

Table 6. Residential Location in Large Scale

	DownTown	Suburb	Rural
Connecticut*	27.30%	68.30%	4.40%
CT State Teleworker**	4.76%	47.62%	47.62%
Distribution Difference from CT	Significant (P=3.33×10 ⁻³²)		<0.05
CT State Frequent Teleworker	5.89%	11.76%	82.53%
Distribution Difference from CT	Significant (P=4.68×10 ⁻⁵⁴)		<0.05
Distribution Differ. from CT State Twrkr	Significant (P=1.14×10 ⁻²)		<0.05

*U.S. Census Bureau, Census 2000. It categorizes area by being in and out of Metropolitan Area first, and then divide Metropolitan Area into in and out of central city. Here we chose central city as the possible nearest definition of downtown, out of central city as suburb, and out of Metropolitan Area as rural.

**Due to the privacy problem, we could not obtain their zip code or address leaving us only choice to ask teleworkers' own understanding of their residential area. Therefore, data might not be accurate in terms of population size or density of the area, however, it could contains usually hidden preferences such as landscape characteristics or convenience of life which are important in understanding their environment.

Table 7. Residential Location in Small Scale

	Average Distance to Town center	
U.S.A. National*	Grocery store	Public Place
	13.41	7.69
CT State Teleworker	2.62	
CT State Frequent Teleworker	2.64	

*U.S. Department of Transportation, 2001 National Household Travel Survey

Table 8. Location. Differ. by Motivation & Time Use (L Scale)

	Down Town	Suburb	Rural
CT State Teleworker**	4.76%	47.62%	47.62%
Time-seeking CT Teleworker(N=29)	3.57%	42.86%	53.57%
Distribution Difference from CT State Twrkr	N.S.	(P=8.08×10 ⁻¹)	>0.05
Work-motivated CT Teleworker(N=30)	3.22%	54.84%	41.94%
Distribution Difference from CT State Twrkr	N.S.	(P=7.04×10 ⁻¹)	>0.05
Comfort-seeking CT Teleworker(N=13)	7.14%	28.57%	64.23%
Distribution Difference from CT State Twrkr	N.S.	(P=3.59×10 ⁻¹)	>0.05
Home-bounded CT Teleworker(N=19)	5.00%	50.00%	45.00%
Distribution Difference from CT State Twrkr	N.S.	(P=9.73×10 ⁻¹)	>0.05
Being with Family (N=31)	6.45%	38.71%	54.83%
Distribution Difference from CT State Twrkr	N.S.	(P=5.94×10 ⁻¹)	>0.05
Work more (N=6)	0.00%	50.00%	50.00%
Distribution Difference from CT State Twrkr	N.S.	(P=8.61×10 ⁻¹)	>0.05

attorney and medical doctor, taking classes, volunteering, daycare service, tax paying and in addition, seeing friends which might not be called as service use but an important social activity.

As shown in Table 10, distribution of shopping location choices in all significantly changed after they started telework. Both neighborhood reliance and internet reliance went up shrinking the share for downtown and mall shopping. It is a little surprise that distribution change for frequent teleworkers was not significant although the direction of change is consistent.

In case of service uses, distribution of location choices in all significantly changed again, yet this time, only neighborhood reliance increased having less activity in downtown and on internet (Table 11). Distribution for frequent teleworkers is also significant in this case, yet interestingly, both neighborhood and internet reliance increased here.

In order to see if any specific characteristic of teleworkers co-relate with this location change tendency, we picked up those who changed the location for at least one type of shopping or service use, and analyzed their background such as gender, age, their residential location (both in large and small scale), motivation, time use, and digital environment in comparison with those of the main body (Table 12). In background, only the gender ratio of shopping location changers is significantly different from the body having 81% as female.

For residential location in large scale, there is no significant indication that those who live in country side change locations more than those in the city.

