Environmental and Travel Preferences of Cyclists

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Current recommendations for designing bicycle facilities are most often based on experience rather than on findings from scientific inquiry. This study pools cyclists' opinions on environmental design issues, substantiating experts' knowledge about designs for cycling environments. The study examines the influence of personal characteristics, travel resources, and travel constraints on cyclists' environmental preferences, evaluations of cycling conditions, and decisions to bicycle for transportation. Questionnaires were distributed to 552 cyclists at four recreational bicycle tours in Michigan during the summer of 1992. Analysis of variance and correlations were used to investigate relationships of interest. Cyclists indicated their preferences for different types of cycling facilities and the importance that they placed on environmental factors such as traffic volume and surface quality when choosing cycling routes. Age was positively correlated with preference for on-road facilities (striped bike lanes, wide curb lanes), with importance placed on surface quality, scenery, and bike safety education. Age was negatively correlated with preference for bike paths separated from the roadway. Safety, scenery, terrain, and bike safety education were more important to women on average than to men. As expected, cycling experience was negatively correlated with preference for off-road facilities and concerns about safety, traffic, and terrain. Bike safety education was rated almost as high as the need for bike lanes, to improve community cycling conditions. Thirty-two percent of the cyclists surveyed commute by bicycle; 68 percent run errands by bicycle. Commute distance was strongly associated with the likelihood and frequency of commuting by bicycle.

The Intermodal Surface Transportation Efficiency Act of 1991 sets aside funding for the development of nonmotorized transportation, indicating a growing awareness of the need for a more diversified transportation system and, perhaps, a new approach to transportation planning in the face of budget constraints. But the American landscape is imprinted with infrastructure for automobiles, often to the exclusion of pedestrians and bicyclists. Research is needed to determine how to integrate pedestrians and cyclists safely into the automobile-dominated transportation system. This study focuses on bicycling, examining issues related to efforts to design environments for bicycling. Cyclists were surveyed to determine the importance they place on environmental factors theorized to affect cycling conditions.

THE CASE FOR BICYCLING

Enthusiasm for bicycling has grown in the United States during the past decade, evidenced by a steady increase in bicycle ridership (*1*). Bicycling has the potential to fill many travel needs (*2*), to reduce pollutants from automobile emissions, and to increase mobility for people without access to automobiles. Reducing motor vehicle congestion is a major public policy objective, and every decision to substitute other travel modes for single-occupancy vehicles contributes to reducing congestion. Bicycling must be developed within the constraints of existing land use patterns and infrastructure and the distance limitations of the bicycle. In many areas, discontinuous bike routes, rough pavement, and heavy traffic thwart potential cyclists. Knowledge of how to integrate cyclists safely into the stream of motorized traffic is not widespread and usually not familiar to local planners and engineers responsible for implementing change in travel environments.

To date, bicycle transportation planners and engineers have relied heavily upon the American Association of State Highway and Transportation Officials standards (*3*) when designing bikeways. The tendency in the United States to treat bicyclists as pedestrians, keeping them on sidewalks or bike paths, has angered some bicycling advocates, who claim that riding on sidewalks or separate pathways does not solve all safety problems. The League of American Wheelmen recommends educating bicyclists about proper riding techniques and retaining cyclists' full rights to use the roadway (*4*). Treatments to integrate all traffic modes, and to separate modes, have been used successfully in redesigned street environments in Europe in conjunction with traffic calming.

STUDY PURPOSE

This study was conducted to contribute to a sparse base of knowledge on cyclists' opinions of how to improve cycling conditions. Data were collected from cyclists at four recreational bicycle tours in Michigan during the summer of 1992. The sampling design made it possible to survey large numbers of cyclists at fixed locations such as rest stops along tour routes, reducing the time and cost required for data collection. The sample thus excludes cyclists who bicycle only for transportation and noncyclists, although studies of these groups are needed also.

