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# What does telework *really* do to us?

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**Presents the results of extensive surveys of about 400 telecommuters in the USA, including transportation impacts, and whether telecommuting is actually related to any net reduction in travel in general and in car use in particular. Gives findings from trip logs completed by driving age household members for an entire week. Concludes also that teleworking also has no severe negative socio-psychological effects on either teleworkers or telemanagers, at least short term and provided all parties are properly selected and trained and do not telework full time. Touches on the differences between teleworkers in the USA and elsewhere.**

Over the past two decades the topic of telework has become engulfed in a welter of theories about its nature and impacts. I have been aware of, and have been testing, most of the potential benefits and disbenefits of telework since I first began to study it in 1970 (at which time I used the unwieldy appellation: the telecommunications-transportation tradeoff). This article is an attempt to inject reality into some of these theories.

The results presented here are not fabricated. They are the product of extensive and detailed surveys of practising teleworkers and their co-workers[1]. Although the information presented here is about a specific group of about 400 telecommuters, the results are quite consonant with – and comparable to – those of thousands of others that we have tested since the mid-1970s in a variety of organizations, both public and private.

Having said that, I should also mention that these results are solely of workers in the USA. Most of them, more than 80 per cent, are in mid-level positions in large organizations, placing them in the middle class. They tend to be about evenly split between males and females, although that is probably not the distribution of sexes holding those positions. Hence, there are probably more women teleworkers as a proportion of their representation in the organizational hierarchy. They are not necessarily techno-adepts; about one-third of them do not use computers while teleworking. They represent a great variety of types of jobs, including some that might not immediately seem telework-suitable. Almost all are part-time, home-based teleworkers. That is, although they are full-time employees, they telework from home less than half the time, on average. The rest of the time they commute to their more traditional offices.

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## Transportation impacts

The predominant favourite theory is that teleworking actually does not *reduce* travel, it simply displaces it; commute trips saved are at least replaced by more shopping, visits to friends, etc. To test this, since telework projects in the USA are often tied to efforts to

comply with environmental quality regulations, we ask the telecommuters, the members of a control group, and their driving-age household members to complete trip logs for an entire week. The following information is derived from a set of trip logs completed by these groups.

Figure 1 shows the distribution of trip lengths (of all sorts) for the telecommuter and control group households. The members of the telecommuter households take shorter trips, on average, with a mean of 13.5 miles, as compared to the control group mean of 15.9 miles. The median[2] trip lengths follow a similar pattern, with 8.0 miles for the telecommuters and 10.8 miles for the control group. (The *mean* is the average, taken by adding up all the trips and dividing by the number of trips; the *median* is the point where half the reported distances are longer (or shorter). If the trips were normally distributed, the mean and median would be the same; a higher mean indicates a disproportionate number of long trips.)

A series for the average commuter residing in the region is included in the figure for comparison. The mean trip distance for the latter set of people – commute trips only – is 16.6 miles and the median is 10 miles, very similar to the total household data from our employee group. (Data are from an annual regional commuter survey.)

Of the 3,997 trips logged during the 7-day test period, 3,739, or 95.6 per cent, were by car, amounting to 16.0 car trips per reporting individual during the week. Table I shows the breakdown. Telecommuters, with 96.6 per cent of their reported trips by car, were slightly more intensive car users than were members of the control group, who used their cars for 92.7 per cent of the trips. Apparently, mass transit and car/van pooling have had little influence on the travel behaviour of either of these groups. Consequently, most of this section will concentrate on the automobile trip behaviour.

Where are all these people going? Figure 2 shows the percentage distribution of types of trips taken by the two groups in terms of their purpose. There are no major differences between the two groups. That is, both groups allocate the nature of their trips about the

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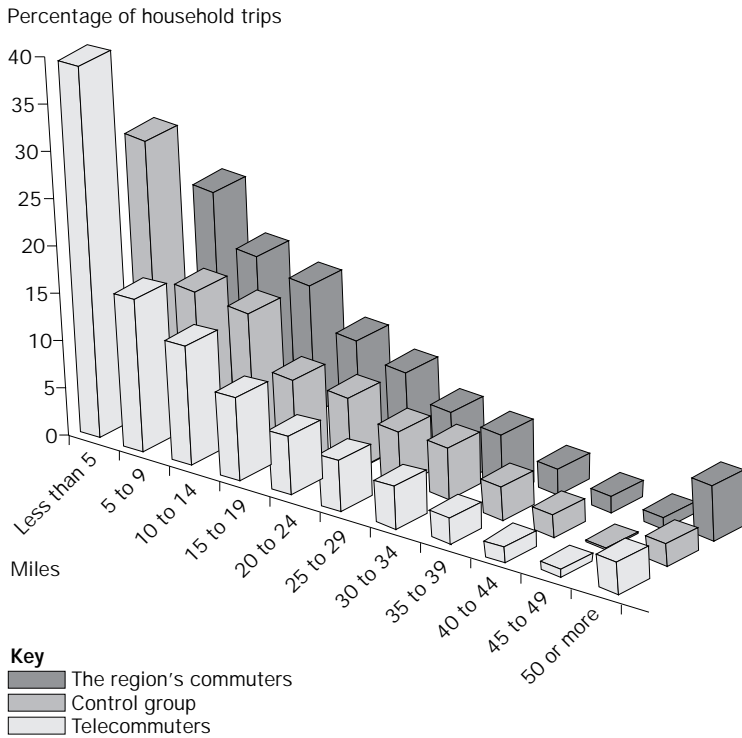
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same way. Trips to work account for at least one of every four trips for both groups.

The distances required to achieve those purposes do differ in some respects. In particular, the telecommuters have significantly shorter trips for medical purposes. This is

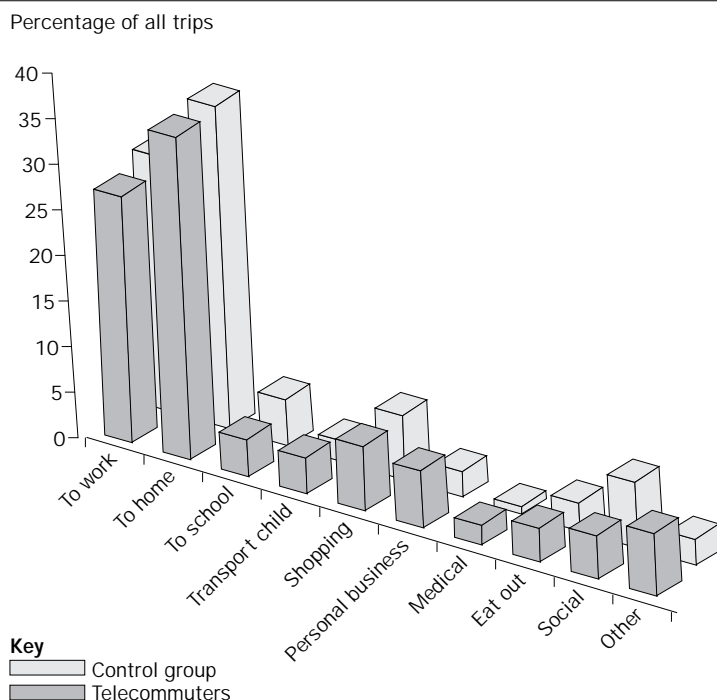
**Figure 1**

Distribution of household trip lengths



**Figure 2**

Distribution of household trip lengths by trip purpose



**Table 1**

Allocation of participants' trips by mode

Transportation mode	Telecommuter households (%)	Control group households (%)
Private car/van (as driver)	96.6	92.7
Mass transit	2.1	3.4
Walking	0.1	0.3
Car/van pool passenger	1.2	3.5

consonant with the theory that most family's physicians or dentists are located closer to home than to work. Figure 3 shows the distribution. The telecommuters also appear to eat out at closer distances than the members of the control group.

Work-related travel remains the dominant factor throughout the week. Figure 4 shows this graphically. Weekday trips, including commuting, for both the telecommuter and control group households account for about 85 per cent of all reported trips, with Saturday and Sunday trips together constituting the rest of the trips. Interestingly - and in defiance of the theorists' forecasts - the control group households make a slightly higher proportion of their trips on weekends than do the telecommuter households, 16.9 per cent and 14.8 per cent of the totals, respectively.

Figure 5 shows the information in terms of car miles travelled, rather than percentage of total trips. The same relationships hold, however, although the difference between weekday and weekend trips is less pronounced. This is because some members of both groups took fairly long distance (greater than 100 miles) trips during the weekend. However, the control group households show significantly longer mean weekend mileage.

### The telecommuting impacts

Given this overall view of travel characteristics, generally indicating that the travel habits of the telecommuting and control group households are similar, and that they, in turn, are generally similar to those of the region in which they live, what is the impact of telecommuting? The question of greatest importance is whether telecommuting is actually related to any net reduction in travel in general, and in car use in particular.

First, Figure 6 shows how the average telecommuter allocates his/her trips on a daily basis. The trips are distributed between working at home, working at a satellite office (only one of the telecommuter group does this), working in the principal office (mostly

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in the central city), and everything else. The "everything else" category includes all the non-work trip categories shown in the previous figures. It is clear that 70 to 80 per cent of the average telecommuter's weekday trips are to and from the principal office, at least from Monday through Thursday. Friday is a popular day off for those on modified work schedules. The erosion of the *Principal Office* column for

Friday in the figure is matched by the increase in the *Other* column. Although some telecommuters work at home or at the principal office on weekends, most are off, therefore, the Saturday and Sunday trips are mostly in the *Other* category.

