

# A KNOWLEDGE-BASED INTERVENTION FOR PROMOTING CARPOOLING

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**ABSTRACT:** The use of interesting text, particularly stories, has been shown to be an effective way of transferring information. This is due, in part, to the compatibility of narrative forms of information with human information processing biases. This study tested the impact of a story-based intervention on employees' knowledge and attitudes about, and stated willingness to adopt, carpooling. The story-based intervention was compared to a fact sheet-based intervention and to a control. A total of 645 employees at five sites participated in the study. Results indicate that individuals who received information, whether in story or factual format, felt more comfortable with their carpool knowledge and felt that they had adequate knowledge to guide them in discussions and problem solving regarding carpooling. Furthermore, regardless of the type of intervention, the more interesting text was associated with greater perceived knowledge, greater confidence and comfort with knowledge, and increased willingness to try carpooling. The interventions had no significant impact on attitudes. Implications and suggestions for future research are offered.

**Despite continuing technological improvements** in vehicle emission control systems, transportation sources are still a significant cause of air pollution in the United States. On a

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national level, vehicle emissions account for approximately 35% of nitrogen oxides and hydrocarbons, and about 70% of carbon monoxide emissions (Environmental Protection Agency [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 & 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, yet pollution remains an issue. The most significant factor in vehicle emissions has been the growth in vehicle travel (EPA, 1992; Schreffler & Kuzmyak, 1991). Growth in travel is doubling every 20 years, outpacing population growth in the United States. Although it is true that 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), the continued growth in vehicle travel will eventually outpace improved technology, and emissions will begin to climb. The upturn is projected to begin 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 air quality attainment 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. Employers have considerable flexibility to provide incentives 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. Whereas extensive

research has been done on specific transportation control measures to reduce work-related vehicle trips (e.g., carpool, public transit, bicycle racks) and numerous trip reduction campaigns have been undertaken, the transportation community has been frustrated by consistently disappointing results (Owens, 1981; U.S. Department of Transportation, 1990). What has emerged from these campaigns is the extreme difficulty in bringing about large-scale changes in the area of personal transportation behavior. Our society relies on and subsidizes solo driving. For most employees, driving to work alone is simply too convenient, comfortable, and cost-effective to consider alternative transportation modes. For others, there are no 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 element will involve providing information to employees.

## LITERATURE

Psychological studies on the differences between solo drivers and alternate-mode users (e.g., ridesharers, high-occupancy vehicle lane users, mass transit users) show that a lack of information and the desire to avoid uncertain or unfamiliar situations play significant roles in the decision not to adopt alternatives to solo commuting. Solo commuters often have misgivings about their ability to handle specific alternate mode problems (e.g., what to do about carpool members who are late, how to handle finances in ride share situations) (Margolin & Misch, 1979; Margolin, Misch, & Stahr, 1978). Other studies suggest that solo commuters may be more conservative when it comes to trying unfamiliar behaviors than alternate mode users (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 away from solo driving

(Margolin & Misch, 1979). It is clear from surveys of solo commuters that people are not eager to become involved with those they know nothing about (Margolin et al., 1978). For instance, the desirability of carpooling has been found to decrease with an increase in the number of nonacquaintances in the carpool (Levin & Gray, 1979).

These findings support the notion put forth in Kaplan's (1991) clarity-based decision-making model that suggests that the state of one's knowledge about an issue, and one's lack of knowledge about that issue, significantly impacts decision making. 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, situations where they have insufficient knowledge to guide their behavior and where the possibility of confusion is great. Thus it is possible to see why someone may choose not to adopt an alternative commuting option like carpooling when they feel they do not know enough about it. This may occur even though all the information they have clearly makes adopting the behavior the "rational" choice. In these cases, forcing someone to do something (e.g., by charging hefty parking fees or making compliance mandatory) may only reinforce the perception of having inadequate knowledge. This can result in considerable repercussions, including negative reactions (Brehm & Brehm, 1981; Reich & Robertson, 1979), a need to continually increase the external motivation, and a cessation of the behavior when the external inducement is stopped (Cook & 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 nonrecyclers (De Young, 1988-1989) found no difference in attitudes or motives between the two groups, but there was a significant difference in procedural knowledge. Confusion about the process of recycling was associated with nonrecycling behavior. Others have shown that belief in a goal is not enough to influence behavior; people must also have sufficient knowl-

edge of appropriate behavior (Cook & Berrenberg, 1981; Weigel & 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 & Sheehan, 1991) or show defensive avoidance of the issue (Janis & Mann, 1977).