Cyclists were questioned on a number of issues that planners consider as they develop bicycle plans. Are bike paths, bike lanes, or wide curb lanes preferred? Do these "route corridor preferences" differ for recreational and commuting cycling? Do surface quality, traffic volume, traffic speed, and scenery influence a cyclist's choice of recreational and commuting bike routes? Do preferences vary by age and sex or with different levels of cycling experience? Do cyclists on road bikes have different preferences than cyclists on mountain bikes or hybrids? What influences a person's decision to ride a bicycle for transportation?

TRAVEL BEHAVIOR THEORY FOR CYCLING

Most of the publications on cycling date to the 1970s, when the oil embargo led the United States to take a long look at alternatives

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TABLE 1 Factors Studied in Research on Cyclists' Travel Behavior

	Environmental Factors	Personal Characteristics
Stated Preferences *(12)*	Pavement Quality Bicycle Facility Traffic Distance/Travel Time	Age Gender Socioeconomic Status Auto Availability
Mode Choice *(13)*	Traffic Secure Parking Climate Terrain	Age Gender Type of School Availability of Bicycle Desire for Companionship on the Way to School
Travel Behavior *(14)*	Number of Establishments within 1 Km of Home	Age Gender Employment Status Travel Mode Activity

to the automobile. Because cyclists' demand for better facilities, traffic congestion, and the number of car-bike collisions have increased, the topic of cycling has reemerged. Recent publications cover issues related to planning and designing bicycle facilities, including street designs that channel or favor bicycle traffic (*5–11*).

A few studies have examined cyclists' travel behavior and environmental preferences, using personal and environmental characteristics as explanatory variables (*12–14*) (Table 1). In particular, Bovy and Bradley (*12*) established the importance of a limited set of personal and environmental factors in cyclists' commuting route preferences. This study tests the influence of personal characteristics, travel resources and constraints, and environmental characteristics on cyclists' environmental preferences, evaluations of cycling conditions, and cycling for transportation (Table 2). Numerous explanatory and outcome variables are included to test the model of cyclists' travel behavior shown in Figure 1 and to expand on earlier studies, though the list of factors tested is not all inclusive. Weather and climate are not measured, nor are many factors that might influence a person's decision to commute by bicycle, such as safe bicycle parking at destinations.

Many of the factors in Table 2 relate to traffic and transportation infrastructure, implying constraints imposed or opportunities presented by the built environment. Bicycle facilities (bike paths off the roadway and striped bike lanes on the road) are often major components of community bicycle plans. Natural features, such as scenery and hills, may affect a cyclist's enjoyment of a bicycle route and the level of physical effort required. Most of the environmental attributes relate to both recreational and commute cycling, though some are most relevant for commuting. Pathway design options for off-road cycling are more diverse than options for on-road cycling; they are incorporated as well.

If preferences are shown to be associated with easily measured personal characteristics, planners who are familiar with cyclists in their communities may be better able to provide facilities and programs to suit those cyclists. Age and sex may determine, in part, a cyclist's physical strength and in turn how tolerant a cyclist is of rough pavement or difficult terrain. More experienced cyclists, who are more confident of their cycling skills, may prefer riding in the street rather than on a separate bike path. Cyclists who ride mountain bikes or hybrids may be less affected by rough

TABLE 2 Factors Theorized To Influence Cyclists' Environmental Preferences

Personal Characteristics	Travel Resources and Constraints	Environmental Factors	Type of Route Corridor
Age Gender Cycling Experience	Type of Bicycle Auto Availability Commute Distance	Safety Traffic Volume Traffic Speed Pavement Quality Scenery Hilliness Traffic Stops Pavement Markings Road Signs Direct Route Quick Route Convenient for Errands	Bike Lane Wide Curb Lane Bike Path Trail Dirt Road Sidewalk