However, since the main body has strong propensity toward rural area, we should not generalize this to say that neighborhood reliance and residential location in large scale does not correlate at all. On the other hand, residential location in small scale shows some, if not exactly significant, correlation with the neighborhood reliance. Those who live nearer to town center has

Table 9. Location Differ. by Motivation & Time Use (S Scale)

		Distance to town center in miles					
		1 or less	-2	-3	-4	-5	more than 5
CT State Teleworker	Time-seeking CT Teleworker (N=29)	21.31%	26.23%	24.59%	11.48%	13.11%	3.28%
	Distribution Difference from CT State Twrkr	20.68%	17.24%	17.24%	20.68%	20.68%	3.45%
	Distribution Differ. from Home-bounded Twrkr	Significant (P=4.22×10 ⁻¹)					>0.05
	Work-motivated CT Teleworker (N=30)	16.67%	20.00%	23.33%	13.33%	23.33%	3.33%
	Distribution Difference from CT State Twrkr	N.S.	(P=6.62×10 ⁻¹)				>0.05
Motivation Difference	Home-bounded CT Teleworker (N=19)	5.00%	50.00%	45.00%			
	Distribution Difference from CT State Twrkr	Significant (P=4.49×10 ⁻¹)					<0.05
	Comfort-seeking CT Teleworker (N=13)	30.77%	23.08%	30.77%	7.69%	7.69%	0.00%
	Distribution Difference from CT State Twrkr	N.S.	(P=8.91×10 ⁻¹)				>0.05
	Home-bounded CT Teleworker (N=19)	26.31%	31.58%	15.79%	15.79%	5.26%	5.26%
Time Use Difference	Distribution Difference from CT State Twrkr	N.S.	(P=7.83×10 ⁻¹)				>0.05
	Be with family (N=30)	13.33%	23.33%	26.67%	20.00%	13.33%	3.33%
	Distribution Difference from CT State Twrkr	N.S.	(P=7.09×10 ⁻¹)				>0.05
	Work more (N=5)	20.00%	40.00%	0.00%	0.00%	40.00%	0.00%
	Distribution Difference from CT State Twrkr	N.S.	(P=4.05×10 ⁻¹)				>0.05
Time Use Difference	Do errands / house work (N=12)	50.00%	16.67%	0.00%	25.00%	8.33%	0.00%
	Distribution Difference from CT State Twrkr	N.S.(Δ) (0.1 > P=6.18×10 ⁻²)					>0.05

stronger tendency to change shopping location than others after they started telework.

While time use and digital environment do not correlate with location change, the motivation to start telework, especially home-boundness has association with location change. Teleworkers who are home-bounded changed shopping locations significantly more than those who are not.

Although the overall direction of change is fairly consistent for all teleworkers as the above, not all kinds of shopping and service use locations changed in the exact same way and same degree. As for shopping, the proportion of those who changed eating out location is much lower than for other kinds of shopping (Fig.4). Internet reliance went up for cloth, books and gift shopping but not for grocery (Table 13). Concerning service use, banking and postal services have higher rate of changing location than others, while that for consulting attorney, medical doctors and daycare services are relatively low (Fig.5). Only two cases that we saw the internet increases are banking and tax filing (Table 14). It is not difficult to believe that these difference occur depending on frequencies of activities (ie; we go to post office more often than law offices), on if those activities could be easily done on internet such as buying books, and on the extent to which the personal relationship are important for the activities.

It is also noticeable that for every shopping and service activities, proportion of frequent teleworkers who changed location is almost twice as high as the ones for all in many cases, which indicates telework frequency affects the degree of change in habit.

Related to this increase of neighborhood reliance is satisfaction to the facilities in their towns. It is high among CT government teleworkers. Almost 70% say

Table 10. Location Change for All Shopping

		Neighborhood	Shopping mall	Downtown	Internet
CT State Teleworker	Before	31.23%	47.32%	13.88%	7.57%
	After	34.38%	46.06%	9.46%	10.99%
Distribution Change before & after		Significant (P=4.12×10 ⁻² <0.05)			
CT State Frequent Teleworker	Before	28.89%	44.44%	17.78%	8.89%
	After	36.36%	38.64%	11.36%	13.64%
Distribution Change before & after		Not Significant (P=8.44×10 ⁻² <0.10)			

