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**PROMOTING RIDE SHARING: THE EFFECT
OF INFORMATION ON KNOWLEDGE
STRUCTURE AND BEHAVIOR**

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**Prepared for
U. S. Environmental Protection Agency
Office of Mobile Sources
2565 Plymouth Road
Ann Arbor, MI 48105**

**UNIVERSITY OF MICHIGAN
SCHOOL OF NATURAL RESOURCES AND ENVIRONMENT**

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TABLE OF CONTENTS

I. INTRODUCTION	1
FOCUS OF THE STUDY	3
PURPOSE OF THE STUDY.....	4
HYPOTHESES	5
II. LITERATURE REVIEW	7
FINANCIAL-BASED STRATEGIES FOR ENCOURAGING ALTERNATIVE MODES OF TRANSPORTATION.....	8
Financial Incentives	8
Financial Disincentives	11
INFORMATION-BASED STRATEGIES FOR ENCOURAGING ALTERNATIVE MODES OF TRANSPORTATION.....	12
Antecedent Information.....	12
Feedback	13
Direct Experience	14
OTHER STRATEGIES FOR ENCOURAGING ALTERNATIVE MODES OF TRANSPORTATION.....	14
Ride Matching and Coordination	14
Guaranteed Ride Home	16
Corporate Support	16
Improved Facilities	17
RELEVANT PSYCHOLOGICAL RESEARCH	17
Attitudinal Factors.....	17
Cognitive Issues.....	18
SUMMARY AND CONCLUSIONS	19
III. THEORETICAL OVERVIEW	22
DECISION MAKING - THE ROLE OF KNOWLEDGE	22
Acquiring Information.....	24
COGNITIVE STRUCTURE - A THEORETICAL OVERVIEW.....	26
A More Detailed Analysis of Cognitive Structure	27
Cognitive Biases in Knowledge Acquisition.....	28
Information Selection Through Attention.....	29
Indirect Attention and Knowledge Acquisition	31
TOWARDS EFFECTIVE COMMUNICATION.....	36
Communicating Through Story.....	38
SUMMARY.....	39

IV. METHODS	41
STUDY AREAS	42
SITE COORDINATORS	43
STUDY SAMPLE.....	43
INTERVENTION.....	44
Story-based information sheets.....	46
Factual-based information sheets.....	47
SURVEYS.....	47
Pre-intervention survey.....	47
Opinion Sheets	48
Post-intervention survey	49
Follow-up survey.....	49
SURVEY ANALYSIS	49
COGNITIVE MAPPING	50
Application of the modified F-sort	52
COGNITIVE MAPPING ANALYSIS	53
V. RESULTS.....	55
PRE-INTERVENTION SURVEY.....	55
OPINION SHEETS	60
POST-INTERVENTION SURVEY	60
Effects of intervention on survey data	64
FOLLOW-UP SURVEY.....	69
CHANGES IN VARIABLES ACROSS SURVEYS.....	70
COGNITIVE MAPPING TASK.....	71
Latent Partition Analysis	72
Analysis of category content.....	75
VI. DISCUSSION.....	79
QUANTITATIVE DIFFERENCES IN KNOWLEDGE STRUCTURE.....	80
QUALITATIVE DIFFERENCES IN KNOWLEDGE STRUCTURE	82
CONCLUSIONS.....	85
VII. CONCLUSIONS AND IMPLICATIONS.....	86
THEORETICAL IMPLICATIONS.....	86
PRACTICAL IMPLICATIONS	88
REFERENCES CITED.....	90

FIGURES AND TABLES

Figure 4.1	Study Design.....	41
Table 4.1	Number of survey respondents by site	45
Table 5.1	Pre-Intervention Survey Scales.....	56
Table 5.2	Additional pre-intervention survey variables used in analysis.....	57
Table 5.3	Differences in mean age by treatment group	58
Table 5.4	Results of Tukey HSD showing significant differences among sites	59
Table 5.5	Differences in overall interestingness and overall informativeness by treatment .	60
Table 5.6	Post-intervention survey knowledge scale	62
Table 5.7	Additional post-intervention survey variables used in analysis	63
Table 5.8	Significant differences in post-intervention knowledge variables by treatment ...	65
Table 5.9	Significant differences in knowledge variables by rigidity.....	67
Table 5.10	Significant differences in knowledge variables by amount of prior information ..	67
Table 5.11	Significant differences in knowledge variables by overall interestingness	68
Table 5.12	Significant differences in knowledge variables by overall informativeness.....	68
Table 5.13	Changes in attitude about transportation across surveys	71
Table 5.14	Modified F-sort data by treatment group	72
Table 5.15	Latent Partition Analysis on modified F-sort by treatment group	74
Table 5.16	General Categories in modified F-sort and frequency of use.....	78

I. INTRODUCTION

Despite continuing technological improvements in vehicle emission control systems, transportation sources are still a very significant cause of air pollution in the United States. On a national level, vehicle emissions account for 30% to 40% of nitrogen oxides and hydrocarbons, pollutants which react in the atmosphere to form ground-level ozone (a component of "smog") (EPA, 1991). They are responsible for about 70% of carbon monoxide emissions (EPA, 1991). In cities, the relative contribution is often much higher. Transportation sources emit about 30% of U. S. carbon dioxide (a "greenhouse gas") (Clinton and Gore, 1993). And vehicle air toxics cause more than half the cancers attributable to outdoor sources of air pollution. (EPA, 1993).

The regulatory framework for vehicle emission control in the United States is very stringent and highly effective. However, pollution remains an issue due to several factors, including cars that for various reasons do not stay clean in actual use. Sources of emissions which have not yet been controlled through regulation (such as high-pollution driving modes that are not currently measured during emission tests) also contribute to the problem. Most significant, however, has been the growth in vehicle travel (Schreffler and Kuzmyak, 1991; EPA, 1992).

Travel growth is doubling every 20 years, outpacing population growth in the United States. Still, overall vehicle emissions of the traditional pollutants are lower than they were in 1970 because of the tremendous technological progress in emission control systems over the last 20 years (EPA, 1992). It will be much more difficult and costly to achieve the next "order of magnitude" reduction. The continued growth in vehicle travel will eventually outpace improved technology and emissions will begin to climb. The upturn is projected to begin by about 2010 in most parts of the country, and as early as 1998 in some high-growth areas (EPA, 1992).

With vehicle use continuing to increase, it is clear that technological advances alone will not solve our air pollution problems in the foreseeable future. The 1990 Clean Air Act recognizes the role of travel management in the quest for attainment of healthy air, and attempts to mitigate

the more-cars-more-miles trend through a variety of programs. Travel-related provisions of the Act include an Employee Commute Options (ECO) program, which focuses on work-related commuting. The program requires employers of 100 or more in cities with very high ozone levels to encourage the use of alternatives to solo commuting among their employees. Employers have considerable flexibility to provide incentives and/or disincentives to switch from single occupancy vehicles to alternative modes of transportation that include transit, carpools, vanpools, telecommuting, walking, and bicycling (EPA, 1992).

The success of ECO programs will revolve around employee willingness to change travel behavior. While extensive research has been done on specific transportation control measures to reduce work-related vehicle trips (e.g., carpool, public transit, bicycle racks) and while numerous trip reduction campaigns have been undertaken, the transportation community has been frustrated by consistently disappointing results (U.S. DoT, 1990; Owens, 1981). Few of these programs, however, have been analyzed to examine what factors are most important in contributing to a change in employee behavior.

A source of new ideas can be found in the emerging field of Conservation Behavior. There is a growing body of literature that explores how and why people change their behavior to protect the environment. Studies of behaviors such as source reduction, recycling, energy use, and water conservation have shown that certain types of messages clearly work better than others to stimulate lasting change.

Contrary to popular belief, it appears that strong incentives and disincentives may be less motivating over time than might be expected. These techniques require constant monitoring and steadily stronger "rewards" or "punishments" to maintain initial levels of compliance. They also can result in undesirable negative reactions in individuals, causing them, for example, to increase their non-work automobile usage or to creatively circumvent the intent of an ECO program. On the other hand, messages that engage interest on the intellectual level may hold surprising power to bring about behavior change. This study is one of the first to explore whether findings from previous work also apply to transportation behavior.

It will be extremely difficult to bring about large-scale changes in the area of personal transportation behavior. Our society both relies on and subsidizes solo driving. For a great many employees, driving to work alone is simply too convenient, comfortable, and cost-effective to consider alternative transportation modes. For others, there are not alternatives. Any tool that can help overcome barriers to behavior change deserves thorough investigation. Regardless of which package of incentives, disincentives, or other motivational techniques employers choose in structuring their ECO programs, a key common element will involve providing information to employees. This study looks at one method of providing information and its impact on personal transportation decisions.

FOCUS OF THE STUDY

A descriptive model of human decision making has been proposed by Kaplan (1991) and is based on what is known about human cognition, human behavior, and human evolution. While this model recognizes that economic incentives are one factor in the decision making process, emphasis is also placed on the role knowledge plays in the decision making process. Support for this position is derived from numerous other studies pointing to the importance of knowledge and the impact of a lack of knowledge when making decisions (e.g., De Young, 1988-1989; Wiegel and Amsterdam, 1976). It is hypothesized that this knowledge-based model will prove useful for the examination of individual decision making with regard to employee travel behavior.

Because the presence or absence of knowledge is closely linked to individual decision making, it may seem that affecting decisions is a simple matter of transferring knowledge. However, the acquisition of knowledge can be problematic. Learning is very selective and is strongly biased towards certain informational characteristics. Unfortunately, designing informational campaigns that take advantage of these biases has not generally been a priority. Most programs promoting energy conservation have relied on information campaigns which, while factual, are dull and uninteresting (Stern and Aronson, 1984). Information presented in this

uninteresting format is unlikely to be internalized. Lack of such internalization may contribute to the failure of individuals to adopt many technically and economically feasible programs.

The use of case-studies or narratives (or "stories" as they will be referred to in this report) which provide interesting, vivid, concrete, and personalized information has been suggested as an effective way to transfer information (Monroe and Kaplan, 1988). The characteristics of a good story (e.g., coherence, vivid and concrete detail, a sense of mystery) readily encourage a depth of cognitive processing which makes it likely that the information will be used when making future decisions. Stories have great potential for educating people about phenomena which cannot be directly experienced and for offering behavioral solutions to environmental problems.

PURPOSE OF THE STUDY

This study will use Kaplan's (1991) knowledge-based decision making model to explore the impact of knowledge on attitudes and intended behavior towards carpooling. The model predicts that the knowledge an individual has about a particular subject has a significant effect on their decisions. In general, people with little or no knowledge about a behavior (or the consequences of a behavior) will tend to avoid that behavior. People with a well developed knowledge structure about a particular behavior will feel more confident in their ability to carry out the behavior and will thus be more likely to engage in that behavior. This assumption is supported by empirical studies on the differences between solo drivers and individuals who use alternative transportation (e.g., public transit, carpools). These studies (covered in the Literature Review Section) suggest that a possible reason why drivers will not switch to alternative modes of transportation is because they lack information on how to switch and how to deal with problems which may be encountered while using an alternative mode.

Another purpose of the study is to compare two different information campaigns on their effectiveness in imparting knowledge about carpooling to the study participants. Studies (covered in the Literature Review Section) show that pallid, relatively abstract information (e.g., factsheet,

factual brochures) is not very effective at transferring information. In contrast, using stories to transfer information may be very effective. In this study, a story-based information campaign will be compared to a factual-based information campaign. Both of the groups receiving the information campaigns will be compared to a control group.

Carpooling was chosen as the target behavior because it traditionally has a low level of adoption and because of its wide applicability (e.g., as compared to public transit). Carpooling has been shown to be an effective means of reducing employee vehicle trips, thereby reducing vehicle emissions generated during the commute (EPA, 1991).

HYPOTHESES

1. The knowledge structures of the group receiving the story-based information will differ *qualitatively* from the knowledge structures of the other two groups (as measured by an F-sort and latent partition analysis).
2. The knowledge structures of the group receiving the story-based information campaign will differ *quantitatively* from the knowledge structures of the other two groups (as measured by the post-intervention survey). Specifically, the group receiving the story-based information campaign:
 - a. will feel they have more knowledge about carpooling;
 - b. will be more confident in their ability to address carpooling problems; and,
 - c. will feel better able to use their knowledge about carpooling (i.e., will be more "comfortable" with their knowledge).
3. General environmental attitudes will not substantially change in any of the three study groups.

4. Participants who receive the story-based intervention will be more likely to indicate a willingness to begin to carpool following the intervention than participants in either the factsheet-based intervention group or the control group.

II. LITERATURE REVIEW

Policies designed to promote alternative modes of transportation (e.g., bus, carpool) have traditionally been based on the idea that people will change their behavior only if offered an external reward or if coerced into doing so (see Wachs, 1991 for a review of this position). These policies are often based on financial incentives and disincentives (e.g., fines, rebates, and tax credits). While there is considerable evidence (Winett, 1978) to show these methods work in the short term, lasting behavior change over time is less clear. Most of the effects are limited and terminate once the external incentive is removed (Cook and Berrenberg, 1981). In fact, these methods may act to inhibit a lasting and generalized change in conservation behavior (Stern and Kirkpatrick, 1977). When a behavior change in one area (e.g., commuting) causes a change in behavior in another area (e.g., non-work related travel) it is referred to as a generalized change in conservation behavior. More recently, attention has been paid to the social and psychological processes involved in behavior change. Programs which are based on neither financial reward nor coercion have been investigated.

An overview of research that explores methods of encouraging the use of alternative modes of transportation follows. Both financial-based techniques and other strategies are discussed. This is not intended to be an exhaustive review of the literature, however, it is representative of the work that has been done. It is important to note that these studies look at specific transportation situations and may not have broad applicability. For example, studies of students using campus buses may have little relevance with regard to the adult working public. In light of the purpose of the current study, special attention is paid to research focusing on information-based strategies. A special section on other relevant psychological research is included as well.

FINANCIAL-BASED STRATEGIES FOR ENCOURAGING ALTERNATIVE MODES OF TRANSPORTATION

Financial Incentives

Most systematic research done on the promotion of alternative modes of transportation has focused on public transportation. Specifically, the focus has been on various bus fare manipulations, including token reinforcements, variable-ratio reinforcement, and free bus service; for the employer, this usually translates into public transportation subsidies. Everett and his colleagues have undertaken a series of studies exploring the effect of various forms of monetary reinforcement on bus ridership. The first study (Everett, 1973) employed both prompting and positive reinforcement to encourage bus ridership. The study was conducted on campus buses. Throughout the experiment riders paid the regular ten cent fare. During the intervention period, all riders on one of the campus buses were thanked for riding the bus and handed twenty-five cents. This did result in an increase in ridership over baseline rates; however, the procedure was not very cost-effective and it is not known if the contingencies attracted individuals who normally rode another bus or walked.

In an attempt to reduce the costs of reinforcing bus ridership, Everett (1974) introduced a token reinforcement procedure. Tokens were redeemable at specified businesses for a variety of items or could be used in the place of bus fare. The procedure increased ridership over baseline. In a follow-up study (Deslauriers and Everett, 1977) an intermittent schedule of token reinforcement was employed during which every third passenger, on average, received a token. There was no difference between the effectiveness of this intermittent reinforcement and the effectiveness of continuous reinforcement; both led to a similar increase in bus ridership over baseline. This suggests that intermittent token reinforcement may provide an economically viable approach to increasing bus ridership.

The major problem with the Everett *et al.* studies, is that, in general, passengers would have walked if they had not bussed; the campus setting may thus have been inadequate for testing

the effects of financial incentives on bus ridership. In answer to this problem, Bachman and Katzev (1982) extended the findings of Everett *et al.* to a large urban mass transit system. In their study, 83 non-bus riders were recruited and randomly assigned to one of four treatment groups: 1) a control group where bus route and schedule information was provided; 2) a commitment condition where subjects were asked to agree to ride the bus two times per week for four weeks; 3) a group in which subjects were given unlimited free tickets; and, 4) commitment plus free tickets. During the four week treatment period, only one person in the control group ever boarded a bus. All of the other treatment groups showed levels of ridership which were significantly higher than baseline levels. Interestingly, no systematic differences were found between the treatment groups, suggesting that while free tickets may increase bus ridership, so might other, non-financial strategies (e.g., commitment).

Katzev and Bachman (1982) followed their earlier study with a comparison of the effectiveness of various economic incentives. Subjects were randomly assigned to five groups: 1) a control; 2) a credit only group where subjects were allowed to board the bus at any time and be billed in full at a later date; 3) a credit plus inverted fare group where subjects were billed at a later date at half price if they rode the bus frequently; 4) a credit plus differential fare group where subjects were billed later at half price for all off-peak hours; and, 5) a group which received free tickets for use at any time. Results indicate that credit alone and credit plus off-peak reductions did not significantly increase ridership. Reduced fares for frequent riding and free tickets both led to a small but significant increase in ridership. In general, it was found that while selective economic incentives can facilitate ridership, the changes were small and were not sustained when incentives were removed. It is also important to note that although bus ridership increased, study participants did not correspondingly reduce the number of miles they drove their cars. In effect, they were riding the bus *in addition to* the car travel they were doing prior to the study.

Token reinforcement has also been applied to encourage carpooling. Jacobs *et al.* (1982) combined the effects of a token economy and reserved parking as a means of increasing carpooling among students at a university campus. Spaces in two lots were reserved for carpools

and carpoolers were given tokens redeemable for merchandise at participating stores. After the initial treatment period, the tokens were no longer distributed while the reserved parking remained in effect. Results indicate that the tokens and reserved parking together were effective in promoting carpooling. It is interesting to note that the rate of carpooling remained stable after the removal of the tokens; this indicates that while tokens may have been an effective element in encouraging initial carpooling, preferential parking on its own was enough to sustain carpooling behavior.

Financial contingencies have been extensively used by employers promoting ride reduction. Many of these strategies have been quite effective at encouraging behavior change. In a survey of 1110 employer sites, it was found that all mode-specific financial incentives (e.g., incentives for public transportation, carpooling, vanpooling, walking, biking) were significantly related to an increase in average vehicle ridership (Giuliano *et al.*, 1992). Another evaluation of transportation demand management programs concluded that those programs with the greatest impact (reducing trips by over 30%) all provided incentives and disincentives to affect employee travel behavior (these largely included financial contingencies such as commuter subsidies and parking fees but also included non-financial contingencies such as preferential parking) (U.S. DoT, 1990).

It is difficult to determine the relative effectiveness of individual economic incentives from these case studies, as most employers use a combination of incentives. For example, CH2M Hill, an architectural/engineering firm in Bellevue, Washington, was able to decrease the number of employees commuting by single occupancy vehicle from 89% to 54% through a combination of restricted parking, transportation allowances, and subsidies for transit and ride share options (e.g., carpool, vanpool) (U.S. DoT, 1990).

Though economic incentives have perhaps received the most attention in research on changing travel behavior, the problem of durability has uniformly plagued studies on this theme (e.g., Deslauriers and Everett, 1977; Everett *et al.*, 1974; Foxx and Hake, 1977; Hake and Foxx,

1978). Thus, a situation is created where constant economic reinforcement is necessary to maintain the target behavior.

Financial Disincentives

Financial disincentives may be more effective than financial incentives at changing travel behavior, at least when imposed as a parking fee. Studies show that, generally, changes in transit fares have had less impact on transportation behavior than has the imposition of parking fees (typically between \$30-40 per month) (Wachs, 1991). It has been noted that having to pay for parking is a highly ranked motivation to switch to alternative modes of transportation (Angell and Ercolano, 1991).

Parking management strategies are the most common form of employer-based disincentives and can include: charging for employee parking; reduced or free parking for carpools and vanpools; limited supply of parking for single occupancy vehicles; and preferential or closer parking for carpools and vanpools. The success of these strategies appears to depend largely on the relative disincentive they produce and the extent to which travel alternatives are available (Sierra Research, Inc., 1990).

Several studies illustrate the effectiveness of financial disincentives in the form of parking fees. In a study of six large medical institutions in San Francisco, CA, a monthly charge for on-site parking was found to be the single most influential factor for determining the percentage of employees that drive alone to work. This factor alone accounted for 80% of the variability in commute modes (Dowling *et al.*, 1991). A corporation in Southern California ended employer-paid parking for single occupancy vehicles and found a large increase (from 17 to 58 %) in the number of employees carpooling. Carpoolers were recruited both from solo drivers and from employees who used the bus (Surber *et al.*, 1984). A survey of large firms in Southern California indicates that when free parking for all employees is the norm, financial incentives to ride share were not associated with an increase in ride sharing (Ferguson, 1990).

Despite the reported effectiveness of parking fees illustrated in these data, parking fees may not be a fail-safe method of promoting ride reduction. One study of suburban commuters found that the disincentive of high parking costs was not sufficient to attract riders to standard transit services. However, enhanced service (e.g., guaranteed seating) did provide an incentive for transit use even when the disincentives were comparably low (Flannelly and McLeod, 1991).

Another concern which has received little attention is that financial disincentives may cause employees to find creative ways to avoid the imposed penalties. For example, analysis of a transportation management program at USWest, which used limited parking and parking fees as disincentives for driving alone, showed that, while the number of carpoolers increased, many of the employees who began carpooling were driving to meet their carpool at a park and ride lot within one mile of the work site (U.S. DoT, 1990). In cases such as this, the mode of transportation in which people arrive at work (e.g., carpool) is not indicative of a change in travel behavior, which is the intent of an Employee Commute Options program. It seems that other, non-financial, factors need to be considered.

INFORMATION-BASED STRATEGIES FOR ENCOURAGING ALTERNATIVE MODES OF TRANSPORTATION

Antecedent Information

Data on the effectiveness of information campaigns on promoting changes in commuting travel behavior points to no clear conclusions. A survey of 1110 employee sites found that information programs (e.g., commuter information centers, commuter fairs, new-hire orientation) were not significantly associated with an increase in average vehicle ridership (Giuliano *et al.*, 1992). However, a study of the Yorkshire car-sharing scheme, which was implemented at four different sites, found that the rate of application to the program tended to increase with the intensity of the publicity campaign at each site (Bonsall *et al.*, 1984).

One factor influencing the success of information campaigns may be the extent to which the information is personalized. Information campaigns concentrating on abstract or impersonal issues, such as social and environmental responsibility and problems related to the usage of automobiles, have generally been ineffective (Nelson, 1981). The mass media efforts during the fuel crisis in the mid-seventies which were directed towards changing individual commuting behavior, tended to focus on a broad set of shared goals for society (e.g., patriotism, social responsibility, saving fuel, money). While the public did reduce vehicle miles traveled during the period when gas prices were high and began to demand and purchase more fuel efficient vehicles, there was not a significant move toward use of alternative modes of travel. It is possible, however, that pleas to adopt alternate modes of travel did increase public awareness of the problem.

An intensive analysis of various transit information techniques in the 1970s concluded "... it was demonstrated that the information function does not appear to be a sensitive variable and, therefore, will not influence people or change their attitudes one way or another toward utilizing public transit" (Rosenbloom, 1982, p.161). Other studies, however, conclude that information and education efforts have been significantly under-utilized and have great potential for changing attitudes and behavior regarding the use of alternative modes of transportation (U.S. DoT, 1978). Further research is needed to explore which specific types of information and styles of presentation are most effective.

Feedback

The use of feedback has been successfully employed to change travel behavior among individuals (Reichel and Geller, 1981). A study done by Hake and Foxx (1978) looked at the reduction of the number of miles driven by commuting college students. Three groups were compared: 1) a control group; 2) a group which received monetary reinforcement for reducing the number of miles driven; and, 3) a group which received monetary awards only for keeping track of the number of miles driven, regardless of whether or not the miles were reduced. This last

group essentially received feedback based on the number of miles traveled with no initial instructions to decrease their mileage. It is interesting to note that an average 10.4% reduction was found among this self-recording group (compared to a 22.5% reduction in the reinforcement condition) indicating that mileage reduction may be as much a result of feedback as of financial incentives. Caution must be used in interpreting these results, however, as the sample size was very small. A later study (Reichel and Geller, 1981) successfully employed public feedback and a contest to reduce vehicle miles traveled in an organizational setting.

Direct Experience

There is some indication that information gained through direct experience can be very effective at changing behavior (Fazio and Zanna, 1981). Some companies have encouraged direct experience as a means of allowing employees to get acquainted with alternative transportation modes. These include the Guest Pass Program in Connecticut and the loaner bike program of Fleetwood Enterprises, Inc. in California which allows employees to test out bicycle commuting without investing in bicycles (Winslow, 1991; Malaspina *et al.*, 1992). "Bike to Work" or "No-Drive" days or weeks are other means by which direct experience with alternative modes can be encouraged.

Direct experience, however, is not always possible. Though substitutes for direct experience have been explored in other environmental domains and are promising strategies for behavior change (Monroe, 1991; Monroe and Kaplan, 1988), no research on this topic in relation to transportation control measures is known to exist.

OTHER STRATEGIES FOR ENCOURAGING ALTERNATIVE MODES OF TRANSPORTATION

Ride Matching and Coordination

The effectiveness of ride matching programs contradicts the notion that explicit incentives or disincentives are the only means by which employees can be induced to change their travel

behavior (Reichel and Geller, 1981). One study of companies in Southern California found that ride matching services were more important than direct incentives for inducing people to ride share (Margolin *et al.*, 1978). Studies are needed to determine whether this is still true.

An evaluation of the National Ridesharing Demonstration Program (NRDP), which was established by the Department of Transportation in 1979, showed that contact with a ride share program was strongly associated with an increase in employee ride sharing (Booth and Waksman, 1985). However, not all matching strategies are equally effective. The two most common programs offered, locator lists (usually mounted in a lobby or some other common area) and computerized match systems, have been found to have the least appeal. Interest in being contacted by a carpooler or having the help of a coordinator is generally greater than the interest in either locator lists or computerized matches (Margolin and Misch, 1979; Margolin *et al.*, 1978). It is not known whether or not these preferences have changed along with recent improvements in computer technology.

Personalized ride matching assistance has had a profound effect in increasing the success rates of programs across the country (Hershey and Hekimian, 1983; Ferguson, 1990). The Share-A-Ride program in Silver Spring, Maryland, has successfully used a personalized approach to ride share matching to overcome the traditional barriers to ride sharing. The program humanizes the ride share assistance process by making use of personalized marketing, matching, and follow-up contact (Hekimian and Hershey, 1981).

The role of an on-site coordinator has also been shown to have a positive effect on the number of employees participating in ride share programs. By way of example, a carpool coordinator demonstration project undertaken by the New York State Department of Transportation in 1979, showed that carpool coordinator activities produced a positive shift in both employee attitudes toward carpooling, and the proportion of employees who participated in carpools (Brunso and Hartgen, 1981). Typical activities carried out by ride share coordinators include disseminating information about the program, providing carpool matching, and answering employee inquiries.

Guaranteed Ride Home

In the survey of 1110 employee sites mentioned earlier, a guaranteed ride home program was found to be associated with a significant increase in average vehicle ridership (Giuliano *et al.*, 1992). These programs address one of the often expressed concerns with switching from solo driving to an alternative transportation mode by assuring employees that their transportation needs will be taken care of during an emergency (e.g., in case of personal illness or illness of a child) (Kadesh and Elder, 1989). Programs may compensate employees either partially or fully for the cost of a taxi fare, or company vehicles may be made available for employee use. Guaranteed ride home programs are typically inexpensive to operate (Winslow, 1991; Kadesh and Elder, 1989).