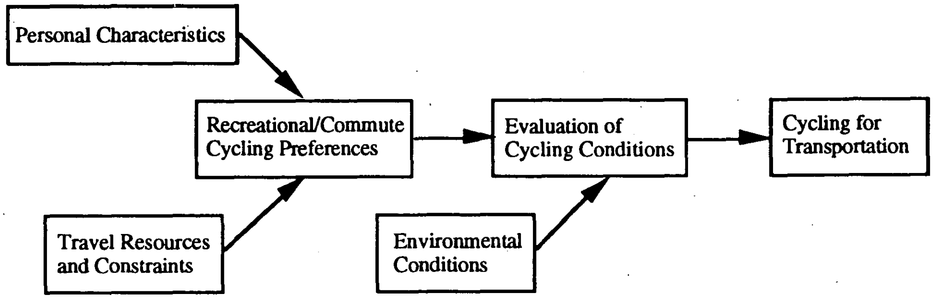

FIGURE 1 Theory of travel behavior for cycling.

pavement. Cyclists without access to automobiles and cyclists who live close to work may be more likely to commute by bicycle. The relationships shown in Figure 1 are summarized below.

1. Environmental Preference: Personal characteristics and the type of bicycle used are expected to influence environmental preferences for cycling.
2. Environmental Evaluation: Environmental preferences are expected to influence evaluations of cycling conditions.
3. Cycling for Transportation: Personal characteristics, travel resources and constraints, and environmental preferences are expected to influence cycling for transportation.

DATA COLLECTION METHODOLOGY

To test the relationships of interest, data were required from cyclists with diverse personal characteristics, cycling experience, and travel resources and constraints. Recreational bicycle tours provided an opportunity to survey a large group of cyclists at a single location, limiting the cost and time required for data collection. Bicyclists on recreational bicycle tours are fairly diverse in age and sex. Some bicycle tours are billed as challenging and fit intermediate or avid cyclists, and others attract cyclists of all abilities. Cyclists were surveyed at four bicycle tours in lower Michigan in the summer of 1992 (Figure 2). Three of the tours were on-road tours. One off-road tour was included to capture cyclists on mountain bikes.

Surveys were conducted where large crowds of cyclists were expected to assemble, such as at planned rest stops. Over 100 questionnaires were distributed and collected at each site in 2 to 3 hr. Cyclists required 5 to 10 min to complete the questionnaire. A total of 552 cyclists were surveyed at a cost of approximately $500 for travel to and from the data collection sites and printing expenses. Response rates at all of the tours were very good. About 95 percent of the questionnaires distributed were returned. The rate of missing data was 5.6 percent on average for survey items asked of all participants. The timing of surveys was critical to achieve a low refusal rate and low rate of missing data: cyclists are best approached when they are relaxing or resting, not at the end of a tour when their thoughts are on packing. The questionnaire length was appropriate for the circumstances, judging by the low rate of missing data.

Farm Lake Tour

The Farm Lake Tour (June 7, 1992)—a one-day tour held in the Plymouth, Michigan, area each year—attracts many less-than-avid cyclists. Approximately 900 cyclists participated in the 1992 tour. Three routes—32, 52, and 100 km (20, 32, and 64 mi)—are offered each year. Cyclists were approached at a rest stop common to all three routes and asked to participate in a brief survey. Then 114 questionnaires were distributed and collected. The refusal rate was less than 5 percent.

Pedal Across Lower Michigan (PALM) Tour

The Pedal Across Lower Michigan (PALM) tour (June 20–26, 1992) is an annual 6-day tour across the state of Michigan, attracting families and intermediate or avid touring cyclists. Two routes—a north and a south route—cross the state of Michigan from west to east. The routes converged on the next-to-last day of the tour. That evening, questionnaires were distributed to cyclists attending a general meeting, and the response was very positive: 150 questionnaires were distributed and 136 were returned.