### ACQUIRING INFORMATION

Given that 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 change 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, & Tamera, 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). 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 & 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. Whereas 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, which is exactly the opposite of the effect intended. This effect is especially powerful when experience with that situation is limited. It is also quite difficult to convince people to try a new behavior when they have no information about it.

Another choice for transferring knowledge is written information, or text. However, not just any text will do. 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. And information that does get processed by the brain is rarely stored as received. People apply their prior knowledge, experiences, and biases to every new bit of information. Because of this, information is lost, altered, or added during processing (Bartlett, 1932).

This selectivity is one reason that the mere provision of information (e.g., pamphlets, slogans, instructions, newspaper articles) has typically been ineffective at changing behavior (Dennis, Soderstrom, Koncinski, & Cavanaugh, 1990; Ester & Winnett, 1981-1982; Stern & Aronson, 1984). Information-based programs that fail to get the intended audience's attention, or get the audience's attention but do not present the information in a meaningful and understandable way, will not be effective at creating understanding or changing behavior.

#### **STORIES AS INFORMATION INTERVENTIONS**

The use of stories (also referred to as case studies or narratives) that provide interesting, vivid, concrete, and personalized information has been proposed as an effective way to transfer information and promote behavior change (Schank, 1991). The characteristics of a good story (e.g., coherence, vivid and concrete detail, a sense of mystery) readily encourage a depth of cognitive processing that makes it likely that the information will be used when making decisions (Kearney,

1994). An added benefit of stories is that they are inexpensive to create and distribute and can be used across age groups.

The effectiveness of stories at transferring information and impacting decisions has been extensively studied in the field of education (Anderson, Shirey, Wilson, & Fielding, 1987; Bernstein, 1955; Common, 1986; Kintsch, 1980; Schank, 1990) and, to a lesser extent, in decision making (Halford & Sheehan, 1991; Neustadt & May, 1986). Several studies have explored the effectiveness of stories in encouraging conservation behavior. Monroe and Kaplan (1988) found that the use of case studies 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 action. Yates and Aronson (1983) have found that stories of "super-conservers" were particularly effective methods of promoting energy conservation.

Although stories may prove to be particularly powerful tools for transferring information and changing behavior, they have not been widely used in education and behavioral change strategies. One possible reason is that stories and storytelling are associated with recreation, fantasy, or pretending; this may make the scientist and educator skeptical of their use, and, instead, favor the use of fact sheets or textbooks. Such reasoning has largely limited the use of stories in formal education to the primary level (Rosen, 1985).

## METHODS

### FOCUS OF THE STUDY

This study explores the effectiveness of stories in transferring information about and increasing the willingness to adopt carpooling. The story informational intervention will be compared to a fact sheet informational intervention (fact sheets and brochures are traditionally used in transferring information about carpooling) and to a control. Carpooling was chosen as

the target behavior because it is theoretically an effective means of reducing employee vehicle trips, it traditionally has a low level of adoption, and it is widely applicable compared to other employee commute options (EPA, 1991).

Knowledge was measured in terms of how much participants felt they knew about carpooling at the end of the intervention, how confident they were in their ability to address carpooling problems, and how readily they felt they could apply that knowledge (i.e., their comfort with their knowledge). Attitudes toward ride reduction and a variety of conservation behaviors were also measured. It was hypothesized that the group receiving the story-based information would (a) perceive that they had more knowledge about carpooling, (b) feel more confident in their ability to address carpooling problems, and (c) be more comfortable with their carpooling knowledge than the participants in the group receiving the fact sheet-based information and the control group. Based on previous studies showing that attitudes often do not become more positive with increased knowledge (De Young, 1988-1989; De Young et al., 1995), it was not expected that general attitudes would change substantially in any of the three groups.

## STUDY SITES

Employees at each of five sites were randomly assigned to a story-based information group, a fact sheet-based information group, or a control. Four of the five sites were EPA offices; two of these were suburban and two were urban. In addition, a non-EPA site in an urban area was included. Each study site had a study coordinator who was responsible for the dissemination and collection of all surveys and interventions. A preintervention survey instrument was administered to employees at each of the sites with the help of the study coordinator at each site. This survey was used to select the study participants and to gather baseline 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 the story group and the fact sheet group received daily information about carpooling (each information sheet was one to two pages long) for a period of 2 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 2-week intervention period, all participants were asked to complete a postintervention survey that assessed the participants' knowledge relating to carpooling.