Corporate Support

Management commitment to alternative transportation modes and ride reduction programs can be a strong positive motivation in encouraging employees to change their travel behavior (Malaspina *et al.*, 1992; Angell and Ercolano, 1991; Giuliano *et al.*, 1992). A comparison of two very similar companies, both of which had virtually identical incentives for alternative transportation shows the power of corporate support. The company which was much more active in terms of corporate backing and promotion had twice as many employees participate in ride share programs and 30% more employees commute by public transportation as did the second company, where there was little corporate support (U.S. DoT, 1990).

A study on motivating commuting college students to reduce the number of miles they drove found that the presence of a leader was significantly related to a decrease in driving (Hake and Foxx, 1978). Though further study is warranted before clear conclusions can be drawn, these findings suggest that supervisors, managers, and foremen in organizational settings should be incorporated into ride reduction programs in order to motivate individual participation. Again, these data suggest that personal attention is a strong motivating force.

Improved Facilities

Improved facilities can reduce some of the barriers associated with alternative transportation modes and thus increase travel by those modes. This is especially true of non-traditional modes such as biking or walking. Fleetwood Enterprises, Inc. in California was able to increase the percentage of employees who regularly commute by bicycle from virtually 0% to 12% by installing on-site lockers and showers and by providing loaner bikes and a pick-up service for accidents or flats (Malaspina *et al.*, 1992).

Preferential parking can also be viewed as an improvement in the facilities available to ride share users. While it is not clear whether preferential parking alone is sufficient to encourage ride sharing initially, it does seem to be a significant factor in motivating people to continue to ride share once they have begun (Jacobs *et al.*, 1982).

RELEVANT PSYCHOLOGICAL RESEARCH

Attitudinal Factors

While perceived commuting costs and travel time are two important factors in commuting behavior, they are far from the only factors. Personal, psychological, and social issues, such as perceived constraints on independence and requirements of semi-public behavior, also play a large role in the decision making process regarding commuter mode choice (Oppenheim, 1979).

To identify some of the other factors affecting modal choice, it is useful to look at the attitudinal differences between solo drivers and individuals using transit or ride share (e.g., car or van pools). In general, people who drive alone view transit and ride share options as less convenient, less reliable, less pleasurable, and less comfortable than do commuters who use these options (Horowitz and Sheth, 1978; Oppenheim, 1979). The attitudes of the two groups generally do not differ significantly with regard to the social benefits and problems associated with mode choice (e.g., air pollution, traffic congestion, energy use, noise levels, transportation system

degradation) (Horowitz and Sheth, 1978; Oppenheim, 1979). This suggests that strategies based on appeals to civic-mindedness are likely to be ineffective at altering travel behavior, while strategies addressing concerns such as convenience and reliability may be more effective.

Positive motivations for changing travel behavior include: reducing the stress related to driving, reducing safety risks, and providing the opportunity for socializing (Angell and Ercolano, 1991, Margolin *et al.*, 1978). However, in general, solo drivers tend to be more concerned with the possible drawbacks to alternatives than they are with its benefits (Margolin and Misch, 1979; Angell and Ercolano, 1991). This is in concurrence with studies done on the decision making process which find that people generally will act more strongly to avoid something perceived as negative than they will to accrue some desirable benefit (Stern and Aronson, 1984; Yates and Aronson, 1983; Tversky and Kahneman, 1982a). This has implications for the framing of transit and ride share promotion efforts; it may be more effective to frame the advantages associated with transit and ride share use in terms of avoiding the personal negatives associated with driving alone (e.g., highlight the stress associated with solo driving, offer transportation choices as ways to avoid that stress).

Cognitive Issues

Lack of information and the desire to avoid uncertain or unfamiliar situations also seem to play significant roles in the decision not to change from solo commuting to use of transit or ride share. Solo commuters often have misgivings about their ability to handle specific problems (e.g., what to do about carpool members who are late, how to handle finances in ride share situations) related to transit and ride share options (Margolin *et al.*, 1978; Margolin and Misch, 1979). Other studies suggest that solo commuters may be more conservative when it comes to trying unfamiliar behaviors than are users of transit or ride share options (Nelson, 1981). This suggests that solo commuters may need more information on exactly what to expect before trying an alternative mode of transportation.

The prospect of becoming involved in a difficult social situation can also deter people from switching to transit or ride share (Margolin and Misch, 1979). It is clear from surveys of solo commuters that people are not eager to become involved with others about whom they know nothing (Margolin *et al.*, 1978). For instance, the desirability of carpooling has been found to decrease with an increase in the number of non-acquaintances in the carpool (Levin and Gray, 1979).

SUMMARY AND CONCLUSIONS

While financial incentives and disincentives are successful techniques for initiating changes in commuting behavior, the issues of durability and negative reactance point to the need for other types of techniques to address these issues as well. Studies exploring financial interventions typically employ an A-B-A reversal design where the return to baseline not only supports the effectiveness of the intervention but, in doing so, points out its non-durable nature (Deslauriers and Everett, 1977; Everett *et al.*, 1974; Foxx and Hake, 1977; Hake and Foxx, 1978). The question of durability cannot be ignored. Certain market-based techniques (i.e., financial disincentives) have been shown to produce negative reactions in individuals: people may show an increased desire for a forbidden alternative or a decreased desire to do what they are being coerced into doing (De Young, 1993; Brehm and Brehm, 1981). People can become motivated to re-establish a personal sense of control, sometimes by creative, and subtle, misbehavior. This phenomenon is more than just a theoretical possibility. Reactance effects have been noted in numerous investigations including the study of legal mandates (Mazis, 1975), and strongly worded prompts for conservation behavior (Reich and Robertson, 1979).

Other techniques may be as or more successful at changing behavior while avoiding some of the problems described above. Preferential parking and guaranteed ride home programs may not be sufficient incentives for initial behavior change, but may play a role in the continuation of the changed behavior. The availability of ride matching services seems to be a successful strategy

to encourage carpooling and vanpooling, but only when the service is highly personalized. Commitment techniques, though not well explored in the travel behavior literature, may also be an effective means of changing behavior. Literature in other areas of behavior change research indicates that commitment techniques may be as or more effective than material incentives at changing behavior (Katzew, 1986) and that these changes may be more durable than those realized by other techniques (Stern and Aronson, 1984). Though few analytical studies exist on the impact of direct experience on travel behavior change, anecdotal evidence (e.g., "bike to work", "no-drive" days, the policy of giving employees loaner bikes so that they can try bicycle commuting, a Guest Pass program for public transit) suggests that this is a potentially powerful technique. Research elsewhere indicates that case studies can provide effective substitutes for direct experience; the key to their effectiveness may lie in the ease with which multiple "experiences" can be provided through these case studies (Monroe and Kaplan, 1988).

Results on the use of information in initiating changes in travel behavior are somewhat ambiguous. In general, pallid, relatively abstract information (e.g., factsheets, factual brochures) on the benefits of alternative modes of transportation and on opportunities for using these modes does not seem highly effective. In contrast, specific, personalized information, such as that provided by on-site ride sharing coordinators or by feedback mechanisms, does seem to be effective at changing commuting behavior.

Psychological studies on the differences between solo drivers and users of transit or ride share options suggest that two reasons why solo drivers won't switch to alternative modes of transportation are: 1) a lack of information on how to switch and how to deal with problems which may be encountered while using an alternative mode; and, 2) negative perceptions of transit and ride share options (e.g., seeing alternatives as unreliable or inconvenient). These findings suggest that promotional efforts aimed at providing procedural knowledge and addressing specific concerns may be effective. Since attitudes regarding cost, energy use, and pollution associated with solo driving and transit or ride share options generally do not differ

between solo drivers and users of these alternatives, emphasis on these factors may not be particularly effective.

Ideally, programs designed to change employee travel behavior will: 1) initiate significant changes in individual behavior; 2) will not cause unintended side effects such as increased driving during non-work hours; 3) will encourage the durability of changed behaviors without continual financial input; 4) will be cost effective; and, 5) may result in a generalization of behavior to other realms (e.g., using alternative modes of transportation during non-work hours).

III. THEORETICAL OVERVIEW

DECISION MAKING - THE ROLE OF KNOWLEDGE

Few would argue against the importance of information in the decision making process, however, the problem of communicating - of transforming information into knowledge - is often disregarded. Indeed, in many models of decision making, it is trivialized to the point that information is *equated* with understanding (see Yohe, 1991). These models assume that information need only be presented and that the individual who receives it will receive it *as presented*. The individual will then be able to combine the new information with existing information to arrive at a decision. In these models, the important informational variable is simply the amount of information the individual is given; the more information presented, the better the final decision will be.

Another assumption of many decision making models (e.g., the rational-economic model) is that people strive to maximize their gain. Underlying the notion of maximizing are the assumptions that: 1) all of the things people care about can be placed on a single scale; this is the assumption of *substitutability* (that is, that two things of equal value can be freely substituted for one another regardless of their content); and, 2) people have the computational capacity necessary to *determine the probability* of an event happening, thus allowing them to determine which alternative has a greater potential payoff.

The assumptions upon which these decision making models are based have received much criticism (Simon, 1957; Midgley, 1978; Foa, 1971; Tversky and Kahneman, 1982b; Nisbett and Ross, 1980), and attacks have come from several directions (see Jungermann, 1983). Perhaps the strongest evidence against decision making models such as the rational-economic model is that they simply do not do a good job of predicting behavior of individuals either in lab situations (e.g., Kahneman and Tversky, 1984) or in real-life scenarios (Simon, 1957). However, despite these

claims, there seems to be no general agreement on an alternative decision making model (Selten, 1983).

The acquisition of knowledge is not a straight-forward process. Because the human brain is a system with finite information processing resources operating in a world of infinite complexity, it is impossible to process and store everything. Humans are very selective about which stimuli they attend to and what information they remember. Information that is uninteresting, confusing, or seemingly-irrelevant will tend to be ignored altogether. It is also important to note that the information that does get processed by the brain is rarely stored as received. People bring their own knowledge, experiences, and biases to every new bit of information. Because of this, information is lost, warped, or even added to during processing (Bartlett, 1932). This selectivity is one reason that the mere provision of information (e.g., pamphlets, slogans, instructions, newspaper articles) has often been ineffective at changing behavior (Ester and Winett, 1981-1982; Stern and Aronson, 1984; Dennis *et al.*, 1990). The manner in which information is conveyed is as important as how much information is presented (Stern, 1992).

Once information is stored in the brain, it can enter into the decision making process. Again, this process is not as straight-forward as it may appear. Specific bits of information are not the only components of the decision making process; the *state* of an individual's knowledge about the topic in question also plays an important role (Simon, 1992; see Kaplan, 1991 for a thorough discussion on this position). During decision making, an automatic assessment is made of how much knowledge an individual has and how comfortable the individual is with that knowledge (i.e., whether or not they can rely on that knowledge to guide them in a new situation). This assessment is then combined with the content of the individual's knowledge about the issue, resulting in a decision.

The importance of this assessment of the state of an individual's knowledge cannot be overstressed. People prefer making decisions that put them in situations where they can use what they know and where they feel they have sufficient knowledge to deal with unexpected events.

Likewise, people dislike, and thus tend to avoid, decisions that would place them in situations where they have insufficient knowledge to guide their behavior and where the possibility of confusion is great. In cases where people are forced to adopt a behavior despite insufficient knowledge there can be considerable repercussions, including negative reactance (Reich and Robertson, 1979; Brehm and Brehm, 1981), a need to continually increase the external motivation, or a cessation of the behavior when the external motivation is stopped (Cook and Berrenberg, 1981).

The importance of knowledge (and the impact of a lack of knowledge) in the decision making process has been demonstrated in numerous studies. A study of recyclers and non-recyclers (De Young, 1988-1989) found no difference in attitudes or motives between the two groups, but a significant difference in knowledge. Confusion about the process of recycling was associated with non-recycling behavior. Others have shown that belief in a goal isn't enough to influence behavior; people must also have sufficient knowledge of appropriate behavior (Cook and Berrenberg, 1982; Weigel and Amsterdam, 1976). Without adequate knowledge an individual may not be confident enough to act (Ehrlich, 1969) or may not know how to achieve a goal (Levanthal, 1970). Confusion about a situation has been shown to have serious detrimental effects, causing people to give up on a problem (Halford and Sheehan, 1991) or show defensive avoidance of the issue (Janis and Mann, 1977).

Acquiring Information

The state of an individual's knowledge about environmental issues and about appropriate behaviors for ameliorating environmental problems plays a large role in the decision making process. It follows that people should have an adequate understanding of a process or an issue (in this case, carpooling and environmental degradation caused by automobiles) if they are to be expected to respond with a change in behavior. The challenge, then, is to design effective communication techniques that make salient an important and somewhat abstract issue.

One way to gain information about these processes is through direct experience (Ramsey, Hungerford, and Tomera, 1981). A study by Fazio and Zanna (1981) points to the importance of direct experience in learning and suggests that there is a difference between indirect and direct experience with respect to how the information is processed and retrieved. Their findings indicate that attitudes developed through direct experience are much better predictors of future behavior than are attitudes formed without behavioral experience (e.g., gained through reading a brochure filled with factual information). These attitudes are also held with greater confidence, are more well-defined, and are more resistant to change than those formed without direct experience. Direct experience, however, may not always be the best strategy (Monroe and Kaplan, 1988) nor may it always be possible.

In the case of carpooling, direct experience has been encouraged through the promotion of "no-drive" days and trial carpooling periods. While this strategy may be effective in some cases, there is a risk of doing more harm than good. If this first experience is negative, it may lead to the avoidance of similar situations - exactly the opposite of the effect intended. This effect is especially powerful when experience with that situation is limited. There is some evidence that negative affect developed during the initial experience with a behavior remains more durable than a positive affect (Nisbett and Ross, 1980). It can also be quite difficult to convince people to try a new behavior when they have no information about it.

Another obvious choice for transferring knowledge is written information, or text. But, as we've seen, not just any text will do. Many information-based programs fail because they never get the intended audience's attention, or because they get their audience's attention but don't present the information in a meaningful and understandable way (Dennis *et al.*, 1990; Ester and Winett, 1982). In order to understand what is meaningful and understandable, it is necessary to discuss how people acquire knowledge and which informational characteristics facilitate this process. These cognitive processes and biases provide constraints and direction for designing effective communication techniques.

COGNITIVE STRUCTURE - A THEORETICAL OVERVIEW

A basic argument in cognitive science is that individuals have mental models that serve as internal representations of the world. The position taken in this paper is that these models - cognitive maps - can be represented as networks of objects, or "mental entities", that come to be linked through experience (Kaplan and Kaplan, 1982).¹ The structure of these mental entities, called prototypes, and the linkages between them are discussed in more detail in the next section.

What is a cognitive map? Take a moment to imagine the town in which you live. If you have been there for any length of time, you likely have a well-developed cognitive map of those areas in which you spend time. The prototypes, in this case, represent landmarks - your house, the building in which you work, a grove of evergreens, the park where you run, your neighbor's flower garden. The linkages between these prototypes represent the physical paths you take to get from place to place. If your structure is well-developed, you can think of many different routes to get from place to place, even if you've never actually taken one of those routes. In contrast, imagine a city that you've been to only once or twice. In this case, you have a very weak cognitive map of the area; there are few landmarks you recognize and getting from one place to the next is difficult. In these situations, the chances of getting lost are quite high and most people don't relish exploring without some guidance. Notice the important role of an individual's state of knowledge in the decision making process. We tend to feel most comfortable in those areas for which we have a well-developed cognitive map. In contrast, we are often wary of those areas for which we have no, or at most a very weak, cognitive map. In the latter case, we may very well make a decision not to enter an area even if we were offered an external reward or were otherwise enticed.

¹ Other models of knowledge organization (e.g., schemas, scenarios, scripts) have been proposed yet lack physiological support. The cognitive map model has been accepted in fields as diverse as neuropsychology, psychology, and architecture (Downs and Stea, 1973; Alexander, 1965).

The cognitive map model can be used equally well to describe the structure of information that is not physical (Siegel and White, 1975; Kaplan, 1976); in such cases, the map consists of a group of associated prototypes that represent objects and concepts relating to a particular domain. For example, if you recycle regularly, you will have a well-developed map of the recycling process. The process is familiar to you, and you have a good sense of how all the objects and concepts that are relevant to recycling (e.g., plastic resins, cleaning out cans, waste reduction, curbside pickup) are related to each other (i.e., are linked together). For people without a cognitive map of the recycling process, thinking about recycling can be daunting. Just as we do not relish the prospect of roaming around a city for which we have no cognitive map, we are also reluctant to delve into situations for which we have no structure to guide our actions. In this case, not being sure how to recycle or what is expected of you may be enough to deter you from recycling even if there is a city ordinance (or some other incentive) to recycle.

A More Detailed Analysis of Cognitive Structure

Prototypes - the basic mental entity. Things in the world come to be represented in the brain by groups of tightly interconnected neurons; these structures are called cell assemblies (Posner, 1986; Rosch, 1973), or prototypes. A prototype is an abstraction, or distillation of multiple experiences with a particular object or concept in the world; thus prototypes take numerous and varied experiences to create. Once prototypes are formed, they can be activated by something in the world. If an object has enough features in common with a particular prototype - or alternatively, enough of the most typical or salient features - then it will activate that prototype resulting in "recognition." Prototypes can also be activated internally, allowing us to think about things that aren't present in the environment. The more experience we have with a particular object or concept, the more tightly connected the corresponding prototype becomes and the easier it is to activate.

Prototypes appear to be hierarchically arranged, with lower-level prototypes representing concrete things (e.g., your house, a tree, water) and higher level prototypes representing more

abstract concepts (e.g., waste reduction, global warming, sustainable development) (Kaplan, 1982). At all levels, prototypes can be connected to modifiers such as language,² color, spatial orientation, and affective codes (Kaplan and Kaplan, 1982).

Networking - making associations. Once a prototype has been formed, it can become linked, or associated, with other prototypes. These linkages are a reflection of experience: things that are related in the world temporally, spatially, or conceptually become associated in the mind. Activation spreads from prototype to prototype through these links, allowing the mind to go from one object or concept to the next - a "train of thought." In this way, we are able to make plans, run various scenarios in our head before taking action, and put individual objects and concepts into a larger context (Bruner, 1973). In short, cognitive maps are the means by which we model our world. This model, in turn, directs and constrains our thoughts, decisions, and actions.

Cognitive Biases in Knowledge Acquisition

Because an individual's cognitive maps are built from experience in a particular environment, we would expect great variability in the components of people's maps. The process of map construction (building prototypes and making linkages between prototypes), however, is universal; cognitive maps have been found in very young children and non-human primates as well as in human adults (Olton, 1979; Ratner and Myers, 1981). There are two important implications of these biases in knowledge acquisition and organization. The first is that unless new information is integrated into existing maps, it will be very difficult to access in the future. The nature of a cognitive map is such that activation can spread from one prototype to associated prototypes. In

² Though words and thoughts are strongly related, they are not the same things (Ong, 1973); we know this intuitively from our own experience with forgetting a word but remembering the associated image, or visa versa. Several investigators have formally conceptualized the separation between verbal and imagistic thought in terms of separate yet interconnected systems (Paivio, 1978; Bruner, 1986; Tulving, 1983). Though it is not entirely clear how this separation is manifested in the brain, evidence overwhelmingly supports the notion that language and thought are not synonymous (Furth, 1971). For example, numerous studies show a lack of interference between verbal and spatial tasks (see Reed, 1982 for an overview). If the processes were the same, we would expect one task to inhibit, or interfere, with the other (as is the case with two verbal or two spatial tasks).

this way, the system has immediate access to concepts and thoughts that are related to the situation at hand. Information that is stored with few or no associations to existing prototypes cannot be activated in this way. This is referred to as the problem of inert knowledge (Bereiter and Scardamalia, 1985, Schank, 1991). For example, a student of physics may do well on textbook problems but then be unable to apply the memorized laws and formulas to interpret actual physical events. It is often the case that students revert to their preconceptions of the way the natural world works in order to interpret and predict "real-world" events (Resnick, 1983).

A second implication of the biases in knowledge acquisition and organization is that knowledge is *constructed* rather than *received* (Resnick, 1984); there is no simple correspondence between information presented and information stored. Because knowledge acquisition is not a trivial process and because we are bombarded by an almost infinite amount of information every day, we cannot possibly process and store all the information we encounter. A system of selective learning is necessary to guide us towards important information. Selectivity operates at two different phases of information processing: the first is perception (the activation of prototypes by the environment), the second is knowledge integration (making linkages between new information and existing maps). For example, in order to maximize learning from a text, a reader must first attend to the text (perception) and then, while reading, must integrate the information in the text with what is already known (knowledge integration).

Information Selection Through Attention

One of the most powerful mechanisms of selectivity in learning is attention. Attention is the means by which we are able to select and persist in processing particular information while ignoring other information. James (1892) distinguishes two types of attention: involuntary and voluntary (or directed) attention. Involuntary attention is based on interest; it is spontaneous and effortless and easily inhibits competing thoughts. Involuntary attention can either involve things of innate interest (James's list includes "strange things, moving things, wild animals, bright things, pretty things, metallic things, words, blows, blood, etc..." p.88) or be based on interests that have

been gained through extended experience. Examples of learned interests include the interest an avid bird watcher takes in an unusual call or the interest of an expert chess player in a novel board configuration. The spontaneous nature of involuntary attention is quite adaptive as it assures that potentially important events and objects in the environment will be noticed without effort.

Directed (voluntary) attention is used to deal with numerous activities throughout the day that are necessary and important but that are intrinsically uninteresting (Cimprich, 1990). Invoking directed attention allows us to engage in purposeful, directed activity and thought. However, there is a cost associated with directed attention: it requires mental effort to sustain; it is neither spontaneous nor effortless and is thus subject to fatigue.³

Involuntary attention often falls under the general heading of *interest*. Information that we find interesting "elicits spontaneous rather than conscious, selective allocation of attention" (Hidi, 1990, p. 561). The role of interest in learning from text has received some attention (see Hidi and Baird, 1986, and Hidi, 1990, for excellent reviews). In general, interesting texts have been found not only to motivate people to read but also to increase comprehension of the text and to increase the likelihood that information in the text will be applied to novel situations. Drawing on involuntary attention is an effective strategy for increasing the probability that the reader will begin a text, learn the information contained in the text, and be able to use this information in the future. In this case, involuntary attention is acting on both stages of knowledge acquisition: *activation of prototypes* and *knowledge integration*. The section below provides a more detailed analysis of the characteristics of information that draws on involuntary attention at each stage of knowledge acquisition.

³ Directed attention appears to involve a different inhibitory mechanism than involuntary attention (Kaplan and Kaplan, 1982). The mechanism associated with directed attention is subject to fatigue through use while the inhibitory mechanism used in conjunction with involuntary attention is not. As the inhibitory mechanism fatigues, it becomes harder to keep out other thoughts, making directed attention difficult or impossible to sustain.

Indirect Attention and Knowledge Acquisition

Activating prototypes

Cognitive maps are accessed through the activation of prototypes. Once a prototype is active, a host of associated prototypes can potentially become active. This network of associated prototypes provides a context into which the new information becomes integrated which makes it more memorable. There are four major characteristics of text that aid in the activation of prototypes: content of the text, the degree to which it relates to the reader's prior knowledge, the concreteness of the text, and the use of vivid detail.

Content – Attention can be involuntarily drawn to text because of the text's specific content. Some themes draw on innate interest (e.g., death) and will be interesting to almost everyone. Other themes draw on learned interest (e.g., a text about the discovery of a new plant species may be very interesting to a botanist) and will vary among different cultural, age, and socio-economic groups.

The role of prior knowledge – Only a prototype that exists can become active,⁴ and the stronger a prototype is (i.e., the more familiar it is to the reader) the easier it will be to activate. The importance of "knowing your audience"- of personalizing information so that it relates to the prior knowledge of a particular group - cannot be overemphasized. Anderson *et al.* (1987) suggested that "character identification" and "life themes" were important attributes of text that contribute to text-based interest. That is, they found that information was considered interesting if it had characters and themes with which the reader could identify. Other studies have shown that readers ignore or rework events and details that are unfamiliar. Bartlett (1932) presented a group of students with Native American folk tales. In general, the students forgot those events

⁴ Of course it is possible to build prototypes from scratch, but this process can be difficult and time-consuming (recall the roles of variability and multiple experiences in building a prototype). If an unfamiliar concept is introduced in the text, it may be remembered briefly, but it is unlikely that it will be retained.

that seemed bizarre, reorganized sequences of actions to better fit their own expectations, and invented information to fit their own interpretations.

Concreteness – A short route to prototype activation in the absence of an environmental stimulus is through imagery. An image is, essentially, an active prototype (or group of prototypes) that represents something not present. The image can be formed through mental effort or it can be elicited by something in the environment (e.g., a word, a smell). The ease with which an image is formed is directly related to the ease with which a prototype is activated. In the case of written text, access to an individual's cognitive maps (i.e., prototype activation) can be achieved by choosing words that aid in imagery.

Paivio and Yuille (1969) argues that the concrete-abstract dimension is the most important determinant of the ease with which one can form an image (i.e., can activate a prototype). Concrete refers to a word or group of words that can be represented by a single image. The word "clown" is concrete; most people cannot help but conjure up an image when presented with this word. In contrast, abstract words (e.g., the word "justice") stand for concepts that cannot be encapsulated within a single image. Paivio and Yuille (1969) presented pairs of words to subjects and found that imagery was reported for 62% of the concrete word-pairs and only 26% of the abstract word-pairs. Images for concrete words are often created spontaneously and effortlessly (pointing to the role of involuntary attention) while abstract words generally take longer to image, if they can be imaged at all (Clark and Paivio, 1987). Hidi and Baird (1988) showed that students tend to recall concrete, personally involving material better than generalized, abstract material, even when the abstract material was more important in expressing the main ideas of the passage.

A striking example of the importance of concrete information in understanding text comes from a study looking at how children solve word problems in mathematics (Hudson, 1983). The same problem was presented in two different forms: the first read, "There are 5 birds and 3 worms. How many more birds are there than worms?"; the second read, "There are 5 birds and 3 worms. How many birds won't get a worm?" The first problem was correctly solved by only 39

percent of the students while the second problem was correctly solved by 79 percent. In this case, reading a problem involving a real-life situation that was easy to image made it much easier to form an appropriate model of the problem than did reading a problem with the abstract relational term "more than."

The importance of concrete information in decision making has also been widely explored (Nisbett and Ross, 1980; Nisbett *et al.*, 1976). For example, Nisbett and Borgida (1975) found that when study participants were given abstract information about a group of people they were unwilling to apply this information when making predictions about the behavior of particular individuals. However, they were very willing to take concrete information about the behavior of two individuals to make predictions about the entire population. In this case, information from specific, concrete cases was utilized in making decisions about future behavior, while abstract information was ignored. This occurred even though, in a statistical sense, the abstract information had more predictive power.