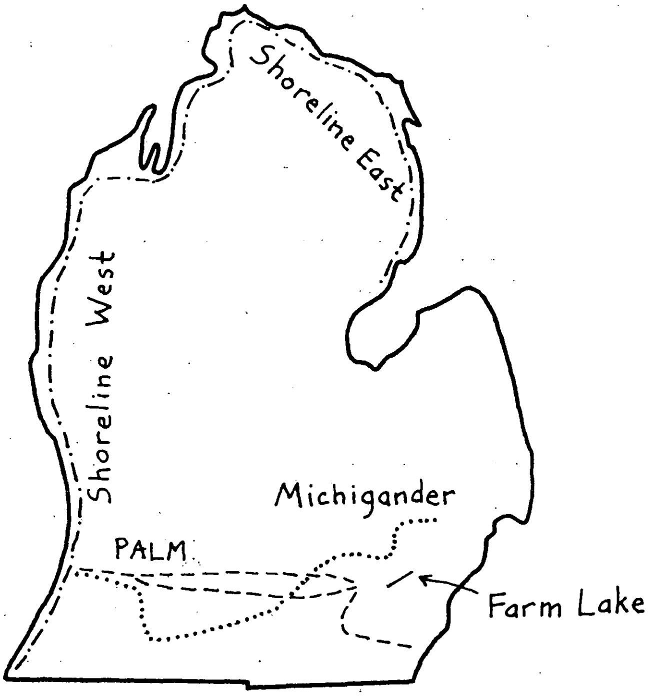

FIGURE 2 Recreational tour locations in lower Michigan.

Shoreline Tour

The Shoreline Tour (August 1–8, 1992) offers challenging east and west routes along the coast of northern lower Michigan. About 800 cyclists from Michigan, Illinois, Ohio, and other U.S. states, and from Canada participated in 1992. The tour is known for its scenery, hilly terrain, and the long distances traveled each day. Cyclists were surveyed as they ate lunch at the final destination of the two routes in Traverse City. The refusal rate was much higher for this tour because cyclists were preparing to collect their belongings, pack, and travel home. Approximately 200 questionnaires were distributed, and 177 collected.

Michigander Tour

The Michigander Tour (August 17–22, 1992)—a 6-day, cross-state, mostly off-road tour—was chosen for this study to determine whether the preferences of cyclists on mountain bikes differ from those of cyclists on road bikes and to examine issues relevant to designing off-road recreational trails for bicycling. Cyclists were surveyed on the fourth day of the tour in the afternoon, shortly after arriving in camp and setting up tents for the night. The refusal rate at this tour was very low (less than 5 percent). A total of 125 questionnaires were distributed and collected.

SAMPLE CHARACTERISTICS

Most of the cyclists in the sample had had considerable cycling experience. It would have been difficult to capture less-experienced cyclists than these in this sample using recreational bicycle tours as a field, although sampling methodologies (such as surveys at recreational bicycling paths along riverfronts) could be devised to capture novice recreational cyclists.

The sample provided a fair distribution on age, sex, and cycling experience (Table 3). As expected, cyclists at the Farm Lake and Michigander tours had less cycling experience than those on the PALM and Shoreline tours. Approximately 70 percent of the cyclists in the on-road tours were using road bikes, whereas in the Michigander Tour—the off-road tour—about 96 percent of the respondents were on mountain bikes or hybrids. Compared with estimates of cycling in the general population (*1*), the rate of cycling for transportation among this group of cyclists is very high: 32 percent commute by bike and 68 percent run errands by bike. Approximately 17 percent of the survey respondents had been involved in a car-bike collision.

ANALYTICAL METHODOLOGY AND FINDINGS

Summary statistics and findings from analyses conducted to investigate the theoretical model shown in Figure 1 are presented in this section. Descriptive statistics summarize cyclists' preferences and evaluations of cycling conditions in their communities. Statistics generated to test relationships in Figure 1 are also presented. An index of cycling experience used in the bivariate analyses was created by collapsing and summing three interval-scaled variables, "miles cycled past month," "miles cycled past year," and "years bicycled over 100 miles," to create a nine-category cycling experience index, referred to as "Cycling Experience" in some of the following tables. Missing values and "don't know" responses were coded zero.