Table 13. Location Change for each Shopping Category

			Neighborhood	Shopping mall	Downtown	Internet
Grocery Shopping	All CT twrks	before	61.9%	22.2%	20.6%	-
		after	66.7%	22.2%	12.7%	-
	Frequent twrks	before	50.0%	27.8%	27.8%	-
		after	61.1%	27.8%	11.1%	-
Cloth Shopping	All CT twrks	before	12.7%	65.1%	9.5%	9.5%
		after	14.3%	66.7%	4.8%	11.1%
	Frequent twrks	before	11.1%	61.1%	11.1%	16.7%
		after	16.7%	55.6%	5.6%	16.7%
Books Shopping	All CT twrks	before	14.3%	60.3%	7.9%	20.6%
		after	15.9%	52.4%	7.9%	28.6%
	Frequent twrks	before	16.7%	50.0%	5.6%	22.2%
		after	16.7%	27.8%	11.1%	33.3%
Gift Shopping	All CT twrks	before	15.9%	61.9%	14.3%	7.9%
		after	19.0%	63.5%	7.9%	11.1%
	Frequent twrks	before	22.2%	50.0%	22.2%	5.6%
		after	27.8%	50.0%	11.1%	16.7%
Restaurant	All CT twrks	before	52.4%	28.6%	17.5%	-
		after	57.1%	27.0%	14.3%	-
	Frequent twrks	before	44.4%	33.3%	22.2%	-
		after	55.6%	27.8%	16.7%	-

Table 12. Background of Location Changer

	Distribution difference from all CT state teleworkers								
	Background		Residential Location		Motivation		Time-Use		Digital Environment
	Age	Gender	in Large scale	in Town	Home-bound or not	Be with family or not	Do Errands or not	Broad Band or not	
Shopping location changed	N.S.	Significant (p=0.05)	N.S.	Δ(p=0.06)	Significant (p=0.008)	N.S.	N.S.	N.S.	N.S.
Service location changed	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

nothing they want is missing in their towns. At the time of the interviews, even when they gave us some additional desirable facilities, many said “There is really nothing missing, but since you ask, it will not hurt to have this and this” Some mentioned facilities here are athletic ones, restaurants and shops all by less than 10 % teleworkers⁵.

5.5 Residential Environment

5.5.1 Homes and home-offices

Homes of CT state teleworkers are no larger than owner-occupied houses in CT. Distribution of number of bed rooms that teleworkers have are not significantly different from the state wide data, although we see that teleworkers tend to have more 4BR houses than the others (Table 15). For frequent teleworkers, we did not see significant difference from state-wide data, neither, and in comparison with all CT teleworkers, they actually have less number of 4BR houses and more 3 BR ones. Average number of bed rooms at home is 3.1 both among whole CT teleworkers and frequent teleworkers. Assuming that they have a living room, a dining and a kitchen, the average number of rooms they have is 6.1. This is slightly larger than the average of whole housing units in CT which is 5.6 rooms, yet again not significantly.

As for the office space at home, nearly 90 % of CT government teleworkers have dedicated office space (Table 16). Among those, almost 60% have independent office. These ratios do not significantly changes depending on the frequency of telework.

These numbers indicate that, although not larger than

Table 11. Location Change for All Services Use

		Neighborhood	Downtown	Internet
CT State Teleworker	Before	68.85%	27.54%	13.88%
	After	75.11%	20.48%	4.41%
Distribution Change before & after		Significant (P=3.05×10 ⁻³ <0.05)		
CT State Frequent Teleworker	Before	65.89%	32.56%	1.55%
	After	74.81%	22.22%	2.96%
Distribution Change before & after		Significant (P=2.02×10 ⁻² <0.05)		