### **SAMPLE**

In total, 2,014 preintervention survey instruments were distributed, and 1,111 were returned, giving a response rate of 55%. Of those employees who returned the preintervention 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.

Once study participants were chosen, they were randomly assigned to groups. Those employees who interacted during work on a daily basis (e.g., 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 non-EPA site ( $N=85$ ), no control was used. At all sites, roughly equal numbers of participants were assigned to each group.

### **INTERVENTIONS**

Both the story-based information treatment and the factual-based information treatment consisted of 10 information sheets, each between one and two pages long.<sup>1</sup> Each infor-

mation sheet was numbered and included a title at the top. All of the information sheets contained only text. The information sheets were distributed by the site coordinators at the beginning of each workday for 10 consecutive workdays. The information sheets were distributed over electronic mail at three sites. At two of the sites, the information sheets were distributed by hand.

All 10 stories were written by a single author. The author used four types of information in constructing the stories: (a) background information on carpooling and environmental degradation associated with automobiles; (b) a list of themes drawn from studies on attitudes toward carpooling, perceived barriers to carpooling, and perceived benefits of carpooling (Angell & Ercolano, 1991; Horowitz & Sheth, 1978; Margolin et al., 1978; Oppenheim, 1979); (c) a collection of articles from newspapers and commuter newsletters that included personal interest stories about carpoolers; and (d) a summary of anecdotes that were collected during phone interviews of several carpoolers. These stories were then rated by an independent panel. 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-type scale and the data were used to rewrite and improve the stories.

The 10 fact sheets 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 a fact sheet; in most cases components of several brochures were combined. The carpooling themes identified by the independent panel in their evaluation of the stories were used during creation of the fact sheets.

All the information sheets were then pretested to ensure that the same content was covered in both sets of stories and fact sheets. However, these common themes were not necessarily covered in the same order or with the same frequency. On an average, the fact sheets were somewhat shorter than the stories.

## **SURVEY INSTRUMENTS**

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 fact sheet group and the story group to assess perceptions of the intervention. All participants were assigned a unique code so that measurements taken at the different stages of the study could be matched at the end of the study while protecting the participants' anonymity. Most survey questions utilized a 5-point Likert-type scale (Oppenheim, 1966), which gives a measurement of the direction and intensity of response (Weisberg & Bowen, 1977).

### **Preintervention Survey**

The two-page preintervention survey 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 & Lusk, 1977) and has been found to be negatively related to acceptance of information, particularly for new or discrepant information (Rokeach, 1960).

Six questions about conservation behavior were also included. These questions were adapted 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).

Participants' prior experiences with various commute modes (e.g., carpooling, public transit) were measured; the length of time they had used other commute modes and their overall level of satisfaction with that mode were measured. In addition, the amount of information a participant had been exposed to regarding the various commute modes was measured, as were characteristics of the participant's commute trip (i.e., commute time, commute distance) and several demographic variables (i.e., age, gender, education).

### **Opinion Sheets**

The opinion sheets were distributed to the participants in the two treatment groups along with the first information sheet. During the 2-week intervention period, participants recorded their responses to two questions after reading each information sheet. These questions measured both the perceived interest-iness and informativeness of each information sheet. The opinion sheets lent some context to the intervention as well as provided data about the information.

### **Postintervention Survey**

Following the 2-week intervention period, a second survey was administered to all study participants. The one and a half page survey included the same attitude and conservation behavior measures found on the preintervention survey. In addition, numerous questions measuring perceived knowledge were included. These questions were designed to measure amount of knowledge, comfort with knowledge, and confidence. Six questions pertaining to the information sheets were asked only of the fact sheet and story groups. 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.

#### DATA ANALYSIS

The distinct sets of Likert-scale survey items (i.e., attitudes, rigidity, conservation behavior, knowledge questions) were subjected to Guttman-Lingoes nonmetric factor analysis (SSA-III, see Lingoes, 1972), and stable categories were identified. The stable categories were then tested for their degree of coherence using Cronbach's coefficient alpha, which is a measure of internal consistency (Cronbach, 1951).<sup>2</sup> Participants' responses on each item comprising a category were averaged, resulting in a single numeric score. This new variable was then used in all subsequent analyses.

