Impacts of Car Sharing on Walking Behavior

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Abstract

Car sharing, now being offered in about 30 cities in North America, and perhaps 50 organizations throughout Europe, provides convenient short-term automobile use without car ownership. A number of studies indicate that car sharing members use public transit, walk and bicycle at higher rates that the general population. This paper and presentation provide a summary of the impact of car sharing on walking behavior from recent studies and from primary research conducted for this paper.

In a study of CarSharing Portland in 2000 car sharing members reported a 14% increase in public transit trips, a 10% increase in bicycling trips, and a 26% increase in walking trips since becoming members. The Swiss Federal Office of Energy, in their Energie 2000/Mobility study found that people who switch from owning a car to car sharing used other forms of mobility, including walking, to a far greater extent. The 2000 Portland study also found that members used walking for almost 37% of all trips, compared to using a private or shared automobile for about 32% of all trips. Further, for six of the ten types of trips, walking has the largest mode share.

In a recent survey of Portland Flexcar members conducted for this paper, 29% reported that they walk more often than they did before joining Flexcar. Members also reported that they were somewhat more willing to walk in the rain and walk longer distances after joining Flexcar.

As an alternative to car ownership, car sharing imposes some scheduling and accessibility constraints that would encourage walking, but perhaps more importantly, members pay full incremental cost when they use car sharing, with itemized monthly bills describing each trip. Walking and transportation alternatives such as transit and bicycling are thus encouraged by car sharing membership.

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Introduction

Car sharing is membership-based, shared-use access to an automobile fleet for as little as an hour at a time. Vehicles are located in reserved parking spaces in neighborhoods close to where members live and work. After reserving the car share vehicle by phone, members typically walk, bike or take public transit to the vehicle, and gain access by using a special code or proximity card. The hourly fee covers use of the vehicle as well as gas, insurance maintenance, cleaning, and insurance. Car sharing is now being offered in about 30 cities in North America, and through about 50 organizations throughout Europe.

While private autos are typically used only 2% of the time they are available, car share vehicles are used 30-40% of the time. This makes for a more effective use of resources.

Instead of high fixed costs of ownership (for payment/depreciation, insurance and sometimes registration) which approach 80% of the total costs of owning a car, car share members pay the incremental cost of vehicle ownership and operation, and only when they are actually using a vehicle. For people who drive less than about 12,000 km per year (7,500 mi), car sharing is less expensive than owning a new car. This provides an economic incentive not to drive that would be overlooked by private car owners. Car share members can estimate the cost of an auto trip in advance, and can weigh it against the convenience, comfort, or carrying capacity desired. Members may then consider alternative transportation modes such as public transit, bicycling, and walking. A number of studies indicate that car sharing members use public transit, walk and bicycle at higher rates that the general population. This paper presents a summary of the impact of car sharing on walking behavior from recent studies from primary research conducted for this paper.

While it is often difficult to determine the specific cause of behavioral change, there appears to be a strong relationship between car share membership and walking. The authors also recognize that other variables may be involved which affect changes in walking behaviors among car sharing members. For example, it is well known that that car share members, especially "early-adopters" have “green” attributes that make otherwise “alternative” modes like walking and bicycling more acceptable. Also, since car sharing is typically offered in locations that provide a pedestrian-friendly urban environment (dense development with sidewalks, close-by shopping and business centers) this also contributes to walking behavior.

Our fundamental goal in this paper is to document that the attitude and behavior of car sharing members around walking and other transportation modes change after becoming members.

We first gathered information from other studies that addressed walking behaviors in relation to car share membership (reported below).

We then conducted a survey of Flexcar members in Portland, Oregon to assess their changes in walking behavior. Preliminary results are reported below and final results will be reported in the presentation at Walk21 and also reported in an updated version of this paper to be found at www.MetaResource.com.

Existing Studies on Walking and Car Sharing

We identified four studies that documented the relationships between car sharing organization membership and walking. This work took place in Portland, Oregon, San Francisco, Washington DC, and Switzerland.

Portland, Oregon

The graduate student team of Cooper, Howe, and Mye prepared an evaluation of car sharing in Portland in 2000.

Table 1 summarizes the self-reported change in travel behavior by mode after membership. The data only indicate trends and do not indicate a statistically significant change in behavior.