One other factor is also apparent from Figure 6. Telecommuters do make trips on days that they are telecommuting. They do not just stay at home all day. A key question is whether these trips are sufficiently long and/or frequent to offset the commute savings in any significant way. It is also important to compare the telecommuter trips with those of the control group.

Figure 7 shows the comparison. This depiction of the average number of miles travelled per trip on each day shows that the telecommuters and the members of the control group have about the same characteristics on regular office days. The telecommuters' trips on telecommuting days are relatively short, averaging four miles over the work week, as well as being relatively few. Therefore, it appears safe to say that telecommuters are making significant reductions in their commute savings, even though some are taking telecommute-day trips.

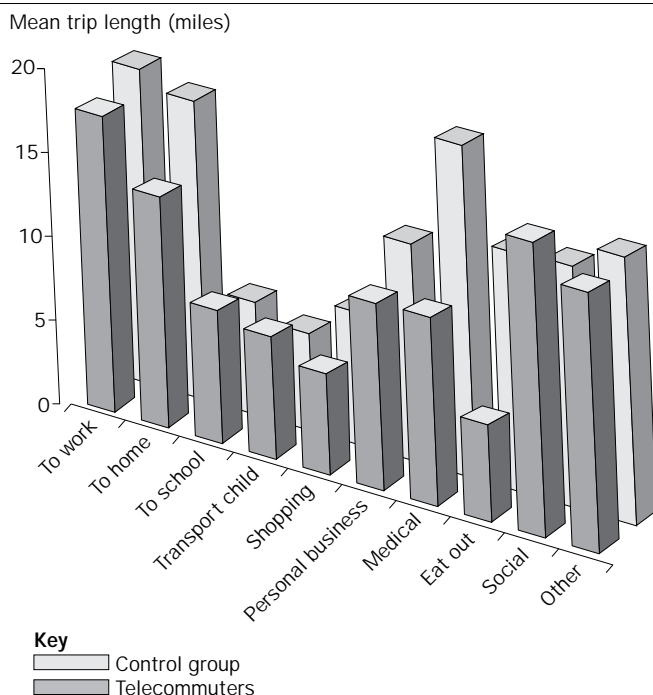
The average trip length gives a clue as to the type of trip being taken. For example, short trips indicate local travel, while trips on the order of 15 miles or more are more associated with work related travel. Possibly more important than trip length is the total mileage covered per day, particularly those covered by car. Figure 8 shows that for the telecommuters and the control group.

As in the previous figure, Figure 8 shows little difference between the telecommuters and the control group during regular at-office days. Discrepancies in office day mileage during the weekends are more apparent than real; few members of either the telecommuter or control groups worked weekends during the survey. From these figures it would appear that the average telecommuter is reducing his/her daily car mileage by about 30 miles even though trips are being made during telecommuting days.

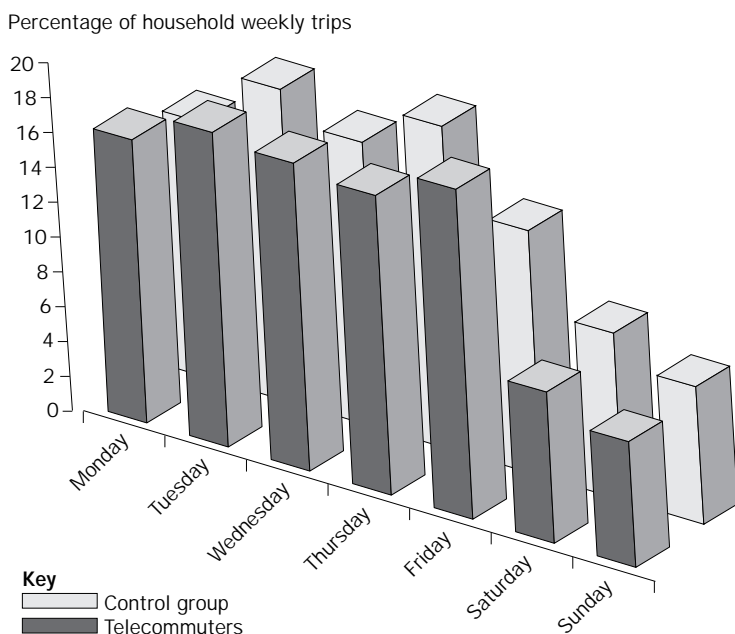
Therefore, at least part of the doomsday hypothesis (that additional household car use will totally offset or even exceed the telecommuting reductions) is disproved by the data from the telecommuters themselves. While there is still some residual car travel, indicating some life remaining in that hypothesis, it is still significantly less than the office-day travel.

Further, the question remains as to the effect of telecommuting on overall household car travel. Figure 9 shows the additional car mileage put on the telecommuters'

**Figure 3**  
 Distance distribution by trip purpose



**Figure 4**  
 Distribution of household trip during the week



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households on both telecommuting and regular office days. The office day total mileages are scaled down to reflect only the mileage added by the same number of households that were telecommuting that day. That is, if 29 people were telecommuting on Wednesday, the office day total mileage residuals are shown for 29 households as well.

Clearly, there is little additional household travel on telecommuting days. *What appears*

*to be happening is that trips ordinarily taken by other household members, such as transporting children to and from school, are being taken over by the telecommuters. In addition, the overall level of car travel during telecommuting days is significantly diminished relative to the data for equivalent numbers of households on regular office days.*

Hence, these results appear to support a counter-doomsday hypothesis: *Telecommuting acts to reduce car use over and above the commuting related reduction.* Specifically, for this group of telecommuter households, the average weekly reduction in car use[2] is 19 miles per household. Telecommuting is, without question, an important means of reducing automobile travel.

### Ridesharing

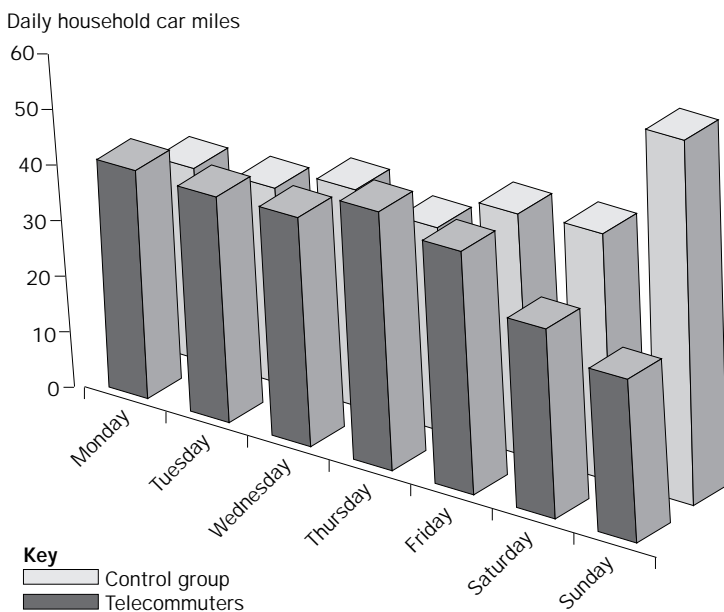
Although most of the reported trips were via single occupant automobiles, there was some ridesharing. Thirty per cent of all telecommuter household trips and 31 per cent of all control household trips included one or more passengers. Nineteen per cent of the telecommuter household trips were with one passenger, compared with 24 per cent one-passenger trips among the control group households. Both groups include some van drivers, with 0.4 per cent of the telecommuter - and 0.1 per cent of the control-group-households reporting trips with six or more passengers. For both groups the multi-passenger trips were work related slightly more than 62 per cent of the time. All eight of the van trips reported were work related.

### Experience effects

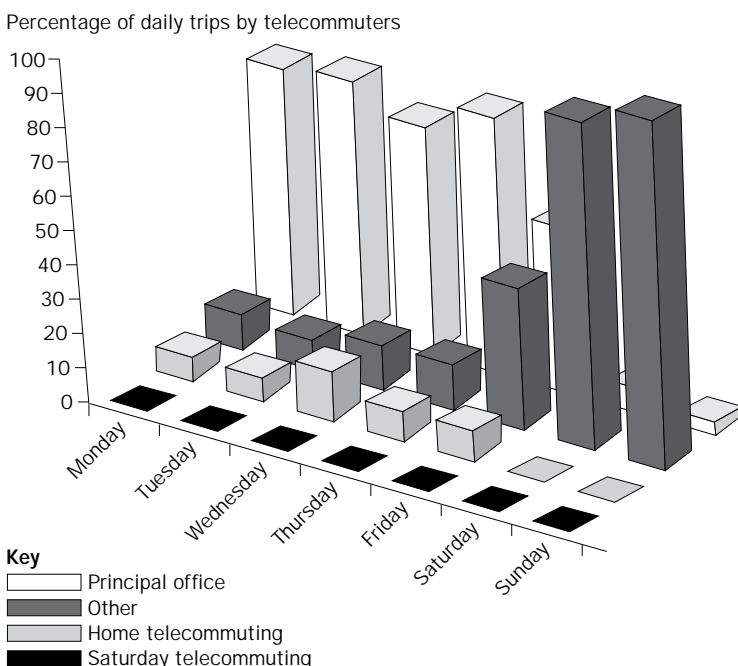
Some telecommuting pilot projects in the USA, notably the State of California and Los Angeles County projects, had multiple "waves" of trip log surveys[3]. Those projects only used three-day trip logs during each survey, rather than the seven-day logs used here, as a means of reducing "form filling fatigue". The reason for multiple surveys is to see if there are changes in trip behaviour with time.