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

For all statistical tests,  $\alpha = .05$ . 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 nonparametric test was used: The

Kruskal-Wallis test is the nonparametric one-way analysis of variance; the Mann-Whitney test is the nonparametric independent groups *t* test.

## RESULTS

### PREINTERVENTION SURVEY DATA

The scales identified through nonmetric factor analysis are presented in Table 1 along with each scale's mean score, standard deviation, and Cronbach's coefficient of internal consistency. The Rigidity scale is comprised of seven items and reflects an individual's overall resistance to change. A high score on the Rigidity scale indicates that the respondent is highly resistant to change. The Attitude About Transportation scale is comprised of five items; a high score on this scale indicates that the respondent believes environmental problems can be reduced if the use of automobiles is reduced. The Proconservation Behavior scale is comprised of three items; 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.

### OPINION SHEET DATA

Opinion sheets were completed by participants in the fact sheet and story groups. The sheets asked participants to rate the interestingness and informativeness of each of the 10 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

**TABLE 1**  
**Preintervention Survey Instrument Scales**

<i>Scale Names and Items Included</i>	M	SD	$\alpha$
<b>Rigidity</b>	2.99	.60	.70
I dislike interacting with groups of strangers			
I enjoy the challenge of unfamiliar experiences <sup>a</sup>			
I am uncomfortable in situations where I'm not sure how to act			
I enjoy adapting myself to unfamiliar situations <sup>a</sup>			
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			
<b>Attitude About Transportation</b>	4.09	.59	.77
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 signifi- cantly affect the global environment			
Commuter travel is a major contributor to air pollution			
<b>Proconservation Behavior</b>	4.20	.61	.85
Avoid purchasing products made by a company that pollutes the environment			
Conserve electricity			
Buy things made from recycled products			

NOTE: A high score indicates a strong endorsement of the scale.

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

create an overall informativeness score. Student's *t* tests were used to compare the fact sheet and story groups on each of these variables. Table 2 shows that both overall interestingness and overall informativeness were significantly higher for the fact sheet group.

#### POSTINTERVENTION SURVEY DATA

The Attitude About Transportation and Proconservation Behavior scales identified in the preintervention survey were

**TABLE 2**  
**Differences in Overall Interestingness**  
**and Informativeness by Treatment Group**

	<i>Fact Sheet</i>	<i>Story</i>	<i>t Test</i>
Interestingness			
M	3.36	3.02	<i>t</i> = 4.07
SD	.70	.81	<i>df</i> = 327
<i>n</i>	163	166	<i>p</i> < .001
Informativeness			
M	3.23	2.43	<i>t</i> = 9.72
SD	.70	.79	<i>df</i> = 327
<i>n</i>	163	166	<i>p</i> < .001

also included on the postintervention survey so that changes in response could be measured. The bank of knowledge questions in the postintervention survey clustered into one cohesive scale, labeled Comfort With Knowledge. This scale is a reflection of how comfortable a participant is with his or her knowledge about carpooling. Respondents with high scores on this scale feel 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 3 along with its mean score, standard deviation, and Cronbach's coefficient of internal consistency. Two items that did not load on the scale were retained as separate variables: "I am not interested in the topic of carpooling" (carpooling interest) and "During the past two weeks, I found myself thinking more about carpooling than usual" (increased thought). The scale of the first item was reversed so that a high score reflects a high interest in carpooling. In addition, there were six questions that were asked only of the fact sheet and story groups. These questions, as well as other items included in the analysis, are shown in Table 4, along with the names used to identify them in the text, their means, and their standard deviations.

#### 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 differ-



**TABLE 3**  
**Postintervention Survey Instrument Knowledge Scale**

<i>Scale Name and Items Included</i>	M	SD	$\alpha$
Comfort With Knowledge	3.05	.73	.85
If I started carpooling, I could resolve most problems that arise			
I doubt I could troubleshoot a problem occurring in another carpool <sup>a</sup>			
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 startup 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			

NOTE: High score indicates higher endorsement of the scale.

a. Item scale was reversed before knowledge scale was created.

ences between the fact sheet and story groups on postintervention measurements might simply be attributable to the number of information sheets (either fact sheets or stories) 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 postintervention variables (referred to as knowledge variables) was confounded by another variable, a series of two-way analyses of variance was conducted. The independent variables used were rigidity, prior information, overall interestingness of intervention, and overall informativeness of intervention.<sup>3</sup> These variables were dichotomized along the mean to form a high and low group. In each case, the variable was paired with a treatment group as the second independent variable. Each of these pairs of independent