Vividness – While concrete refers to something that can be imaged, vivid can be defined in terms of the *ease* with which imagery occurs (Tulving *et al.*, 1965). Superior recall is found for text that is concrete and contains vivid detail over text that is concrete but not vivid (Tulving *et al.*, 1965). Vividness can be increased through the addition of detail (e.g., "a storm" vs. "a storm with a vicious wind and torrential rains"). Bower (1979) found that the rated vividness of a particular word-pair was predictive of the later recall of the pair; this effect was found even under incidental learning conditions, suggesting that in these situations, imaging occurred with no directed effort. Using vivid detail can also add power or importance to a message. A study on fear-arousing persuasive communication (Sherer and Rogers, 1984) showed that while concrete information significantly affected attitudes and increased recall, making the information more vivid by adding detail had a main effect not only on attitudes but on behavioral intent as well.

Knowledge integration

Learning from text requires more than the activation of prototypes; a series of isolated facts or details do not create meaning. In fact, understanding and the ability to make

generalizations from a text can be undermined by the provision of interesting but irrelevant detail (Garner *et al.*, 1991). This means that it is not enough to entice the reader to the end of a text through the use of interesting detail; the information in the text must also be integrated with the reader's existing cognitive maps. This is necessary so that the information can be accessed in the future, combined with other information in new ways, and applied to novel situations (Garner *et al.*, 1991; Schiefele, 1991).

Knowledge integration requires making linkages, or associations, among prototypes; this requires a certain level of involvement, or *cognitive engagement* on the part of the reader. Cognitive engagement refers to the process by which active prototypes are able to continually activate other, associated, prototypes which are pertinent to the issue or environment at hand. In this way, predictions can be made and compared to what occurs next in the environment. Cognitive engagement implies that competing thoughts are inhibited, allowing for a self-sustaining train of thought. Involuntary attention plays a large role here. If the structure of the text is interesting (draws involuntary attention), it can direct thoughts and cause the reader to make associations while expending little mental effort. If the structure of the text is not interesting (e.g., dry, boring facts), the reader must invoke directed attention, purposively focusing on the flow of information and relating it to knowledge they already have. When using directed attention, the mental effort required to block out competing thoughts can be great and as soon as this effort is relaxed or as soon as fatigue sets in, the train of thought is interrupted. This is a particularly worrisome problem because there is often little incentive to continue a text that requires a great deal of mental effort.

Interesting stories are structured so that they are cognitively engaging, allowing for an effortless integration of new knowledge with existing cognitive structure. Sadoski (1990) found that students who read an interesting short story not only formed powerful visual images from the text, but they also elaborated on and synthesized information in the text to the point that these elaborations were recalled as part of the original text. In this case, information from the story was being integrated with the readers' existing knowledge to form a map, or model, of the story.

Interestingly, even students who were told to read the story for typographical errors (not for enjoyment or for recall) made these kinds of elaborations, supporting the notion that imaging and integration occurs spontaneously and effortlessly when a text is interesting (Hidi, 1990).

Interesting stories (as compared to stories of low interest) are also related to greater comprehension of the story's main ideas, greater ability to answer complex questions about the story, and greater ability to apply the information in the story to new situations (Schiefele, 1991; Bernstein, 1955). There are two major structural characteristics of text that aid in knowledge integration: the coherence of the text, and the presence of mystery in the text.⁵

Coherence – An analysis of stories by Stein and Glenn (1979) showed a striking linear relationship between the percentage of causally related events in the story and recall, showing that memorability of a story depends on causal cohesion among its events. In terms of cognitive engagement, if there is no cohesion or connection between the various elements making up a story, it is difficult to make associations between them and a train of thought cannot be maintained. The information must hang together sufficiently well so that the reader is able to see how the various parts of the text relate (Kintsch, 1980). An incoherent text is unlikely to hold one's interest for long.

Coherence can be effectively achieved through a sense of movement, or direction through time yet this need not be linear movement. In order to do this, the reader must be at least marginally aware of a goal state or valued endpoint (e.g., the destruction of something evil, victory over something, the discovery of something interesting or precious). Events in the text must then be arranged so that they bear some relation to the goal state (e.g., rendering it more or less probable) (Gergen and Gergen, 1986).

An element of mystery – Though a text needs to make sense, it shouldn't give everything away. Engagement is increased if the reader must predict and anticipate what will happen next

⁵ There is an implicit assumption that the reader has prior knowledge of generic social and causal relationships, and of potential outcomes which can be used in interpreting the text.

(Kintsch, 1980; Schank, 1979). The presence of mystery, or uncertainty, causes the reader to generate a set of expectations (e.g., about what will happen next, about possible outcomes of the story, about motivations of the characters) against which future information can be matched. The reader is put in the position of wanting to know what will happen next, of searching for the very information that will be given in the proceeding text. When working optimally, this process will occur involuntarily and will wholly involve the brain in the text. As Dewey (1916, p.126) writes, the "self and the world are engaged with each other in a developing situation."

In more specific terms, prediction and anticipation cause an active prototype to activate (or partially activate) several associated prototypes - these are the nominations, or expectations, for what is to come. Notice that these associated prototypes are part of the reader's existing cognitive maps; they are, in turn associated with numerous other prototypes in the map. In this way, the information in the text becomes integrated into the map. When the map is accessed in the future, the information from the text will become available.⁶

TOWARDS EFFECTIVE COMMUNICATION

The selectivity of knowledge acquisition gives us useful direction and constraints in designing effective communication strategies. That is, a text should be compatible with the processes of human knowledge acquisition. More specifically, the text must fulfill the following:

1) *It must be interesting.* With the plethora of information bombarding people everyday, it is understandable that much of it is ignored. We cannot assume that people will read all that they are given. Because of this fierce competition for an individual's attention, one must design information that draws on involuntary attention. Information must be able to "hook" the reader, carry them through to the end of the text, and leave them with useful knowledge. Interesting content, a presence of mystery, and vivid detail have been suggested as ways to increase interest.

⁶ The description here is quite abbreviated. The interested reader should consult Kaplan and Kaplan (1982) for a general overview of the concepts and Hidi (1990) for an overview of the process, specifically as it relates to text processing.

2) *It must present abstract information in such a way that the reader can imagine it.*

Much of the information about environmental issues is in the form of scientific data (i.e., highly abstract facts and figures) or uses highly abstract concepts (e.g., global warming, ecosystem deterioration). This information often has little impact on a non-expert's understanding of the issue. To promote understanding, information should be made concrete (through the use of specific examples) and vivid (through the use of detail).

3) *It must relate to the reader's existing knowledge.* New information that is wholly unrelated to the way people understand the world is likely to be ignored or, at best, stored as a chunk of inert knowledge that is unlikely to be factored into everyday decisions and behavior. Information about processes such as carpooling and issues such as environmental degradation must speak to the beliefs that people already hold. It must also relate to their daily experiences and address perceived obstacles to behavior change.

4) *It must present global issues at a human scale.* Information about large-scale events can be overwhelming. Telling examples come from the literature on natural disasters. In the face of large-scale disasters, people have a tendency to ignore information and warnings, leading them to deny the threat, refuse to leave an area, and return to the same site to rebuild (Burton *et al.*, 1968; Watt, 1974). This behavior can be understood when we consider that thinking about something that you can't do anything about leads to a state of helplessness; this is a state that people actively avoid (Kaplan and Kaplan, 1982).

The current emphasis on "think globally, act locally" is a recognition that it is hard for people to feel they are making a contribution to a global problem (Bardwell, 1991). Bringing global environmental issues down to a human scale may be achieved through the use of characters or by highlighting local problems or behaviors that are related to global changes in the environment.

5) *It must be varied and presented on multiple occasions.* One interesting and useful text is a good start, but in most cases it will not be enough. Recall that the prototypes that make up a cognitive map are built up slowly through repeated experience. Because building prototypes is a

slow and conservative process, people generally need to be exposed to a number and variety of presentations of a particular concept or idea in order to generalize the information and apply it to new situations. Those prototypes which are the strongest (i.e., those corresponding to objects and ideas that are familiar - supported by numerous experiences - to an individual) will have a larger influence during decision making than will concepts that are less familiar (Tversky and Kahneman, 1982b).

Communicating Through Story

A good story (also referred to as a case study or analogy) is one form of text that fulfills the above criteria. Stories have been proposed as effective tools for teaching and encouraging behavioral change (Monroe and Kaplan, 1988; Schank, 1991). They are inherently interesting, provide concrete examples of abstract issues or concepts, can be extended to provide multiple and varied "experiences," can be crafted to relate to people's lives and what they already know, are inexpensive to create and distribute, and can be used across all age groups.

Stories have traditionally been used in all cultures to explain natural phenomenon, convey morals and values, and guide appropriate behavior (Stein and Glenn, 1984; Bettelheim, 1976). Oral stories were often the only records of a culture passed down through generations. Tales were told with great care as they were recognized to be influential in the evolution of a given society (Baker and Greene, 1977).

Stories are still very much a part of the way we understand our world. Much of our daily communication is in the form of stories told and listened to (Schank, 1990b). A study of "excellent companies" (Peters and Waterman, 1982) found that myths, stories, and legends appear to be very important in passing on and conveying the organization's shared values and culture. Stories have also been used by photocopy repairmen to diagnose problems with photocopiers; these stories are told and retold and become part of the knowledge base of the repairmen (Gudmundsdottir, 1991).

Stories have been particularly influential in decision making (Schank, 1990a; Halford and Sheehan, 1991). One study on the decision making process in government showed that people generally make decisions based on stories of incidents that had previously occurred and were similar to the situation at hand (Neustadt and May, 1986). Traditional midwives have been found to share stories to aid in diagnosis of problems and identify remedies (Gudmundsdottir, 1991). Monroe and Kaplan (1988) found that the use of case studies (stories) and talking about what others do to solve environmental problems may be more effective than "learning by doing" for teaching environmental problem-solving skills. A later study of Monroe's (1991) showed a significant correlation between interesting stories and willingness to take environmental actions. Schank (1990a) has effectively used computer simulations containing databases of stories as teaching tools and one particularly effective method of promoting energy conservation made use of case-studies (stories) of "super-conservers" (Yates and Aronson, 1983).

Though stories are particularly powerful tools for transferring information, they have not been widely used in education and behavioral change strategies. One possible reason is that stories and storytelling are associated with fantasy and pretending and thus may make the serious scientist or educator skeptical of their use, and, instead, favor the use of factsheets or textbooks. This reasoning has largely limited the use of stories in formal education to the primary level (Rosen, 1985). The urgency of global change problems, however, requires that we put preconceptions aside and utilize strategies that work with human nature rather than against it. Stories are one such strategy. A good story is particularly effective at transmitting information in a memorable and useful way because it is compatible with human information processes; the characteristics of a story take advantage of the way people process, store, and utilize information.

SUMMARY

Learning from text is greatly facilitated when the text is structured to take advantage of cognitive processes. Specifically, the effectiveness of text depends on activating prototypes and

integrating the information contained in the text into existing cognitive maps so that it becomes part of the readers "real-world" knowledge. Textual characteristics that facilitate this process are: *interesting content, relatedness to a reader's prior knowledge, concreteness, vividness, coherence, and mystery*. These characteristics are perfectly encapsulated within a "good story." A prototypical story is organized into cohesive, thematic episodes that are causally related; it contains a character, a predicament with an uncertain outcome, and resolution of the predicament (Stein and Policastro, 1984). Stories are of concrete things (though their overall meaning may be much more abstract) and are told with vivid detail. Stories can speak to people's lives and experiences the way no other text can. They are also able to put large-scale issues into a familiar context reducing "reality to a smaller scale that mimics it and yet enables us to deal with it in some manageable way" (Common, 1986).

It is no accident that stories have had such powerful influences on thought and behavior throughout history and throughout different cultures (Stein and Policastro, 1984). Stories can make the abstract concrete and accessible, turning what was only dimly perceived into something vivid and powerful. Stories put issues on a people-appropriate scale; they fill our heads without overwhelming us with information. A good story is incorporated into the cognitive structures that represent the reader's knowledge, thus altering the content and organization of their knowledge about the world and, ultimately, affecting their beliefs and how they might act in the future. Stories allow us to vicariously experience many different places, events, and situations; in this way we can prepare ourselves in imagination for what life might bring and learn how to solve problems we have not yet experienced.

IV. METHODS

Employees at each of five sites were randomly assigned to either a story-based information group, a factual-based information group, or to a control. In early October, 1992, a pre-test survey instrument was administered to employees at each of the sites. This survey was used to choose the study participants and to gather base-line data. Employees who were not currently driving to work alone or who worked less than 30 hours per week were not included in the study. Participants in both the story-based information group and the factual-based information group received daily information about carpooling (each information sheet was one to two pages long) for a period of two weeks. These participants were asked to record their opinion of each information sheet after they read it (an opinion sheet accompanied the first information sheet). The control group received no information during this time. Following the two-week intervention period all participants were asked to complete a post-intervention survey instrument and a cognitive mapping task (the modified F-sort, described below). Both of these measures were used to assess the participants' knowledge structures relating to carpooling. Following a one month interval, participants were given a brief follow-up survey which measured behavior and attitude change. The study is diagrammed in Figure 4.1.

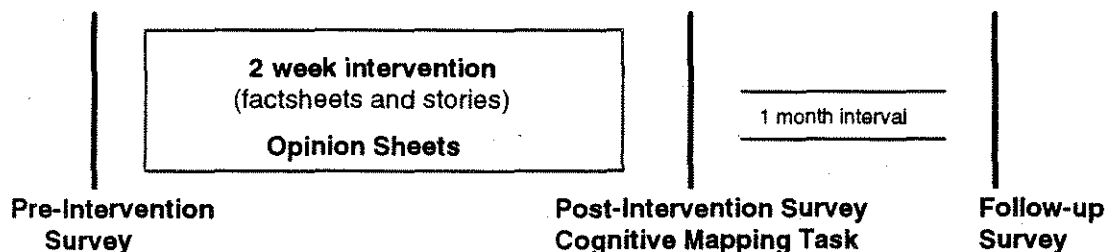


Figure 4.1. Study Design

STUDY AREAS

Potential study areas were recruited by EPA . The final decision on study sites was made by the researcher in conjunction with EPA. Four of the five sites were EPA offices, two were suburban and two were urban. In addition, a non-EPA site in an urban area was chosen. Brief descriptions of the sites follow:

EPA Ann Arbor (referred to hereafter as Ann Arbor). This suburban site is located in Ann Arbor, Michigan, which is home to The University of Michigan and to about 120,000 residents.. Approximately 350 people are employed at the Ann Arbor site. On-site parking is plentiful and free. Reserved parking spaces, which are closer to the building, are available for carpools. The site is serviced by both city and university buses but no subsidy is given for public transportation users. Carpooling has been promoted internally through information distributed by a staff group, "Earth Day Every Day", and through articles in newsletters distributed internally. The site has a ride-sharing board to match interested parties to carpools.

EPA-Atlanta (referred to hereafter as Atlanta). Atlanta is a large urban center of approximately 2.5 million people. The EPA site in Atlanta occupies two buildings and employs roughly 1100 people. On-site parking is readily available for a fee. There are a limited number of reserved spaces available to carpools. The site is serviced by both bus and transit rail and until March 1, 1993, transit riders received a subsidy. There is an on-going carpooling matching service offered at the site, but matching riders to carpools is difficult due to a low participation rate. The site organizes a ride-share fair one to three times per year and supports "Clean Commuter Day" once per year.

BellSouth (referred to hereafter as BellSouth). BellSouth, also located in Atlanta, is the only non-EPA site included in the study. It is one of the urban sites studied. Study participants were

drawn from two different buildings. One building, a 21 story structure, houses approximately 2500 BellSouth employees. The other, a 45 story complex, houses approximately 2500 BellSouth employees.

EPA Edison (referred to hereafter as Edison). The Edison site is located in Edison Township, New Jersey, a suburban area not far from New York City. It is one of the largest of New Jersey's townships, with a population of about 100,000 people. There are 321 federal employees on the site, which occupies five buildings and three trailers. On-site parking is readily available at no cost. There are no reserved parking spaces for carpools and the site has only very limited bus service.

EPA Research Triangle Park (referred to hereafter as RTP). This suburban site is located in North Carolina in the area known as the "Triangle" (comprised of Raleigh, Durham, and Chapel Hill). The Triangle has approximately 600,000 residents and three universities. The EPA site employs roughly 1200 people and occupies all or portions of five buildings.

SITE COORDINATORS

One person was appointed from each site to act as a study coordinator. The coordinators assisted in assigning employees to study groups, distributed the information sheets during the intervention period, and distributed and collected all measurement instruments. The site coordinators were fully briefed on the purpose and mechanics of the study.

STUDY SAMPLE

In total, 2014 pre-intervention surveys were distributed, and 1111 were returned; a response rate of 55%. Of those employees who returned the pre-intervention survey, 42% were ineligible for the study (either they did not drive to work alone, worked less than 30 hours per

week, or did not write their name on the survey). The total number of study participants was 645. Number of responses to all surveys, by site, are shown in Table 4.1.

Once study participants were chosen, they were assigned to groups. Those employees who interacted during work on a daily basis (e.g., who were working on the same project, in the same office) were assigned to the same group. These groups were then randomly assigned to one of the two treatments or to the control. Assignment by group was intended to reduce treatment interaction, thereby increasing internal validity. Due to the low number of study participants at the BellSouth site, no control was used; all study participants at this site were assigned to one of the two treatment groups. At all sites, roughly equal numbers of participants were assigned to each group.

INTERVENTION

Both the story-based information treatment and the factual-based information treatment consisted of ten information sheets, each one between one and two pages long. Each information sheet was numbered and included a title at the top. All of the information sheets contained text only. The information sheets were distributed by the site coordinators at the beginning of each work day for ten consecutive workdays. The information sheets were distributed over electronic mail at Atlanta-EPA, RTP-EPA, and BellSouth. At the Ann Arbor-EPA and Edison-EPA sites, the information sheets were

Table 4.1. Number of survey respondents by site

SITE **SURVEY RETURN RATES**

	Pre- Intervention Surveys Distributed	Pre- Intervention Surveys Returned	Study Participants			Opinion Sheets Returned			Post-Intervention Surveys Returned			Cognitive Mapping Tasks Returned			Follow-up Surveys Returned		
			ctrl	fact	story	ctrl	fact	story	ctrl	fact	story	ctrl	fact	story	ctrl	fact	story
Ann Arbor	300	187	29	42	41	--	30	27	14	23	17	11	18	13	16	23	25
Atlanta	1000	450	30	53	55	--	34	29	20	22	23	17	21	21	23	28	25
BellSouth	93	93	*	42	43	--	26	31	*	18	25	*	14	20	*	10	19
Edison	321	147	18	51	59	--	36	37	14	30	26	13	21	22	†	†	†
RTP	300	234	52	54	76	--	37	42	40	37	38	†	†	†	†	†	†
TOTAL	2014	1111	129	242	274	--	163	166	88	130	129	41	74	76	39	61	69

* BellSouth did not have a control group.

† Data are unavailable for these site.

distributed by hand. All the information sheets were pre-tested to insure that the same content was covered in both the story-based information campaign and the factual-based information campaign. However, these common themes were not necessarily covered in the same order nor with the same frequency.

Story-based information sheets

All ten story-based information sheets (see Appendix A) were written by the same author. The author used four types of information in constructing the stories: 1) background information of carpooling and environmental degradation associated with automobiles; 2) a list of themes drawn from studies on attitudes towards carpooling, perceived barriers to carpooling, and perceived benefits of carpooling (Horowitz and Sheth, 1978; Margolin *et al.*, 1978; Oppenheim, 1979; Angell and Ercolano, 1991); 3) a collection of articles from newspapers and commuter newsletters that included personal interest stories about carpoolers; and, 4) a summary of anecdotes that were collected during phone interviews of several carpoolers. From this information, the story-based information sheets were drafted. These stories were then rated by an independent panel consisting of five graduate students and three other adults. Each story was rated on three dimensions: interestingness ("How interesting did you find this story?"), informativeness ("With respect to carpooling, how informative did you find this story?"), coherence ("How easy was this story to get through?") and carpooling themes covered ("Briefly list what you learned about carpooling from this story"). The first three responses were recorded on a 5-point Likert scale. Ratings on interest, informativeness, and coherence were used to rewrite the information sheets. The carpooling themes that were identified were used during creation of the factual-based information sheets; care was taken to ensure that the same themes were covered by both the stories and the factsheets.

Factual-based information sheets

The ten factual-based information sheets (see Appendix B) were adapted from existing brochures promoting carpooling. Brochures were gathered from private companies, from organizations supporting alternative modes of transportation, and from state and local transportation authorities across the country. In some cases an entire brochure was used to create an information sheet; in many cases components of several brochures were combined to create one information sheet. The resulting information sheets were rewritten to ensure consistency of style and were evaluated on the carpooling themes that they covered. On average, the factual-based information sheets were somewhat shorter than the story-based information sheets.

SURVEYS

To understand the effect of the information treatment on the participants' knowledge structure, survey instruments were administered prior to and following the intervention period. Opinion sheets were filled out by the factsheet group and the story group to assess perceptions of the intervention. All participants were assigned a unique code so that measurements taken at different times could be matched up at the end of the study while protecting the participants' anonymity. Most survey questions utilized a 5-point Likert scale (Oppenheim, 1966), which gives a measurement of the direction and intensity of response (Weisberg and Bowen, 1977).

Pre-intervention survey

The two-page pre-intervention survey (see Appendix C) included six questions designed to measure attitudes about automobiles and environmental degradation [both specific and general attitudes were measured]. Eleven questions designed to measure *rigidity* were used. This bank of questions was adapted from the Gough-Sanford rigidity scale as used by Rokeach (1960). Rigidity reflects overall resistance to change (Bariff and Lusk, 1977) and has been found to be negatively related to acceptance of information, particularly for new or discrepant information

(Rokeach, 1960). Both attitude and rigidity questions were answered on a 5-point Likert scale from strongly disagree to strongly agree; respondents were also given the option to respond with "no opinion."

Six questions about conservation behavior were also included. These questions were borrowed from an earlier study by Monroe (1991). Participants were asked how likely they would be to engage in a variety of conservation activities (e.g., conserve electricity; buy things made from recycled products). Responses were recorded on a 5-point Likert scale from very unlikely to very likely. Again, participants were also given the option to respond with "no opinion."

Participant's prior experience with various commute modes (e.g., carpooling, public transit) was measured; both the length of time they had used other commute modes and their overall level of satisfaction with that mode were recorded. Satisfaction was measured on a 5-point Likert scale from very dissatisfied to very satisfied. In addition, the amount of information a participant had been exposed to regarding the various commute modes was measured; a 5-point Likert scale from none to a very great deal was used.

Several background variables were also included in the survey. Characteristics of the participants commute trip (e.g., commute time, commute distance) were measured as were several demographic variables (e.g., age, gender, education).

Opinion Sheets

The opinion sheets (see Appendix D) were distributed to the participants in the two treatment groups along with the first information sheet. Over the two-week intervention period, participants recorded their responses to two questions after reading each information sheet. These questions measured both the perceived interestingness and informativeness of each information sheet. In addition to obtaining data about the information sheets, the opinion sheets were important because they provided a context into which to place the information sheets. In

other words, asking the participants their opinions on the information sheets provided a rationale for reading the sheets.

Post-intervention survey

Following the two-week intervention period, a second survey instrument (see Appendix E) was administered to all study participants along with the cognitive mapping task (described below). The one and one-half page survey included the same attitude and conservation behavior measures found in the pre-intervention survey. In addition, numerous questions measuring perceived knowledge were included. These questions were designed to measure confidence, comfort with knowledge, and perceived amount of knowledge. Six questions pertaining to the information sheets were asked only of the factsheet group and the story group. Participants were asked how many of the information sheets they read, whether or not their knowledge about carpooling had increased since reading the information sheets, and several other questions on the impact of the information sheets.

Follow-up survey

One month after the intervention period, the final survey instrument was administered to all study participants (see Appendix F). The half-page survey included the same attitude measures found in the pre-intervention survey. In addition, several questions were asked about changes made in driving habits in the month following the intervention. Participants were also asked what they perceived as the major barriers to carpooling.

SURVEY ANALYSIS

The distinct sets of Likert-scale survey items (i.e., attitudes, rigidity, conservation behavior, knowledge questions) were subjected to Guttman-Lingoes non-metric factor analysis (Lingoes, 1972) and stable categories were identified. These categories were comprised of those items which clustered together statistically, indicating that they measure the same construct. The

stable categories were then tested for their degree of coherence using Cronbach's coefficient alpha - a measure of internal consistency (Cronbach, 1951). Participant's responses on each item comprising a category were averaged, resulting in a single numeric score. This new variable was used in all subsequent analyses; the individual items comprising the category were no longer considered separately.

A series of 2-way analysis of variance (F) (with treatment group and site as the independent variables) followed by Tukey HSD pairwise comparisons was used to determine if there were significant differences between treatment groups or between sites. Because no pattern of differences was found, treatment groups were combined across study sites in subsequent analysis. Differences between treatment groups on post-intervention measurements were assessed with a series of one-way and two-way analysis of variance. Measurements unique to the factsheet and story groups were analyzed with the Student's T-test (t). A series of one-way analysis of variance with multiple measures was used to examine changes in attitudes and conservation behavior over time.

A level of significance (α) of 0.05 was used for all statistical tests. In each case, parametric assumptions were tested. Normality was assessed by examining skewness and kurtosis measures. If either of these measures was greater than 1.00, Lilliefors test for normality was used. Homogeneity of variances was tested using Bartlett's test. If assumptions for the parametric test were not met, the appropriate non-parametric test was used: The Kruskal-Wallis test is the non-parametric one-way analysis of variance; the Mann-Whitney Test is the non-parametric independent groups t-test.

COGNITIVE MAPPING

A modified F-sort (Miller *et al.*, 1986) was used to map the cognitive structure of study participants directly following the intervention period. The F-sort is a free-sorting technique, the end result of which is a set of stimulus categories completely defined by the sorter. Participants

are given a set of stimuli and are asked to sort them into categories of their own choice; no restriction is placed on size or order of categories (Miller *et al.*, 1986). This technique for data collection, along with a data summarization technique (latent partition analysis, described below) comprise a powerful methodology for the investigation of a wide variety of perceptual and cognitive phenomena. Specifically, this methodology is useful in assessing the substance and structure of a specific group's knowledge about a particular subject. In this paper, knowledge structure, cognitive structure, and cognitive map will be used interchangeably (refer back to Section 3 for a theoretical overview of these concepts). Categorization methodology has been used in a variety of studies (see Miller *et al.*, 1986 for an extensive review). Lane (1967) investigated counselor's classifications of client statements. Hauslein *et al.* (1992) compared scientists, teachers, and college seniors on how they structured selected content knowledge in the discipline of biology. Several studies have investigated teacher's perceptions of teaching techniques (Coletta and Gable, 1975; Diamond, 1983; Whitely and Doyle, 1978).

The F-sort begins by presenting subjects with a group of cards, each containing a stimulus. Most often, the stimulus is a word, but it could also be a sentence, paragraph, picture, etc. Subjects are given few instructions other than to sort the cards into groups of items which seem to belong together.