Table 14. Location Change for Each Service Use

			Neighborhood	Downtown	Internet	Don't use
Banking	All twrks	before	55.6%	27.0%	9.5%	7.9%
		after	60.9%	15.6%	14.1%	9.4%
	Frequent twrks	before	61.1%	27.8%	0.0%	11.1%
		after	68.4%	10.5%	5.3%	15.8%
Post Office	All twrks	before	65.1%	23.8%	0.0%	9.5%
		after	79.4%	9.5%	0.0%	9.5%
	Frequent twrks	before	66.7%	22.2%	0.0%	11.1%
		after	88.9%	0.0%	0.0%	11.1%
Museum/Theater	All twrks	before	50.8%	31.7%	-	19.0%
		after	52.4%	28.6%	-	20.6%
	Frequent twrks	before	19.0%	19.0%	-	11.1%
		after	20.6%	20.6%	-	16.7%
See Friends	All twrks	before	73.0%	25.4%	-	7.9%
		after	77.8%	20.6%	-	7.9%
	Frequent twrks	before	66.7%	33.3%	-	11.1%
		after	77.8%	22.2%	-	11.1%
Consult Attorney	All twrks	before	23.8%	9.5%	1.6%	65.1%
		after	27.0%	6.3%	1.6%	65.1%
	Frequent twrks	before	27.8%	5.6%	0.0%	72.2%
		after	27.8%	5.6%	0.0%	72.2%
Medical Doctor	All twrks	before	76.2%	25.4%	-	3.2%
		after	79.4%	22.2%	-	3.2%
	Frequent twrks	before	66.7%	44.4%	-	5.6%
		after	72.2%	38.9%	-	5.6%
Volunteering	All twrks	before	38.1%	12.7%	1.6%	50.8%
		after	39.7%	11.1%	1.6%	52.4%
	Frequent twrks	before	33.3%	16.7%	0.0%	61.1%
		after	38.9%	11.1%	5.6%	61.1%
Tax Paying	All twrks	before	36.5%	12.7%	12.7%	27.0%
		after	36.5%	12.7%	14.3%	27.0%
	Frequent twrks	before	44.4%	5.6%	11.1%	33.3%
		after	38.9%	11.1%	16.7%	33.3%

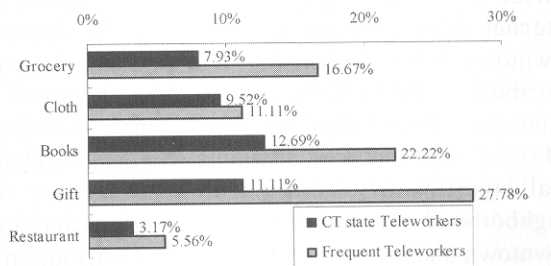


Fig.4. % of Teleworkers who changed Shopping Location

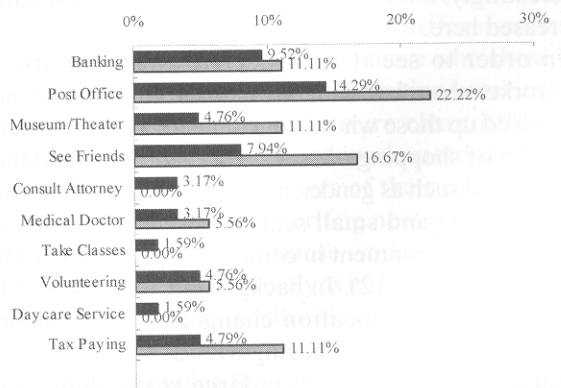


Fig.5. % of Teleworkers who changed Service Location

average homes in CT, they have enough space to accommodate their work at home. Considering that typical household of CT state teleworkers is consisted of a pair of adults and one child which usually require 2 bed rooms and that they have 3 bed rooms in average, it is easy to imagine that one extra bed room was turned into the office. This assumption coincides with that fact

Table 15. House Size

	0BR	1BR	2BR	3BR	4BR	5 or
CT owner-occupied housing units*	0.10%	3.30%	20.70%	47.90%	22.60%	5.40%
CT State Teleworker	0.00%	3.20%	15.90%	42.90%	34.90%	0.00%
Distribution differ from CT housing unit	Not Significant (P=1.10× ⁻¹ >0.05)					
CT State Frequent Teleworker	0.00%	11.10%	5.00%	61.10%	22.20%	0.00%
Distribution differ from CT housing units	Not Significant (P=2.22× ⁻¹ >0.05)					