Environmental Preferences for Recreational and Commuting Cycling

Cyclists rated their preferences for different types of cycling corridors using a five-point scale ranging from 1 (not at all preferred) to 5 (very preferred) (Table 4). Cyclists also indicated the importance they place on particular route characteristics when choosing a cycling route, using a five-point scale ranging from 1 (not at all important) to 5 (extremely important). Bike lanes, wide unmarked

TABLE 3 Characteristics of Survey Participants

Cyclist Characteristics			
Personal Characteristics	Age	40.8 Years (ave.)	Range: 11 to 77 Years
	Gender	44% Female, 56% Male	
	Km Cycled Past Month	560 (ave.)[a]	Range: 0 to 2580 Km[b]
	Km Cycled Past Year	1951 (ave.)[a]	Range: 0 to 15323 Km [b]
	Years Cycled > 62 Km	8.8 (ave.)	Range: 0 to 40 Years
	Commute by Bike	32%	
	Run Errands by Bike	68%	
Travel Resources and Constraints	Commute Distance - All Respondents	20.0 Km (ave.)	Range: 0.3 to 177 Km.
	Commute Distance - Bike Commuters	10.8 Km (ave.)	Range: 0.3 to 53 Km.
	Access to Automobile	96.6%	
	Type of Bicycle	Road Bike	59.8%
		Mt. Bike/Hybrid	39.3%

[a] 1 km = 0.6 mi.
[b] Some respondents on the Farm Lake Tour were on their first cycling trip of the season, and did not include the tour mileage when calculating distance cycled.

TABLE 4 Environmental Preferences for Recreational and Commuting Cycling

Recreation		Commuting	
Corridor Type	(ave. score)	Corridor Type	(ave. score)
Bike Lane	3.9	Bike Lane	4.1
Wide Curb Lane	3.6	Wide Curb Lane	3.8
Bike Path	3.4	Bike Path	3.1
Trail	2.4	Trail	2.0
Dirt Road	1.8	Sidewalk	1.9
Sidewalk	1.5	Dirt Road	1.7
Off-Road Corridors[a]	(ave. score)		
Prepared Trail	4.0		
Paved Trail	3.7		
Unsurfaced Trail	3.4		
Route Characteristic	(ave. score)	Route Characteristic	(ave. score)
Safety	4.4	Safety	4.2
Traffic Volume	4.1	Quick Route	3.9
Smooth Pavement	4.1	Direct Route	3.8
Scenery	3.9	Smooth Pavement	3.8
Slow Traffic	3.6	Low Traffic Volume	3.6
Few Stops	3.0	Slow Traffic	3.3
Few Hills	2.7	Convenient for Errands	3.2
		Avoid Hills	2.2
		Scenery	2.0

Items were rated on a scale from 1 (not at all preferred/not at all important) to 5 (very preferred/extremely important).
[a] Opinions about off-road corridor types were not asked in the context of commute cycling.

curb lanes, and bike paths are most preferred for recreational and commuting cycling. For off-road recreational cycling, prepared trails (surfaced and widened) are preferred over paved (asphalt) and unprepared (unimproved) trails. Scenery is important for recreational cycling but not for commuting by bike. Traffic, surface quality, and scenery are the most important factors for choosing recreational cycling routes, whereas safe, quick, and direct routes with smooth pavement are important for commuting.

Tables 5 through 7 summarize the results of analyses conducted to determine the strength of association among age, sex, cycling experience, type of bicycle, and environmental preferences for cycling. Highlights of the findings are discussed in the context of recreational and commuting cycling.

Recreational Preferences

Cycling experience and age are negatively associated with preference for bike paths, sidewalks, dirt roads, and trails for recreational cycling. Cycling experience is positively correlated with preference for wide curb lanes. Women rate bike lanes and bike paths higher, and their ratings for dirt roads are lower, on average, compared with men's ratings. Cyclists on road bikes and cyclists who use mountain bikes or hybrids both rate bike lanes high. Cyclists on road bikes also rate wide curb lanes high, and cyclists on mountain bikes or hybrids give comparatively higher scores to bike paths, trails, and dirt roads.

Age is positively correlated with importance placed on pavement quality and scenery and negatively correlated with few stops along a route in the choice of a recreational cycling route. Age is not associated with concerns about traffic and safety. Women and men both rate traffic and safety high, though women give higher ratings to those items on average than men. Women rate scenery and few hills higher as well. Not surprisingly, cyclists on road bikes place more emphasis on surface quality than cyclists on mountain bikes. Safety and traffic speed are more important to cyclists on mountain bikes than to cyclists on road bikes. For off-road cycling, older cyclists prefer paved (asphalt) trails (Table 6). Prepared (surfaced and widened) trails receive higher scores from women on average than from men.