Table 1: Use of Transit, Bike and Walk by CarShare Portland Members

Travel Mode	More Often	About the Same	Less Often
Transit	14%	79%	8%
Bicycle	10%	80%	7%
Walk	26%	72%	2%

The evaluation also found that over 50 percent of car sharing members in Portland used a transit pass and augment their transit travel with other transportation modes and car sharing so as to access areas not served by transit. The flexibility in timing and destinations offered by car sharing might be viewed as a service that supports the use of public transit by car sharing members. The study concluded that members of car sharing in Portland "exhibit multi-modal transportation behavior."

An informal survey, conducted independently by Flexcar via the Internet of its members in Seattle, Portland, Washington DC, Bay Area, Los Angeles and San Diego asked if membership in Flexcar had changed the needs of members for vehicles. Altogether 58% of members had either sold a vehicle or avoided purchase. This may be a contributing factor in increases in walking behaviors. The results are summarized in Table 2.

Table 2: Vehicle Need Changes since Joining Flexcar

Since joining Flexcar I have:	Response %
Sold my car / truck	10%
Sold one of my cars / trucks	3%
Avoided buying a new car / truck	39%
Avoided buying a second car / truck	5%
Considering selling a car	6%
None of the above	36%

San Francisco

Robert Cervero of UC Berkeley is leading a three-year evaluation of the City CarShare program for San Francisco's Department of Transportation and Parking. His research is investigating car share's effects on travel, car ownership, the environment, and parking. Surveys were conducted of members after 3 and 9 months of membership. At the time of the study, City CarShare had 1,000 members and 70 vehicles.

Two of the study findings indicate higher acceptance of walking among car share members than non-members. The first, described in Table 3, compares a mode choice survey of City CarShare members with a survey of San Francisco commuters. Car share members were found to choose walking about three times more often than average commuters, and choose bicycling about a six times more often.

Table 3: Comparison of Mode Choice

Commute Mode	City CarShare Members	SF Commuters
Drive Alone	2.1%	47.9%
Share Ride	3.1%	4.6%
Motorcycle	2.1%	1.2%
Bus	27.8%	23.8%
Rail	27.8%	12.7%
Walk	22.7%	6.2%
Bicycle	13.4%	2.0%
Other	1.0%	1.5%

Table 4 compares members to non-members in terms of how they get to and from rail. Although not directly related to the use of a car sharing vehicle, this provides additional insight into car share members propensity towards walking. In this case, car share members walk to and from rail an average of about fifteen percentage points more than non-members, and bicycle and use transit substantially less.

Table 4: Distribution of Modes for Rail Access

Mode	Members		Non-Members	
	Access	Egress	Access	Egress
Walk	78%	90%	67%	71%
Bicycle	3%	3%	13%	9%
Bus	14%	2%	14%	20%
Other	5%	5%	6%	0%

Washington DC

During the first half of 2002, Flexcar conducted an informal survey of over 300 members to assess their travel behaviors after joining the car sharing organization. While 2000 Census data indicate that 10.5% of Washington DC residents walk to work, it appears that Flexcar members walk much more often, with 60% walking to work two or more days per week. Table 5 summarizes the results of this survey.

Table 5: Flexcar Member DC Commute Walking Behavior

	Percent Respondents
Walk 5 – 7 days per week	49%
Walk 2 – 4 days per week	11%
Walk 1 day per week	6%
Walk sometimes	5%
Walk never	11%
No answer / not applicable	18%

In September of 2002 Flexcar, sponsored a "Commuter Challenge" in Washington DC to get people to take transit and use Flexcar instead of driving their own car. In return for free usage of Flexcar during the period, participants were asked to keep a diary of their thoughts on how getting around changed with a shared auto. Although only anecdotal evidence, there were several quotes that described people's new experience with walking:

> *"We decided to rent a movie tonight. We Metroed (that's a verb now!) up to Clarendon and back tracked down Wilson 'The Hill' Blvd. to the Video Store. Then we walked down Wilson home. Beautiful evening. We would have missed a great walk if we had used the car."*

> *"We went out to dinner with my father-in-law. He drove and we Metroed. I think it took him about 15 minutes just to find parking! It took us 15-minutes to walk and Metro to the grill. We love Metro!"*

Switzerland

The largest and oldest car sharing company is in Switzerland, with more than 52,000 members sharing 1,750 vehicles at locations all over Switzerland served by 113 full time staff. Peter

Muheim researched the behaviors of this large car sharing membership in his report to the Swiss energy bureau. It was found that three-quarters of the users of car sharing also favor the most environment-friendly forms of transport – walking, cycling, and public transport. It was concluded that car sharing makes a significant contribution to a sustainable transport system, and to modern-day environment-friendly and convenient mobility.