The modified F-sort used in this study differs from the traditional F-sort in one major respect: before sorting the cards, participants were allowed to discard those items which did not relate to their perceptions of carpooling to work. Thus, in most cases, only a sub-set of the cards were sorted by any one participant. The decision to allow discarding was theoretically grounded. It cannot be assumed that an individual's cognitive map will be comprised of an exhaustive set of domain-specific concepts. On the contrary, we would expect someone with low familiarity with a particular topic to have an impoverished knowledge structure related to that domain; requiring such an individual to sort all of a given set of cards - when some of the cards bear no relationship to what is inside that individual's head - will not result in meaningful data. Instructing participants

to choose only those concepts which represent how they perceive a particular topic is more meaningful for assessing the substance and structure of their knowledge.

Application of the modified F-sort

Study participants were presented with 46 concepts relating to carpooling to work. These concepts were generated by surveying 19 carpooling "experts" (chosen from among the attendees of the Association for Commuter Transportation National Conference, 1992). An additional list of concepts was compiled by reviewing several studies on people's perspectives and attitudes towards carpooling (Horowitz and Sheth, 1978; Margolin *et al.*, 1978; Oppenheim, 1979; Angell and Ercolano, 1991). Along with the list of concepts, the study participants were given an envelope containing 50 blank 2" x 2" cards, 8 paper clips (for holding the final categories together), and a set of written instructions explaining the task. Pre-tests showed that a written set of instructions was sufficient for completion of the task. The written instructions along with the list of concepts is included in Appendix G. In brief, the participants were asked to complete the following five steps in order.

1. Participants were asked to imagine that they are sharing their perspective on carpooling from home to work with a co-worker who has not thought much about the issue. They were instructed to read through the list of concepts and choose *only* those that they would choose to talk about when explaining their views. Next, participants were asked to write each concept on a separate card.
2. Participants were then instructed to look through the cards and organize them into groups of related concepts. No restrictions on the size or number of categories was given; participants were simply told to categorize the concepts in any way which would help them explain their views about carpooling to work.

3. Next, participants were instructed to think of a label, or name, for each category. These labels were written on a separate card and grouped with the categories. The labels were helpful in describing and interpreting the latent structures defined later by the latent partition analysis (LPA - described below) and in encouraging the participants to sort the cards into meaningful categories.
4. Finally, participants were asked to paperclip the cards in each category together and put them back in the envelope. Envelopes contained the participant's unique codes; this allowed later matching to the other survey data.

COGNITIVE MAPPING ANALYSIS

Latent partition analysis (LPA) (Wiley, 1967) was used to analyze the data resulting from the modified F-sort. LPA is a technique formulated to study the relationships between two or more partitions of the same set of items. The analysis consists of two steps. First, an aggregated tabulation of the stimulus groupings formed by a group of participants is constructed. The output of this step is a triangular matrix containing the relative frequencies with which the participants combined each pair of stimuli. Next, this matrix is analyzed to detect patterns of consistency in how participants categorized the stimuli. Items which are consistently combined are considered to form a *latent category*. These categories are assumed to represent the way the group, as a whole, structures their knowledge. In this respect, LPA is similar to factor analysis, though LPA is suited to categorical rather than ordinal or interval data. Identification of latent categories allows for empirical investigation of the substance (the content of the categories) and the structure (the number and size of the categories) of a particular group's views.

In the current study, an LPA was performed on the modified F-sort data from each treatment group. The resulting latent categories were qualitatively compared. In addition, the category labels and content of each participant were examined and common categories were

identified (i.e., those categories which were used by numerous participants). A series of Chi-squared tests (χ^2) was used to assess differences, by treatment group, in the number of participants who used a particular common category. Differences between treatment groups in the average number of concepts and categories used were also quantitatively assessed.

V. RESULTS

PRE-INTERVENTION SURVEY

The banks of environmental attitude questions, rigidity questions, and conservation behavior questions were subjected to non-metric factor analysis and stable scales were identified. Individual's scores for these scales were created by averaging the items which comprised the scale.⁷ These scales are presented in Table 5.1 along with each scale's mean score, standard deviation, and Cronbach's coefficient of internal consistency, alpha. Cronbach's coefficient can be considered a rough measure of construct validity (Cronbach, 1951; Nunnally, 1978) since it reflects the degree to which the collection of items in the scale "hang together."

Seven of the eleven items included in the bank of rigidity questions clustered together, forming the RIGIDITY scale. As described in the methods section, the rigidity scale reflects an individual's overall resistance to change (Bariff and Lusk, 1977). A high score on the rigidity scale indicates that the respondent is highly resistant to change. Five of the six questions included in the bank of environmental attitude questions clustered together, forming the ATTITUDE ABOUT TRANSPORTATION scale. A high score on this scale indicates that the respondent believes environmental problems can be reduced if the use of automobiles is reduced. Three of the five behavior questions clustered together, forming the PRO-CONSERVATION BEHAVIOR scale. A high score on this scale indicates that the respondent is likely to be more engaged in conservation behavior. An additional behavior question (How likely are you to walk or use public transportation instead of driving?) was not included in the scale, but was retained as a separate variable for further analysis. This variable will be referred to as *alternative transit behavior*.

⁷ Before averaging, negative items were re-coded.

Table 5.1. Pre-Intervention Survey Scales†

Scale Names and Items Included	Mean	S. D.	Alpha
RIGIDITY	2.99	.60	.70
<ul style="list-style-type: none"> • I dislike interacting with groups of strangers • I enjoy the challenge of unfamiliar experiences* • I am uncomfortable in situations where I'm not sure how to act • I enjoy adapting myself to unfamiliar situations* • I always prefer what I'm used to over what is unfamiliar • I prefer to lead a life where few surprises or unexpected happenings arise • I am most comfortable when I can predict how things will turn out 			
ATTITUDE ABOUT TRANSPORTATION	4.09	.59	.77
<ul style="list-style-type: none"> • Air pollution caused by cars and trucks is a significant problem in this country today • Air pollution can be reduced if commuters stop driving by themselves • If more commuters stop driving alone, large-scale environmental degradation will be reduced • Emissions from transportation sources significantly affect the global environment • Commuter travel is a major contributor to air pollution 			
PRO-CONSERVATION BEHAVIOR	4.20	.61	.85
<ul style="list-style-type: none"> • Avoid purchasing products made by a company that pollutes the environment • Conserve electricity • Buy things made from recycled products 			

* The scale for this item was reversed before the rigidity scale was created.

† A high score indicates a strong endorsement of the scale.

In addition to the attitude, behavior, and rigidity questions, the pre-intervention survey instrument also included a bank of demographic questions and a bank of questions describing the participants' commuting trip and commuting history. The mean scores for these questions can be found in Appendix H along with the grand means for all questions included in the pre-intervention survey instrument.

In order to determine whether there were significant differences between the sites or between the treatment groups which may bias the results of the post-intervention measurements, a series of two-way anovas was performed on the *rigidity*, *attitude towards transportation*, and *pro-conservation* scales behavior scales, as well as on several demographic variables and on several variables relating to prior experience with carpooling. The variables that were included in this analysis were those which have been found to be significant predictors of carpooling in other studies (Horowitz and Sheth, 1978; Margolin *et al.*, 1978; Oppenheim, 1979; Angell and Ercolano, 1991) and those which are hypothesized to be significant. These variables are shown in Table 5.2 along with their means and standard deviations.

Table 5.2. Additional pre-intervention survey variables used in analysis

Item	Variable Name	Mean	S. D.
• Please indicate how much information you have been exposed to regarding carpooling (5-point Likert scale)*	Prior Information	2.74	1.16
• Indicate how long you have carpoled (in months)	Prior Experience	41.01	49.60
• How satisfied were you, overall, with your carpooling experience (5-point Likert)*	Satisfaction	3.38	1.08
• Age	Age	40.31	11.13
• Education (from 1 = grade school to 7 = Ph.D. or other advanced degree)	Education	4.74	1.35

* High scores indicate a high level of information and high satisfaction, respectively.

No significant differences were found between sites or treatment groups on *prior experience* with carpooling, *satisfaction* with prior carpooling experience, the *rigidity* scale, nor

alternative transit behavior. The only significant differences between treatments groups was on *age* ($F = 7.54$; $df = 2,603$; $p < .001$). A Tukey HSD comparison test revealed that participants in the factsheet group tended to be slightly older than participants in either the story group ($p < .001$) or the control group ($p < .008$) (Table 5.3).

Table 5.3. Differences in mean age by treatment group

		TREATMENT GROUP		
		Control	Factsheet	Story
AGE	Mean =	38.86 _a *	42.58 _{a,b}	38.94 _b
	S. D. =	10.40	11.33	11.01
	n =	119	232	259

* Tukey HSD comparison results: means sharing same subscript are significantly different at $p < .05$

Significant differences were found between the sites on amount of *prior information* regarding carpooling ($F = 9.77$; $df = 4,622$; $p < .001$), *age* ($F = 9.20$; $df = 4,603$; $p < .001$), *attitude towards transportation* ($F = 4.77$; $df = 4,615$; $p < .001$), *pro-conservation behavior* ($F = 3.33$; $df = 4,614$; $p < .01$) and *education* ($F = 2.97$; $df = 4,612$; $p < .02$). Table 5.4 shows the significant pairwise differences among the different sites. Participants at RTP tended to have a higher level of education than participants at BellSouth ($p < .014$). One might speculate that this is due to RTP being situated between three major universities. RTP also had a higher mean on the *attitude about transportation* scale than all other sites. Participants at Edison tended to be slightly older than participants at the other sites and had received less information about carpooling than the other sites. While these differences between sites are important to note, they present no discernible pattern. Because of this, and for ease of analysis, the treatment groups were combined across sites.

Table 5.4. Results of Tukey HSD showing significant differences among sites

SITE

DEPENDENT VARIABLE

	Attitude about Transportation			Prior Information			Pro-conservation Behavior			Age			Education		
	Mean	S. D.	n	Mean	S. D.	n	Mean	S. D.	n	Mean	S. D.	n	Mean	S. D.	n
Ann Arbor	4.05 _{a*}	.56	112	2.97 _a	.95	112	4.20	.56	111	40.93 _a	10.90	110	4.73	1.28	110
Atlanta	4.09 _b	.65	132	2.90 _b	1.11	136	4.21	.57	133	37.65 _b	11.09	130	4.81	1.32	133
BellSouth	3.93 _c	.64	85	2.85 _c	1.13	80	4.23	.64	85	40.35 _c	8.09	85	4.37 _a	1.37	85
Edison	4.04 _d	.52	116	2.18 _{a,b}	1.30	121	4.03 _a	.76	115	45.44 _a	14.02	112	4.69	1.44	115
RTP	4.24 _{a,b}	.56	177	2.81 _d	1.11	180	4.28 _a	.54	177	38.57 _d	9.36	173	4.92 _a	1.30	176

* Tukey HSD comparison results: Variable means sharing the same subscript are significantly different at $p < .05$

OPINION SHEETS

Opinion sheets were completed by participants in the factsheet group and in the story group. The sheets asked participants to rate the interestingness and informativeness of each of the ten pieces of information they read. For purposes of analysis, each participant's interestingness ratings were averaged, resulting in a single overall interestingness score for each participant. Likewise, informativeness ratings were averaged to create an overall informativeness score. Student's T-tests were used to compare the factsheet and the story group on each of these variables. Table 5.5 shows that both *overall interestingness* ($t = 4.07$; $df = 327$; $p < .001$) and *overall informativeness* ($t = 9.72$; $df = 327$; $p < .001$) were significantly higher for the factsheet group. Appendix I shows the mean interestingness and informativeness for each story and factsheet.

Table 5.5. Differences in overall interestingness and overall informativeness by treatment group

		Factsheet	Story	t-test
Interestingness	Mean =	3.36	3.02	$t = 4.07$
	S. D. =	.70	.81	$df = 327$
	n =	163	166	$p < .001$
Informativeness	Mean =	3.23	2.43	$t = 9.72$
	S. D. =	.70	.79	$df = 327$
	n =	163	166	$p < .001$

POST-INTERVENTION SURVEY

The *attitude about transportation* and *pro-conservation behavior* scales identified in the pre-intervention survey were also used for the post-intervention survey so that changes in response could be measured. The bank of knowledge questions in the post-intervention survey

clustered into one cohesive scale, labeled COMFORT WITH KNOWLEDGE. The scale is a reflection of how comfortable a participant is with their knowledge about carpooling. A respondent with a high score on this scale feels they know enough to solve problems relating to carpooling, to competently communicate about carpooling, and to give advice about carpooling. The scale is presented in Table 5.6 along with its mean score, standard deviation, and Cronbach's coefficient of internal consistency, alpha. Two items which did not load on the scale were retained as separate variables. These items were "I am not interested in the topic of carpooling" and "During the past two weeks, I found myself thinking more about carpooling than usual." The scale of the first item was re-reversed so that a high score reflects a high interest in carpooling. In addition, there were six questions which were asked only of the factsheet and the story group. These questions, as well as other individual items included in the analysis are shown in Table 5.7 along with their means and standard deviations. The grand means for all post-intervention survey items are shown in Appendix J.

Table 5.6. Post-intervention survey knowledge scale†

Scale Name and Items Included	Mean	S. D.	Alpha
COMFORT WITH KNOWLEDGE	3.05	.73	.85
<ul style="list-style-type: none"> • If I started carpooling, I could resolve most problems that arise • I doubt I could troubleshoot a problem occurring in another carpool* • If someone came to me with a carpool-related problem, I would be able to offer advice • I am willing to organize a carpool on my own • I would have no trouble making a list of the pros and cons to carpooling • I'm sure I could help resolve problems that come up in a carpool • I can easily imagine the sorts of problems that people in a carpool would encounter • I would feel comfortable talking about the carpooling process • I can easily imagine the start-up problems a carpool would face • I have enough knowledge about carpooling to write a memo for the office • I could generate a couple of different solutions to most carpool problems 			

* Item scale was reversed before knowledge scale was created.

† High score indicates higher endorsement of the scale.

Table 5.7. Additional post-intervention survey variables used in analysis†

Item (all responses on 5-point Likert scale)	Variable Name	Mean	S. D.
<i>Factsheet and Story Groups Only</i>			
• Compared to what you knew before you read the factsheets/stories, how much do you now know about carpooling? (1=no more than before to 5=a great deal more than before)	Perceived knowledge	2.60	.97
• Compared to how confident you were about your ability to solve carpooling problems before you read the factsheets/stories, how would you now rate your level of confidence? (1=no more confident to 5=a very great deal more confident)	Confidence	2.02	1.00
• Did you read the factsheets/stories?	Number factsheets/stories read	4.82	.57
• The factsheets/stories did not persuade me to give carpooling another thought	Persuasion	2.72	1.42
• During the past two weeks, I found myself mentioning the factsheets/stories to other people	Mentioning intervention	1.58	.87
<i>All Groups</i>			
• I am interested in the topic of carpooling*	Carpooling interest	3.53	1.36
• During the past two weeks, I found myself thinking more about carpooling than usual	Increased thought	2.18	1.27

* This question was re-coded. The original question stated, "I am not interested in the topic of carpooling."

† Higher value indicates stronger endorsement of the statement.

Effects of intervention on survey data

A Student's t-test, by treatment group, was run on the variable *number of information sheets read* to determine if differences between the factsheet and story groups on post-intervention measurements might simply be attributable to the number of information sheets (either factsheets or stories) which the participants read. Results show that there was no significant difference between the two groups.

To rule out the possibility that the effect of the intervention on the post-intervention variables (these will be referred to as knowledge variables) was confounded by another variable, a series of two-way analysis of variance was run. The independent variables used were: *rigidity*, *prior information*, *overall interestingness* of intervention, and *overall informativeness* of intervention.⁸ These variables were dichotomized along the mean to form a "high" and "low" group. In each case, the variable was paired with *treatment group* as the second independent variable. Each of these pairs of independent variables were run, in turn, with the following dependent knowledge variables: *perceived knowledge*, *comfort with knowledge*, *confidence*, *persuasion*, and *increased thought*. Results show that in each case, *treatment group* had a main effect on *perceived knowledge*, *comfort with knowledge*, and *increased thought*. A Tukey HSD pairwise comparison (Table 5.8) shows that both the factsheet group and the story group scored significantly higher than the control group on *comfort with knowledge* and *increased thought*. There was no significant difference between the factsheet group and the story group on these two variables ($p < .05$). The factsheet group did score significantly higher than the story group on *perceived knowledge* ($p < .05$).

⁸ These variables were chosen because the literature gives some indication that they may effect knowledge acquisition and assessment (Lusk, 1977; Hidi and Baird, 1986; Monroe, 1991).

Table 5.8. Significant differences in post-intervention knowledge variables by treatment group

TREATMENT GROUP	KNOWLEDGE VARIABLES								
	Comfort with Knowledge			Increased Thought			Perceived Knowledge		
	Mean	S. D.	n	Mean	S. D.	n	Mean	S. D.	n
Control	2.82 _{a,b} *	.71	87	1.46 _{a,b}	.95	87	--	--	--
Factsheet	3.19 _a	.70	130	2.55 _a	1.36	130	2.98 _a	.91	128
Story	3.06 _b	.73	129	2.28 _b	1.18	129	2.21 _a	.88	126

* Tukey HSD comparison results: Variable means sharing the same subscript are significantly different at $p < .05$

Main effects for dichotomized independent variables are shown in Tables 5.9 to 5.12. In general, participants who scored high on *rigidity* tended to be less confident ($F = 3.93$; $df = 1,241$; $p < .05$), less comfortable with their knowledge ($F = 20.371$; $df = 1,329$, $p < .001$) less likely to have thought more about carpooling during the intervention ($F = 7.10$; $df = 1,329$; $p < .01$), but more likely to indicate that the stories/factsheets persuaded them to give carpooling another thought ($F = 4.33$; $df = 1,242$; $p < .04$). Participants who had been exposed to more information about carpooling prior to the study were more likely to rate lower both *perceived knowledge* ($F = 4.25$; $df = 1,242$; $p < .05$) and *confidence* ($F = 4.60$; $df = 1,242$; $p < .03$). However, they tended to rate higher *comfort with knowledge* ($F = 7.63$; $df = 1,334$; $p < .01$).

There was a significant interaction effect between amount of prior information and treatment group on confidence ($F = 3.98$; $df = 1,242$; $p < .05$). In the factsheet group, participants with lower levels of prior knowledge tended to rate their confidence higher than participants with high levels of prior knowledge. There was no difference in confidence ratings between the two levels of prior information in the story group.

Participants who rated the intervention (either factsheets or stories) high on *interestingness* tended to score higher on *perceived knowledge* ($F = 41.24$; $df = 1,230$; $p < .001$), *comfort with knowledge* ($F = 10.00$; $df = 1,235$; $p < .002$), and *confidence* ($F = 16.76$; $df = 1,228$;

$p < .001$). These participants also tended to claim that during the intervention period they had thought more about carpooling than those with low interest in the intervention ($F = 32.72$; $df = 1,235$; $p < .001$). However, those with low interest in the intervention were more likely to have been persuaded to give carpooling another thought ($F = 4.71$; $df = 1,229$; $p < .03$). Participants who rated the intervention high on *informativeness* tended to score higher on *perceived knowledge* ($F = 28.53$; $df = 1,230$; $p < .001$) and *confidence* ($F = 27.60$; $df = 1,228$; $p < .001$), but not on *comfort with knowledge*.

Table 5.9. Significant differences in knowledge variables by rigidity

KNOWLEDGE VARIABLE		RIGIDITY SCORE		
		Low Rigidity	High Rigidity	Significance Level
Confidence	Mean =	2.15	1.88	$p < .05$
	S. D. =	1.11	.88	
	n =	116	129	
Persuasion	Mean =	2.51	2.90	$p < .04$
	S. D. =	1.46	1.35	
	n =	120	126	
Comfort with Knowledge	Mean =	3.24	2.89	$p < .001$
	S. D. =	.75	.66	
	n =	159	174	
Increased Thought	Mean =	2.39	2.02	$p < .01$
	S. D. =	1.31	1.22	
	n =	159	174	

Table 5.10. Significant differences in knowledge variables by amount of prior information regarding carpooling

KNOWLEDGE VARIABLE		PRIOR INFORMATION SCORE		
		Low Prior Information	High Prior Information	Significance Level
Perceived Knowledge	Mean =	2.68	2.42	$p < .04$
	S. D. =	1.01	.85	
	n =	184	63	
Confidence	Mean =	2.10	1.78	$p < .03$
	S. D. =	1.02	.92	
	n =	183	63	
Comfort with Knowledge	Mean =	2.98	3.25	$p < .01$
	S. D. =	.70	.79	
	n =	257	81	

Table 5.11. Significant differences in knowledge variables by overall interestingness

KNOWLEDGE VARIABLE	INTERESTINGNESS SCORE			Significance Level
		Low Interest	High Interest	
Perceived Knowledge	Mean =	2.15	3.01	$p < .001$
	S. D. =	.79	.89	
	n =	98	136	
Confidence	Mean =	1.73	2.27	$p < .001$
	S. D. =	.87	1.02	
	n =	97	135	
Persuasion	Mean =	2.95	2.54	$p < .03$
	S. D. =	1.50	1.31	
	n =	97	136	
Comfort with Knowledge	Mean =	2.94	3.26	$p < .002$
	S. D. =	.78	.66	
	n =	100	139	
Increased Thought	Mean =	1.90	2.86	$p < .001$
	S. D. =	1.06	1.29	
	n =	100	139	

Table 5.12. Significant differences in knowledge variables by overall informativeness

KNOWLEDGE VARIABLE	INFORMATIVENESS SCORE			Significance Level
		Low Informativeness	High Informativeness	
Perceived Knowledge	Mean =	2.23	3.02	$p < .001$
	S. D. =	.82	.90	
	n =	111	123	
Confidence	Mean =	1.70	2.35	$p < .001$
	S. D. =	.83	1.03	
	n =	110	122	
Increased Thought	Mean =	1.42	1.76	$p < .001$
	S. D. =	.80	.93	
	n =	112	127	

FOLLOW-UP SURVEY

Of the 645 original study participants, only 168 returned the follow-up survey. Because of this low return rate, the following results should be viewed cautiously. On the follow-up survey participants were asked whether they had made changes in their driving habits since the intervention. If they answered 'yes', they were asked to list the changes made. These changes fell into four categories; codes were assigned for each category to indicate whether or not the participant had mentioned it. The four categories and the percentage of respondents who mentioned them are listed here: 1) carpool to work (6%); 2) carpool during non-work (2.4%); 3) consolidate trips/errands or change schedule to use car less (11%); and, 4) take bus or walk more (6%). A series of Chi-squared tests were performed on the number of participants in each treatment group who included a particular category.⁹ All results were non-significant at the 0.05 level, indicating that there were no significant differences in the changes made in driving habits among the treatment groups. In general, the number of participants who mentioned each category of change was quite small; this is shown in Appendix K along with the grand means for the follow-up survey.

In addition to the behavior change questions, questions were asked assessing: 1) anticipated ease of dealing with problems that might arise in a carpool; and, 2) awareness of commuting patterns. A one-way analysis of variance was run on each of these variables, using *treatment group* as the grouping variable. No significant differences were found ($p < .05$). Next, *comfort with knowledge* and *perceived knowledge* (both variables from the post-intervention survey) were dichotimized along the mean to form a "high" group and a "low" group. These variables were then used as independent variables in a series of Student's t-tests with *anticipated ease of dealing with problems* and *awareness of commuting patterns*. The only significant result was the relationship between *perceived knowledge* and *anticipated ease of dealing with problems* ($t = 3.628, df = 54.5, p < .001$). This result is not surprising and indicates that people who think

⁹ Because of the relatively small return rate, treatment groups were combined across study sites.

they know more about carpooling are more likely to think they would be able to deal with carpooling problems.

Participants were also asked about the perceived barriers to carpooling. These responses fell into six categories; they are listed here along with the percentage of respondents who mentioned them: 1) scheduling problems (55%); 2) lack of convenience/loss of independence (21%); 3) lack of privacy (2%); 4) time commitment (10%); 5) children (11%); and, 6) not knowing people with whom to carpool (17%).

CHANGES IN VARIABLES ACROSS SURVEYS

Measurements of two variables (i.e., *pro-conservation behavior*, *alternative transit behavior*) were taken in both the pre-intervention survey and the post-intervention survey. In order to detect changes in these measurements, a series of one-way analysis of variance with repeated measures was performed with treatment group as the independent variable. Results show that there were no significant changes for any of the three treatment groups on *pro-conservation behavior*, nor on *alternative transit behavior*.

Attitude about transportation was measured three times - in the pre-intervention survey, the post-intervention survey, and the follow-up survey. Three separate one-way analysis of variance with repeated measures were performed, again using treatment group as the independent variable. Results show that while treatment group had no effect, there was an overall significant difference in *attitude about transportation* between the pre-intervention survey and the post-intervention survey ($F = 10.230$; $df = 1,316$; $p < .002$) and between the post-intervention survey and the follow-up survey ($F = 8.028$; $df = 1,106$; $p < .006$). No significant difference was found between the pre-intervention survey and the follow-up survey. Results are shown in Table 5.13. It appears that across the treatment groups, *attitude about transportation* increased slightly as a result of the intervention but that this increase was not permanent.

Table 5.13. Changes in attitude about transportation across surveys

		SURVEY		
		Pre- Intervention	Post- Intervention	Follow- up
ATTITUDE	Mean	= 4.096 _a *	4.201 _{a,b}	4.052 _b
	S. D.	= .592	.626	.643
	n	= 622	334	168

* Means sharing same subscript are significantly different at $p < .05$

COGNITIVE MAPPING TASK

Four of the five sites (a total of 191 people) participated in the cognitive mapping task. A Kruskal-Wallis test was performed on the average number of concepts selected by the participants in each treatment group and on the average number of categories into which those concepts were organized.¹⁰ Results in Table 5.14 show that there were no significant differences between the treatment groups on the number of concepts chosen. The mean number of categories for the control group was slightly less than the means for either the factsheet or the story group, but this difference was not significant.

¹⁰ The Kruskal-Wallis is the non-parametric version of the analysis of variance. The test was used because the dependent variables did not meet the assumptions for the analysis of variance (i.e., normality and equal variances).

Table 5.14. Modified F-sort data by treatment group

		Control	Factsheet	Story	Kruskal-Wallis
Number of Categories	Mean =	3.10	3.26	3.46	n. s.
	S. D. =	1.18	1.25	1.13	
	n =	41	74	76	
Number of Concepts	Mean =	12.71	12.87	12.49	n. s.
	S. D. =	5.61	6.57	5.42	
	n =	41	74	76	

Latent Partition Analysis

The modified F-sorts of each treatment group were subjected to latent partition analysis (LPA). A particular concept was included in a final category if it met the following two criteria: 1) had a loading of 0.50 or higher (Miller *et al.*, 1986), and 2) at least 30% of the participants in the treatment group selected that concept.¹¹ The resultant categories reflect the way in which the group, as a whole, organized their thoughts about carpooling.