*U.S.Census Bureau, 2000

Table 17. Home Satisfaction

	CT state teleworkers	Frequent teleworkers	Twkr with 2 B.R. or less	Twkr with no desk
Nothing / Satisfied	87.30%	88.89%	75.00%	83.33%
Larger Space/Office	7.94%	11.11%	25.00%	16.67%
Others	1.59%	0.00%	0.00%	0.00%

Table 18. Reason not to prefer Telework Center

	No. of answers chosen	TIME		WORK COMFORT			SOCIAL	HOME-BOUNDNESS		
		Time Factors exclud. Commute	Commute Related Time Factors	Work Factors exclud. Quietness**	Quietness	Comfort Factors exclud. Quietness***	Environmental Factor	Convenience	Family Factors	Medical Reasons
All Teleworkers	54	3	6	16	7	15	2	0	2	3
answer distribution %		5.4	10.7	28.6	12.5	26.8	3.6	0.0	3.6	5.4
% to all teleworkers		4.8	9.5	25.4	11.1	23.8	3.2	0.0	3.2	4.8

*Save time, prefer flexibility, confidentiality of work

** easy/no dress up, comfortable, relax, no bad weather, longer sleep

*** have work be done at home, work efficiency, no interruption, good concentration

that the ratio for independent office drops significantly when their houses become smaller with 2 or less bed rooms.

When asked the former use of independent office, more than 70 % of independent office holders stated that it had been a office or a study even before they started telework (Fig.6). This means that nearly half of CT state teleworkers houses were ready to accommodate office use even before they started telework.

As shown, the majority of CT state teleworkers have privilege of having large enough space at home, yet is this “fit for telework” house size or office setting very important for them? By analyzing their answers to some of our questions, we came to believe that house size means to them to some degree, but for the formal office space, we have enough facts to let us doubt the importance of it. First, the degree of satisfaction to the home does not drop when they do not have a desk for work, while it drops when they only have 2 or less bed room (Table 17). Also, furniture that CT government teleworkers have in their office space seems less than perfect than the image we have from the word “home office”; one fifth of their offices do not have a desk (Fig.7), for example, and this ratio is consistent even for frequent teleworkers. Some mentioned working in the lounge chair with files on lap. Third, even though it is just a little more than 10%, there are people who do not have dedicated office space, and about half of them do not feel the need to have one. Three of interviewees, who are with dedicated office space, commented that they are happier in using dining table or kitchen counter for their work. By looking at discrepancy between the proportion of those with independent office (about 60%) and those who are satisfied with house (about 90%), we could visualize more are working happily with dedicated but casual office setting at home.

Table 16. Location of office in the house

	CT teleworkers	Frequent teleworkers	Twkr with 2 or less B.R.
Dedicated office space	88.9%	100.00%	83.33%
No dedicated office	11.11%	0.00%	16.67%
Office Location			
Independent Office	58.92%	55.56%	20.00%
Part of Family Room	16.07%	16.67%	20.00%
Part of Bed Room	10.71%	5.56%	30.00%
Part of Dining Kitch	8.93%	16.67%	10.00%
Part of Living Room	5.36%	0.00%	20.00%
Others	0.00%	5.56%	0.00%
Distribution difference from CT twkr	N.S.		Significant

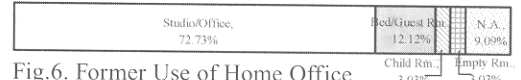


Fig.6. Former Use of Home Office

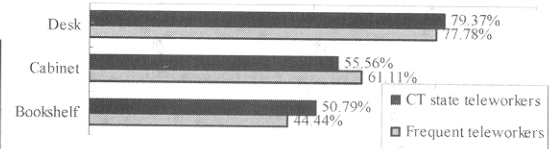


Fig.7. Furniture in Home Office

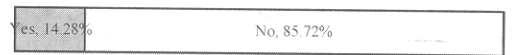


Fig.8. Preference of Telework Center to Home

5.5.2 Home-office V.S. Telework center

CT government teleworkers prefer teleworking at home to using telework center.