Commuting Preferences

Age and cycling experience are negatively correlated with preference for bike paths, sidewalks, and dirt trails for commuting (Table 7). Women and men both rate bike lanes and wide curb lanes high. Wide curb lanes received higher ratings from cyclists on road bikes than from cyclists on mountain bikes, though both groups rate bike lanes high.

Age is positively correlated with consideration of convenience for errands in the choice of a commuting bike route. Cycling experience is negatively correlated with concerns about safety and low traffic volume. Safety, few hills, and convenience for errands are, on average, more important to women than to men. Surface quality for commuting, as it is for recreational cycling, is more important for cyclists on road bikes than cyclists on mountain bikes and hybrids.

TABLE 5 On-Road Recreational Cycling Preferences, Personal Characteristics, and Type of Bicycle

	Age	Cycling Experience	Gender			Type of Bicycle		
Corridor Type[a]	(Pearson r)	(Pearson r)	Male (ave.)	Female (ave.)	(eta)	Road Bike (ave.)	Mt. Bike (ave.)	(eta)
Bike Lane	.06	.00	3.8	4.0	.12[b]	3.9	3.8	.05
Wide Curb Lane	.09	.14[b]	3.5	3.6	.03	3.8	3.3	.21[b]
Bike Path	-.11[b]	-.20[b]	3.2	3.5	.11[b]	3.0	3.9	.28[b]
Trail	-.11[b]	-.15[b]	2.5	2.3	.05	1.8	3.3	.50[b]
Dirt Road	-.13[b]	-.02	1.9	1.5	.15[b]	1.3	2.3	.48[b]
Sidewalk	-.10[b]	-.25[b]	1.4	1.6	.06	1.3	1.7	.23[b]
Route Characteristic[a]								
Safety	.04	-.09[b]	4.3	4.5	.13[b]	4.3	4.5	.12[b]
Traffic Volume	-.01	-.02	4.0	4.1	.06	4.0	4.2	.08
Surface Quality	.10b	.08	4.0	4.1	.09	4.2	3.9	.17[b]
Scenery	.11b	.02	3.8	4.0	.13[b]	3.9	3.9	.00
Traffic Speed	.01	-.14[b]	3.5	3.8	.11[b]	3.5	3.8	.18[b]
Few Stops	-.14[b]	-.04	2.9	3.0	.04	3.1	2.8	.10[b]
Few Hills	.04	-.15[b]	2.5	3.1	.23[b]	2.7	2.8	.02

[a] Items were rated on a scale from 1 (not at all preferred/not at all important) to 5 (very preferred/extremely important).
[b] Significant at alpha equal to .05, two-tailed.

Evaluation of Cycling Conditions

Community Conditions

Survey respondents indicated the importance of different means to improve cycling conditions in their communities using a five-point scale ranging from 1 (not at all important) to 5 (extremely important). Education for bicyclists of all ages and improved awareness on the part of motorists were rated about as high as the need for bike lanes (Table 8). Road signs, pavement markings, and slower traffic speed were less favored improvements.

Age and cycling experience are positively correlated with improving motorist awareness and negatively correlated with perceived need for bike paths (Table 9). Cycling experience is also negatively correlated with preference for slower traffic. Motorist awareness, bike safety education, bike lanes, and road signs were rated higher by women than by men. Cyclists on mountain bikes gave lower ratings to surface quality and higher ratings to bike paths and slower traffic than did cyclists on road bikes.

Tour Route Terrain

One part of the questionnaire collected cyclists' evaluations of routes they had ridden earlier in the day. For one route characteristic—hilliness—objective data were compiled from topographic maps to create slope profiles of the routes for comparison with cyclists' evaluations of route hilliness. Several metrics for hilliness were devised to quantify the difficulty of climbs, steepness of descents, and variation in terrain. Overall, the routes were found to be relatively flat, and cyclists' evaluations of them showed little variance. A more complete discussion of the analysis of route terrain has been provided elsewhere (*15*).