The results in Table 5.15 show that the control group clustered the concepts into two different categories, while both the factsheet group and the story group clustered the concepts into three categories. The order of the concepts within each category is not meaningful, nor is the order of the categories themselves. The first category for each group is virtually identical. The

¹¹ Due to the modification of the F-sort, this later criterion was included. Participants were not required to categorize all of the concepts and because of this, a number of concepts were categorized by only a few people. The nature of the latent partition analysis includes even these low frequency concepts in the final categories. It is possible, then, that a concept that was chosen by only a few people in the group will load in a category. However, this is obviously not reflective of the group as a whole. A method of cutting these low-frequency concepts out of the final categories was required. The 30% cutoff was arrived at by examining the average number of concepts participants in each group chose. Since people tended to select approximately one-third of the total number of concepts available, then if all concepts were equally salient, they would be chosen by 30% of the participants. Setting the cutoff point at 30% captures those concepts which were more salient (chosen more often than random chance) to the group.

second categories of the factsheet group and the story group are also virtually identical and are a subset of the second category for the control group (the factsheet group has the addition of "energy use"). The third category of the factsheet group and the story group are qualitatively different. This category for the story group has three concepts in common with the control group ("company of others", "conversation", and "driving related stress") and an additional two concepts ("length of commute" and "shared driving responsibility"). The third category for the factsheet group shares two concepts with the story group ("length of commute" and "shared driving responsibility") and shares no concepts with the control group. The additional concepts making up the third factsheet category are: "privacy" and "automobile insurance."

Table 5.15. Latent Partition Analysis on modified F-sort by treatment group

CONTROL GROUP (n = 41)		
Category One <ul style="list-style-type: none"> • independence • freedom • convenience • personal emergency • flexibility • scheduling demands • time spent waiting • errands • fixed schedule • reliability*† 	Category Two <ul style="list-style-type: none"> • parking costs • automobile maintenance • gasoline costs • air pollution • company of others* • driving related stress* • conversation* • physical comfort*† • relaxation*† 	
FACTSHEET GROUP (n =74)		
Category One <ul style="list-style-type: none"> • independence • freedom • convenience • personal emergency • flexibility • scheduling demands • time spent waiting • errands • fixed schedule 	Category Two <ul style="list-style-type: none"> • parking costs • automobile maintenance • gasoline costs • air pollution • energy use** 	Category Three <ul style="list-style-type: none"> • privacy** • automobile insurance** • shared driving responsibility** • length of commute**
STORY GROUP (n = 76)		
Category One <ul style="list-style-type: none"> • independence • freedom • convenience • personal emergency • flexibility • scheduling demands • time spent waiting • errands • fixed schedule • mobility†† 	Category Two <ul style="list-style-type: none"> • parking costs • automobile maintenance • gasoline costs • air pollution 	Category Three <ul style="list-style-type: none"> • company of others • driving related stress • conversation • shared driving responsibility†† • length of commute††

* Concept included in control group but not in factsheet group.

** Concept included in factsheet group but not in control group.

† Concept included in control group but not in story group.

†† Concept included in story group but not in control group.

Analysis of category content

In order to further explore the differences in categorization noted above, the categories for each participant were examined. This analysis was independent of the LPA done on the participants' categories. After examining 40 participants' categories in depth (including participants from each treatment group), 6 general categories (described below) were identified. Next, the categories of all the participants were coded as one of these general categories (or as "other"). The individual participants' categories were assigned to general categories based on both the label names and the concepts included in each participant's category. This coding process was repeated by one independent rater on a random sample of 30. Inter-rater reliability on this sample was 95%.

The six general categories were: 1) impact on daily schedule; 2) personal/social aspects of carpooling; 3) economic aspects of carpooling; 4) environmental aspects of carpooling; 5) organizational aspects of carpooling; and, 6) positive things about carpooling. The "impact on daily schedule" category included aspects of carpooling that would either positively or negatively affect one's daily schedule; typical concepts in this category included reliability, convenience, freedom, errands, flexible schedule, time spent waiting, and personal emergency. The "personal/social" category included non-economic and non-environmental benefits and drawbacks of driving with other people; typical concepts in this category included conversation, fun, shared driving responsibility, privacy, relaxation, company of others, driving-related stress, and making friends. The "economic" category included concepts such as parking costs, automobile maintenance, gasoline costs, and insurance costs. The "environmental aspects" category included concepts such as air pollution and energy use. The "organizational aspects" category included the components of setting up a carpool; typical concepts in this category included setting up a carpool, scheduling demands, and carpooling protocol. The final category, "positive things about carpooling" was a composite of "personal/social aspects", "economic aspects", and "environmental aspects."

The stories and factsheets were analyzed to determine the frequency with which each of the general categories was mentioned. (Some participants lumped several general categories under one heading - "positive things about carpooling." Because this category was a composite of several other categories, the frequency with which it appeared in the factsheets and stories could not be assessed independently.) Frequencies of general category presentation were used to determine whether or not the category differences between treatment groups were due to differences in the frequency of category presentation. Each time a new element of a particular category was mentioned, "one" was added to the frequency score for that category. The analysis was repeated by one independent rater for the stories and another independent rater for the factsheets. Inter-rater reliability for the factsheets was 89% and inter-rater reliability for the stories was 81%.¹²

A series of Chi-squared tests were performed on the percentages of participants from each group who included a particular category in their cognitive mapping task. The results are shown in Table 5.16 along with the frequency with which the categories were mentioned in the factsheets and stories. Results indicate that there are significant differences between the treatment groups on the percentage of people who included the "personal/social aspects" category ($\chi^2 = 6.52$; $df = 2$; $p < .038$) and the percentage of people who included the "economic aspects" category ($\chi^2 = 8.99$; $df = 2$; $p < .011$). Separate Chi-squared tests were run on each pair of treatment groups to determine which treatment groups differed. Results indicate that participants in the story group included the "personal/social aspects" category significantly more than participants in the factsheet group ($\chi^2 = 6.52$; $df = 1$; $p < .011$) and that participants in the story group included the "economic aspects" category significantly more than participants in the control group ($\chi^2 = 8.86$; $df = 1$; $p < .003$). There was no significant difference in the number of

¹² Because the categories in the stories had more context than those in the factsheets, they were more difficult to identify and inter-rater reliability was lower. However, given the purpose of the task (to assess relative frequencies), the reliability rate is acceptable. Even assuming a higher error rate in the stories, it is clear that the frequencies of concept mention in the factsheets is higher for all general categories.

participants in the factsheet group and the story group who included the “economic aspects” category. Significant differences between treatment groups are indicated in Table 5.16.

Table 5.16. General Categories in modified F-sort and frequency of use

	GENERAL CATEGORIES					
	Impact on Daily Schedule	Personal/ Social Aspects	Economic Aspects	Environmental Aspects	Organizational Aspects	Positive Aspects
Frequency mentioned in factsheets	45	40	53	50	31	--
Frequency mentioned in stories	33	21	13	6	7	--
% control respondents	85%	34%	37% ^{ob}	32%	15%	29%
% factsheet respondents	70%	24% ^{oa*}	52%	38%	18%	28%
% story respondents	67%	44% ^{oa}	65% ^{ob}	43%	21%	16%
Chi-Squared	n. s.	$\chi^2 = 6.52$ $df = 1$ $p < .011$	$\chi^2 = 8.86$ $df = 1$ $p < .003$	n. s.	n. s.	n. s.

* Results of pairwise Chi-squared tests: Percentages sharing subscripts are significantly different at $p < .05$

VI. DISCUSSION

Overall, these data support the notion that information has an impact on knowledge structure (as measured both quantitatively and qualitatively). Both the factsheet group and the story group had significantly higher scores on comfort with carpooling knowledge than did the control group. This indicates that the groups receiving information about carpooling felt more sure that they had adequate knowledge to guide them in discussions and problem solving regarding carpooling. Not surprisingly, both the factsheet group and the story group also thought more about carpooling during the two-week intervention period than did the control group. In both the factsheet group and the story group, participants who scored higher on the rigidity scale were less likely to have been affected by the information (as shown by lower scores on post-intervention confidence and comfort with knowledge). This indicates that there are individual differences among people's willingness and/or ability to incorporate new information into their knowledge structure.

Contrary to the hypothesis, no significant differences were found between the treatment groups in the amount of behavior change as measured by responses to a single survey administered one month after intervention. This survey was a one-time measure of behavior and not intended to measure durable behavior change. There are several explanations for these results. First, as expected, the response rate decreased considerably throughout the study; as a result of this, significant differences may have gone undetected due to the low response rate on the follow-up survey. More significantly, the overall percentages of respondents who indicated they had changed their behavior were very low (see Appendix J). It appears that despite the change in knowledge structure attributable to the intervention, factors other than a lack of knowledge prevented a change in commuting behavior. Many of the respondents listed perceived barriers to carpooling. The most frequently mentioned barrier (55%) was scheduling problems; this included problems with arranging one's working hours to accommodate carpooling, and pre or post work obligations. Barriers such as these are often outside an employee's control and

cannot be overcome with a change in knowledge and perception. This indicates that barriers to behavior change must be acknowledged and minimized in conjunction with story-based information campaigns if trip reduction programs are to succeed.

As hypothesized, there was no significant effect of the intervention on attitudes about transportation. Participants who had read either the factsheets or the stories judged the impact of automobiles on the environment the same as participants in the control group in both the post-intervention survey and the follow-up survey. This finding parallels studies on recycling that have found that pro-recycling attitudes were not increased through exposure to information about recycling (De Young, 1988-1989; Boerschig *et al.*, 1992). It is interesting to note that though there were no attitudinal differences between treatment group, there was a slight overall increase in attitudes towards carpooling as an alternative mode of transit immediately following the intervention period. By one month later, however, attitudes had dropped to pre-intervention levels. Because there was no difference between the treatment groups and the control, this change in attitudes cannot be attributed to the intervention. Most likely, the change was an artifact of the study itself; that is, merely being aware that they were participants in a study about carpooling caused the respondents to express a more positive attitude about alternative transportation. As noted, this effect had disappeared by the end of the study.

The remaining discussion focuses on the significant differences in knowledge structure between the factsheet and story groups. These differences were not entirely as expected.

QUANTITATIVE DIFFERENCES IN KNOWLEDGE STRUCTURE

It was hypothesized that the story group (as compared to the factsheet group) would: 1) feel they had more knowledge about carpooling; 2) be more confident in their ability to address carpooling problems; and, 3) feel better able to use their knowledge about carpooling (i.e., will be more "comfortable" with their knowledge). We will use the terms "perceived knowledge", "confidence", and "comfort", respectively, to refer to these three hypotheses. Contrary to these expectations, the factsheet group felt they had significantly more perceived knowledge about

carpooling after reading the information than did the story group. A closer look at the stories and factsheets helps explain this result.

Overall, the factsheets were found to be significantly more interesting and informative than the stories. In light of this, the differences in perceived knowledge make sense; one would expect a correlation between perceived informativeness and perceived knowledge. The differences in interestingness is harder to interpret.

In general, studies on learning from text have found stories to be significantly more interesting than declarative text (e.g., textbooks, factsheets) (Hidi and Baird, 1986; Hidi, 1990). However, most of the subjects in these studies were students who read the stories and texts during school hours. It is very possible that the lower interestingness score in this study was due to the context in which the study was performed. All subjects in the current study were employees in large organizations and regularly receive technical information in factsheet form while at work. The sudden appearance of stories through regular mailing routes (assumably reserved for "serious information") may have caused suspicion and a negative reactance towards the stories. Unfamiliarity with receiving information in story form may have created a bias against the stories and resulted in the lower interestingness scores.

Another factor may have been the nature of the stories themselves. The stories used in this study, though rated high in interestingness by an independent panel (see Section 4), were obviously fictitious. Though some participants indicated that they identified with the characters in the stories, many participants questioned the stories' purpose and felt they were being patronized. It is possible that this caused the participants to perceive them as unreliable sources of information. Any or all of these factors could have impacted the interestingness and informativeness scores.

In a more general sense, these results do confirm the findings of previous studies (Hidi, 1990; Sadoski, 1990) which indicate that text perceived as interesting has a greater impact on knowledge structure than does less interesting text. Participants in both the factsheet group and the story group who perceived the information as more interesting tended to score higher on

perceived knowledge, confidence, and comfort with knowledge. They also thought about carpooling more during the intervention period and were more likely to have been persuaded to give carpooling another thought. This indicates that interestingness has a powerful impact on knowledge structure.

It is worth noting that despite the possible bias against the stories and the fact that they were rated lower than the factsheets on informativeness and interestingness, there was no corresponding difference in the confidence and comfort with knowledge scores. After the two-week intervention period, the story group felt equally confident in their ability to solve carpooling problems as did the factsheet group. The story group was also equally as comfortable with their carpooling knowledge. Apparently, in spite of the fact that they were perceived as ineffective by the participants, the stories were effective at changing the knowledge structures of these same participants. The nature of these changes is made more clear in the following section.

QUALITATIVE DIFFERENCES IN KNOWLEDGE STRUCTURE

As hypothesized, there were qualitative differences in the knowledge structures of the three treatment groups. The results of the latent partition analysis (LPA) done on the modified F-sort (the cognitive mapping task) show that, on average, the knowledge structures of the factsheet and story groups were more differentiated than the knowledge structures of the control group. The concepts for the control group clustered into two latent categories while the concepts from both the factsheet and story groups clustered into three latent categories (refer to Table 5.15). These categories represent the way each group, as a whole, organized their knowledge about carpooling. A higher number of categories is indicative of the more complex organization of knowledge that would be expected to be developed through experience.

Despite the differences in the number of latent categories between the three groups, there were no significant differences in the number of concepts that the participants in each group selected. This is an indication that, in general, the participants were familiar with the components

of carpooling (i.e., the concepts that were used in the cognitive mapping task) before the study began. In structural terms, the prototypes corresponding to these components of carpooling already existed (refer back to the theoretical discussion of knowledge structure in Section 3). The impact of the intervention was to structure (organize) and strengthen these prototypes.

Visual inspection of the latent categories which resulted from the LPA, along with the category analysis (described in Section 5) further illuminates the differences in knowledge structure among the treatment groups. One striking finding is that the first latent category of all groups is virtually identical. This category is comprised of "impacts on daily schedule" and was generally viewed as negative components of carpooling. Though many of these issues (e.g., flexibility, errands) were specifically addressed in both the factsheets and the stories, they did not drop out of the knowledge representations of these groups. This is further confirmation of the findings of previous studies (De Young, 1988-1989; Boerschig *et al.*, 1992) showing that negative components of an issue are generally not eliminated as a result of information.

The second latent categories of the factsheet group and the story group are virtually identical. This category is comprised of "economic" and "environmental" aspects of carpooling. It is interesting that these aspects of carpooling clustered together. Possibly it is because "economic" aspects and "environmental" aspects are both very tangible. The concepts may also have been linked together because of numerous references in the factsheets, and to a lesser extent in the stories, to the economic costs of environmental degradation.

Inspection of the third categories of the factsheet and story groups shows some differences in content. In the story group, this category strongly reflects the "personal/social" aspects of carpooling (e.g., conversation, company of others). The factsheet category has some of these components, but is muddled by other factors (e.g., automobile insurance). It is interesting to note that four of the five concepts that were present in the control group but not in the factsheet group were "personal/social" aspects of carpooling. (The concepts which dropped out were: conversation, company of others, driving related stress, and relaxation.) It appears that

after reading the factsheets, participants were less likely to include “personal/social” issues in their thoughts about carpooling.

The analysis of the content of these F-sort categories (refer to Table 5.16) further supports these results. Significantly more participants in the story group than in the factsheet group included “personal/social” aspects of carpooling as one of their categories. In fact, though not statistically significant, the percentage of participants in the factsheet group who included the concept was lower than that of the control group. These findings are made more powerful by the fact that the “personal/social” aspects of carpooling were mentioned much more frequently in the factsheets than in the stories (40 mentions in the factsheets versus 21 mentions in the stories).

Results of the category analysis also indicate that, in general, the knowledge structures of the story group may be more differentiated than that of the factsheet group. The percentage of participants in the story group who included the general category “positive things about carpooling” was lower than the other two groups while the percentages who included “personal/social” aspects, “economic” aspects, and “environmental” aspects were higher. It appears that participants in the story group were more likely to organize their knowledge in discrete categories rather than lump concepts together in a single category. (Recall that the “positive things about carpooling” was determined to be a composite of the other categories.) Though not all of these differences are statistically significant, the exploratory nature of this study warrants their mention. Again, these results are particularly powerful in light of the fact that all of the general categories were mentioned much more frequently in the factsheets than in the stories. This strongly supports the theory that the *structure* of the information being presented has as much (and in some cases has more) impact on knowledge structure as the *content* of that information.

CONCLUSIONS

Overall, the results indicate that while the participants in the factsheet group tended to perceive their knowledge about carpooling to be greater than the story group, there was no corresponding difference in their confidence in and comfort with their knowledge. Qualitative analysis indicates that the stories had a greater effect on the organization of knowledge than did the factsheets. This occurred despite the fact that all of the general categories were mentioned more frequently in the factsheets than in the stories. The stories were also better at communicating the intangible (i.e., personal/social) aspects of carpooling. In fact, the factsheets appeared to have the unintended and undesirable effect of making these intangible aspects less salient.

VII. CONCLUSIONS AND IMPLICATIONS

Results of this study have both theoretical and practical implications. These are discussed below.

THEORETICAL IMPLICATIONS

As predicted by the clarity-based decision making model (Kaplan, 1992 - see Section 3), the results of this study indicate that there are several separate components of knowledge structure. The *content* of the participants' knowledge about carpooling was similar across treatment groups (as measured by the LPA). The *strength* of that knowledge and its *organization*, however, were different. (The term strength refers to how strong the prototypes themselves are; organization refers to the extent to which the prototypes in the map are interconnected. See Section 3 for a review of these concepts.)

It is speculated that the prototypes corresponding to the carpooling concepts were stronger among the factsheet group as indicated by a higher score on perceived knowledge. This difference in strength was likely due to the high rate of concept repetition found in the factsheets and to the perception that the information in the factsheets was a composite of many instances. It is further speculated that the prototypes were more highly organized (i.e., more differentiated) among the story group as indicated by the results of the category analysis performed on the modified F-sort. The similarity in comfort with knowledge between the two groups in light of the differences above, supports the notion that comfort with knowledge is a function of both the strength of individual prototypes and the level of prototype organization. Aspects of these two components are discussed in more detail below.

Some of the items found in the factsheets would be expected to be very effective at activating *existing* prototypes. Specifically, one would expect the mention of *concrete* aspects of carpooling (e.g., saving money on gas, reducing air pollution) to readily activate corresponding prototypes. The high rate of concept repetition in the factsheets would tend to strengthen these

prototypes (see Section 3). However, one would not expect the nature of the factsheets (i.e., a list of concepts without much context) to encourage the formation of associations between prototypes (recall that associations are encouraged when there is an orderly flow of information rather than a series of independent factual "nuggets"). Thus, one would expect existing prototypes to be strengthened as a result of reading the factsheets but not to have a particularly high degree of organization. In addition, one would expect the activation of prototypes corresponding to the more abstract aspects of carpooling (e.g., personal/social aspects) to be difficult to achieve through a factsheet. Recall that abstract prototypes are most easily externally activated by way of specific examples and vivid language; these characteristics are generally lacking in factsheets. Results of this study (i.e., the higher score on perceived knowledge, the lower level of knowledge organization, and the less frequent inclusion of the "personal/social" aspects of carpooling category among the factsheet group) support this theoretical framework.

In contrast, one would expect the stories to be more effective at conveying abstract information and encouraging the formation of associations between prototypes. Stories are able to activate prototypes corresponding to abstract concepts through the inclusion of specific examples and vivid language. Stories also provide a framework in which to relate (associate) activated prototypes. Here, the emphasis is more on organizing knowledge rather than strengthening specific prototypes. Again, data from this study (i.e., higher level of knowledge structure organization, and the more frequent inclusion of the "personal/social" aspects of carpooling category among the story group) strongly support this theoretical framework.

Differences in the effect of the factsheets and the stories on knowledge structure point out that stories are not necessarily more effective at transferring information in all cases. The choice of information style will depend on what aspect of knowledge one is trying to impart. If the goal is to strengthen existing concepts which are relatively concrete, a factsheet may be the most effective method. If the goal is to communicate more abstract concepts or to structure existing knowledge, a story may be most appropriate.

The potential bias against stories in the workplace should not be ignored. It appears that familiarity with the style of information may be as important as familiarity with the content of information in determining how people will perceive the information. Information in an unfamiliar style or from a source that is perceived to be inappropriate or unreliable (e.g., fiction) will be read with skepticism. This may affect how the information is coded and whether it will have an effect on behavior. In many cases, a combination of information (e.g., stories presented within more factual information, "success stories" about real people) may be the most effective way to transfer information.

PRACTICAL IMPLICATIONS

For trip reduction programs to be successful, an array of methods will most likely need to be utilized in order to encourage individual drivers to use alternative modes of transportation. Stories offer one promising tool because of their effectiveness at communicating the intangible aspect of carpooling and at creating a more complex knowledge structure related to carpooling. Fact sheets, on the other hand, are promising because they appear to reinforce existing knowledge.

The role of using story in the workplace setting needs further investigation. It is suggested that a combination of these two types of information (facts and stories) may be the most effective way to change the way people think about carpooling and, ultimately, to encourage people to carpool. One approach is to embed several "mini-stories" or scenarios within a more factual text (indeed, this is the preferred style of many journalists). Using "success stories" about real people may also be effective. In this way, information would be perceived as reliable and worthwhile while the benefits of using stories would be realized.

The importance of minimizing or removing other barriers to carpooling cannot be over-emphasized. The failure of the intervention to result in a willingness to change commuting behavior indicates that increased knowledge and changed perceptions of carpooling is not enough

to change behavior; any informational campaign must be preceded or accompanied by a concerted effort to remove real barriers. Possible solutions may include restructuring employees' work schedule so they may take advantage of carpooling, making a company car available for use in emergencies, and setting up a carpool matching service.

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APPENDIX A

STORY INTERVENTION

COMMUTER TRANSPORTATION STUDY Transportation Fables for Our Time #1

"SCHMARPOOL"

"Pollution, schmollution," says Ralph Mudgeon, and you can bet he means it, as he sucks down his morning coffee. His wife ignores him, so he tries again.

"Carpool, schmarpool." He takes another drink and grimaces. The coffee he makes is quite awful, but that's the way he likes it, he says: thick as tar, get you going in the morning. His wife is drinking milk and reading the front page of the newspaper. He tries again.

"Somebody decided it was a 'no-drive' day at work." (His tone implies that he suspects some eco-terrorist group may be behind it all.) "They want to give us incentives to carpool. 'Positive Motivation,' they want to call it. Positive, schmositive, I say. Incentives!"

"I'm sorry, what?" his wife says, looking up from the paper.

Ralph sighs, the heart-felt sigh of the unjustly ignored. "You can take the car today."

"Car, schmar," his wife says. "I haven't finished the paper." She gathers it up and tucks it into her bag. "Have fun," she says, and is out the door on her way to the bus stop before Ralph can muster all the reasons why that cannot possibly occur.

"They'll be late, of course... well, I'll give them ten minutes, then I'm taking the car...." Muttering to himself as he puts his coffee cup to soak in the sink, he glances out the window and sees a car idling at the curb. As if to spite him, the carpool is two minutes early.

Every carpool has its own personality and its own style. Conversation, non-conversation, gossip... carpoolers who talk, carpoolers who listen to the radio. Ralph filled out the questionnaire he was given, told them his work schedule and his preferences, and at the bottom where it asked for comments he wrote "Ha!" Whatever that means.

But apparently the questionnaire did the job properly, because his fellow riders all seem to have the same attitude -- whatever that is... and to welcome him aboard, someone brought doughnuts. And -- remembered to bring napkins. (Nothing annoys Ralph in quite the same way as having to eat a doughnut without proper accessories.)

Everyone introduces themselves: Marv, who brought the doughnuts; and Kimberly, the driver. And Ralph. They hit the road, and Marv offers Ralph any section of the paper except the one with the comics, which he is describing, panel by panel, to Kimberly.

Kimberly drives around, seemingly aimlessly, for a while. Ralph tries to figure out where they are but can't, and checks his watch again and again. He is about to ask

Kimberly, Just where does she think she's going? when they stop in front of a house. Another woman comes out, and Ralph is introduced to Janice. Marv gives her a doughnut and the comics, and off they all go.

Ralph doesn't even bother to check his watch again. He looks out the window instead, intending to brood. It certainly won't be his fault when he's late. He watches the buildings they pass, watches people in other cars: they all look grim, the ones that don't look blank.

The carpool passes through a stand of trees that blots the city from sight. Ralph, forgetting to brood, leans back, relaxes, watching the scenery. After a while he borrows the Entertainment section of the paper from Janice. He reads the comics, but he doesn't laugh. He never laughs at the comics. It's a point of pride with him.

At the office, Kimberly parks the car in the CARPOOLS ONLY spot, right next to the front door. Ralph is sure they must be late, but his watch refuses to back him up: it claims he has three minutes to spare.

When he gets to his office he almost smiles at his secretary, but catches himself in time.

On the way home, Ralph discovers that Janice is a Dallas Cowboys fan. He understands it as his duty, for her own sake, to point out to her the folly of her ways; before long they are discussing the Raiders' continuing need for a decent quarterback, the prospect of another lackluster Monday Night Football matchup, the hardheadedness of the owners, other esoterica. But unfortunately, before the two of them can solve all the problems of professional football, the car pulls up at Janice's house.

When Ralph walks into his own house, five minutes later, his wife is listening to NPR News on the radio; the theme music is playing as he walks in the front door, and he whistles along with it. His wife stares at him, thinking: whistling? What on earth?

"How was the day?" she asks, almost worried.

Ralph considers, and shrugs. "Wasn't too bad."

**Remember to record your opinion of this story on the Commuter Transportation
Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #2

"The Sign"

Ellis was a guy with a strange sense of humor. In fact, that's how most people remembered him. "Ellis... oh, yeah -- nice guy -- weird sense of humor, though. Yeah, I know him." Well, there was the wheelchair, too; obviously, lots of people remembered him that way. "You know, Ellis... brown hair, glasses, wheelchair? Him."

He had a plan to make the world a better place. It didn't involve carpooling... mostly, it involved things being blue. Actually, it wasn't so much a plan, as it was an expression: along the lines of, "Worse things happen at sea," or, "If wishes were horses, then beggars would ride." This will show you the way it worked:

Claire Penske would say something like, "You would be helping to make the world a better place if you joined a carpool."

Ellis would say something like, "I would be making the world a better place if I dyed my hair blue, too." (If that doesn't make sense, well, that's the way Ellis usually liked things.)

And if Claire pressed him for a real reason, he might say something like, "I have a flexible schedule, and a rigid wheelchair, and neither one of them will fit in a carpool."

But, finally, he said he would try it. For a few days, he said; just for a few days.

Claire didn't ask him why he'd changed his mind, which is just as well, because the truth is not noble. The truth is that Claire was not only persistent, but good-looking. That sort of thing isn't supposed to matter in the 90s -- the good-looking part, that is -- but one can't help it. It has always been a persuasive combination.

Also, Ellis's car was in the garage.

Claire and her friend Peggy showed up Wednesday morning to pick him up.

"Welcome to our humble carpool," Claire said.

"Well, I'm sure I'll hate it. I'll probably quit after today," Ellis said cheerfully. He opened the back door and hoisted himself in; Claire folded up his chair and slid it in after him.