**TABLE 4**  
**Additional Postintervention Survey Instrument Variables**

<i>Item (all responses on 5-point Likert scale)</i>	<i>Variable</i>	<i>M</i>	<i>SD</i>
Fact sheet and story groups only			
Compared to what you knew before you read the fact sheets/stories, how much do you now know about carpooling? (1 = <i>no more than before</i> to 5 = <i>a great deal more than before</i> )	Perceived knowledge	2.60	.97
Compared to how confident you were about your ability to solve carpooling problems before you read the fact sheets/stories, how would you now rate your level of confidence? (1 = <i>no more confident</i> to 5 = <i>a very great deal more confident</i> )	Confidence	2.02	1.00
Did you read the fact sheets/stories?	Number of fact sheets/stories read	4.82	.57
The fact sheets/stories did not persuade me to give carpooling another thought	Persuasion	2.72	1.42
During the past 2 weeks, I found myself mentioning the fact sheets/stories to other people	Mentioning intervention	1.58	.87
All groups			
I am interested in the topic of carpooling <sup>a</sup>	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

NOTE: Higher value indicates stronger endorsement of the statement.

a. This question was recoded; the original question stated, "I am not interested in the topic of carpooling."

**TABLE 5**  
**Significant Differences in Postintervention Knowledge Variables by Treatment Group**

Treatment Group	Comfort With Knowledge			Increased Thought			Perceived Knowledge		
	M	SD	n	M	SD	n	M	SD	n
Control	2.82 <sub>a,b</sub>	.71	87	1.46 <sub>a,b</sub>	.95	87	—	—	—
Fact sheet	3.19 <sub>a</sub>	.70	130	2.55 <sub>a</sub>	1.36	130	2.98 <sub>a</sub>	.91	128
Story	3.06 <sub>b</sub>	.73	129	2.28 <sub>b</sub>	1.18	129	2.21 <sub>a</sub>	.88	126

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

variables were used as predictors in turn for the following dependent knowledge variables: perceived knowledge, comfort with knowledge, confidence, persuasion, and increased thought. Results show that in each case, a treatment group had a main effect on perceived knowledge, comfort with knowledge, and increased thought. Tukey's HSD pairwise comparison (Table 5) shows that both the fact sheet and story groups scored significantly higher than the control group on comfort with knowledge and increased thought.] There was no significant difference between the fact sheet group and the story group on these two variables. The fact sheet group did score significantly higher than the story group on [perceived knowledge.

Main effects for the dichotomized independent variables are shown in Tables 6 through 9. 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 and fact sheets 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 report a lower rating for both perceived knowledge ( $F = 4.25, df = 1, 242, p < .04$ ) and confidence ( $F = 4.60, df = 1, 242, p < .03$ ). However, they tended to report a higher rating for their comfort with knowledge ( $F = 7.63, df = 1, 334, p < .01$ ).

**TABLE 6**  
**Significant Differences in Knowledge Variables by Rigidity**

<i>Knowledge Variable</i>	<i>Low</i>	<i>High</i>	<i>Significance</i>
<b>Confidence</b>			
<i>M</i>	2.15	1.88	$p < .05$
<i>SD</i>	1.11	.88	
<i>n</i>	116	129	
<b>Persuasion</b>			
<i>M</i>	2.51	2.90	$p < .04$
<i>SD</i>	1.46	1.35	
<i>n</i>	120	126	
<b>Comfort with knowledge</b>			
<i>M</i>	3.24	2.89	$p < .001$
<i>SD</i>	.75	.66	
<i>n</i>	159	174	
<b>Increased thought</b>			
<i>M</i>	2.39	2.02	$p < .01$
<i>SD</i>	1.31	1.22	
<i>n</i>	159	174	

**TABLE 7**  
**Significant Differences in Knowledge Variables**  
**by Amount of Prior Information Regarding Carpooling**

<i>Knowledge Variable</i>	<i>Low Prior Information</i>	<i>High Prior Information</i>	<i>Significance</i>
<b>Perceived knowledge</b>			
<i>M</i>	2.68	2.42	$p < .04$
<i>SD</i>	1.01	.85	
<i>n</i>	184	63	
<b>Confidence</b>			
<i>M</i>	2.10	1.78	$p < .03$
<i>SD</i>	1.02	.92	
<i>n</i>	183	63	
<b>Comfort with knowledge</b>			
<i>M</i>	2.98	3.25	$p < .01$
<i>SD</i>	.70	.79	
<i>n</i>	257	81	

