early carsharing adopters in Europe. Differences are reflected in the areas of gender, income, and land use. In Europe, there are more male participants than women. The overall profile results indicate an equal interest among men and women. However, in the CarLink field test this same relationship holds. It will be interesting to observe U.S. carsharing organizations over time to determine whether or not this initial trend, found in the CarLink field test, continues.

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CONCLUSION

The purpose of the CarLink longitudinal survey and field test is to develop an understanding of the processes by which travelers can and might accept or adapt to a transportation innovation. An informational brochure, video, and drive clinic explaining the CarLink system were developed and examined for the survey.

In the final-phase questionnaire, researchers asked participants if they would be interested in participating in a field test of CarLink in the Dublin/Pleasanton area. The field test provides an opportunity for individuals who participated in the longitudinal survey to move from contemplating adoption to real “action.” Furthermore, this question allowed researchers to contrast these results to those of the study’s main dependent variable, i.e., “Do you think that you would use CarLink?”

In the final phase of the longitudinal survey, 77.9% of experimental and 32.6% of control respondents said they would use the CarLink system. In contrast, only 53.6% of experimental and 17.8% of control participants indicated in the final questionnaire that they would be interested in participating in the CarLink field test. Not surprisingly, the number joining the field test is lower than that indicated by the main dependent variable in this study and field test interest. It is likely that the final percentages provide a more accurate picture of the initial adopter rates that might be expected from a targeted market segment, similar to this study (i.e., ranging between approximately 10 to 15%, depending upon the amount of informational exposure).

After the survey was completed, researchers contacted individuals who indicated they would be interested in CarLink field test participation. Individuals were able to enroll in CarLink, if they had a match with one or more of the program requirements, including:

- Homeside Use, those who could use the Dublin/Pleasanton BART Station to commute to work;
- Workside Commuter Use, individuals who work at LLNL and could commute via BART; and
- Day Use, those who work at LLNL.

If an individual did not have a match with one of these user groups, researchers were unable to enroll them in the field test. Consequently, the target market cannot be accurately assessed by the actual number of participants who joined the CarLink field test. Unfortunately, a majority of interested participants did not meet the criteria for program participation. Nevertheless, the number of participants who expressed interest in joining the field test can provide an estimate of early adopter potential for the targeted market segments included in this study.

Interestingly, no one from the control group joined the field test. Twenty-eight percent of experimental respondents who requested to be contacted about field test participation actually

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became members (or 15% of the total experimental population). These individuals (i.e., from the longitudinal survey) represent 59.6% of the field test population. Twenty additional individuals joined the field test (i.e., not from the survey), primarily in the Homeside User and Workside Commuter group categories. The next phase of the CarLink study includes an evaluation of the field test, participant usage patterns over time, and feedback from members on how to improve the program.

Next, researchers developed a CarLink early adopter profile. It is interesting to note that many of the above profile characteristics are comparable to those of early carsharing adopters in Europe. Differences are reflected in the areas of gender, income, and land use. In Europe, there are more male participants than women. The overall profile results indicate an equal interest among men and women. However, in the CarLink field test this same relationship holds. It will be interesting to observe U.S. carsharing organizations over time to determine whether or not this initial trend, found in the CarLink field test, continues.

Second, in Europe, participants tend to have lower incomes, which is typically explained by the lower average age of carsharing members. In this study, a majority of the households earn over \$50,000 a year. This difference can be explained by the region of California in which the study is conducted, as well as the interest of older individuals. Another difference is related to land use. In Europe, carsharing is primarily an urban phenomenon. In this study, CarLink was tested in a medium to large-size city. This model was established to support “reverse” commute travel patterns. Hence, it is difficult to contrast community patterns in this study to those common in Europe.

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