"See, there's plenty of room," she said. As if that had worried Ellis. Well, maybe she had been worried. Still smirking to herself, Claire got in, and off they drove to work.

Peggy, much to Ellis's satisfaction, thought he was pretty funny. In fact, those were her exact words. It was after Claire had said something about "the differently abled"; Ellis piped up from the back seat, "I'm not 'differently abled.' People who can touch their noses with their tongues are differently abled. Disabled, that's me."

"You're pretty funny," Peggy announced. She sounded like a wine taster, pronouncing her verdict on an unfamiliar vintage: funny, with a hint of nonsense, and a full-bodied, sarcastic bouquet.

It shut Ellis right up... but he got over it.

At the end of the day, they all drove home together. Claire parked outside Ellis's apartment, turned and asked how he liked carpooling *now*?

"Well, I don't know," he said. "I'll probably quit after tomorrow. I'm waiting for a Sign."

"Should we pick you up tomorrow?" Claire asked, quite as if she hadn't heard him.

"Oh, sure."

It went like that the next day... and then the next week. Ellis was waiting for a Sign. And then it was nearly his turn to drive.

"You're driving next week," Claire told him.

"I am?" Ellis asked.

"Time to decide," she said.

"Now?"

"Now."

"Well," he said. "I'm waiting for a Sign. God will tell me if He wants me to quit carpooling. I'll let you know."

Claire rolled her eyes. "Call me," she said, "today."

So Ellis rolled into his office, shut the door and figured it out. Ten miles either way to work, that was a hundred miles a week... working fifty weeks... with gas, and repairs, and... He plugged in numbers. It came to about a thousand dollars a year. Nine hundred and ninety-nine, using his estimates. So, by splitting the driving three ways, he'd be saving almost seven hundred dollars. 666, to be precise.

The number of the Beast. Uh-oh.

That looked like nothing so much as a Sign from Above.

Of course, that meant he wouldn't be riding with Peggy anymore. Or Claire either.

Although... now that he came to think of it, there would probably be more wear and tear on the car -- surely that number was too low. He added a few more dollars to his estimate, and calculated again, just to be safe. This time it came to 672. *Not* the number of the Beast... surely *that* was a Sign. What could be clearer?

It looked as if he were destined to carpool. The choice had been taken from him. There was nothing he could do.

Ellis shrugged, and reached for the phone.

Remember to record your opinion of this story on the Commuter Transportation Study Opinion Sheet

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #3

"The Late Mr. Mudgeon"

Time is Ralph Mudgeon's enemy, and he attacks it on all fronts. He has a digital wristwatch, a wristwatch with four hands and a revolving date display, a wristwatch with a plastic band and a roll-bar (which he wears while exercising, for exactly twenty minutes every day); a desk-clock, a wall-clock, and a clock in his car; a calendar, an appointment book, a date-book, a personal organizer, and a book of days (which his wife gave him for Christmas).

Sitting in his office, he picks up the phone and buzzes his secretary's desk.

"Renee, what time is it?" This is Ralph's day for growling. He thinks it makes him sound decisive.

"Hold on," comes the reply. A moment later the door opens and Renee comes in. She checks the wall-clock, glances at the desk-clock, and informs Ralph that it is five minutes till three.

"Thank you," says Ralph, with what he considers admirable restraint, all things considered.

"Is that all?"

"No, it's not all!" If Renee weren't as efficient as she is snide... well, it would be a different story, that's all. "I'm having lunch with what's his name, Snodgrass, tomorrow."

Renee sighs. "Mr. Mudgeon, just because you can't remember someone's name is no reason to call everyone Snodgrass." They have had this discussion before.

"You know, you know... the legal department, called yesterday, him."

"Stanwyck."

"Whatever. Make us a reservation, *please*," (there's that restraint again), "and confirm it with him." He tells her the phone number.

"What kind of food do you want?" Renee doesn't write down the number; she never writes anything down, and this annoys Ralph. One day she'll forget something. He just wishes she would hurry up and get it over with.

"Food, schmood! Just something nice, not too expensive, you know..."

He is still grumbling as Renee slips out the door to arrange tomorrow's lunch.

Next morning, Ralph wakes with everything planned, his briefcase packed, his tie already picked out, a pot of mud-thick coffee steaming under the auto-timer coffee machine. (Every morning Ralph grimaces at his first taste of this evil brew; but he believes this grimace is what prepares the muscles of his face for the day ahead. He always has several cups.) A bowl of cereal and a piece of toast later -- not long at all -- he is out the door with a grumbled "Goodbye" to his wife's cheerful "Have a good day."

Occupied with the likelihood that he will not have a good day at all, he climbs into the car and heads for the freeway.

It isn't until he hits the morning's impenetrable wall of traffic, and finds himself looking wistfully at the diamond lane, that it suddenly occurs to him that he forgot to call Marv -- the driver -- his carpool -- it all comes in a rush. Forgot! But Ralph Mudgeon never

forgets -- he plans! But somewhere, there is a carpool waiting for him... waiting.... His oversight -- well, maybe his neglect... his -- and his mind, overdriven by the several cups of caffeine he has forced into it, leapfrogs over other possible words and lands on *treachery*, surely too strong a word, surely...

"But I needed the car today," he explains to the vaguely-imagined kangaroo court that his hyperactive mind has suddenly convened. What is the penalty for being absent? He read the suggested ground rules when he joined the carpool, and there was something in there about late members... but Ralph Mudgeon is never late. He has a clock in the kitchen, a clock in the living room, two in the bedroom and a wristwatch to boot. How could he be late?

But he's not just late, horrible as that would be: he's Missing, and surely the penalty for being Missing must be severe. Oh, severe.

Ralph Mudgeon feels the fine structure of his day beginning to crumble into what will surely be hopeless ruins. And he's not even out of traffic yet.

to be continued...

**Remember to record your opinion of this story on the Commuter Transportation
Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #4

"The Late Mr. Mudgeon (later)"

Arriving at the office in a frenzy of... well, frenzy... Ralph Mudgeon's first discovery is that Renee, his secretary, is late. His second discovery, that she is not late but was only getting a cup of tea and a bagel from the kitchen, does nothing to improve his temper. He, Ralph Mudgeon, is late; worse still, he has betrayed his carpool: the world is ruled by chaos this morning, and he is extremely annoyed that Renee does not seem to realize this.

"Call Marv Henberg," Ralph commands. (Marv is the driver of the carpool this week.)

Renee dials the phone and reports: Marv Henberg isn't in.

"Not *in*?"

"No," says Renee, puzzled to see Mr. Mudgeon hit himself on the head. "Should I leave him a message?"

"No!" Not in... he must be late. Ralph checks the time on one of his clocks -- the desk clock: it's 9:20. Oh no, he thinks; oh no, I've done it. Everyone is late, and they're all blaming it on Ralph Mudgeon. And rightly. No, he doesn't want to leave a message. He can't face them.

Everyone blames him. He can feel it. He evicts Renee from his office and shuts the door.

Outside, Renee shrugs. *She* saw Marv in the kitchen a few minutes ago: he was eating a bagel.

Mr. Mudgeon's voice comes out of her intercom: "Renee? Call Kim Emel." (Kim is another of his carpool-mates.)

Before she can dial, the voice comes again: "No, don't call her."

Then: "Don't call anybody, please."

A moment later, finally: "Hold my calls."

The telephone is a wonderful device. Among other uses, if one is a member of a carpool, it allows appointments and errands to be scheduled for days when one will be able to drive and get them done... or, in a similar way, it can be used to determine who will be able to drive to lunch. This is what Renee, master of the telephone, has done, and that is why, just before noon, there comes a knock on Ralph's office door. "What?" he growls, and Steve Stanwyck comes in: five foot five, thin as a monk, bald as a walnut.

"Ready for lunch? We'll take my car. Just got the Jag out of the shop. Renee told me you carpooled. Don't have your car today. Don't mind driving myself. Carpooling, though. Admire that. When I was in the Army --" He begins an anecdote that seems to be headed toward no particular point.

"Excuse me for just a minute," Ralph begs, and hurries out to Renee's desk.

"Why didn't you tell me Stanwyck was going to drive?" he whispers.

Renee has a charming way of cocking one eyebrow when confronted by a stupid question. "You're not driving this week, Mr. Mudgeon. Do you even have your car?"

"Of course I do! I should -- you -- when I --" But even his spluttering cannot drive away the sense that his day is near becoming a total loss. Not only did he miss his

carpool, but it now turns out that he had no reason to miss it; any sort of excuse is impossible.

And on top of everything, here comes Stanwyck, and his senseless story with him.

Ralph's wife has no sympathy for him. "Why didn't you just call them and apologize?" she asks. The question is all the more annoying because Ralph cannot answer it. Besides, now it's too late, isn't it? How can he apologize now? It's all too much.

But -- tomorrow they'll come again; the carpool will stop at his door, and he will have to face them. And how can he, after all this?

But Ralph's wife has a plan, a way for Ralph to redeem himself. And this plan, when she tells it to him, completes the destruction of his day.

And so it comes to pass the next morning that Ralph Mudgeon's neighbors are treated to the sight of the penitent Ralph, his head covered by a large brown paper bag, holding a box of doughnuts and shifting from foot to foot as he stands by the curb.

Soon enough, right on time, comes Marv's car, and in it (Ralph lifts a corner of the paper bag so he can see) are Marv, Kim, and Janice. Feeling a fool, he lets the corner of the bag flop back down into place.

He hears the car door open, and stumbles off the curb (nearly dropping the doughnut box) and into the back seat, where he sits, fighting the urge to peek out again. But after they have driven for a minute he hears Kim ask, "Should we forgive him?"

Silence; then:

"Does he have any jelly doughnuts?" asks Janice.

And fortunately, it turns out that he does.

**Remember to record your opinion of this story on the Commuter Transportation
Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #5

"The Ballad of the Diamond Lane"

1.

Early that morning I awoke
Upon the stroke of Two;
I groggily remembered what
I'd said that I would do.

I'd promised this and promised that;
Oh! I had been a darn-fool!
Because I'd promised so last week
Today I'd ride a Carpool.

Although before I'd always held
That ride-sharing was nonsense,
I had been hit with a sudden fit
Of Ecologic Conscience.

For when the sky turned brown with Fumes,
And Smog was in the air,
It pained me much to know my car
Contributed its share

For (as you see) I worried lots
About Ecology...
And then, another thing as well:
I mean a Parking Fee.

The Powers that decide such things
Had spoke, as oft they speak:
"Starting from now, a Parking Spot
Will cost Ten Bucks a Week."

So I would carpool in to work
Though I was sure I'd hate it;
At least I wouldn't pay to park:
The Fee would be Rebated.

But soon I went to sleep once more
For it was not yet time:

I didn't have to be at work
Until the stroke of Nine.

2.

I woke again; the clock said Four;
The darkness was extreme;
I went to sleep again, and fell
Into an awful Dream.

A Hundred Million drive to work
Each day, so I have read;
I drove in my dream, and they all, it seemed,
Were on the road ahead.

And none of them could drive too well,
And no one smiled at all,
And everyone drove slowly, for
The road was just too small.

And some of them were burning oil,
And some had blown their Clutch;
Some of them needed tune-ups, for
They'd driven far too much.

And I was trapped among them all
And I had far to go
But traffic was backed up for miles
(I heard on my Radio).

So far my dream was just the same
As every day's commute
But soon I noticed something new,
And Horror struck me Mute!

There by my side -- a Diamond Lane!
The sign said "Carpools -- 3 or more"!
And as I watched, a Car sped past
And vanished with a Roar!

And as I watched, more cars went by!
(I counted twenty-four)
And all of them were moving fast
And all held 3 -- or More!

What madness is this? I exclaimed,
But there was no reply
Because I always drive alone
So no one heard my cry.

I tried to turn aside, but soon
Discovered I was stuck
I was alone within my car
Alone -- what rotten luck!

If I had just two passengers
Our number would be 3
And we would be a Carpool then...
But it was not to be.

I'm doomed! I screamed (within my dream);
O cruel, O mocking fate!
Not only am I quite annoyed,
I'm also running late!

3.

And now, I dreamed I had arrived
And finally was at work
I paid ten bucks and drove around
To find a place to park.

To find a place to park I searched:
I searched both far and near,
And also High and Low I looked;
I wandered There and Here.

Aha! I cried, as I espied
A spot right by the door...
But then, aghast, I saw the sign
said "CARPOOLS ONLY -- 3 OR MORE."

4.

I woke! I jumped up from my bed!
My clock was ringing shrilly
And I was in a cold, cold sweat:
That dream had scared me silly!

My hair stood straight up from my head!

My mouth was dry and sour!
There was but one thing I could do:
So I got up and took a shower.

But that was many months ago;
I feel much better now
For now I carpool every day
My schedule will allow.

I drive my car much less these days --
one week in every three:
I save on Gas, and Maintenance,
And Liability.

I do not dream the awful dreams
That once did cloud my brain;
My nights are filled with blissful sleep;
I do not fear the Diamond Lane.

This happy thought now comforts me
When all the world is cold and dark:
I'm ecologically correct --
And finally have a Place to Park.

**Remember to record your opinion of this story on the Commuter Transportation
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COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #6

"Sandbox Rules"

Becky came out with a skinned knee and a band-aid on her elbow, and as soon as she got in the car she displayed them proudly. "See?" she said. "Tina pushed me. See?"

"Oh, my," said Marla, respectfully. Sherry Baumgartner, Becky's mother, who was the carpool's driver this week, sighed but said nothing. Stan, the other member of the carpool, sat like a lump in the front seat, reading his newspaper, ignoring everyone.

"She pushed me down in the sandbox at recess, but I, but I --" Becky's tongue got tangled up in a rush of words.

"Becky, put your seatbelt on." Sherry Baumgartner turned in the driver's seat so she could reach back. "Do you want me to help you?"

"I can do it," said Becky indignantly, and buckled herself in. Mrs. Baumgartner smiled, chalking up another triumph for applied psychology, as she put the car into gear and backed up.

Stan was first on the route home: Sherry turned left out of the day-car center parking lot, toward his house, and Marla smiled. This was the part of her day she enjoyed most.

"Mama, Tina pushed me down in the sandbox at recess."

"Oh, no," said Mrs. Baumgartner absently, watching traffic.

"That was against sandbox rules, but Mrs. Anderson said it was an accident, but it wasn't."

"Why did Tina push you?" Marla asked.

"I don't know," said Becky, with so little conviction that Marla nearly laughed out loud.

"But then I put a leaf in Tina's dress and said it was a bug," Becky said gleefully. "She yelled *loud*."

"Rebecca!" cried her mother from the front seat. "That wasn't very nice."

"I know," said Becky, with the most perfect lack of concern that Marla had ever seen.

"What did I tell you about sharing?"

A month ago, Marla Cheney thought that this was probably going to be the last straw. Not that there had been so many straws in her carpooling career; but when she heard that Sherry Baumgartner's five-year-old daughter would be joining the carpool... well, she got a sinking feeling, no denying it.

But Stan had seemed unperturbed by the idea; maybe, she thought, he wouldn't mind coping with the child. Three adults -- if one of them were the mother -- ought to make it bearable.

So Marla resigned herself to it... at least, she told herself, she would give it a few weeks.

She never thought she would come to look forward to it. But it's like this: after a day's work, at least it's a change to hear about someone else's day. Even Stan's day, even

Sherry's... though their days tended to be just like hers. But Becky's days, now: they're always interesting. Marla likes her job, but fighting the twin dragons of red tape and bureaucracy is sometimes hard.... But what could be worse -- honestly -- than getting pushed down in the sandbox?

Though she knows she shouldn't, Marla finds herself approving of Becky's revenge. Justice has been served... and the wonderful thing is that by recess tomorrow, Becky and Tina will be best friends again.

"But Mrs. Anderson made me stay inside for recess," Becky explained, with the patient air of one who has been punished enough. "Cause she said it was against sandbox rules."

"Well, it wasn't a nice thing to do," her mother repeated absently, negotiating a left turn.

"I know," said Becky, insulted. "I *know that*."

"Well, I hope you told Tina you were sorry."

"She's a pooper-scoop."

"Rebecca!" cried Mrs. Baumgartner. Marla stifled a snort of amusement.

"She's a dummy-nose," Becky said under her breath.

"You have to learn to share things," Sherry Baumgartner lectured from the front seat.

"Mrs. Anderson made the sandbox rules for a good --"

"Sharing is for grownups," Becky said positively.

"Rebecca! It is not."

Becky said nothing, as if knowing that this would satisfy her mother; it did.

But Marla winked at her, and Becky winked back. Both eyes at once.

**Remember to record your opinion of this story on the Commuter Transportation
Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #7

"A Cautionary Tale"

There was a little girl, and she had a little curl, right in the middle of her forehead. And when she was good, she was very, very good; and when she was bad... well, you'll see.

Marcy Darcy hates her name. A little girl's name, a sing-song name, it sounds like something from Mother Goose.

It didn't help that when she was in first grade (and oh, she still remembers this very clearly) the teacher read the class that nursery rhyme about the little girl with the little curl. As it happened, Marcy did have a little curl, and it was in the middle of her forehead. And everyone thought she looked just like the picture in the book the teacher passed around. The other kids didn't let her forget it. For one whole summer, girls jumped rope to a song they made up about her. She got into a lot of fights over it.

She's always hated her name. Which is why she stopped carpooling.

Now that she's grown up, her name is Marcia Darcy -- she pronounces it "marSEEda," and you had better not call her "Marsha" -- and the little curl is long, long gone. When she's good, she is very, very good: she got promoted for being so good. When she's bad... well, she's never bad. (As she would tell you, if you asked. But you'd best not ask.)

Four days a week she would take a carpool to work with two other people: Andy (her boss's secretary) and Mary (who works in payroll). They never had any trouble with her name. But then Quincy joined the carpool, and there were just too many people with two-syllable names ending in -y. Quincy simply could not remember not to call her Marcy; and then Mary started in with it, and when finally Andy started calling her that at work, it was the last straw.

Marcy -- I mean, Marcia -- Marcia called in one week and said she wouldn't be taking the carpool that week. She said something about working late, but she wasn't working late. She drove to work alone that week.

Then she drove to work alone the next week.

The week after that, she had her name taken off the carpool list for good. She thought about finding another carpool, but she was still too miffed. That was what she was: deeply and sincerely miffed.

So here is what happened when she was bad.

She had a long commute: thirty miles each way. Sixty miles a day, so three hundred miles a week, the car spewing out carbon monoxide and fumes all the way, and her with no one to talk to, and nothing to do but listen to traffic reports on the radio. And there was weekend driving on top of that. She had to buy gas twice a week, which came to about twenty dollars. With so much stop-and-go driving, the car soon needed a tune-up. Then a front-end alignment. Then it was new tires.

And Marcia didn't even *like* driving. It gave her a headache, and driving alone bored her to distraction. In summer, the air conditioning made her sneeze; when it got cold, the

heater made her sleepy. And then when she arrived at work she couldn't park near the building, where the carpools got to go: she had to find an unclaimed parking spot, which usually ended up being at the far end of the lot. She didn't mind the walk, unless she was late... or it was hot... or humid... or cold... or she had things to carry... or...

So after a while she decided she would go back to being good, and since no one had taken her place she was able to rejoin her old carpool. Through a combination of hitting him on the head with a rolled-up newspaper and mispronouncing *his* name every time he mispronounces hers, she's been able to get Quincy to stop calling her Marcy. Sometimes he slips and calls her "Marce," but she manages to be philosophical about it; and besides it really annoys him when she calls him "Quince," so that's all right.

And... she lived happily ever after. You know she did.

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Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #8

"The First Two Times"

When Stephanie Rush joined a carpool for the first time, she didn't expect it to last long. She would try it for a week -- she reckoned that would be long enough -- and then she could quit with a clear conscience, able to say that she had tried ride-sharing and found it wanting.

Only it didn't work out that way. At the end of the week, she sat at her desk trying and trying to think of a graceful way to bow out of the carpool... when it struck her that perhaps the reason she found it difficult was that she *didn't* want to quit.

She tried that explanation on for size, and liked the fit. The carpool wasn't the haphazard assortment of do-gooders she had thought it would be. In fact, she rather liked the others. They had fun; it was nice to have someone to drive with, to talk to after work. She had expected a carpool to be slow, but it wasn't slow; she had thought it would be disorganized, but in fact it had been organized by the company... well-organized by the company, and how was that for a pleasant surprise?

Besides, it would be rude -- wouldn't it? -- to leave before she had done her turn at driving.

So she decided to give it another week.

At the end of that week, she gave it another; then it was her turn to drive, and she found she didn't mind that, either. After that, she decided she rather liked carpooling. She stopped setting deadlines and settled into convenient routine.

That was the first time Stephanie almost quit.

Then she got a promotion, which meant a bit more money, and a much longer, more impressive title. But she took it, because it *was* a better job, and also because you don't turn down a promotion. But taking it meant that she would have to drive during the day, so she'd need her car; and with her new schedule so unpredictable, she wouldn't be able to carpool. So, though this time she was more reluctant, once again, she thought she would have to quit.

But then it occurred to her that people had been around for tens of thousands of years; rides must have been around for at least ten thousand of those years; if you assume that it took mankind five thousand years to come up with the idea of ride *sharing*, that still left five thousand years; and in all that time, someone might already have solved the problem she was facing.

Stephanie called the carpooling coordinator and found that her reasoning had been quite correct. The solution had been around since the invention of the telephone, a mere handful of years ago. She found that, using this new technology, she could schedule all her off-site trips for Mondays and Wednesdays, which would still allow her to carpool the other days. It was easy to arrange, so she arranged it.

That was the second time Stephanie almost quit.

Now, tradition demands "a third time Stephanie almost quit." And of course you are expecting one; and I apologize. But, regrettably, Stephanie enjoys carpooling too much; she's never been tempted to quit since. So there is no third time.

Sorry.

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Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #9

"Another Part of Life's Rich Pageant"

The last good bus leaves from Seventh and Broadway at three-thirty in the afternoon. That's only four blocks from Jeremy McClellan's office; it's the Express, last one of the day, and if he could take it, he would end up at home an hour and fifteen minutes later, after only four stops. But of course, he can't take that bus: he has to work. The bus he *could* take, the one that leaves at 5:15, makes twenty stops and takes twice as long. And after all, who wants to ride a bus for nearly seventy miles?

People tell him he ought to live in the city. At least one of his neighbors thinks he's crazy. (It's the guy who leaves out milk and cookies on Elvis's birthday, though, so Jeremy tends to discount his opinion.)

It is a long way to drive. But move? Moving to the city would involve *living* in the city, which God forbid. Jeremy likes his job, and he likes where he lives.

So instead of driving alone -- which gets expensive, not to mention boring, as he discovered early on -- or spending four hours a day on the bus, he shares rides with Christine Appleberry, who lives half a mile from him, and works in Personnel. One week he drives, the next week she does. It's a good arrangement, saving him not only money and time, but boredom... possibly millions of dollars worth of boredom...

Weeks Christine drives, Jeremy has time to sit and think, if he likes; most often, he watches out the window. Behind the wheel, you don't see as much as you think: the world is a road you have to navigate, other cars you have to anticipate and avoid. The week he doesn't drive is like a vacation. And, too, there's something about the presence of another person that Jeremy enjoys; even when they don't talk. Sometimes, especially when they don't. Watching the land, Jeremy remembers why he moved out of the city. The country is beautiful. And early morning, late afternoon: these are the best times to see it.

And he's discovered something: you see things when you're not preoccupied with driving. Sometimes, in the city, peculiar things. Week to week, Jeremy and Christine take turns seeing them, and telling what they see.

There was the time, early in August, Jeremy was the Designated Rubber-necker, looking out as they drove past the courthouse with its great, multi-level fountain. Christine, driving, wondered what the three police cars were doing, pulled up onto the curb.

"I think they're probably after the people in the fountain," Jeremy reported. "The people floating on inner-tubes in the fountain. I think they're sunbathing.

"There are three cops, standing on the edge of the water, yelling. I think they're...

"Uh-oh." He craned his neck to see around another car that had slowed -- the driver was alone in his car, staring at the fountain; behind him, another driver began leaning on his horn.

"What?" demanded Christine. "Uh-oh, what?"

"They're definitely sunbathing. They don't have any clothes on. Four men and three women. The police are yelling at them."

Christine turned off the radio. This was better.

One of the nudists flashed a peace sign at the officers. "It doesn't seem to be making them peaceful, though," Jeremy reported.

He saw one of the inner-tubes float close to the edge of the fountain, and the nearest of the cops, grabbing at it, overbalance and fall in. The sunbather splashed off, unscathed. Jeremy narrated the whole thing, play by play, blow by blow. The cop floundered to the side, where he was pulled out by the others.

There was a squeal of tires behind them, and more horns: traffic starting to jam up, people gawking. Christine, though, just concentrated on driving...and listening to Jeremy.

"It looks bad: indecent exposure, and now embarrassing a cop. They'll throw the book at them...."

"Oh. He's jumped back in, and he's taking out his nightstick. Uh-oh..."

"What?" Christine demanded.

"No! he's down again!" Jeremy shouted gleefully, as the cop slipped and disappeared into the water, flailing his arms, and the nightstick sailed gracefully up into the air.

Then they turned a corner, passed out of the incipient traffic jam, and out of sight. Another part of life's rich pageant, the sort of thing you can't really enjoy when you're driving alone. It lasted them all the way home.

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Study Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Transportation Fables for Our Time #10

"Picking Up the Pretender"

Kevin had forty-seven reasons not to carpool, or claimed he did. And he thought he was pretty good. But he's just a pretender. I am the all-time champion. I've thought of every reason you have -- trust me -- and more besides. Every day I think of more.

Like, how's this one: say you're in a carpool, driving to work, and suddenly there's a plague. I mean a Biblical plague, like say a rain of frogs. Well, all of a sudden there are frogs all over the road, frogs covering the windshield, and unless it's Mario Andretti's turn to drive that week, there's *going* to be an accident. No way around it.

You may say, But that would happen even if you weren't carpooling. But you haven't thought this through, the way I have. What's the first thing you're going to want to do? (After you call AAA, I mean.) Of course: call your mother, to make sure she's all right, that she didn't get caught in the rain of frogs. Or your boyfriend, to tell him what just happened, and hear him ask, "Are you all right?" Maybe the weather bureau, to lodge a complaint. Whatever, you're going to want to call *somebody*, aren't you? And there you'll be, two or three or maybe four or even five of you... and no matter where you have an accident, there's *never* more than one phone anywhere nearby.

That means waiting in line. Which is no good.

Don't laugh. It has been known to happen.

Of course, I don't have a car, so I carpool to work anyway. But I like to be prepared for any eventuality.

Don't call me a pessimist. I prefer the term, "negative realist."

Public transportation? Could you imagine what would happen if a *bus* were caught in a rain of frogs? My God. Anyway, the busses don't always run on time. The carpool does. And it's cheaper.

That's the sort of thing Kevin worries about: being late to work, the driver not showing up on time, and so on. I used to think those were pretty good reasons not to carpool. But it's been five months, and Mavis hasn't been late once. Well, I guess it's not surprising that a responsible adult, with a car and a job, should be on time. And we get to park in the carpool spaces at work, so that saves us some more time. It's coming up with more *realistic* reasons not to carpool that has made me the all-time champion.