At this present, there is no telework center for CT government, yet we asked them if they would choose to work there instead of working at home, under the hypothesis there would be a center near to their home. 86 % said they would not (Fig.8), and even when they showed the preference to telework center, it was under condition that the center locates in the range of 15 minutes commuting time. This strong preference of home telework to telework center is all the way consistent for frequent teleworkers (p=0.29), for those who are not satisfied either with their town, house or home office (p=0.39~0.91), for those with smaller house (p=0.56) and for those who live far from the town core (p=0.29).

It is interesting to compare their reasons for not to choose telework center both with their motivation to telework and with their new way of time use. Although the highest ratio of teleworkers said it was because of their work, as they did for motivation question, comfort factors came very close to it this time (Table 18). In short, they started to telework at home for work efficiency, begun to use extra time gained for the family and do not want to give up comfort of it for the sake of telework center. And this implication was supported by the remarks of many interviewee; “Why should I go to telework center, when I can do everything at home?”

6. Concluding Remarks

In this paper, some significances of teleworkers’ physical environment in smaller scale and in broader aspects were verified using CT state teleworkers as case study. Finding includes the followings;

- Their residences locate significantly closer to the centers of their towns than national average.

- Their residential distribution in large scale differs significantly from that of all Connecticut residents; they clearly tend to live either in suburbs or in country side than in urban area.
- After they started telework, their neighborhood reliance in shopping and in service use noticeably increased shrinking the share of down town.
- Their houses are no larger than the average houses in the area, yet with their household size, majority of them can afford independent offices or large enough space to accommodate dedicated office space in the rooms of other function.
- Formal office, both as a room as furniture setting, is not always desired, and comfort of the house is important advantage for home teleworkers.
- Some of the above tendencies clearly correlate with their telework frequency, their motivation to telework or their new way of time use; e.g. frequent teleworkers tend to live more in rural settings, home-bounded teleworkers tend to live closer to town centers and more likely to change shopping location than others.

This founding shows how people's propensity, though in limited area and professions, toward regional and residential environments, is by the specific work-life style of teleworkers. To project another forecast on teleworkers' environment or to prove the existing one directly was not the purpose of this paper. Yet, if teleworkers of similar type increase steadily in long-term, then their propensity would affect the form of our environment in the future. The fact that our research subject belongs to the occupational main stream of teleworkers, it should heighten the credibility of this result as a prominent material for future discussions on telework and environment in more general terms.

It is also worth mentioning that many teleworkers in Asia are in similar employment conditions and professions⁶. Under the strict condition that geographical/cultural background carefully be considered, the environmental propensity of our subjects could be applied to their Asian countertype, thus it could possibly be utilized in finding schemes to solve problems such as urban congestion or regional inequity.

Since we took the people-oriented approach as firstly mentioned, further steps including surveys of different types of teleworkers should be taken to have a complete picture for generalization. A place-oriented approach could also be taken for deeper analysis, and we would like to pursue both of them in the future.

Acknowledgements

We would like to thank Dr. Martin W. Anderson and the teleworkers of State of Connecticut for all the variable information we obtained for this research.

Notes

1. This is possibly due to the two day telework limit that Department of Revenue Service sets on its employee except for the managers.
2. We chose "twice a week" as notable boundary of "frequent" and "not frequent" in judging telework influence on life and environment, because by teleworking 2 days a week, they stay at home for more than a half of the whole week.
3. International Telework Association
4. Voice mail is a popular contact method in U.S., to which people who call to the office can leave messages directed to each employee personally, and to which an employee calls from outside to check messages directed to him/her. Some agencies of CT government make checking voice mails compulsory to teleworkers.
5. e.g. 9.5% want more athletic facilities, 7.9% want more restaurants
6. e.g. there are 1.57 million employed white-collar teleworkers in Japan (Japan Telework Society Survey (2000))

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- 20) Pratt, Joanne H. (2003), "Teleworking Comes of Age with Broadband, Telework America Survey 2002", pp.8