Cycling for Transportation

As expected, commute distance is negatively correlated with the likelihood and frequency of commuting by bicycle (Table 10). (Reasons respondents gave for not commuting by bicycle included

TABLE 6 Off-Road Cycling Preferences and Personal Characteristics

	Age	Cycling Experience	Gender		
Route Corridor[a]	(Pearson r)	(Pearson r)	Male (ave.)	Female (ave.)	(eta)
Paved Trail	.16	.06	3.6	4.0	.16
Prepared Trail	-.03	-.09	3.8	4.4	.29[b]
Unsurfaced Trail	-.40[b]	.08	3.5	3.0	.18

[a] Items were rated on a scale from 1 (not at all preferred) to 5 (very preferred).
[b] Significant at alpha equal to .05, two-tailed.

TABLE 7 Commute Cycling Preferences, Personal Characteristics, and Type of Bicycle

	Age	Cycling Experience	Gender			Type of Bicycle		
Corridor Type[a]	(Pearson r)	(Pearson r)	Male (ave.)	Female (ave.)	(eta)	Road Bike (ave.)	Mt. Bike (ave.)	(eta)
Bike Lane	.08	.06	3.9	4.2	.13[b]	4.2	3.9	.11
Wide Curb Lane	.06	.02	3.6	4.1	.25[b]	4.0	3.5	.21[b]
Bike Path	-.20[b]	-.17[b]	3.1	3.1	.01	2.8	3.3	.17[b]
Trail	-.15	-.16	2.0	1.9	.06	1.7	1.9	.08
Sidewalk	-.31[b]	-.30[b]	1.9	1.7	.06	1.4	2.1	.34[b]
Dirt Road	-.27[b]	-.23[b]	1.8	1.5	.12	1.7	2.2	.21[b]
Route Characteristic[a]								
Safety	.05	-.15	4.1	4.5	.19[b]	4.2	4.3	.00
Quick Route	-.10	-.05	3.9	3.7	.05	3.7	4.0	.12
Direct Route	.01	.04	3.8	3.8	00	3.7	3.9	.10
Surface Quality	.08	.07	3.7	3.9	.09	3.9	3.6	.13
Traffic Volume	-.09	-.10	3.7	3.7	.00	3.8	3.6	.09
Traffic Speed	.06	-.03	3.4	3.3	.04	3.5	3.2	.10
Convenient for Errands	.16[b]	-.02	3.0	3.3	.12	3.0	3.3	.10
Few Hills	-.01	.01	2.1	2.4	.13	2.2	2.2	.01
Scenery	.04	.01	1.9	2.1	.07	2.2	1.8	.20[b]

[a] Items were rated on a scale from 1 (not at all preferred/not at all important) to 5 (very preferred/very important).
[b] Significant at alpha equal to .05, two-tailed.

unsafe roads, dress code at work, traveling before or after daylight, and commute distance.) More experienced cyclists are more likely to commute and run errands by bicycle. Age is not associated with cycling for transportation. A significantly higher percentage of male respondents commute and run errands by bicycle (40 and 73 percent, respectively) as compared with female respondents (30 and 58 percent, respectively). Respondents without access to automobiles are more likely to bicycle for transportation, though the number of survey respondents in this analysis who do not have access to an automobile on a regular basis is so small (n = 17) that this finding may be unreliable.

TABLE 8 Evaluations of Needed Community Improvements

	(Ave. Score)
Bike Lanes	4.5
Motorist Awareness Should Increase	4.4
Child/Youth Bike Safety Education	4.2
Surface Quality	4.2
Adult Bike Safety Education	4.1
Bike Paths	3.8
Road Markings	3.4
Road Signs	3.3
Slower Traffic	3.2

Items were rated on a scale from 1 (not at all important) to 5 (extremely important).