The Swiss study found that people who give up owning a car use alternative transportation (public transit, bicycling, and walking) to a greater extent. Among those car sharing members in Switzerland that gave up their cars upon joining a car share organization, per person per year walking and bicycling distances increased 70%. In a personal communication the author reported that most of this increase was due to bicycling. Figure 1 below describes these results from the Muheim study.

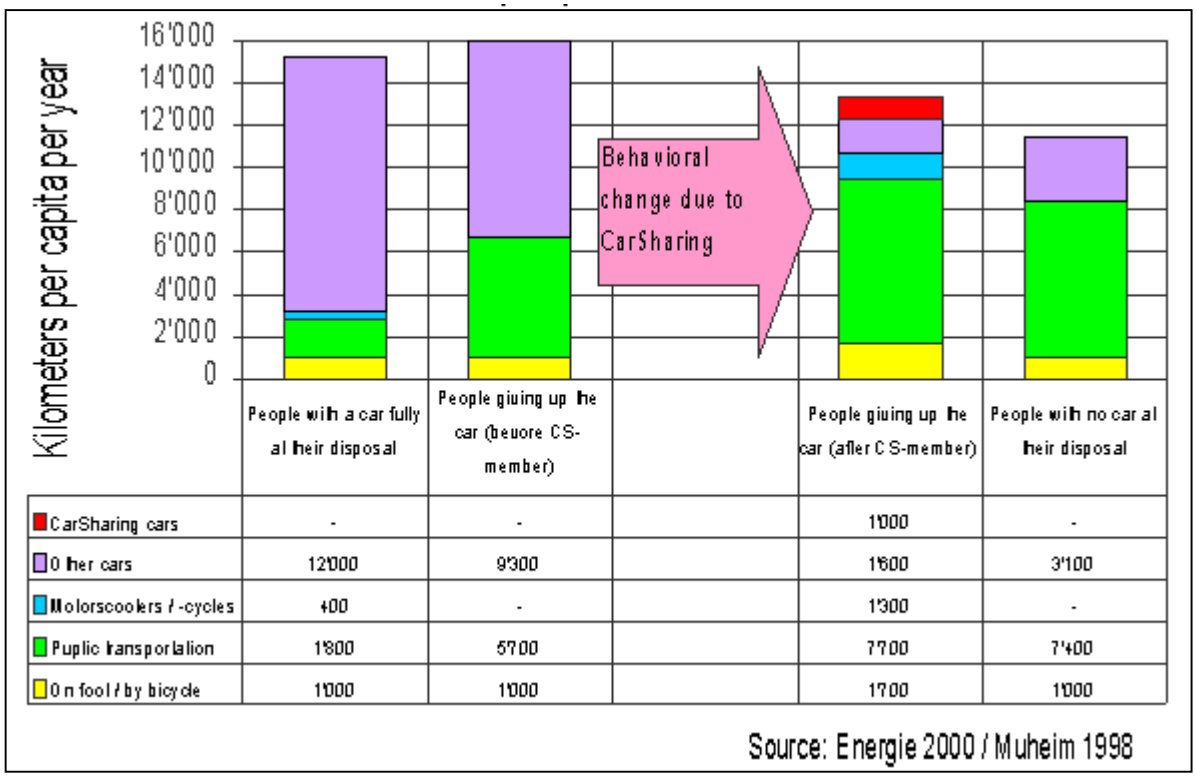

Figure 1: Energy 2000 Study Results

2003 Survey of Flexcar Portland Members

In February of 2003 the authors of this paper fielded two short surveys to gather information on self-reported changes in mode choice among members of Flexcar in Portland, Oregon. As this work was still underway when this paper was being written, preliminary results have been provided and final results will be reported in an updated paper at www.MetaResource.com.