Kevin's big reason is this: what if something comes up? What if I have to go somewhere at lunchtime? What if I need to run an errand?

For a while I thought this was a good reason. But Mavis has this theory that there is no problem so large that a telephone call cannot take care of it. How about a lunch date? I asked her. Make the other person drive, she countered. What if the other person doesn't have a car, either? Then what is she doing making a lunch date? Mavis asked, reasonably enough. I tried another tack: How about acute appendicitis? I asked. Dial 911, she told me.

I was forced to concede her point.

So much for Kevin's reasoning. If you really want to avoid carpooling, you have to be a bit more creative. Like me. I'm afraid Kevin's just not up to it.

Now, ordinarily, I would respect someone's obstinate opposition to carpooling... however mundane his reasons. But they just opened up that new section of highway they've been working on, and there's a stretch of diamond lane on it that doesn't consider two people a carpool. "Three or more," the stupid thing says. Mavis and I thought about maybe getting a dummy that we could prop up in the back seat and pass off as another person, maybe get a hat for it or something. But then we thought, why go to the expense and bother of getting a dummy, when we already know Kevin?

We just had to lean on him a little. Creative persuasion. You'll excuse me, but I prefer not to reveal my methods.

So that's why, this morning, right now in fact, Mavis and I are on our way to pick up Kevin.

And he'd better not give us a hard time about it.

Remember to record your opinion of this story on the Commuter Transportation Study Opinion Sheet

APPENDIX B

FACTSHEET INTERVENTION

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #1</p>

There are a lot of reasons to drive your car to work. But there are equally good reasons not to. Reduce stress! Save money! Conserve our valuable energy sources! Clean up the air!

Reduce stress

Cars are driven in the United States approximately the same distance as all other cars in the world combined! With 165 million licensed drivers and 144.4 million automobiles on the roads, it's no wonder we waste about 20 minutes per day sitting idle in traffic. All this waiting and maneuvering through traffic causes stress. In fact, car commuting is one of the main sources of stress for working America. Named as one of the top health problems in the country, stress from rush hour commuting can lead to many related ailments, including high blood pressure, headache and chronic back pain. Carpooling reduces stress by allowing you to relax during those commutes when you aren't driving.

Save money

Driving alone to work every day costs the average American worker approximately \$2,800 a year, assuming that an intermediate sized car's average cost includes gas, oil, maintenance, tires, depreciation, insurance and taxes. Idling and stop-and-go driving in 1988 cost motorists an estimated 753 million gallons of motor fuel. The value of this wasted motor fuel and time was about \$17 billion - or \$1,194 per motorist. These costs are reduced by carpooling!

Conserve resources

In 1989, Americans used 131 billion gallons of gas on highways alone, and this amount continues to increase. Sixty three percent of all annual oil consumption is for transportation, making it the single largest use for oil. You can reduce America's consumption of oil by carpooling!

Clean up the air

Every 25 miles you drive adds one pound of pollution to the air. Every year, our cars pump almost 320 million tons of carbon dioxide into the air. Vehicles also contribute to particulate pollution and to ozone or "smog" pollution. Pollutants can cause serious health problems, affecting your heart, lungs, and even fetal development in pregnant women. In fact, \$40 billion a year is spent on treatment of air pollution related health

problems in the U.S. The solution to air pollution is not simple or easy, but carpooling is one way you can help!

What can you do?

Carpooling will allow you to reduce the stress of driving while helping the environment and saving money. By sharing the ride with someone who lives in your neighborhood and works in the same area as you, you could save up to 50% of your commuting costs. You might even be eligible for a discount on your car insurance.

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #2</p>

Are you wasting your spare time, waiting alone in bumper to bumper traffic every day? Commuting in the 1990s is no longer as simple as getting into our cars and driving off to work each day. Now, as we strive to curtail the daily disruptions of traffic congestion; as we face environmental challenges like clean air; and as we explore new ways to manage our energy resources; we must look at commuting from a new perspective. Our times demand a change in commuter transportation - carpooling is something you can do to help!

By joining a carpool, you'll have a wealth of "found time" in your commute which you can use to relax, reflect, read, catch up on paperwork, or just have someone to talk to on the way home.

A carpool gives you a flexible commute option which you can tailor to your specific transportation needs. You can opt to share driving time with other members of your carpool, you can drive all the time, or you can even become a ride only member. Carpools can be as flexible or structured as you like. If the people in your carpool all have fixed schedules, try riding together every day. If personal needs, varied work schedules, or other factors won't allow you to pool daily, just ride together two days a week and you're still going to save money and enjoy other benefits.

Carpools are like a breath of fresh air

Everyone is concerned about the environment and more and more people have realized that there are small things which they can do every day to help preserve our natural resources. Riding in a carpool is one of the easiest. If more people carpool, there will be fewer cars on the road. That means less traffic. Less traffic means less air pollution. That makes better air for us all to breathe.

When you fill it up, the savings add up

People who ride to work in carpools really do save a bundle. Even if you drive only 30 miles round trip daily, you can realize dramatic savings.

Consider this: If you combine the cost of gasoline, maintenance, insurance, finance charges, and depreciation on your automobile, a 30 mile commute costs you about \$3,163 annually - and that's on top of your regular monthly car payment. Share the ride in a two-person carpool and the cost drops to \$1,582, make it three and it plummets to \$1,054. When it comes to finding an easy way to save some cash, a carpool is a good place to start.

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #4</p>

Carpooling is back!

An often neglected but familiar old friend, carpooling is emerging as the most positive and practical solution to today's problems of traffic congestion and the high cost of commuting.

Carpooling is an immediately available way to improve transportation productivity and reduce costs. Each two percent increase in auto occupancy at rush hour would save over 1 billion dollars annually in operating costs and capital expenditures. By sharing rides, this country can effectively reduce energy consumption, highway congestion, and air pollution while saving billions of dollars annually.

Why should you carpool?

Commuting to work is a hassle. Long lines of cars at traffic lights or on highways, one passenger in each, seem to stretch on forever. As you inch your way to and from work, you must be wondering if there isn't a better way. There is. Carpooling is an easy way to improve your ride to work. By carpooling with three other people who live and work near you, you can share the driving and take three cars off the road. If everyone did that, traffic tie-ups would untie for good.

Carpooling is also an excellent way to reduce the stress of driving. On those days that you don't drive, you can read, sleep, and relax rather than fight congestion. And of course, there's the companionship of your fellow poolers. When you join a carpool, you can develop friendships and camaraderie.

More importantly for your pocketbook, a carpool of four means you can save up to 75% of your commuting costs. A 20-mile round-trip solo commute costs you over \$1000 a year in gas and wear and tear on your car. By splitting the drive with three others in a carpool, you can save \$750. Surely there's someplace else you'd rather spend this money.

Depending on where you live and work, other benefits of carpooling can include preferential parking, reduced parking costs, lower insurance rates, and faster travel in "Diamond Lanes" (carpool only lanes).

How do I start?

Starting a carpool is easier than you might think. Most employers have some sort of matching service, and once you know others in your area who are interested in carpooling, joining a carpool may be as easy as making a phone call.

Carpools are very flexible. They can adjust to the desires and schedules of the people in the pool. A carpool, for example, may decide that members have to be on-time to participate. Driving may be split, so that everyone in the carpool uses their car only one week a month. Or, members may decide to carpool only part time, say two or three days a week.

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #5</p>

Stop paying the commuter toll

Feel like things are getting a little out of hand lately? Tempers flaring as traffic worsens? Clear blue skies not what they used to be? Expenses rising? Don't despair. Sharing a ride to and from work a few days a week can make a difference in your temperament, the air you breathe and your budget.

Gear up for great savings

Joining a carpool not only cuts obvious commuting costs like gas, oil, and parking, but also the less noticeable expense of tires and tune-ups. What a bonus, considering you also avoid the stress that takes a toll on your physical and mental health. In fact, research shows that long congested commuter trips can drive up blood pressure, lower tolerance, adversely affect short-term memory and lead to increased illness. Carpooling may also decrease your commuting time by allowing you to roll right past the traffic jams in special "diamond lanes" for carpools, or by allowing you preferential parking. You can make a choice that will improve your life, the environment, and air quality.

Carpools are flexible

You don't need to share a ride every day to make a difference. You can carpool on a regular basis and still drive alone a day or two a week to take care of errands or other side-trips. Ridesharing is *not* an all-or-nothing proposition.

Carpools are social

Carpooling is a great way to socialize with your co-workers in a non-work setting - you may even meet people you didn't know before. Friendships are some of the most important benefits of carpooling!

Carpools work

A few moments spent outlining formal or informal "rules" of the carpool will make things run smoothly. Once you decide how to split costs and driving, how often to ride together, and what to do about late members, your carpool will be as convenient and reliable as driving on your own.

Starting is easy

Carpools flexible and easy to coordinate since they need only a few people. One person can do all the driving while the riders split the bill, or you can take turns at the wheel. You can choose to pick up people at home, or meet in a central location like a Park&Ride lot.

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #7</p>

You're sitting in your car in yet another traffic jam. It's hot, there's nothing interesting on the radio and you'd rather be somewhere else. The money you just spent to fill up your fuel tank is flying right out the tailpipe and the thought of looking around for a parking space just causes you greater distress. Before you start yelling at the other drivers, cars, or even traffic lights, remember there is a better way - carpooling.

What's wrong with driving alone?

Let's face it, our love affair with the car has gone sour. The average occupancy of a typical trip in the United States is a startlingly low 1.09. That's less than the occupancy of a bicycle in India which, on average, carries 1.4 people! The average American male already spends 4 of his 16 waking hours driving a car or gathering the resources to pay for it. That works out to 1600 hours per year to travel (on average) a distance of 7500 miles, or 5 miles an hour. He might as well be walking.

Statistics confirm that driving is a strain on our health. Besides the deaths and injuries associated with automobile accidents, the American Lung Association estimates that 30,000 deaths a year result from our use of gasoline and diesel fuels.

Besides the costs to us personally, automobiles are also choking the planet. We can no longer ignore that the clouds of fumes spewing from our exhaust pipes are harming the planet. Even the pollution control strategies that have been introduced over the past few years, such as unleaded gasoline and catalytic converters, are being overwhelmed by the increased number of automobiles on the road. While technological advances have been proposed as potential 'solutions' to the automobile pollution problems, they are not cure-alls. We must reduce the number of cars on the road - carpooling is the easy answer.

Why carpool?

It's no longer fashionable, feasible, or fun to ride alone to work. Carpooling is three times more efficient than driving alone - it's good for the environment, saves us money, reduces stress, is good for our health, and it's fun!

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

COMMUTER TRANSPORTATION STUDY
Carpooling Fact Sheet #8

Air pollution is everybody's problem!

With poor air quality a fact of life in both city and suburb, breathing has become hazardous. Thus, the term "clean air", once relegated to environmentalists, is a matter of concern to everyone.

Vehicle emissions are the leading contributor to air pollution. The Environmental Protection Agency estimates that over 70 percent of the carbon monoxide and nearly one-third of all hydrocarbons in the air come from cars and trucks. Polluted air destroys our environment and shortens our lives. Lung disease, heart disease and cancer are serious threats to the millions of Americans who live in areas where the air is unhealthy.

America's dependency on the single occupant vehicle (SOV) has polluted the air and contributes to 10,000 - 20,000 air pollution related deaths each year. Because of these factors, commuting patterns have become an important concern nationwide.

What can we do?

While cleaner fuels and engines are reducing air pollution, more needs to be done. Driving less and ridesharing are some of the steps we can take to reduce pollution.

How can carpooling help?

If everyone would carpool just one day a week, traffic would be reduced by 20%, resulting in cleaner air, less congestion, and potentially fewer accidents. Given this, carpooling is one of the most practical and positive solutions to our air pollution problem!

What if my schedule doesn't allow me to carpool all the time?

Because carpools are made up of small personal groups they can be very flexible. If you have a regular schedule, you may choose to carpool every day. If you have an irregular schedule, you can carpool on days when your schedule allows, even if that only means one day per week.

What about errands and kids?

Errands are easy to schedule on those days which you don't carpool or on those days which you are the carpool driver. If you drop your kids off at school or day care on the way to work, you can consider them part of the carpool. Many adults would welcome the opportunity to interact with a child - it can be a pleasant break from the normal routine of work.

There are many good reasons to carpool! Don't be an "SOV"! It's vitally important to the quality of the air we breathe.

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #9</p>

Try carpooling - a flexible, comfortable, cost-saving way to travel ...

Carpoolers enjoy...

- **Cost savings in Commuting Dollars.** Employees who pool virtually give themselves a pay raise by saving money on gas, vehicle maintenance, insurance, and parking costs.
- **Reduced Stress of Driving.** According to Dr. Anthony Redding of U.C.L.A. Department of Stress Management, commuting is the main source of stress for working America.
- **Companionship of Fellow Poolers.** By spending time with other poolers twice a day, friendships are commonly formed.
- **Flexibility.** Carpooling offers individuals the choice of pooling on a regular basis or on days when their schedule allows, even if that means only one day each week.
- **Preferential Treatment.** Depending on the employer's pool program, employees who pool often receive preferential parking and reduced parking costs.
- **Lower Insurance Rates.** By reducing the number of miles driven, poolers may either be eligible for a "low-mileage discount" or a reclassification of their car as a pleasure-use or recreational vehicle. Premiums may be lowered by 10-20%.
- **Faster Travel in Diamond Lanes.** High occupancy vehicle lanes enable "pools" to skip the regular bumper-to-bumper congestion and sail along the highway.
- **Additional Personal Time.** Employees can read, sleep, chat, and relax during time previously spent fighting congestion on the work commute.

The incentives to carpool are numerous. Additional benefits are realized by the community-at-large through reduced traffic congestion, improved air quality due to reduced auto emissions and overall savings in gasoline consumption.

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

<p style="text-align: center;">COMMUTER TRANSPORTATION STUDY Carpooling Fact Sheet #10</p>
--

Commuters have a lot to learn from Dagwood Bumstead. Over the years the fumbling, nap-loving newspaper comic character may have missed his bus occasionally or kept his carpool waiting while he shaved, but he helped ease traffic congestion and reduce air pollution.

Participating in a carpool is not only beneficial for the environment; carpooling will reduce the stress associated with driving, save you money, and be a pleasant social experience. So what's stopping people from joining a carpool? Here are some common concerns people have about carpooling and some answers to these concerns:

Unpredictable work hours

Carpool members have the flexibility of sharing the ride only on days in which they know their exact hours. Another way to work around this concern is the set up of a system where carpool participants ride the bus home when they are required to work later than usual.

Fear of depending on someone else or fear of being depended on

Carpools are encouraged to set up "rules" for their pool before they begin. By establishing policies in advance, this fear is easily eliminated. Participants can decide, as a group, how to share costs, how to split the driving, and what to do about late members.

Reluctance to make pooling arrangements with strangers

There are several ways to overcome this "blind date" syndrome. Simply getting together at work to discuss the carpool is an easy way to meet fellow riders. A breakfast or lunch meeting to discuss the carpool, or a simple phone call are also effective. Once you get to know the people in your carpool, you may find that friendships and camaraderie develop.

Loss of freedom to run errands during work

Most people don't have to run errands every day and with a few phone calls, it's easy to schedule appointments and errands for those days which fit in with your commuting schedule. Use those days on which you either don't carpool or you drive the carpool as errand days. If a special event comes up for which you need your car, simply call your carpool and let them know you won't be riding that day.

Getting started

Joining or forming a carpool is easy. Many employers have a ride board or other matching service. Cities often have free area or region-wide matching services. Carpools can also be started informally, with one or two people you already know.

Carpooling is much more convenient and reliable than many people assume. It is easy to formulate a system of "rules" to keep your carpool running smoother. Why not start a carpool today?

**Remember to record your opinion of this fact sheet on the Commuter
Transportation Opinion Sheet**

APPENDIX C

PRE-INTERVENTION SURVEY

The original survey was in 10 point and was 2 pages long. The memo accompanied the survey.

Subject: Commuter Transportation Study

From: XXXXX

To: XXXXX

This memo is to request and encourage your participation in a short-term effort by EPA's Office of Air and Radiation (OAR) to learn more about factors affecting personal transportation behavior. This is a new area of responsibility for OAR, prompted by transportation-related provisions of the 1990 Clean Air Act. It is crucial for us to develop an understanding of travel behavior as it is increasingly clear that technological fixes alone are no longer enough to solve our air pollution problems. We feel that we will enhance Agency credibility by taking the lead ourselves in developing solutions and by conducting initial research within our own facilities.

We are requesting you to help by reading some information regarding carpooling, and by participating in a series of three surveys to be distributed over the next several months. Please take the time now to fill out the attached initial survey. We need each of you to complete all three of the surveys. Participating in the surveys will in no way require you to participate in a carpool program, though you will have this opportunity if you wish. *Additional information on carpooling will be sent to you soon; please take the time to read all of this information.*

Though we ask that you write your name on the first survey, this information will be used only to make sure that follow-up materials reach you. A unique code will be used to link your answers across surveys; your name will not be associated with the final data. I can assure you that all data will be kept completely confidential.

The urgency of this issue makes this research a priority - we really need everyone to participate. Please fill out and return this survey the day you receive it, but no later than October 22nd. Return the survey to XXXXX.

Thanks.

Attachment

Name: _____

Trip-to-work Survey

We are conducting a study on commuting and would like to hear your views on the following questions.
 Your responses are very important to us. Thank you for your time.

Please return your completed survey to XXXXX.

1. Describe your normal commute to work:

How do you get to work? (check all that you do on a regular basis):
 drive by myself, carpool/vanpool, public transit, bicycle/walk, other: _____

How many miles from work do you live? _____

How long, on average, does your trip to work take? _____

How long have you been making your present commute trip? _____

Do you work more than 30 hours per week? yes no

Are your work hours regular? irregular? Please explain: _____

Do you work a compressed work week? yes no

Do you regularly use your car during work hours for work-related purposes? yes no

Do you regularly use your car for personal errands while commuting? yes no

Do you regularly use you car during work hours for personal (non work-related) purposes? yes no

Explain: _____

2. Please indicate how much information you have been exposed to regarding the following commute modes (other than driving to work alone):

(Please use the following identifiers: 1=none, 2=a little, 3=some, 4=a lot, 5=a very great deal)

1 2 3 4 5	Carpooling	1 2 3 4 5	Vanpooling
1 2 3 4 5	Public transit	1 2 3 4 5	Bicycle/walking

3. Please describe your commuting history:

Place a check by all the modes which you have used to commute and indicate how long you have used them.
 For each mode which you have used, please indicate how satisfied you were, overall, with your experience?

(Use the following rating scale: 1=very dissatisfied, 2=dissatisfied, 3=neutral, 4=satisfied, 5=very satisfied)

<input type="checkbox"/> Carpool	How long? _____	1 2 3 4 5
<input type="checkbox"/> Vanpool	How long? _____	1 2 3 4 5
<input type="checkbox"/> Public transit	How long? _____	1 2 3 4 5
<input type="checkbox"/> Bicycle/walk	How long? _____	1 2 3 4 5

4. Please indicate the extent to which you agree or disagree with the following statements:

(Please use the following: X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- X 1 2 3 4 5 Air pollution caused by cars and trucks is a significant problem in this country today.
- X 1 2 3 4 5 I dislike interacting with groups of strangers.
- X 1 2 3 4 5 People who fit their lives to a schedule miss most of the joy of living.
- X 1 2 3 4 5 I enjoy the challenge of unfamiliar experiences.
- X 1 2 3 4 5 I like parties where I know most of the people.
- X 1 2 3 4 5 Air pollution can be reduced if commuters stop driving by themselves.
- X 1 2 3 4 5 Many of our most important decisions are based upon insufficient information.
- X 1 2 3 4 5 I like having a clear sense of what a new project will entail before beginning it.
- X 1 2 3 4 5 If more commuters stop driving alone, large-scale environmental degradation will be reduced.
- X 1 2 3 4 5 I am uncomfortable in situations where I'm not sure how to act.
- X 1 2 3 4 5 Even when there are alternative forms of transportation available, I still prefer to drive to work by myself.
- X 1 2 3 4 5 I enjoy adapting myself to unfamiliar situations.
- X 1 2 3 4 5 I always prefer what I'm used to over what is unfamiliar.
- X 1 2 3 4 5 Emissions from transportation sources significantly affect the global environment.
- X 1 2 3 4 5 I prefer to lead a life where few surprises or unexpected happenings arise.
- X 1 2 3 4 5 Commuter travel is a major contributor to air pollution.
- X 1 2 3 4 5 I am most comfortable when I can predict how things will turn out.

5. Please indicate how likely you would be to take each of the following actions in order to clean up the environment or conserve resources outside of work?

(Please use the following: X=no opinion 1=very unlikely, 2=unlikely, 3=neutral, 4=likely, 5=very likely)

- X 1 2 3 4 5 Write a letter to a decision maker
- X 1 2 3 4 5 Join in a community environmental clean-up
- X 1 2 3 4 5 Avoid purchasing products made by a company that pollutes the environment
- X 1 2 3 4 5 Walk or use public transportation instead of driving
- X 1 2 3 4 5 Conserve electricity
- X 1 2 3 4 5 Buy things made from recycled products

6. Please answer the following demographics questions (these, and all other data, will be held confidential).

Sex _____ Age _____

Please indicate the number of children in your household:

___ none, ___ under the age of 1, ___ between 1 and 4, ___ between 5 and 10, ___ between 11 and 16

Please check the highest level of school that you have completed:

- ___ Grade school ___ High school degree ___ Some college
- ___ Bachelor degree ___ Some graduate work ___ Masters degree
- ___ Ph.D. or other advanced degree

Thank you!

APPENDIX D

OPINION SHEETS

The original opinion sheets were in 12-point and were one page long. Opinion sheets and memos specific to either the factsheet group or the story group were distributed to participants; the control group did not receive opinion sheets nor memos. The opinion sheets and memos were distributed along with the intervention (factsheets or stories).

Subject: Commuter Transportation Study

From: XXXXXX

To: XXXXXX

Thank you for taking the time to fill out the trip-to-work survey. As I mentioned in the initial letter, you will be receiving some information about carpooling - in the form of fact sheets - over the next two weeks. We are interested in how interesting and informative you find this information. Your answers will help us in designing appropriate information campaigns for carpooling.

Attached is the first of these fact sheets and an additional sheet to record your opinions on this and future fact sheets. You will be receiving 9 more fact sheets over the next two weeks; please take a moment at the beginning of your day to read that day's fact sheet and respond to the questions on the provided opinion sheet. We would like you to read and rate each fact sheet on the day you receive it so that the ratings are independent of one another. At the end of next week, we will ask you to return the completed opinion sheet to XXXXXX. Again, be assured that all of your answers will be kept completely confidential.

Thanks.

Attachments

Subject: Commuter Transportation Study

From: XXXXX

To: XXXXX

Thank you for taking the time to fill out the trip-to-work survey. As I mentioned in the initial letter, you will be receiving some information about carpooling - in the form of stories, or "transportation fables for our time"- over the next two weeks. We are interested in how interesting and informative you find this information. Your answers will help us in designing appropriate information campaigns for carpooling.

Attached is the first of these stories and an additional sheet to record your opinions on this and future stories. You will be receiving 9 more stories over the next two weeks; please take a moment at the beginning of your day to read that day's story and respond to the questions on the provided opinion sheet. We would like you to read and rate each story on the day you receive it so that the ratings are independent of one another. At the end of next week, we will ask you to return the completed opinion sheet to XXXXX. Again, be assured that all of your answers will be kept completely confidential.

Thanks.

Attachments

**Commuter Transportation Study
Opinion Sheet**

For each fact sheet you read, please answer the following two questions:

1. Overall, how interesting did you find this fact sheet?
(Use the following rating scale: 1=very uninteresting; 2=somewhat uninteresting; 3=neutral; 4=somewhat interesting; 5=very interesting)
2. Overall, how informative did you find this fact sheet?
(Use the following scale: 1=not at all informative; 2=a little informative; 3=somewhat informative; 4=informative; 5=very informative)

Fact Sheet #1

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #2

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #3

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #4

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #5

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #6

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #7

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #8

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #9

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Fact Sheet #10

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

**When you have completed the opinion sheet, please return it to Alan Powell, Air Division.
Thank you!**

**Commuter Transportation Study
Opinion Sheet**

For each story you read, please answer the following two questions:

1. Overall, how interesting did you find this story?
(Use the following rating scale: 1=very uninteresting; 2=somewhat uninteresting; 3=neutral; 4=somewhat interesting; 5=very interesting)
2. Overall, how informative did you find this story?
(Use the following scale: 1=not at all informative; 2=a little informative; 3=somewhat informative; 4=informative; 5=very informative)

Transportation Fables for Our Time #1 - Schmarpool

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #2 - The Sign

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #3 - The Late Mr. Mudgeon

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #4 - The Late Mr. Mudgeon (later)

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #5 - The Ballad of the Diamond Lane

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #6 - Sandbox Rules

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #7 - A Cautionary Tale

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #8 - The First Two Times

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #9 - Another Part of Life's Rich Pageant

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

Transportation Fables for Our Time #10 - Picking Up the Pretender

- 1) 1 2 3 4 5
- 2) 1 2 3 4 5

When you have completed the opinion sheet, please return it to Alan Powell, Air Division.
Thank you!

APPENDIX E

POST-INTERVENTION SURVEY

Post-intervention surveys specific to the factsheet, story, and control groups were distributed to the participants along with a memo and the cognitive mapping task (Appendix F). One memo was sent to both the factsheet and story groups and another memo was sent to the control group. The surveys are shown in the following order: factsheet, story, control.

Subject: Commuter Transportation Study

From: XXXXX

To: XXXXX

Thank you for taking the time to read the information you've received over the past two weeks. We would like your opinions on this information and some other issues. Enclosed you will find a short survey and a concept-sorting exercise which will help us understand how you think about carpooling. Please complete these and return them to XXXXX, as soon as possible. We also ask you to return the opinion sheet which you received two weeks ago if you have not already done so. Again, be assured that your answers will be kept completely confidential.

Thanks.

Attachment

Subject: Commuter Transportation Study

From: XXXXXX

To: XXXXXX

Thank you for taking the time to fill out the trip-to-work survey. We would now like your opinions on some related issues. Enclosed you will find a short survey and a concept-sorting exercise which will help us understand how you think about carpooling. Please complete these and return them to XXXXXX, as soon as possible. Again, be assured that your answers will be kept completely confidential.

Thanks.

Attachment

Commuter Transportation Study – Survey #2

A. Compared to what you knew before you read the factsheets, how much do you now know about carpooling?

- 1=no more than before
- 2=very little more than before
- 3=some more than before
- 4=quite a bit more than before
- 5=a great deal more than before

B. Compared to how confident you were about your ability to solve carpooling problems before you read the factsheets, how would you now rate your level of confidence?