We adopted the stratagem of using a longer, but one time only survey, encompassing a group with a range of telecommuting experience, to see if experiential effects could be observed. The range of telecommuting experience in the test group ran from one month to 42 months. Using linear regression analysis of the data, we found no significant experience-related difference in either the average number of daily car trips or the total daily car mileage of the telecommuter households. We conclude that the telecommuting-related savings in vehicle use appear essentially from

**Figure 5**  
 Distance distribution of daily household car trips



**Figure 6**  
 Daily distribution of telecommuters' trips



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the beginning of one's telecommuting experience and continue thereafter.

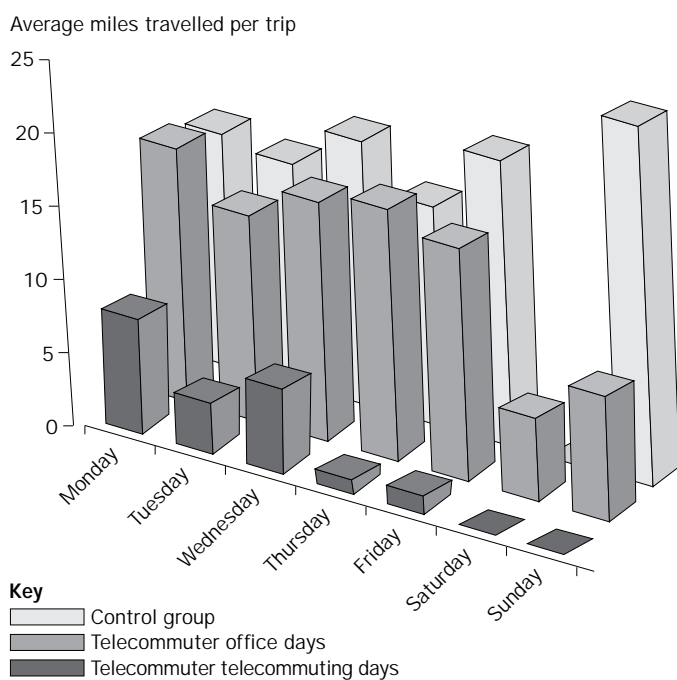
### Changes in the quality of life

Another segment of the speculative literature about telework focuses on the potential

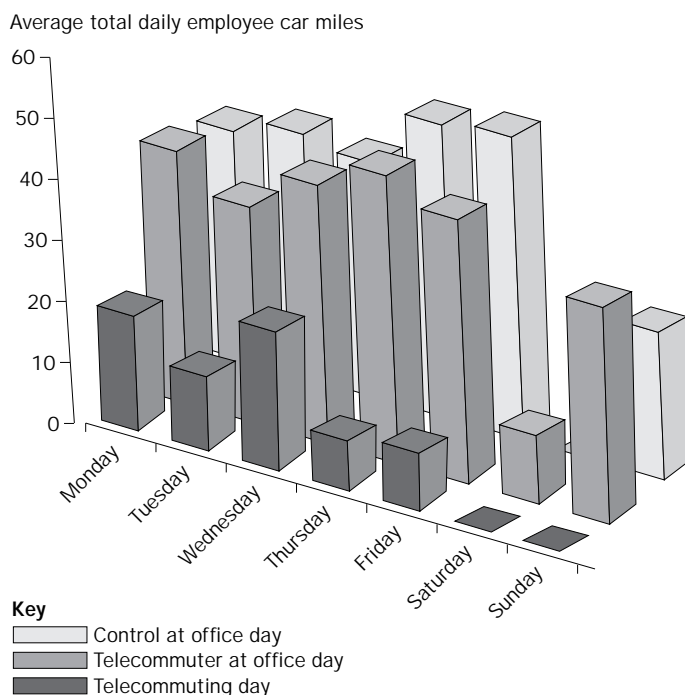
hideous effects of this work style on one's psyche. Feelings of social isolation or, possibly worse, stunted career growth are among the most popular such telemaladies. We do not develop direct evidence of the effects on the families, rather we ask the teleworkers about the impacts. A substantial section in our evaluation questionnaires is specifically oriented towards these impacts[4]. Common factor analysis of the questionnaires allows us to break a number of the work/social impacts into 11 categories, as follows:

- 1 *General work life.* This relates to changes in the individual's relationships with his/her supervisor, self assessment of job skills, feelings of job responsibility, influence, versatility and scope.
- 2 *Personal life.* This factor includes changes in quality of family relationships, discretionary time, feelings of control of one's life, ability to separate work and home life, success in self discipline, co-ordination of family and work time, and knowing when to quit work.
- 3 *Visibility.* Do teleworkers feel out of their supervisor's and co-workers' minds when they are out of sight? This factor includes changes in one's influence on organizational strategy, understanding of what others are doing, how well one's suggestions are received and self assessment of visibility in the organization.
- 4 *Environmental influences.* This includes changes in home office space, stress from environmental noise, ability to match work and biorhythms, and feelings of self empowerment.
- 5 *Belonging.* Do teleworkers feel themselves to be loners? Here we have changes in involvement in office social activities, amount of job-related feedback, career advancement, job stability and relationships with fellow workers.
- 6 *Creativity.* Changes in: creativity in one's work, the amount of flexibility in job performance and feelings of self empowerment, are in this factor.
- 7 *Stress avoidance.* Changes in work related costs, ability to bypass physical handicaps and avoidance of office politics are grouped here.
- 8 *Liberation.* This factor includes changes in ability to concentrate on crucial tasks, the need to cope with traffic, and the ability to get more done.
- 9 *Apprehension.* Changes in uneasiness about equipment failure and feelings of guilt about "not really working" constitute this category.
- 10 *Interdependence.* This factor relates to changes in the quality of meetings with

**Figure 7**  
 Comparative daily trip miles



**Figure 8**  
 Comparative total daily car use



colleagues and dependence on others to help perform one's job.

11 *Continuity*. The final factor calibrates changes in freedom from interruptions.

Figure 10 shows the results for our test groups after about 18 months of telecommuting, as well as pre-telecommuting and mid-project surveys. Hence, it gives a feel for the long-term changes as well.

Note that the emphasis is on *changes* in these categories. We asked the participants what had changed since telecommuting began, whether or not they were telecommuters. We asked how much, if any, change there was and how important each issue was to them. We have developed composite values (amount of change multiplied by importance to the participant) for these factors, as shown in Table I. The scales for *amount* of change are from -2 to +2, with -2 signifying much worse, 0 meaning no change, and +2 signifying much better. Importance ranges from 0 (not important at all) to 4 (extremely important to the participant). Thus, the composite factor can range from -8 (i.e.  $-2 \times 4$ ) to +8 (i.e.  $+2 \times 4$ ).

The surveys show clear differences between the telecommuter and non-telecommuter groups. There are three areas in which we might expect to see negative impacts from telecommuting: Visibility, Apprehension and Belonging. Yet, this group of telecommuters, on average, shows net positive changes for all three, although there are some individual negative responses.

Note that, with the exception of the liberation and continuity factors, both groups at mid-term appear to be more positive than they were during the baseline survey; then both groups tended to decline slightly from the mid-term to final surveys. In two of the key factors - continuity and creativity - the telecommuter group switched rankings between the mid-term and final surveys, while the non-telecommuters stayed about the same. This could arise from a possible increase in interruptions to the telecommuter group as more people get used to contacting them while they are at home, coupled with a decrease in interruptions in the office as the on-site office population decreases. Interestingly, the telecommuters' responses to the liberation and continuity factors declined after the baseline measure, showing the effects of reality slightly modifying expectations. In any case, the telecommuters show quality of life changes that are more positive in every respect than those of the non-telecommuters.

Urban sprawl or redemption?

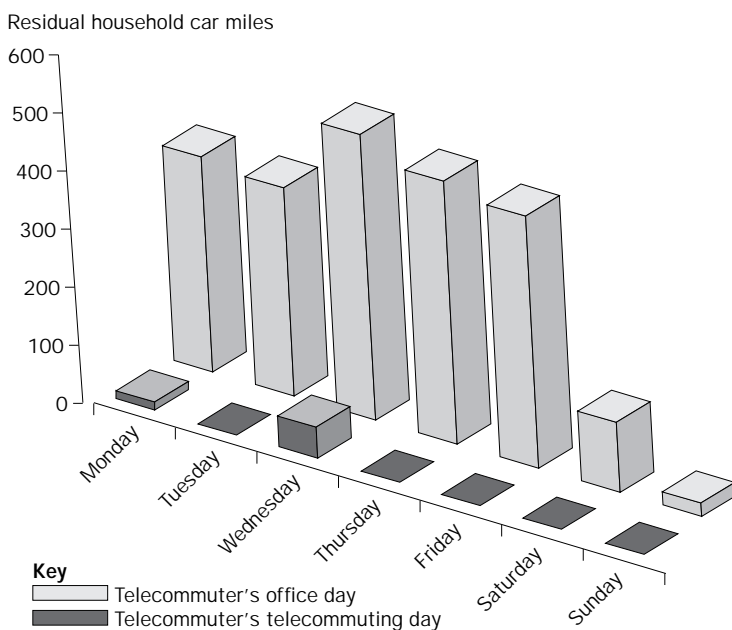
A third area of great speculation is the potential of telework to totally alter the shape of cities. The most popular variant of these is the idea that teleworkers will flee their traffic-strangled and crime-ridden urban locales for the peace and tranquillity of the countryside in general and areas of great scenic beauty in particular. Of course, in the process they are likely to ruin the very scenic wonders that they moved to live among.