**TABLE 8**  
**Significant Differences in Knowledge Variables by Overall Interestingness**

<i>Knowledge Variable</i>	<i>Low Interest</i>	<i>High Interest</i>	<i>Significance</i>
Perceived knowledge			
<i>M</i>	2.15	3.01	$p < .001$
<i>SD</i>	.79	.89	
<i>n</i>	98	136	
Confidence			
<i>M</i>	1.73	2.27	$p < .001$
<i>SD</i>	.87	1.02	
<i>n</i>	97	135	
Persuasion			
<i>M</i>	2.95	2.54	$p < .03$
<i>SD</i>	1.50	1.31	
<i>n</i>	97	136	
Comfort with knowledge			
<i>M</i>	2.94	3.26	$p < .002$
<i>SD</i>	.78	.66	
<i>n</i>	100	139	
Increased thought			
<i>M</i>	1.90	2.86	$p < .001$
<i>SD</i>	1.06	1.29	
<i>n</i>	100	139	

There was a significant interaction effect between the amount of prior information participants reported and the treatment groups when used to predict the level of confidence ( $F = 3.98$ ,  $df = 1, 242$ ,  $p < .05$ ). In the fact sheet 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 interventions (either fact sheets or stories) high on interestingness also tended to report higher scores on perceived knowledge ( $F = 41.24$ ,  $df = 1, 230$ ,  $p < .001$ ), confidence ( $F = 16.76$ ,  $df = 1, 228$ ,  $p < .001$ ), and comfort with knowledge ( $F = 10.00$ ,  $df = 1, 235$ ,  $p < .002$ ). These same participants also tended to claim that during the intervention period, they had thought more about carpooling than those with low interest in the intervention ( $F = 32.72$ ,  $df = 1, 235$ ,  $p < .001$ ).

**TABLE 9**  
**Significant Differences in Knowledge Variables by Overall informativeness**

<i>Knowledge Variable</i>	<i>Low</i>	<i>High</i>	<i>Significance</i>
Perceived knowledge			
<i>M</i>	2.23	3.02	$p < .001$
<i>SD</i>	.82	.90	
<i>n</i>	111	123	
Confidence			
<i>M</i>	1.70	2.35	$p < .001$
<i>SD</i>	.83	1.03	
<i>n</i>	110	122	
Increased thought			
<i>M</i>	1.42	1.76	$p < .001$
<i>SD</i>	.80	.93	
<i>n</i>	112	127	

.001). However, those participants who reported 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 also tended to score higher on perceived knowledge ( $F = 28.53$ ,  $df = 1, 230$ ,  $p < .001$ ) and confidence ( $F = 27.60$ ,  $df = 1, 228$ ,  $p < .001$ ), and increased thought ( $F = 20.17$ ,  $df = 1, 235$ ,  $p < .001$ ).

#### COMPARISON OF PRE- AND POSTINTERVENTION SURVEY DATA

Measurements of three variables, attitude about transportation, proconservation (nontransportation-related) behavior, and alternative transit behavior, were assessed in both the preintervention survey and the postintervention survey. To detect changes in these measurements, a series of one-way analyses of variance with repeated measures was performed with the treatment group as the independent variable. Results show that there were no significant changes for any of the three treatment groups on attitude about transportation, proconservation behavior, or alternative transit behavior.

## DISCUSSION

Overall, these data support the notion that information has an impact on knowledge. Both the fact sheet 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 convinced that they had adequate knowledge to guide them in discussions and problem solving regarding carpooling. Not surprisingly, the fact sheet group and the story group also thought more about carpooling during the 2-week intervention period than did the control group. In the fact sheet and the story groups, participants who scored higher on the rigidity scale were less likely to have been affected by the information (as shown by lower scores on postintervention confidence and comfort with knowledge). This indicates that there are individual differences among people's willingness to incorporate new information into their knowledge structure.

As hypothesized, while knowledge appeared to have changed as a result of the informational interventions, there was no corresponding change in attitudes about transportation. Participants who had read the fact sheets or the stories judged the impact of automobiles on the environment the same as did participants in the control group. This finding parallels studies on recycling that have found that prorecycling attitudes were not increased through exposure to information about recycling (De Young et al., 1995). There were significant differences between the fact sheet and story groups that were not predicted. The remaining discussion focuses on these differences.