Survey Conduct

Two identical surveys were fielded simultaneously. A paper version was distributed by mail, with surveys returned by fax or mail; the other was distributed via electronic mail, with survey results gathered from the Internet. Approximately two hundred randomly selected members were surveyed using each method, with response rate of about 9 percent for the mail survey and 18 percent for the Internet method. Responses by both methods appeared consistent for the purposes of this paper; the results from both fielding methods have been combined. The survey disposition is described in Table 6.

Table 6: 2003 Flexcar Portland Survey Disposition

	Mail Survey	**Internet Survey**
Initial Solicitation	195	213
Responses	18	38
Response Rate	9%	18%
Overall Responses	56	
Overall Response Rate	14%	

Summary of Survey Results

A large majority of respondents indicated that there have been changes to the ways they get around after joining Flexcar. Although a few drive more (half of them non-car owners), most report that they walk, use transit, and bicycle more often then before they had access to Flexcar. In addition, 29% percent clearly stated that they walk more often since they had access to Flexcar. These results are described in Table 7.

Table 7: How has Flexcar Changed the Ways You Get Around?

	Response %
I drive more often than before	19%
I walk more often than before	29%
I use transit (bus/MAX/streetcar) more often than before	34%
I bought a monthly on annual transit pass	9%
I ride a bicycle more often than before	30%
I've made other changes in the ways I get around	20%

A few other questions added detailed understanding of the members' interest in walking. They were asked how access to Flexcar changed how much they walked. None of the respondents said that they walked less with Flexcar. They were also asked if their willingness to walk in the rain, to walk longer distances, and to carry items when walking had changed since joining Flexcar. Table 8 and 9 describe these results.

Table 8: Access to Flexcar Changed Walking

	Overall %
Walk much less often	0%
Walk less often	0%
Walk about the same	71%
Walk more often	23%
Walk much more often	6%

Table 9: Willingness to Walk Factors since Joining Flexcar

	Less Willing	Same	More Willing
Walk in the rain?	6%	85%	9%
Walk longer distances?	6%	76%	18%
Carry items while walking?	11%	79%	9%

Results by Walking Accessibility

For this paper the authors also correlated the home address of members responding to the survey with corresponding Traffic Analysis Zones (TAZs). In the Portland metropolitan region an intergovernmental organization known as Metro provides transportation planning and other services for the three counties and 24 cities. In 2002 they investigated how urban design influences transportation choices. They found that the a combination of mixed land-use variables including the number of retail businesses, number of households, and number of local intersections provided a good model for local walking accessibility. The mixed use values range from 0 to 4,690 (with an average value of about 290) for more than twelve hundred TAZs that have been mapped across the metropolitan region.

For those that are familiar with Portland, it may be interesting to relate the mixed use values to some known locales in Table 10. Remember that these values are the result of modeling techniques and represent a good overall fit.

Table 10: Portland Region Locale Mixed Use Value

Locale	Mixed Use Value
NW 21st Avenue	1,234
Wilsonville	429
East portion of West Linn	66
SE Hawthorne @ 39th Avenue	704
Downtown Lake Oswego	496
NE Broadway @ 15th Avenue	771
Powell Butte	25
SW 10th south of Burnside	4,690
Hillsdale	318

Although not statically significant, there are differences in how members responded as a function of the TAZ in which they live. For mixed use values less than 500, members were about two-

thirds as likely to have expanded their walking as compared to those who lived in areas with mixed use values over 500. These results are summarized in Table 11.

Table 11: Access to Flexcar Changed Walking by Mixed Use

	Overall %	% for Mixed Use<500	% for Mixed Use>=500
Walk much less often	0%	0%	0%
Walk less often	0%	0%	0%
Walk about the same	71%	76%	68%
Walk more often	23%	19%	26%
Walk much more often	6%	5%	6%

Conclusions

A number of studies have shown a positive relationship between membership in a car share organization and walking behaviors, ranging from a 16% to 26% increase in walking after joining a car sharing organization. The authors' recent survey of Portland members for this paper indicated a 29% increase in walking

The walking accessibility characteristics of a car sharing member's neighborhood also appears to be a factor in reported changes of walking behaviors, but this alone does not appear to be a significant explanation of walking behaviors – membership in car sharing is more likely a factor. Although car sharing members may have more "green" attributes than the general population, it appears that access to a car sharing vehicle changes mode choice and walking behavior.

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