Short of that exodus is the more familiar freeway effect, in which new communities spring up along newly completed highways. These new communities require further investment in the physical infrastructure (local roads, power distribution, sewer lines, etc.) - creating urban sprawl - and generally act to increase the average amount of automobile use, particularly for commuting. A key issue is whether telecommuting has an equivalent urban sprawl effect.

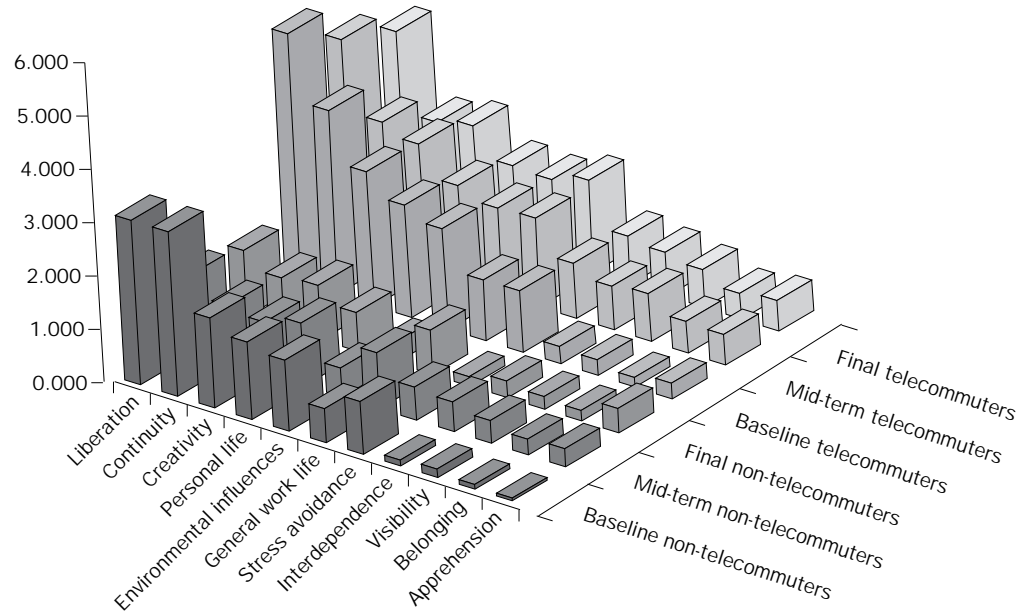
The flight-to-scenic-beauty syndrome does exist, but it appears to be confined (so far) to persons of significant wealth who can afford to live and telework in such communities as Telluride and Aspen. That is, the high land values in such communities tend to act as barriers to significant immigration. Further, as the resources become limited, the prices increase accordingly and the problem may be self-limiting.

Not so in the more conventional urban sprawl case. Here, large numbers of individual family decisions - often motivated by the

Figure 9  
 Additional miles put on by telecommuter households



**Figure 10**  
 Quality of life impacts



need for lower priced housing for growing families – might be expected to be swayed by the reduced number of commutes enabled by teleworking to increase the distance to work for the times when a commute is necessary. In these cases, urban sprawl may indeed be teleworking-induced.

As in the other two areas discussed already, we long ago decided to test the theories with the co-operation of real people. The results of our urban sprawl tests are reported in detail elsewhere (Nilles, 1991; 1995). There is no clear evidence to date of any sprawl effects; most of the telecommuters who moved during our test periods[5] either moved to locations about the same distance from their non-home workplace or moved to another town where, presumably, a local telework centre could act as a surrogate principal office. Yet, the sprawl effect may not appear for several years after teleworking begins, and our surveys have not covered that time span. Hence, this remains an open question and this is one area that requires some vigilance in the future, particularly on the part of urban planners.

On the other hand, telework has great potential for revitalizing existing urban areas by allowing people to live and work in the same neighbourhoods. Aside from the traffic reduction possibilities already discussed, there is a large array of community development opportunities that do not require expensive infrastructure alterations. That is, it is not necessary to tear down existing buildings and build new roads in order to revitalize neighbourhoods, if telework is used appropri-

ately. This possibility is in the planning and early implementation stages in California and Austria (JALA International, Inc. *et al.*, 1994).

### Conclusions

The surveys described here were confined to telecommuters in the USA and did not include the more general type of teleworkers whose travel patterns may be more diverse. However, other studies we have performed indicate that mid-day, work-related travel is significantly less than commuting in large metropolitan areas. Few information workers, with the exception of sales and field support people, engage in much mid-day travel. Although teleworking may induce demand for long-distance travel, other interviews that we have had with mid-level managers and professionals indicate that they are already largely travel-saturated; telework allows them to expand their contacts but may not substantially increase their total travel. In any case, these variants tend to be at the margins when compared to the magnitude of daily commuter travel. Although it was not covered in our daily trips surveys, we also have no evidence that telecommuting induces longer vacation trips.

One comment, often heard, is that the telework-related changes in transportation use are not significant. That is, by themselves they do not “solve” the traffic congestion problem. Let me remind the reader that

traffic flow is non-Newtonian. That is, it does not behave like a watery fluid; its behaviour is much more like that of blood – it flows well until some congestion threshold is reached, whereupon it clots.

In the developed world, about 40 per cent of all automobile use is for commuting. If 50 per cent of the workforce in those countries are potential telecommuters, but only 10 per cent of the workforce is actually telecommuting on any given day, then there is a 4 per cent daily reduction in commute volume, mostly during peak traffic periods. Because traffic flow is non-Newtonian, a “mere” 4 per cent difference in peak volume can eliminate most traffic congestion and the billions of ECU’s or EMU’s or \$\$ wasted every year (given population stability). We made computer models of this effect in the late 1960s and it was proven real in the 1984 Olympics in Los Angeles (the same 4 per cent reduction in peak traffic volume allowed free-flow). That is a primary effect.

This research and comparable surveys we have made also leads me to conclude that telework has no severe negative socio-psychological effects on either teleworkers or telemanagers – at least not in a period as long/short as two years – provided that all parties are properly selected and trained and do not telework full time[6]. On the contrary, there are significant positive effects for the teleworkers, at least.

I am often asked/told about the differences between telework in the USA and elsewhere, particularly in Europe. Clearly there are some differences. Among the foremost is that teleworkers’ homes in the USA typically average at least 160 square metres, as contrasted to 100 square metres or less in Europe and Asia. Thus, because of the greater likelihood of more “discretionary” space, home-based teleworking would appear to be easier in the USA. Yet, evidence from Dutch trials by the Ministry of Transportation in the Amsterdam region indicates that home-based telework is by no means precluded. Therefore, I would expect to see regional and neighbourhood telework centres forming a greater proportion of telework venues outside the USA, but not to the exclusion of home-based teleworking. Indeed, the Bangemann report recommendations (High Level Group on the Information Society, 1994) emphasize development of telework centres but mention both forms. During a trip to Rome for the Telework ’95 conference I found that many Italian information workers have a daily commute of as much as two hours each way from the suburbs to central Rome; a situation very similar to that of major urban areas in the USA and –

in this example – comparable to that in the Tokyo region.

These are differences in degree, not in kind. They do not affect the innate nature or impact of teleworking. More important are what is often called “cultural differences”. Two of these appear to be significant. First is the industrial age hierarchical management mind set that seems to be more intense in Europe than in the USA (in Japan this is further intensified by the ubiquitous togetherness principle). This acts generally to slow the rate of acceptance of teleworking in proportion to its intensity. Second is the lack of a common language. Although not a problem for most telecommuting and local teleworking, it is a definite hindrance to international teleworking. Both of these primary barriers are eroding; they are merely factors that will slow, but not stop, the growth of teleworking in these countries. Note that a substantial fraction of active teleworking in Europe appears to be associated with large multinational companies that have long since learned to function in global markets. Unfortunately, I have not seen much quantitative data on these issues.

This is not to say unequivocally that the counter-teleworking theories are invalid. It is simply that, after years of trying, we have yet to find evidence to support them for any but a very small number of individuals. Research should continue in all of these areas, particularly as more millions of people become teleworkers and more countries appreciate its advantages.

Still, telework is a double-edged sword. Depending on the way it is used, its impacts can be either positive or negative – and rarely neutral. Control of the impacts is only partially in the power of governments; much of the change is made by individual decisions, generally for reasons that have little apparent connection with telework itself. Whatever the ultimate outcome, there appears to be no question that telework is here to stay.

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## Notes

- 1 Our current evaluation questionnaire, to be completed by the teleworkers as well as their co-workers, contains a few hundred items and covers a variety of topics. We also use travel logs that are completed by all driving age members of a household, documenting each of their trips for a one-week period.
- 2 This figure is arrived at by subtracting the residual mileage during telecommuting days (60.6) from the office day residual (2,318.3) and dividing the result by the number of telecommuting households (119).



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### Jack M. Nilles

Educated as a physicist, Jack Nilles headed the preliminary design of several space vehicles and communications systems for the US Air Force and NASA and was a consultant to Presidents Kennedy's and Johnson's Science Advisory Council, the National Science Foundation and other federal departments. He joined the University of Southern California as Director for Interdisciplinary Research and began his empirical research on telecommuting and teleworking, terms he coined, in 1973. He has led a number of studies of present and future impacts of information technology and created the standards by which major telecommuting projects are judged. He has developed and/or evaluated telecommuting projects for *Fortune* 100 companies, state governments, the city of Los Angeles, and companies and government agencies internationally. He is author of *The Telecommunications-Transportation Tradeoff*. His newest book, *Making Telecommuting Happen*, is a manual for telework programme development and management. He is currently involved in developing a series of long range forecasts of the global impacts of telework. He can be reached via email: jala@ix.net-com.com.