It was hypothesized that the people in the story group (as compared to the fact sheet group) would (a) feel they had more knowledge about carpooling, (b) be more confident in their ability to address carpooling problems, and (c) be more comfortable (i.e., ready to use) their knowledge about carpooling. Contrary to these expectations, the fact sheet group felt they had significantly more knowledge about carpooling after

reading the information than did the story group. A closer look at the stories and fact sheets helps explain this result.

Overall, the fact sheets were found to be significantly more interesting and informative than the stories. In light of this, the differences in perceived knowledge make some sense; one might expect a correlation between perceived informativeness and perceived knowledge. The difference 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, fact sheets) (Hidi, 1990; Hidi & Baird, 1986). However, most of the subjects in those 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 participants in the current study were employees in large organizations, most working for the EPA, and regularly receive technical information in fact sheet form while at work. The sudden appearance of stories through regular mailings (normally a source of "serious information") may have caused suspicion and a negative reaction toward the stories. Comments from several of the site coordinators support this notion. Although some participants indicated that they identified with the characters in the stories, many questioned the stories' purpose and felt they were being patronized. Unfamiliarity with receiving information in story form may have created a bias against the stories and resulted in the lower interestingness scores.

Another factor might have been the nature of the stories themselves. The stories used in this study, although rated high in interestingness by the independent panel, were obviously fictitious. It is possible that this caused the participants to perceive them as pure entertainment—something that was perhaps inappropriate in the workplace. It is also possible that the stories were perceived as unreliable sources of information. Any or all of these factors could have affected the interestingness and informativeness scores.

In a general sense, these results confirm the findings of previous studies (Hidi, 1990; Sadoski, Goetz, Olivarez, Lee, &



Roberts, 1990), which reported that text perceived as interesting has a greater impact on knowledge structure than less interesting text. Participants in the fact sheet group and the story group who perceived the information as more interesting tended to report higher scores on their perceived knowledge, confidence, and comfort with knowledge. They also reported thinking about carpooling more during the intervention period. This supports the notion that interestingness has a significant 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 fact sheets on informativeness and interestingness, there was no corresponding difference in the reported confidence and comfort with knowledge scores. After the 2-week intervention period, the story group members felt as confident in their ability to solve carpooling problems as did the fact sheet group. The story group was also equally as comfortable with carpooling knowledge. Apparently, in spite of the finding that they were perceived as ineffective by the participants, the stories were effective at changing the knowledge structures of these same participants.

### CONCLUSION AND IMPLICATIONS

Overall, the results indicate that whereas the participants in the fact sheet 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. It is argued that the difference in perceived knowledge may be due to a bias against stories in the workplace; this is a bias that should not be ignored. Information of an unfamiliar style or from a source that is perceived to be inappropriate or unreliable (e.g., fiction) will be read with skepticism.

The unfamiliarity with information in story form and the potential biases against stories in the workplace imply that fictitious stories, used in isolation, may not be the most effective means of communicating information about carpooling and encouraging carpool use. It is also probable that participants

in the study already had a good notion of what was involved in carpooling (e.g., through exposure to carpooling coworkers, prior information, prior experience). It may be, then, that in this situation, information in any form (fact sheets or stories) was adequate to structure these existing concepts and result in greater confidence and comfort in knowledge. However, regardless of the format of the information, the more interesting the text was perceived to be, the greater impact it had on participants' knowledge structure.

Further research is needed to determine the conditions under which stories and factual text are effective ways of transferring information. It is suggested that stories would be more effective than fact sheets at transferring information in situations where people do not have a good prior understanding of the issue. Combinations of story and factual information should also be explored. One approach might be to embed several "ministories" or scenarios within a more factual text. Indeed, this is the preferred style of many environmental journalists. Using "success stories" about real people may also be effective, causing information, even in story form, to be perceived as reliable and worthwhile.

## NOTES

1. Copies of the intervention documents and surveys are available by writing the authors at the School of Natural Resources and Environment, University of Michigan, 430 East University Avenue, Ann Arbor, MI 48109-1115.

2. Cronbach's coefficient alpha can be considered a rough measure of construct validity (Cronbach, 1951; Nunnally, 1978) because it reflects the degree to which a collection of items in a scale "hang together."

3. These variables were chosen because the literature gives indication that they affect knowledge acquisition and assessment (Hidi & Baird, 1986; Monroe, 1991).

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