POLICY IMPLICATIONS FOR PLANNING

Findings presented in the preceding sections show that personal characteristics and travel resources and constraints are associated with environmental preferences, evaluations of cycling conditions, and cycling for transportation. Recreational and commuting cycling preferences were found to be similar in this study, suggesting that knowledge of recreational cycling preferences may be useful for planning commuting cycling environments.

Bike Lanes and Bike Paths

The cyclists surveyed rated bike lanes highest for recreational and commuting cycling. This preference holds true among cyclists with different personal characteristics and levels of cycling experience. On the basis of these findings, bike lanes may be desirable in communities, and they are much less expensive to install and maintain than bike paths. Yet less experienced cyclists and cyclists on mountain bikes also rate bike paths high. A mix of facilities is thus likely to best satisfy the needs of different types of cyclists.

Bike Safety Education

Respondents indicated that increasing motorists' awareness of cyclists and providing bike safety education for bicyclists of all ages are important means to improve cycling conditions in communities. However, efforts to inform the public of safe driving practices

TABLE 9 Community Cycling Conditions, Personal Characteristics, and Type of Bicycle

Community Improvement[a]	Age	Cycling Experience	Gender			Type of Bicycle		
	(Pearson r)	(Pearson r)	Male (ave.)	Female (ave.)	(eta)	Road Bike (ave.)	Mt. Bike (ave.)	(eta)
Bike Lanes	-.02	.03	4.4	4.7	.18[b]	4.5	4.6	.05
Motorist Awareness Should Increase	.11[b]	.10[b]	4.4	4.6	.14[b]	4.4	4.4	.01
Youth Bike Safety Education	.22[b]	.06	4.1	4.5	.18[b]	4.3	4.2	.05
Surface Quality	.04	.05	4.1	4.2	.04	4.3	4.0	.16[b]
Adult Bike Safety Education	.17[b]	.06	4.0	4.4	.19[b]	4.2	4.1	.04
Bike Paths	-.10[b]	-.22[b]	3.6	3.8	.08	3.6	4.2	.25[b]
Road Markings	.05	-.08	3.5	3.7	.05	3.4	3.6	.08
Road Signs	.01	-.08	3.3	3.7	.15[b]	3.2	3.4	.07
Slower Traffic	.00	-.11[b]	3.1	3.3	.07	3.1	3.3	.09[b]

[a] Items were rated on a scale from 1 (not at all preferred/not at all important) to 5 (very preferred/very important).
[b] Significant at alpha equal to .05, two-tailed.

TABLE 10 Cycling for Transportation, Personal Characteristics, and Travel Resources and Constraints

	Commute by Bike	Errands by Bike
Age	-.04	.08
Cycling Experience	.16[a]	.19[a]
Gender	.10[a]	.09[a]
Commute Distance	-.25[a]	NA
Auto Availability	.16[a]	.08

Coefficients are Pearson's correlations.
[a] Signifiant at alpha equal to .05, two-tailed.

for interactions with cyclists and to educate cyclists about safe cycling are often lacking in bicycle programs. Educational efforts in communities can be instituted at low cost and have much potential to benefit cyclists.

Cycling for Errands

Efforts to increase cycling for transportation often focus on the commute trip. In this study, the percentage of respondents who run errands by bicycle is much larger than the percentage who commute by bicycle, indicating that "errands by bike" should be a major element of pro-bike programs. Trips made for shopping and banking, for instance, are not as constrained with respect to destination, distance, time of departure, and dress as commuting trips. Providing bicycle facilities to link residential areas with nearby shopping may be a more effective way to increase the proportion of trips made by bicycle than efforts to create a more extensive but fragmented network of bicycle facilities.

CONCLUSION

This study substantiates knowledge held by experts familiar with planning environments for bicycling. Further work is needed to determine the preferences of different types of cyclists, such as those who bicycle only for transportation and those who bicycle for recreation but do not participate in bicycle tours, and to determine the characteristics of a truly representative sample of cyclists in the United States. More in-depth studies of bicycle transportation are needed to provide precise evaluations of cycling conditions, which would further aid transportation planners and other professionals interested in improving environmental conditions for cycling.

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