- 3 See, for example: Kitamura, R. *et al.*, *Telecommuting and Travel Demand: An Impact Assessment for State of California Telecommute Pilot Project Participants*. Research Report UCD-TRG-RR-90-8. Davis, California: Transportation Research Group, University of California at Davis, USA.
- 4 We developed this component (as well as the other components) of the questionnaire in studies of telecommuters and other information workers carried out over the past 20 years. It contains 50 questions about the extent and importance to the respondent of any quality of life impacts.
- 5 Some caution is in order here since none of the tests covered more than two years.
- 6 We simply do not have enough evidence about full-time teleworkers' experiences to draw any conclusions.

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# The information highway: just because we're on it doesn't mean we know where we're going

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Looks beyond the hype surrounding telecommunications and suggests that the physical aspects of the information highway are currently short of the ideal and further, that when eventually in place, it may not be ideal. Examines some commonly held beliefs about the transportation, geographic and economic impacts of telecommunications. Suggests numerous further research and policy issues. Concludes by reminding us that telecom technology is inherently neutral. It can facilitate travel reductions and geographic decentralization and economic development, but not alone – we, as policy makers and consumers must have some control over the outcome; the compact city made obsolete and settlements dispersed throughout the countryside should only happen if people decide that is what they want to happen.

This paper owes a substantial intellectual debt to my colleague Ilan Salomon of the Hebrew University in Jerusalem, whose critical questions about the impacts of telecommunications have greatly influenced my own thinking.

World Transport Policy & Practice  
2/1,2 [1996] 24–28

MCB University Press  
[ISSN 1352-7614]

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## Introduction

Telecommunications, like many other technological advances, is often accompanied by a lot of hype, an optimistic, rather naïve, and frequently aggressively self-serving overselling of its potential. Steve Finlay of BC Telephone in Vancouver, British Columbia coined the phrase Information *SuperHYPE*-way – an apt description of the current state of the much-vaunted info highway. We owe a great debt to two other Canadians, Lis and Ian Angus, for explaining to us why the information highway is like teenage sex:

- Everyone thinks about it a lot.
- Everyone thinks everyone else is doing it.
- Everyone talks about doing it, but almost no one is really doing it.
- The few who are doing it are not doing it very well.
- Everyone hopes it will be great when they finally do do it (Gordon, 1994).

I suggest that not only do the physical aspects of the Info Highway currently fall short of the ideal, but that the impacts of the info highway when it eventually is in place may also not be ideal. As a society, we have this touching but usually misguided faith in the ability of technology to solve problems that are essentially human – whether individual or institutional – in nature. The purpose of this paper is to remind us to look behind the hyperbole about what the info highway is and what it will do for us, to peel away the exaggeration and find the reality underneath. First, I will describe three attributes of “conventional wisdom” (CW). Then, I will discuss three examples of the received wisdom regarding the urban impacts of telecommunications technology.

I will briefly present some suggestions for future research into these impacts, and close with three cautionary observations.

## Three attributes of conventional wisdom

At least three attributes that characterize conventional wisdom can be identified. The first is that:

**It is hard to pin down its origin, and (even if it starts out accurate) it often loses something in the translation**

At a 1991 UC Irvine conference on telecommuting, Professor Ilan Salomon, the keynote speaker, traced the “genealogy” of a published forecast that telecommuting may substitute for 12 per cent of all trips. That forecast cited three sources for corroboration. He looked up those three sources. One of them contained no explicit forecast of trip substitution. A second source in turn cited three other studies for corroboration (at least one of which also contained no quantitative forecast), and that second source also contained important qualifications of its findings that were completely ignored by the later study which cited it (Salomon, 1995).

At the same conference, consultant John Nilles gave a droll speech speculating on the origin of the oft repeated factoid that telecommuting results in a 20 per cent increase in productivity. More recently, Professor Salomon has attempted, without success, to trace a brochure claiming a 200 per cent increase in productivity back to its origins. Perhaps it was originally reported as 20.0 and the decimal point got lost.

The message is: Be sceptical. Dare I say the obvious? Do not believe everything you read or hear. Even peer-reviewed papers in academic journals are guilty of careless citations, and they in turn are inaccurately cited by others.

The second feature of the conventional wisdom's argument is that:

**It contains both truth and fiction in varying quantities**

This of course is what makes it so insidious. Consider a recent magazine advertisement by a major software company. The ad states, “It's not WHO you know, it's WHAT you know. The days of getting somewhere in the business world because you know the right people – whoever and whatever they are this week – are ending. Hallelujah”.

Well yes, telecom does, in some but not all cases,

- permit greater access to more people,
- flatten the organizational pyramid,
- decentralize control,

- make it easier for merit to be recognized, and so on.

But do you really think,

- that it is now no longer important to “network” in the human sense of the word?
- that you will hear the same gossip – excuse me, I mean valuable inside information – from random strangers that you get from your carefully cultivated and well-placed sources? – that your e-mail message bypassing the chain of command will receive equal attention whether the recipient actually knows you or not?

I once sent an e-mail message “cold” to an editor of a journal, asking him if he considered the paper summarized in the attached abstract to be appropriate for his journal. When a month had passed and I had received no reply to my message, I fell back to the low-tech approach and telephoned him. “Oh,” he said, “I get 200 e-mail messages a day and I delete most of them without reading them. That must have been what happened.”

Here was a person who was clearly plugged into the information highway and used to operating on it – he promptly e-mailed me the journal’s style requirements and copyright transfer form – but, so much for “access”!

The software company ad is just one example of the mixture of truth and fiction in CW. Our challenge is to separate one from the other.

### It oversimplifies

It does not worry about the fine print, the exceptions.

Einstein once said: “Things should be made as simple as possible, but not simpler”. If only we knew where that invisible line was. Some examples of this feature are presented below.

### Some popular factoids about the impacts of telecom technology

Let us examine three commonly-held beliefs about the transportation, geographic, and economic impacts of telecommunications. The first belief is that:

#### Telecommunications will reduce congestion and improve air quality

Judging by the number of policy documents and regulations which have favourably mentioned telecommuting, this is now the expectation or at least hope of a number of planners and policy makers. And I support these policies, and believe that telecommunications, at least telecommuting, will have a direct positive impact on travel. What is the catch? The question is how much of an

impact, and what the indirect and system-wide impacts will be.

At UC Davis, we recently did a study in which we synthesized the findings regarding the transportation-related impacts of telecommuting from a number of empirical evaluations of pilot projects (Mokhtarian *et al.*, 1995). Two of the most rigorous evaluations took place among California State workers and in the Puget Sound (Seattle) Telecommuting Demonstration Project, which was spearheaded by the Washington State Energy Office. Both studies found quite similar results: on average, telecommuters travelled 52-54 miles on regular weekdays, compared to about 13 miles on telecommuting days – a saving of 75 per cent. Most of all of that reduction was due to the elimination of the work trip.

We thought we had placed this result quite firmly in context. But when the paper was submitted for publication, one of the reviewers commented that it seemed generally well-done and well-written, but the claim that telecommuting would reduce travel by 75 per cent was too extravagant to be credible.

This is a classic example of the CW oversimplifying – not reading the fine print. We suddenly had visions of this number being pulled out of context and carelessly quoted just as the reviewer did: “telecommuting will reduce travel by 75 per cent”. So we inserted even more caveats – in the text, in the tables, everywhere we possibly could. What are those caveats?

First of all, our number represents 75 per cent of travel on a weekday by employed telecommuters. It is not 75 per cent of all travel, which would include weekends, vacations, and travel by non-workers. Furthermore, telecommuters are not typical of all workers. An important finding of our study was that telecommuters, not surprisingly, tend to live farther from work than non-telecommuters – fully twice as far, on average. At least, the early adopters of telecommuting found in these pilot programmes did. The commute trip constitutes about 75 per cent of the weekday travel for these long-distance commuters; hence eliminating that commute trip has the noted result. It is likely that as telecommuting moves into the mainstream, commute lengths for telecommuters will drop closer to the overall average – in which case the average travel savings of telecommuting will decline, both in absolute terms and as a percentage of weekday travel.

Furthermore, a 75 per cent reduction obviously only applies to telecommuters themselves, not to the population as a whole. Any assessment of the aggregate impacts of telecommuting must take into account how

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many people are telecommuting, and how often. Our study estimated that in 1991, 6 per cent of the California workforce was telecommuting 1.2 days a week (24 per cent of the time) on average. This translated to a whopping saving of one-half per cent in vehicle-miles-travelled and in transportation-related fuel consumption in California (it would be a much smaller proportion of all energy consumption). This effect is well within measurement error, i.e. certainly not strong enough to detect by any kind of "field measurements". Notice how easily 75 per cent became 0.5 per cent!

It may be said, "But that is now", or 1991, to be exact. Surely telecommuting will increase considerably, and have a much bigger impact in the future? Again, it all depends on what is reasonable to assume. If the number of telecommuters increases four- or sixfold (to, say, 25-35 per cent of the workforce), and all else remains constant, then the fuel savings would increase to a dizzying 2-3 per cent. But we have just suggested that the savings per telecommuting occasion is likely to decline over time as telecommuters become more representative of the population as a whole. And what about latent or induced demand?