- 1=no more confident
- 2=just a bit more confident
- 3=somewhat more confident
- 4=quite a bit more confident
- 5=a very great deal more confident

C. Did you read the factsheets?

- 1=I did not read any of them
- 2=I read very few of them
- 3=I read some of them
- 4=I read most of them
- 5=I read all of them

D. Please indicate to what extent each of the following statements reflects your thoughts.

(1=not at all 2=a little 3=somewhat 4=quite a bit 5=a great deal)

- | | |
|-----------|---|
| 1 2 3 4 5 | The factsheets did not persuade me to give carpooling another thought |
| 1 2 3 4 5 | The factsheets were enjoyable to read |
| 1 2 3 4 5 | During the past two weeks, I found myself mentioning the factsheets to other people |
| 1 2 3 4 5 | If I started carpooling, I could resolve most problems that arise |
| 1 2 3 4 5 | I am not interested in the topic of carpooling |
| 1 2 3 4 5 | I feel like I'm not fully informed about what carpooling would involve |
| 1 2 3 4 5 | I am willing to organize a carpool on my own |
| 1 2 3 4 5 | I doubt I could troubleshoot a problem occurring in another carpool |
| 1 2 3 4 5 | I cannot imagine what carpooling would be like for me |
| 1 2 3 4 5 | I would look forward to a chance to use my knowledge about carpooling |
| 1 2 3 4 5 | If someone came to me with a carpool-related problem, I would be able to offer advice |
| 1 2 3 4 5 | During the past two weeks, I found myself thinking more about carpooling than usual |
| 1 2 3 4 5 | The first problem a carpool faces would shut it down |
| 1 2 3 4 5 | I can easily imagine what a typical carpool would be like |

Please indicate to what extent each of the following statements reflects your thoughts.

(1=not at all 2=a little 3=somewhat 4=quite a bit 5=a great deal)

- 1 2 3 4 5 I would have no problem making a list of the pros and cons to carpooling
1 2 3 4 5 I'm sure I could help resolve problems that come up in a carpool
1 2 3 4 5 I can easily imagine the sorts of problems that people in a carpool would encounter
1 2 3 4 5 I would feel comfortable talking about the carpooling process
1 2 3 4 5 I enjoy reading about carpooling
- 1 2 3 4 5 I can easily imagine the startup problems a carpool would face
1 2 3 4 5 I would rather not get into a discussion about carpooling
1 2 3 4 5 I have enough knowledge about carpooling to write a memo for the office
1 2 3 4 5 I could generate a couple of different solutions to most carpool problems
1 2 3 4 5 I could easily decide whether or not to join a carpool

E. Please indicate the extent to which you agree or disagree with the following statements:

(X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- X 1 2 3 4 5 Air pollution caused by cars and trucks is a significant problem in this country today.
X 1 2 3 4 5 Air pollution can be reduced if commuters stop driving by themselves.
X 1 2 3 4 5 If more commuters stop driving alone, large-scale environmental degradation will be reduced.
X 1 2 3 4 5 Even when there are alternative forms of transportation available, I still prefer to drive to work by myself.
X 1 2 3 4 5 Emissions from transportation sources significantly affect the global environment.
X 1 2 3 4 5 Commuter travel is a major contributor to air pollution.

F. Please indicate how likely you would be to take each of the following actions in order to clean up the environment or conserve resources outside of work?

(1=very unlikely, 2=unlikely, 3=neutral, 4=likely, 5=very likely)

- X 1 2 3 4 5 Write a letter to a decision maker
X 1 2 3 4 5 Join in a community environmental clean-up
X 1 2 3 4 5 Avoid purchasing products made by a company that pollutes the environment
X 1 2 3 4 5 Walk or use public transportation instead of driving
X 1 2 3 4 5 Conserve electricity
X 1 2 3 4 5 Buy things made from recycled products

Commuter Transportation Study - Survey #2

A. Compared to what you knew before you read the stories, how much do you now know about carpooling?

- 1=no more than before
- 2=very little more than before
- 3=some more than before
- 4=quite a bit more than before
- 5=a great deal more than before

B. Compared to how confident you were about your ability to solve carpooling problems before you read the stories, how would you now rate your level of confidence?

- 1=no more confident
- 2=just a bit more confident
- 3=somewhat more confident
- 4=quite a bit more confident
- 5=a very great deal more confident

C. Did you read the stories?

- 1=i did not read any of them
- 2=i read very few of them
- 3=i read some of them
- 4=i read most of them
- 5=i read all of them

D. Please indicate to what extent each of the following statements reflects your thoughts.

(1=not at all 2=a little 3=somewhat 4=quite a bit 5=a great deal)

- | | |
|-----------|---|
| 1 2 3 4 5 | The stories did not persuade me to give carpooling another thought |
| 1 2 3 4 5 | The stories were enjoyable to read |
| 1 2 3 4 5 | During the past two weeks, I found myself mentioning the stories to other people |
| 1 2 3 4 5 | If I started carpooling, I could resolve most problems that arise |
| 1 2 3 4 5 | I am not interested in the topic of carpooling |
| 1 2 3 4 5 | I feel like I'm not fully informed about what carpooling would involve |
| 1 2 3 4 5 | I am willing to organize a carpool on my own |
| 1 2 3 4 5 | I doubt I could troubleshoot a problem occurring in another carpool |
| 1 2 3 4 5 | I cannot imagine what carpooling would be like for me |
| 1 2 3 4 5 | I would look forward to a chance to use my knowledge about carpooling |
| 1 2 3 4 5 | If someone came to me with a carpool-related problem, I would be able to offer advice |
| 1 2 3 4 5 | During the past two weeks, I found myself thinking more about carpooling than usual |
| 1 2 3 4 5 | The first problem a carpool faces would shut it down |
| 1 2 3 4 5 | I can easily imagine what a typical carpool would be like |

Please indicate to what extent each of the following statements reflects your thoughts.

(1=not at all 2=a little 3=somewhat 4=quite a bit 5=a great deal)

- | | |
|-----------|---|
| 1 2 3 4 5 | I would have no problem making a list of the pros and cons to carpooling |
| 1 2 3 4 5 | I'm sure I could help resolve problems that come up in a carpool |
| 1 2 3 4 5 | I can easily imagine the sorts of problems that people in a carpool would encounter |
| 1 2 3 4 5 | I would feel comfortable talking about the carpooling process |
| 1 2 3 4 5 | I enjoy reading about carpooling |
| 1 2 3 4 5 | I can easily imagine the startup problems a carpool would face |
| 1 2 3 4 5 | I would rather not get into a discussion about carpooling |
| 1 2 3 4 5 | I have enough knowledge about carpooling to write a memo for the office |
| 1 2 3 4 5 | I could generate a couple of different solutions to most carpool problems |
| 1 2 3 4 5 | I could easily decide whether or not to join a carpool |

E. Please indicate the extent to which you agree or disagree with the following statements:

(X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- | | |
|-------------|---|
| X 1 2 3 4 5 | Air pollution caused by cars and trucks is a significant problem in this country today. |
| X 1 2 3 4 5 | Air pollution can be reduced if commuters stop driving by themselves. |
| X 1 2 3 4 5 | If more commuters stop driving alone, large-scale environmental degradation will be reduced. |
| X 1 2 3 4 5 | Even when there are alternative forms of transportation available, I still prefer to drive to work by myself. |
| X 1 2 3 4 5 | Emissions from transportation sources significantly affect the global environment. |
| X 1 2 3 4 5 | Commuter travel is a major contributor to air pollution. |

F. Please indicate how likely you would be to take each of the following actions in order to clean up the environment or conserve resources outside of work?

(1=very unlikely, 2=unlikely, 3=neutral, 4=likely, 5=very likely)

- | | |
|-------------|---|
| X 1 2 3 4 5 | Write a letter to a decision maker |
| X 1 2 3 4 5 | Join in a community environmental clean-up |
| X 1 2 3 4 5 | Avoid purchasing products made by a company that pollutes the environment |
| X 1 2 3 4 5 | Walk or use public transportation instead of driving |
| X 1 2 3 4 5 | Conserve electricity |
| X 1 2 3 4 5 | Buy things made from recycled products |

Commuter Transportation Study – Survey #2

A. Please indicate to what extent each of the following statements reflects your thoughts.

(1=not at all 2=a little 3=somewhat 4=quite a bit 5=a great deal)

- | | |
|-----------|---|
| 1 2 3 4 5 | If I started carpooling, I could resolve most problems that arise |
| 1 2 3 4 5 | I am not interested in the topic of carpooling |
| 1 2 3 4 5 | I feel like I'm not fully informed about what carpooling would involve |
| 1 2 3 4 5 | I am willing to organize a carpool on my own |
| 1 2 3 4 5 | I doubt I could troubleshoot a problem occurring in another carpool |
| 1 2 3 4 5 | I cannot imagine what carpooling would be like for me |
| 1 2 3 4 5 | I would look forward to a chance to use my knowledge about carpooling |
| 1 2 3 4 5 | If someone came to me with a carpool-related problem, I would be able to offer advice |
| 1 2 3 4 5 | During the past two weeks, I found myself thinking more about carpooling than usual |
| 1 2 3 4 5 | The first problem a carpool faces would shut it down |
| 1 2 3 4 5 | I can easily imagine what a typical carpool would be like |
| 1 2 3 4 5 | I would have no problem making a list of the pros and cons to carpooling |
| 1 2 3 4 5 | I'm sure I could help resolve problems that come up in a carpool |
| 1 2 3 4 5 | I can easily imagine the sorts of problems that people in a carpool would encounter |
| 1 2 3 4 5 | I would feel comfortable talking about the carpooling process |
| 1 2 3 4 5 | I enjoy reading about carpooling |
| 1 2 3 4 5 | I can easily imagine the startup problems a carpool would face |
| 1 2 3 4 5 | I would rather not get into a discussion about carpooling |
| 1 2 3 4 5 | I have enough knowledge about carpooling to write a memo for the office |
| 1 2 3 4 5 | I could generate a couple of different solutions to most carpool problems |
| 1 2 3 4 5 | I could easily decide whether or not to join a carpool |

E. Please indicate the extent to which you agree or disagree with the following statements:

(X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- | | |
|-------------|---|
| X 1 2 3 4 5 | Air pollution caused by cars and trucks is a significant problem in this country today. |
| X 1 2 3 4 5 | Air pollution can be reduced if commuters stop driving by themselves. |
| X 1 2 3 4 5 | If more commuters stop driving alone, large-scale environmental degradation will be reduced. |
| X 1 2 3 4 5 | Even when there are alternative forms of transportation available, I still prefer to drive to work by myself. |
| X 1 2 3 4 5 | Emissions from transportation sources significantly affect the global environment. |
| X 1 2 3 4 5 | Commuter travel is a major contributor to air pollution. |

F. Please indicate how likely you would be to take each of the following actions in order to clean up the environment or conserve resources outside of work?

(1=very unlikely, 2=unlikely, 3=neutral, 4=likely, 5=very likely)

- | | |
|-------------|---|
| X 1 2 3 4 5 | Write a letter to a decision maker |
| X 1 2 3 4 5 | Join in a community environmental clean-up |
| X 1 2 3 4 5 | Avoid purchasing products made by a company that pollutes the environment |
| X 1 2 3 4 5 | Walk or use public transportation instead of driving |
| X 1 2 3 4 5 | Conserve electricity |
| X 1 2 3 4 5 | Buy things made from recycled products |

APPENDIX F

FOLLOW-UP SURVEY

Follow-up surveys specific to the factsheet, story, and control groups were distributed to the participants one month after the post-intervention survey was administered. The surveys are shown in the following order: factsheet, story, control.

MEMORANDUM

Subject: Commuter Transportation Study

From: XXXX

To: XXXX

This is the final portion of the commuter transportation study. Please take a moment to answer the questions below and return this form to XXXX. Your answers will be kept completely confidential. *Thank you very much for your participation in this study!*

1. Please indicate the extent to which you agree or disagree with the following statements:

(X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- X 1 2 3 4 5 Air pollution caused by cars and trucks is a significant problem in this country today.
- X 1 2 3 4 5 Air pollution can be reduced if commuters stop driving by themselves.
- X 1 2 3 4 5 If more commuters stop driving alone, large-scale environmental degradation will be reduced.
- X 1 2 3 4 5 Even when there are alternative forms of transportation available, I still prefer to drive to work by myself.
- X 1 2 3 4 5 Emissions from transportation sources significantly affect the global environment.
- X 1 2 3 4 5 Commuter travel is a major contributor to air pollution.

Since reading the carpooling stories:

- X 1 2 3 4 5 I think it would be easier to deal with problems that might arise in a carpool.
- X 1 2 3 4 5 I have become more aware of my own commuting patterns.
- X 1 2 3 4 5 I have made changes in my driving habits (either work-related or non work-related).
If yes, please list any changes:

2. Do you currently carpool to work at least once per week? ___ yes ___ no

3. If you do not currently carpool, what do you perceive as the major barriers to beginning?

MEMORANDUM

Subject: Commuter Transportation Study

From: XXXX

To: XXXX

This is the final portion of the commuter transportation study. Please take a moment to answer the questions below and return this form to XXXX. Your answers will be kept completely confidential. *Thank you very much for your participation in this study!*

1. Please indicate the extent to which you agree or disagree with the following statements:

(X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- X 1 2 3 4 5 Air pollution caused by cars and trucks is a significant problem in this country today.
- X 1 2 3 4 5 Air pollution can be reduced if commuters stop driving by themselves.
- X 1 2 3 4 5 If more commuters stop driving alone, large-scale environmental degradation will be reduced.
- X 1 2 3 4 5 Even when there are alternative forms of transportation available, I still prefer to drive to work by myself.
- X 1 2 3 4 5 Emissions from transportation sources significantly affect the global environment.
- X 1 2 3 4 5 Commuter travel is a major contributor to air pollution.

Since reading the carpooling stories:

- X 1 2 3 4 5 I think it would be easier to deal with problems that might arise in a carpool.
- X 1 2 3 4 5 I have become more aware of my own commuting patterns.
- X 1 2 3 4 5 I have made changes in my driving habits (either work-related or non work-related).
If yes, please list any changes:

2. Do you currently carpool to work at least once per week? ___ yes ___ no

3. If you do not currently carpool, what do you perceive as the major barriers to beginning?

MEMORANDUM

Subject: Commuter Transportation Study

From: XXXX

To: XXXX

This is the final portion of the commuter transportation study. Please take a moment to answer the questions below. Return this form to: XXXX. Your answers will be kept completely confidential. *Thank you very much for your participation in this study!*

1. Please indicate the extent to which you agree or disagree with the following statements:

(X=no opinion 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree)

- X 1 2 3 4 5 Air pollution caused by cars and trucks is a significant problem in this country today.
- X 1 2 3 4 5 Air pollution can be reduced if commuters stop driving by themselves.
- X 1 2 3 4 5 If more commuters stop driving alone, large-scale environmental degradation will be reduced.
- X 1 2 3 4 5 Even when there are alternative forms of transportation available, I still prefer to drive to work by myself.
- X 1 2 3 4 5 Emissions from transportation sources significantly affect the global environment.
- X 1 2 3 4 5 Commuter travel is a major contributor to air pollution.

In the last month and a half:

- X 1 2 3 4 5 I think it would be easier to deal with problems that might arise in a carpool.
- X 1 2 3 4 5 I have become more aware of my own commuting patterns.
- X 1 2 3 4 5 I have made changes in my driving habits (either work-related or non work-related).
If yes, please list any changes:

2. Do you currently carpool to work at least once per week? ____ yes ____ no

3. If you do not currently carpool, what do you perceive as the major barriers to beginning?

APPENDIX G

COGNITIVE MAPPING TASK (MODIFIED F-SORT)

The cognitive mapping task was distributed to all participants along with the post-intervention survey. The instruction sheet for the task was placed in a manila envelope along with 50, 2"X2" slips of paper, and 7 paperclips.

Commuter Transportation Study -- Perspectives on Carpooling

We are interested in seeing how you, personally, think about carpooling to work. The following concept-sorting task goes beyond the typical survey and allows you to express how you view the carpooling process. Please read through ALL the instructions and then follow them in order. There are no "correct" concepts to choose and no correct way to organize the concepts; we are interested in your personal perspective.

1. Imagine that you have been asked to share your perspective on carpooling from home to work with a coworker who hasn't thought much about the issue. *What will you choose to talk about? How will you organize your thoughts?* Listed below are some concepts which may be useful in explaining how you think about the carpooling process. Please read through the concepts and write down only those that are important concepts for you in explaining your views on carpooling to work. (e.g., If you don't think about a particular concept when thinking about carpooling, don't write that concept down.) Write each concept you choose on one of the enclosed slips of paper.

2. Next, look through the concepts you have chosen and organize them into groups of related concepts. Categorize the concepts in any way which would help explain your view about carpooling to work.

3. Now, think of a label, or name, for each category. Write the label name on a separate slip of paper and place it on the top of the appropriate category. On the back of each slip of paper in the category write the number of the category to which it belongs (i.e., for the first category you label, write a "1" on the back of each slip of paper in that category, for the second category you label, write a "2" on the back of each slip of paper in that category, etc. The order you choose to label the categories is not important. The numbers are only so that we can regroup your concepts should they come unattached.)

4. Now, look at the concepts in each category and rate how you feel about each concept in relation to carpooling. Place a "+" on the slip of paper if you feel that the concept is a positive aspect of carpooling; a "-" on the slip of paper if you feel the concept is a negative aspect of carpooling; and a "0" on the slip of paper if you feel the concept is neither a positive nor a negative aspect of carpooling.

5. Finally, carefully paperclip the slips of paper in each category together. Place all categories back in the envelope along with the survey and close the envelope with the metal tab. To make it easier for us, please do not seal the envelope!

CONCEPTS (choose as many or as few as you need to explain your views on carpooling)

gasoline costs	energy use	auto maintenance costs
rural living	relaxation	automobile insurance costs
time to collect thoughts	freedom	time to do work
driving-related stress	air pollution	accident anxiety
flexibility	on-the-road safety	civic duty
parking costs	finding parking	preferred parking
reliability	convenience	socializing
company of others	conversation	making friends
meeting strangers	shared driving responsibilities	errands
fixed schedule	bad weather	child care
physical comfort	independence	mobility
privacy	social conflicts	predictability
fun	personal security	time in travel
time spent waiting	length of commute	spreading illnesses
setting up carpool	carpooling protocol	personal emergency
scheduling demands		

Thank you for sharing your views!!!

APPENDIX H

PRE-INTERVENTION SURVEY GRAND MEANS

N=639

Statement	Mean	S. D.
Commute Characteristics		
• How many miles from work do you live?	17.10	11.97
• How long, on average does your trip to work take? (in minutes)	29.12	16.08
• How long have you been making your present commute trip? (in months)	54.94	59.30
• Are your work hours regular or irregular?	77% reg.	22% irreg.
• Do you work a compressed work week?	57% yes	42% no
• Do you regularly use your car during work hours for work-related purposes?	13% yes	85% no
• Do you regularly use your car for personal errands while commuting?	61% yes	38% no
• Do you regularly use your car during work hours for personal (non work-related) purposes?	31% yes	68% no
Information		
Please indicate how much information you have been exposed to regarding the following commute modes...		
• carpooling		
• public transit	2.74	1.16
• vanpooling	2.70	1.31
• bicycle/walking	1.57	.94
	1.90	1.23
Place a check by all modes which you have used to commute		
	% checked	
• carpool	40%	
• vanpool	3%	
• public transit	34%	
• bicycle/walk	14%	

Statement	Mean	S. D.
Indicate you long you have used each mode (in months)	41.00	49.60
• carpool	36.25	37.35
• vanpool	43.83	56.34
• public transit	30.51	41.02
• bicycle/walk		
For each mode that you have used, please indicate how satisfied you were, overall, with your experience		
• carpool	3.38	1.08
• vanpool	3.80	1.32
• public transit	3.07	1.19
• bicycle/walk	3.54	1.42
Attitude Scale		
Air pollution caused by cars and trucks is a significant problem in this country today	4.46	.78
• Air pollution can be reduced if commuters stop driving by themselves	4.15	.86
• If more commuters stop driving alone, large-scale environmental degradation will be reduced	3.53	1.13
• Even when there are alternative forms of transportation available, I still prefer to drive to work by myself	3.15	1.22
• Emissions from transportation sources significantly affect the global environment	4.03	1.00
• Commuter travel is a major contributor to air pollution	3.94	1.02
Rigidity Scale		
• I dislike interacting with groups of strangers	2.67	1.10
• People who fit their lives to a schedule miss most of the joy of living	2.58	1.16
• I enjoy the challenge of unfamiliar experiences	3.31	1.01
• I like parties where I know most of the people	3.71	1.00
• Many of our most important decisions are based upon insufficient information	3.42	1.21
• I like having a clear sense of what a new project will entail before beginning it	3.71	1.00
• I am uncomfortable in situations where I'm not sure how to act	3.23	1.21
• I enjoy adapting myself to unfamiliar situations	2.95	.96

Statement	Mean	S. D.
• I always prefer what I'm used to over what is unfamiliar	2.94	1.02
• I prefer to lead a life where few surprises or unexpected happenings arise	2.76	1.03
• I am most comfortable when I can predict how things will turn out	3.42	.94

Behavior scale

Please indicate how likely you would be to take each of the following actions in order to clean up the environment or conserve resources outside of work

• Write a letter to a decision maker	2.98	1.22
• Join in a community environmental clean-up	3.39	1.04
• Avoid purchasing products made by a company that pollutes the environment	3.92	1.00
• Walk or use public transportation instead of driving	3.06	1.19
• Conserve electricity	4.31	.70
• Buy things made from recycled products	4.31	.74

Demographics

• Sex	52% male	44% female
• Age	40.31	11.14
• Children under the age of 16	39% yes	
• Education	4.74	1.35

APPENDIX I

OPINION SHEET GRAND MEANS

Infosheet Number			Factsheet (n=166)		Story (n=163)	
			Informative	Interest	Informative	Interest
#1	Mean	=	3.87	3.75	2.64	3.42
	S. D.	=	.95	.97	1.04	1.08
#2	Mean	=	3.22	3.34	2.56	3.19
	S. D.	=	1.06	1.00	1.04	1.78
#3	Mean	=	3.75	3.63	2.00	2.84
	S. D.	=	.97	1.05	1.03	1.17
#4	Mean	=	3.11	3.41	2.35	3.08
	S. D.	=	.97	1.00	1.08	1.21
#5	Mean	=	3.08	3.45	2.80	3.35
	S. D.	=	1.03	1.01	1.25	1.20
#6	Mean	=	3.20	3.50	2.22	2.86
	S. D.	=	1.12	1.03	1.12	1.23
#7	Mean	=	2.98	3.13	2.28	2.70
	S. D.	=	1.12	1.23	1.12	1.18
#8	Mean	=	2.98	3.16	2.74	3.01
	S. D.	=	.93	1.01	1.16	1.08
#9	Mean	=	3.13	3.24	2.49	3.31
	S. D.	=	1.06	1.11	1.17	1.26
#10	Mean	=	3.03	3.22	2.18	2.53
	S. D.	=	1.05	1.04	1.16	1.24

APPENDIX J

POST-INTERVENTION SURVEY GRAND MEANS

N=349

Statement	Mean	S. D.
• Compared to what you knew before you read the [factsheets/stories], how much do you now know about carpooling?	2.60	.97
• Compared to how confident you were about your ability to solve carpooling problems before you read the [factsheets/stories], how would you now rate your level of confidence?	2.02	1.00
• Did you read the [factsheets/stories]?	4.82	.57
• The [factsheets/stories] did not persuade me to give carpooling another thought	2.72	1.42
• The [factsheets/stories] were enjoyable to read	2.86	1.03
• During the past two weeks, I found myself mentioning the [factsheets/stories] to other people	1.58	.87
• If I started carpooling, I could resolve most problems that might arise	2.86	1.27
• I am not at all interested in the topic of carpooling	2.48	1.36
• I feel like I'm not fully informed about what carpooling would be like	1.70	1.14
• I am willing to organize a carpool on my own	1.87	1.12
• I doubt I could troubleshoot a problem occurring in another carpool	2.42	1.22
• I cannot imagine what carpooling would be like for me	1.80	1.14
• I would look forward to a chance to use my knowledge about carpooling	2.05	1.06
• If someone came to me with a carpool-related problem, I would be able to offer advice	2.99	1.11
• During the past two weeks, I found myself talking about carpooling with other people	2.18	1.27
• I feel sure the first problem a carpool faces would shut it down	1.64	.95
• I can easily imagine what a typical carpool would be like	3.55	1.12
• I would have no problem making a list of the pros and cons to carpooling	3.56	1.14
• I'm sure I could help resolve problems that come up in a carpool	3.07	1.04

Statement	Mean	S. D.
• I can easily imagine the sorts of problems that people in a carpool would encounter	3.71	.99
• I would feel comfortable talking about the carpooling process	3.29	1.09
• I enjoy reading about carpooling	2.04	1.02
• I can easily imagine the startup problems a carpool would face	3.57	1.00
• I would rather not get into a discussion about carpooling	2.58	1.26
• I have enough knowledge about carpooling to write a memo for the office	2.47	1.19
• I could generate a couple of different solutions to most carpool problems	2.74	1.02
• I could easily decide whether or not to join a carpool	3.93	1.13
• Air pollution caused by cars and trucks is a significant problem in this country today	4.53	.71
• Air pollution can be reduced if commuters stop driving by themselves	4.29	.79
• If more commuters stop driving alone, large-scale environmental degradation will be reduced	3.81	.97
• Even when there are alternative forms of transportation available, I still prefer to drive to work by myself	3.24	1.25
• Emissions from transportation sources significantly affect the global environment	4.02	.99
• Commuter travel is a major contributor to air pollution	4.21	.82
How likely would you be to take each of the following actions in order to clean up the environment or conserve resources outside of work?		
• Write a letter to a decision maker	2.84	1.18
• Join in a community environmental clean-up	3.41	1.02
• Avoid purchasing products made by a company that pollutes the environment	3.92	.92
• Walk or use public transportation instead of driving	3.21	1.12
• Conserve electricity	4.29	.79
• Buy things made from recycled products	4.35	.70

APPENDIX K

FOLLOW-UP SURVEY GRAND MEANS

N=168

Statement	Mean	S. D.
• Air pollution caused by cars and trucks is a significant problem in this country today	4.42	.73
• Air pollution can be reduced if commuters stop driving by themselves	4.22	.69
• If more commuters stop driving alone, large-scale environmental degradation will be reduced.	3.64	.98
• Even when there are alternative forms of transportation available, I still prefer to drive to work by myself.	3.29	1.13
• Emissions from transportation sources significantly affect the global environment.	3.98	.79
• Commuter travel is a major contributor to air pollution	3.97	.88
[After reading the factsheet/stories] [In the last month and a half]		
• I think it would be easier to deal with problems that might arise in a carpool	3.07	1.00
• I have become more aware of my own commuting patterns.	3.34	1.03
• I have made changes in my driving habits	2.58	1.21
Changes in driving habits listed (figures listed are percentage of participants who mentioned a particular change):		
• carpool to work (even if only occasionally)	6.0%	
• carpool during non-work	2.4%	
• consolidate trips/errands or changed schedule to use car less	10.7%	
• take bus or walk more	6.0%	
• Do you currently carpool to work at least once per week?	7.9% yes	

Statement

If you do not currently carpool, what do you perceive as the major barriers to beginning? (figures listed are the percentage of participants who mentioned a particular barrier)

- scheduling problems 54.8%
- lack of convenience/loss of independence 20.78%
- lack of privacy 2.4%
- takes too much time 9.5%
- children 11.3%
- don't know people to carpool with 17.3%