Even if the freeways ever could become clear, it would not last for long: people would create new trips, and change modes, and destinations, and do all kinds of things to take advantage of the new capacity made available to them. And what about the trip generation effect of telecommunications? There is a lot of evidence to indicate that trips will be created by new technological applications as well as eliminated. These issues of latent demand and trip generation are explored extensively in two recent studies sponsored by the US Department of Energy (1994a,b).

*Bottom line:* Do not count too heavily on the trip reduction benefits of telecommunications technology. Yes, they will be there - at the margin. But they will be counteracted and perhaps completely swamped out by impacts in the opposite direction.

The second commonly-held belief I want to examine is that:

### Telecommunications will make location irrelevant

This CW has several variations:

- telecommunications will create even greater urban sprawl by making it possible for people to move even farther from work (thus, incidentally, potentially negating some of those transportation savings that the CW was so confident would occur. That is by the way a fourth characteristic of CW - it often contradicts itself);

- everyone will move to the countryside, or to those scenic resort villages in the mountains or to that island in the Puget Sound;
- jobs will haemorrhage to cheap labour markets offshore.

Again, there is doubtless some truth to these statements: not only manufacturing and data entry but professional jobs such as software development have been placed overseas.

According to the popular press, resort towns like Telluride, Colorado have been invaded by affluent "lone eagle" telecommuters and mobile executives, driving up land prices to the point that native residents can no longer afford to buy a home in the town in which they grew up.

But human settlement patterns are far from becoming completely homogenized, and technology is far from eliminating locational advantage. In reality, there are sound reasons why cities as we know them will endure:

- agglomeration economies: telecom will not erase the need for face-to-face interaction or for goods movement (we are still going to need not only food, but clothing and shelter and other tangible things that cannot be "downloaded"); it will continue to be more efficient for these activities to be conducted in dense settlements;
- the massive already-built environment (Mandeville, 1983);
- the tendency of similar or inter-related industries (or groups of people) to cluster together (Muth, 1985);
- distinctive geography, climate, and other amenities;
- differences in infrastructure capacity and topology;
- the role of cities as cultural, political, and economic centres (Gottman, 1983).

Depending on how the decision variables are weighted in each instance, the optimal location for a particular individual or firm may be the urban centre, the urban periphery, or an exurban or rural area. But most location choices are likely to be incremental accretions to where most activities are currently located. So, we are likely to see simultaneously, continued growth in metropolitan areas, emergence of multiple nuclei in expanding metropolitan areas, growth of smaller cities into regional hubs and specialized centres, and some movement into currently rural areas. In other words, evolution, not revolution.

The third and final commonly-held belief needing scrutiny is that:

### Telecommunications will stimulate economic development

Whether in a rural or urban setting, the hope is the same: that providing advanced telecom

services will result in a competitive advantage that will attract jobs and dollars to the area. However, Abler (1987) and others point out that communications networks are two-way streets, so to speak. The same technology that, it is hoped, will bring economic benefits from major metropolitan areas to the periphery provides the opportunity to vacuum resources from the periphery to the more powerful urban core.

The belief in telecom as an instrument of economic prosperity sounds suspiciously like the factoids often used to justify enormous investments in transportation infrastructure: this subway or that beltway will increase economic development. To give this a reality test, pick a depressed area of the USA, say downtown Detroit. Will building a new freeway through downtown Detroit revitalize it? It is ludicrous on the face of it; numerous other factors must come together to achieve healthy economic growth. Infrastructure may be necessary, but it is certainly not sufficient. Yet we often seem to subscribe to the "Field of Dreams" school of economic thought: if we install a fibre optic loop, or ISDN, or a teleport or a smart building, or a telecottage in this urban area or that remote town, "they will come".

I have met with a few rural telecottage developers from around the world, and have read about a number of others. I am currently directing the implementation and evaluation of 12 urban and suburban telecommuting centres throughout California, and have studied several others. It appears to me that rural telecottages and urban telecentres alike have a very mixed record to date. Many (although not all) have closed following the conclusion of a heavily subsidized demonstration period. Our study of urban telecommuting centres in California shows that, of those which have been open more than six months (but have not yet closed!), occupancy levels average about 17 per cent. As for rural telecottages, not all of them have the expressed goal of job creation, and most of them have other goals besides that. But any job creation (or even attraction of existing jobs from elsewhere) that does take place is by no means automatic - "because 'it' is there". Rather it is the product of careful, labour-intensive job and skills training, of extensive and tireless marketing, and of patience and an ability to stay in it for the long haul.

*Message:* Getting the technology in place is only one step, not even necessarily the first step, and probably the easiest step. Almost inevitably, the crucial barriers to achieving the desired economic benefits are not techno-

logical, but institutional, social, economic, and personal.

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## Research and policy issues

A number of research studies would be of value in increasing our understanding of the types of impacts of telecommunications technology considered here. Space permits only a brief mention of the possibilities; each suggestion below carries within it numerous specific questions of interest.

In urban areas, we could:

- track telecommuters longitudinally to assess long-term impacts on residential location, job choice and travel;
- continue to study the role of telecommunications in business location and relocation decisions;
- analyse the short- and long-term transportation impacts of those business decisions, at both aggregate and disaggregate levels; and
- explore ways to strengthen the role of telecommunications infrastructure in supporting the urban core.

In urban areas, we could:

- monitor telecommunications-facilitated residential and business relocation to high-amenity areas such as resort towns.

Regarding the use of telecommunications for rural and small town economic development, we could:

- learn more about successful "gardening" (local job creation) projects;
- demonstrate and evaluate rural telecommuting centres as in Kentucky and elsewhere;
- analyse the success of job shifting strategies such as those being followed in Kansas and Japan.

Internationally, we could:

- monitor the location of firms and employees offshore, with distinctions between the situations for data entry workers and skilled professionals likely to be of interest.

Any number of policy issues are implicit in these studies. One such issue is the ability (and desirability) to provide infrastructure to support large shifts in population to the urban fringe or to exurban areas. There is also an equity issue: the greater ability of middle and upper class workers to live anywhere they choose will contribute to the ongoing socio-demographic fragmentation of society. And, how to achieve or maintain economically viable central business districts will continue to be a concern.

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### Patricia L. Mokhtarian

Assistant professor of Civil and Environmental Engineering at UC Davis. Following completion of her PhD in Operations Research from Northwestern University in 1981, she came to Los Angeles to work for the Southern California Association of Governments. That metropolitan planning organization asked her to explore the potential of telecommunications applications to reduce congestion and improve air quality for the region. She became intrigued with the capabilities of telecommunications technologies, and with their impacts on transportation in particular and society in general, and has been studying those issues ever since. From an initial position of naïve optimism about the potential of telecom to reduce travel, she has reached a more critical (but not negative) position. Issues she would like to see studied further include: long-term impacts of telecom on location decisions and urban form; telecommunications as a tool for economic development; short-term travel and communication impacts of online consumer-oriented information/transaction services and community networks; and travel and communication patterns of mobile workers.

## Conclusions

I do believe that telecommunications has an enormous potential to change society. I just do not believe that those changes will necessarily be simple, or on net in the expected or desired direction. For that reason, I do believe in monitoring and analysing trends and impacts of telecom technology, and proactively planning to harness that technology for the public good.

In closing, it is important to remember three things:

### Telecommunications technology is inherently neutral

It can facilitate travel reductions and geographic decentralization and economic development, but it alone does not cause these things. It can also facilitate the opposite results: increased travel, geographic centralization, loss of jobs off-shore and increasing polarization of the haves and have-nots.

External forces will determine how technology is used and what its impacts are. We, as policy makers and as consumers, have some control over the outcome. The well-known geographer Jean Gottman (1983) wrote:

The organization of space is man-made; it is a product of the collective will of the participants ... Living and working together in compact settlements may seem unnecessary once the technology to overcome distance is well-developed. However, it does not necessarily follow that the compact city has been made obsolete and that settlements will disperse throughout the countryside. It all depends on what people decide to do.

### There are no easy answers

Technology may solve some problems while creating others. We will still be faced with hard work and hard choices to achieve a desired outcome. Public policy decisions have historically had an important effect on urban form. Governments have wielded their zoning authority to block or downsize development in the face of favourable market forces. Conversely, they have also attracted development through tax breaks, provision of infrastructure, and other incentives (Giuliano, 1989). Today, policy choices can help determine the extent to which telecommunications technology will support propagating urban sprawl even more widely, and the extent to which location activity will be channelled

into more efficient higher-density, balanced land use, and infill development patterns.

And finally,

### Be sceptical, be realistic

Read the fine print. Ask questions. I am not suggesting planning paralysis – that is, waiting till we have all the answers before acting – we often must go with our instincts and limited knowledge to get anything done. But while proceeding on instincts and limited knowledge, solicit opposing viewpoints, and listen to them. Monitor trends carefully to see if they match your instinct. And support research that will help provide answers to those important unknowns.

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# The social implications of telework: the UK experience

**Horace Mitchell** Telework Practitioner, Observer and Policy Adviser, UK

Gives findings of extensive research into the key social implications of teleworking, carried out over the last five years in the UK. Gives examples of telework parameters at both micro and macro levels for employers to consider when making strategic decisions about siting work locations; to which part of the world he/she will contract out; or subcontract significant operations. Feels we should not concentrate on protecting existing paid workers against the perils of working at home rather than in an office, thereby failing to assess and respond to the implications of the "flight of work" from higher cost, lower skilled to lower cost, higher skilled environments. Equally we must not overprotect those in conventional employment against the "risk" that they may have to move into a newer work style.

## Why "telework parameters"?

Our field work over the last half decade in Britain in trying to understand better some of the key social implications of telework has involved consultation with a wide range of interested parties, including teleworkers, technology and infrastructure suppliers, employers, teleworker representatives, specialist telework practitioners. In this work[1] we encountered two significant stumbling blocks to effective discussion:

- The tendency for the parties to any particular discussion to arrive with considerable "baggage" in the form of pre-conceived notions of "what telework is" and "what telework is about", which in many cases had led to pre-judged conclusions as to such issues as "whether telework is a good thing or not" and "whether telework is something to be promoted or to be avoided".
- The tendency for discussion of issues and policies to be sidetracked into semantic debate or undermined by semantic misunderstanding – for example one party would assume the discussion to be about "the shift of existing employees from office-based to home-based teleworking", another would assume it was about the opportunities for self-employed people to avoid travel; a third might assume it was about the shift of employment and work opportunities from higher cost to lower cost economies. These are of course quite different subjects, but all revolve round the concept of telework. Sometimes discussion revolves around various aspects of all of these perceptions of telework, making it impossible to achieve consensus or even an agreement about issues and priorities for debate and research.

We quickly concluded as follows:

- In any discussion of "telework" issues and policies it is vital to be clear about (and to state clearly) what aspect or characteristic of telework is being considered; for example "this discussion is in the context of office based employees shifting to home based while remaining employees"; or "this discussion is in the context of telework enabling jobs and work opportunities to

move from 'higher net cost' to 'lower net cost' economies or places". When broad economic, employment or social implications are being considered, it is important within the debate to be clear about which dimensions of telework have influenced which elements of discussion and conclusions.

- It is equally important to be clear as to the direction and level of focus of discussion; for example when we discuss issues arising from the fact that much work (and especially "new work") can now readily be moved from a higher cost to a lower cost place, both the discussion and our conclusions will be quite different depending on whether we are talking about "the employer's office versus the employee's home", about "cities versus the peripheral rural areas", or about "Europe versus India".

At first sight this might appear to undermine the possibility of any conclusions or reporting about "telework", since one should say "we are reporting on the implications of employees moving from office based to home based working", not "we are reporting on the implications of telework". However this is not the case – indeed the breadth of impact of telework makes it all the more important to synthesise our understanding of its impacts and to strive for consensus, since narrow consideration of just one facet often leads to false conclusions. What is important is that a "Report on the Social Implications of Telework" (for example) should very clearly state what aspects of telework have been considered and at what level of focus. In particular it should be clear about how the different aspects of telework have influenced any conclusions or recommendations. In particular, if a report (or section of a report) is based on a specific aspect (for example the adoption of home-based working by companies and their employees) this must be very clearly stated and the report should also make clear whether the wider implications have or have not influenced its conclusions and to what extent.

## Examples of telework parameters

The figures following provide examples of sets of telework parameters. The “macro” aspects are perhaps of more interest to some public agencies’ considerations of social implications, but research has shown that “macro” discussion has to be clearly informed by “micro” understanding if it is to reach realistic conclusions.

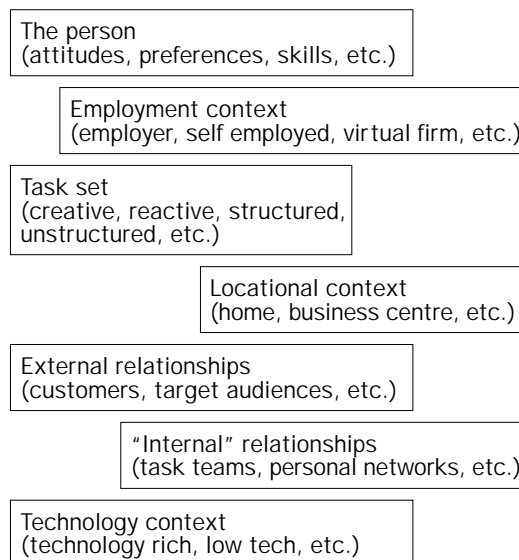
### “Micro” level parameters – individual teleworkers and/or tactical decisions in particular companies

At the “micro” level, when discussing individual teleworkers or telework policies for a particular company, we have expanded the original “four perspectives” identified in the 1991-1992 study to a suggested seven main parameters (Figure 1):

- 1 *The person* – his or her attitudes, preferences, skills, motivation etc.
- 2 *The “employment” context* – is there paid employment with a single employer? Portfolio working? Self employment with multiple customers? Participation in a virtual firm?
- 3 *The task set* – what is the nature of the main work to be done by the person – creative; reactive/reactive; structured vs. unstructured; concentrative vs. communicative.
- 4 *The nature of external relationships* – with customers, suppliers, audiences, related enterprises; for example does a high proportion of the customers expect and prefer

**Figure 1**

Telework parameters: people and tasks – the “micro” level



Source: ©Management Technology Associates 1995

to meet face to face? Do they prefer this to be at supplier premises?

- 5 *The locational context* – are we considering the possibility of people being fully home based, or partly home based, or telecentre/telecottage based, or mainly mobile? In the case of home-based telework, how well suited is the home? Can defended space be provided? Are partners/family welcoming and supportive of home-based working?
- 6 *The nature of internal work relationships* – to what extent does the work or the person’s motivation depend on other members of a team, the manager or people being managed (reporting staffs), personal networks of contacts? What are the preferred workstyles of people with whom there is significant interdependency?
- 7 *The technology context* – in a company, the extent to which it already uses relevant technologies; in networks of relationships, the extent to which others in the networks are comfortable with “distance working” and use the relevant technologies; in the locational context the quality and cost of telecommunications wherever the teleworker’s home (or office) is sited.

Even brief consideration of such a list of parameters demonstrates that no one model of telework (moving existing employees from office based to home based for example) can possibly be “promoted” as being generally applicable to people and companies and tasks and homes. Table I qualifies some of the characteristics for each parameter, in terms that a company should be looking for when it considers whether (and to what extent) to promote “home-based teleworking” to its own employees. Similar sets of “desirable characteristics” for different perspectives on telework can readily be adduced once the set of overall parameters has been identified. The present list of seven is not put forward as being complete, merely convenient. The question of “cost”, though often a prime motivator for both teleworker and employer, is regarded as an underlying driving or restraining factor not a “telework parameter”.

### “Macro” level parameters – strategic considerations for companies or nations/regions

Figure 2 suggests six main parameters to be considered at the “macro” level. An entrepreneur/employer will consider these when making strategic decisions about where to site major work locations or to which parts of the world he will contract out or subcontract significant operations. A local, regional, national or European government will consider the same parameters but from a different



**Table 1**

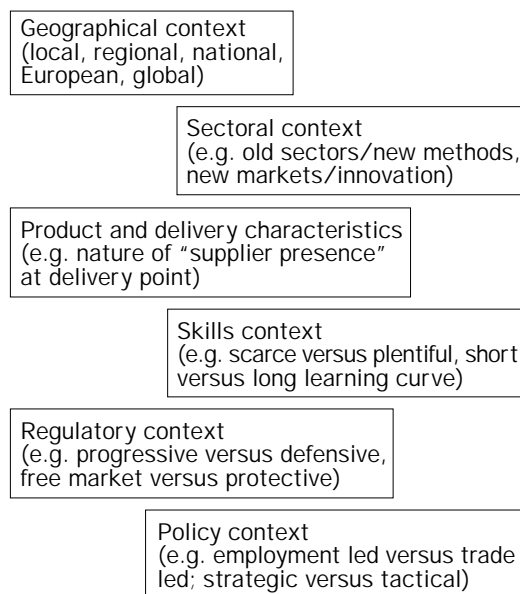
People and tasks – existing employees becoming home based

<b>Person</b>	Likes to work at/from home, good communicator, confident in self and role
<b>Task set</b>	Potentially very wide, includes mobile staff, any "office" work, any "communications" work except face to face tasks at fixed customer-facing premises (e.g. restaurant manager)
<b>Employment</b>	Company and individual manager comfortable with managing at a distance, opportunist and energized culture, managers and employees empowered and self-managing
<b>Location</b>	Home with defended space, family/partners accept/welcome home-based working, good telecoms locally, only geographical constraint is need for customer-related travel
<b>External relationships</b>	Any, except face to face at customer-facing premises
<b>Internal relationships</b>	Well established "networking" environment, good communications, reasonable stability of organization
<b>Technology</b>	Well established electronic networking facilities, resilient IT infrastructure, relatively high IT investment profile, telecoms and integration competence

Source: © Management Technology Associates 1995

**Figure 2**

Telework parameters: jobs, trade, work opportunities – the "macro" level



Source: © Management Technology Associates 1995

perspective when framing its telework-related policies and when developing plans for economic development and the creation of work opportunities:

- 1 Geographical** – are we considering the characteristics of (and policies for/towards) a small locality (Rome, County Antrim), a region (Northern England, Southern Italy), a country (Scotland, the UK, The Netherlands), a wider region (Scandinavia, Mediterranean Europe) or a world region (Europe, North America, South Asia); the further we get from the local, the more dangerous it is to generalize. For example "Europe" cannot be typified as a "high cost employment region" or as particularly strong in particular skills, whereas the City of London can be very clearly typified against these and other characteristics.
- 2 Sectoral** – telework has quite different characteristics when applied to (say) shipbuilding or motor manufacture as compared with computer programming or restaurant catering; companies consider into which markets they will move, regional economic developers consider how to migrate their economies from static or failing sectors into stable or growth sectors. General policies have to understand whether they are biased towards "old/failing" sectors or towards "new/growing" ones. "Unbiased" policies generally tend to favour the old.
- 3 Product and delivery characteristics** – for example the "product" of a top class international hotel relies heavily on the "personal presence" of a multitude of trained, willing and presentable staff (everything is done on site), while the "product" of the *Formule 1* chain of France (offering the cheapest possible overnight stay) dispenses with customer contact staff almost entirely (everything possible is done via telework); both companies and regions have to take a view as to what level of attention to pay to what kind of product/delivery mix. General policies must again be informed by the need to understand such bias and be deliberate about it.
- 4 Skills context** – in corporate strategy, what kinds of skills do we need and what will we need; in regional policies what kinds of skills do we have and what can/should we plan to develop. General policies again will tend to favour either the future or the past and must be conscious of this.
- 5 Regulatory context** – in corporate strategy, is the regulatory environment welcoming or inimical; in regional policies are we to focus on "protecting workers" or

“encouraging innovation”. In today’s Europe this is perhaps the most important issue.

- 6 *Policy context* – in corporate strategy, the extent to which (for example) the enterprise seeks to be self sufficient or to slim down to core skills only; in regional policies whether the political philosophy is (for example) expansionist or defensive, long term or short term, conservative or progressive, free market or planned economy, accelerating change in a desired direction or cleaving to what is known best and most “comfortable”.

Table II summarizes a possible set of local policy stances, approximately as recommended for regional economic developers in Management Technology Associates’ report *Telework and Teletrade: The Local and Regional Response* (Mitchell and Skyrme, 1994).

**Table II**

Jobs, trade, work opportunities – local economic development perspective

<b>Geography</b>	Operational focus is local, strategy focus is global markets and threats as seen locally
<b>Sectors</b>	Focus on sectors that have existing local strengths and impacts; global growth/opportunity sectors; sectors that potentially could employ local skills
<b>Products and delivery</b>	searching for innovation in marketing, delivery and cost reduction in traditional local products/strengths; driving awareness and fostering innovation in new growth sectors; driving “global perspective” for all local enterprises
<b>Skills</b>	Auditing existing skills base against requirements of global growth sectors; enhancing core “information society skills”; strengthening and reinforcing existing and still relevant local skills; strengthening education and training access and quality regardless of source
<b>Regulatory</b>	Seeking to be an attractive place at which to employ people; an attractive place at which to base “future market” enterprises
<b>Policy</b>	Balancing “protection of weak” with promotion of initiative and innovation; striving for local independence to pursue local interests; contributing actively to wider policy debate and formulation

Source: © Management Technology Associates, 1995

Relevance to the present “social implications” work and report

Any consideration of telework at European level cannot avoid being strongly influenced by what most reports call the need for “job creation”, and our own investigations suggest should be regarded as the need to “increase work opportunities” (see below). Once this is accepted, whatever the geographical scale (or within whatever political entity) the highest level issue becomes: (How) can we arrange matters so that the net work opportunities arising within our boundaries or brought in from elsewhere exceed or at the very least equal the net work opportunities that migrate across our boundaries to another region?

At European level this translates as “(How) can we use telework and related techniques to show that there is a net increase in work opportunities for Europeans?” If this were a public paper I would of course be more positive and omit the parentheses around “How”!

If we are to be really ambitious we might refine this question by adding: (How) can we do this in such a way that the overall quality of working life in Europe is enhanced?

And we might further add: What further steps can we take so that this (a net increase in better work opportunities) becomes the long-term trend as well as having a measurable short-term impact?

Of course these questions present significant difficulties. For a start, so far as I can tell there is as yet no consistent effort at measuring whether Europe is a net gainer or loser of work opportunities “across the European boundary” in our progress towards an Information Society. (Establishing a “European Telework Observatory” that starts to undertake and report such consistent measurement appears to be an urgent priority.)

Second, politicians and the media still talk of “creating jobs” when there is a very clear trend across the industrialized world away from “jobs”, in the form of “full-time permanent paid employment”, and towards a much richer and more varied mix of full-time and part-time work, work for employers or self employed working, portfolio working, voluntary work (unpaid or where pay is not the significant factor), periods out of work, periods in education or training etc. It is difficult to make sense in discussing telework unless this varied mix is accepted as being what “work” is now about, but almost all reports pay only lip service to this before concentrating on issues that are firmly rooted in the past of “one employer, one job, one worker” and two now unjustifiable assumptions:

- 1 That the terms and circumstances of “work” are largely determined by employers; this is true only of people who are “in and expecting to remain in permanent, full-time paid employment with a single employer” – such people are already a minority of “working people” or the “potential workforce” in much of Europe.
- 2 That employers “are responsible” and employees “need protection” (see below).

Third, experience with the Internet, our main current practise ground for the Information Society, indicates that increasing work opportunities for Europeans is very much about innovation and the seizing of opportunities, not about analysing or negotiating new work conditions in the context of (relatively) fixed “jobs”. Much of our employment related legislation appears to assume a “relatively fixed job” but practical experience in every sphere from government administration to banking or the railroads suggests that the assumption of fixed jobs is deeply misleading and a serious barrier to progress.

All our research into and experience of telework suggests that:

- It is most prevalent among self employed people and portfolio workers.
- Where it does exist in companies, it is more likely to be formally developed in companies that have a “progressive” (expectations based) rather than a conservative (agreements based) approach to employee-employer relations.
- In companies that still have a more conservative (formalist, agreement based) environment, much of the telework that goes on is informal or even illicit – it has been tacitly agreed between the manager and the employee on a local basis, sometimes when the company even has a formal “no telework” policy.

Much of our employment regulation, health and safety legislation, and social security provision have evolved in the context of most people being in relatively fixed and stable “jobs”, working for a “corporate” employer. It seems reasonable to assume this may no longer be wholly appropriate for an era in which a very high proportion of “workers” will either be self employed or will be working “just now (but not for long)” for one or more rather fragile small firms and micro enterprises, or will be “between work”, or will be working in some voluntary role, or part-time for several employers, or in some mixture of all of these. We still tend, for example, to base the main discussion of regulation or legislation on the assumption of an employer, a job and a worker, then turn to

“self employment” as though this were to some extent an aberration.

As a simple example of such thinking, some government administrations do not allow workers to decide for themselves whether to be self employed. Anyone who wishes to be self employed has to prove that he is not “in practice” an employee. The clear implication is that “employment” is normal, “self employment” is somehow special. It is difficult to detect any sound basis for such thinking, except that “we make the laws on the assumption that most people who work for money will do so through permanent paid employment” – scarcely conducive to innovation and change!

There is also an implied assumption in much regulation that “the employer is responsible” and by implication “the worker is not responsible”. Employment law (and to a great extent health and safety regulation) is framed to “protect” the employee against misdemeanour or default or carelessness on the part of the employer. It is mainly left to the civil or criminal law to protect employers against default on the part of employees. Employees are protected against losing their jobs unexpectedly, employers have difficulty protecting themselves against losing staff unexpectedly. Many high tech growth companies whose key staff have “walked off” and started a successful competitor might justifiably feel the employer needs protection against the employees. The classical stance is only justifiable if one assumes employers generally have the whip hand – they are large wealthy enterprises easily able to outspend and outgun the humble employee in court. It does not make much sense to the entrepreneur who has mortgaged his house to prop up his fragile company and take on three or four staff. The classical stance makes sense in a company engaged in Taylorist management of routine production activities in which the human work element is itself routine and where the employer does indeed make all the significant decisions. It does not make sense in a dynamic, market-led enterprise that is dependent for success on empowered employees and contractors making the day-to-day and minute-by-minute decisions they believe to be right for the enterprise.

None of this should be taken to imply “approval” of the new chaotic mix of work styles and relationships and disapproval of the old style of mass employment in large undertakings. My own belief is that the change is an inevitable social and economic development that can be positive if we understand it and work to help people to respond positively to it, but very damaging if we either ignore it or pretend that it can be

reversed or even delayed by some kind of "rearguard action". The change itself is neither good nor bad, what makes it good or bad is our response.

If we are to develop a European environment of high skills, plentiful work opportunities, innovation, entrepreneurship, growth based on small firms, acceptance and rapid deployment of new technologies, a high degree of individual freedom of choice of where and under what conditions to work, then presumably we need to start framing labour laws, health and safety regulations and social security provisions for a workforce that is as much out of "employment" as in it, where self employment is at least as acceptable as employment, where we recognize that the small firm is a fragile and fluid not a stable entity and cannot carry heavy burdens of responsibility for the general well-being of its teams - whether full-time, part-time, temporary or self employed, where unions focus more on services for their individual, self-determining members and less on representation of serried ranks of "wage slaves", above all where the individual is assumed to be self determining and responsible for his or her own working patterns and the exception rather than the rule is the individual who needs help in deciding how to work, or even what work to do, or may need "protection" from people (as much as companies) who will exploit his or her inability to make such decisions. Our present mechanisms tend to treat "not being employed in a stable job with a single employer" as somehow a defective condition; we need to recognize that it is becoming the "normal" condition for many people most of the time and for all people some of the time.

Of course, in the short term our problem is that we have not yet bred enough innovative, self starting individuals and that not enough Europeans are seizing innovatively the opportunities of the Information Society. A very large proportion of today's workforce have had many years of being led to expect employers (or unions) to make their decisions for them and are lost unless someone "provides them with a job". The unemployed, the underemployed and the about-to-be unemployed need all the help we can give them. But it is deeply cruel to pretend we can reinvent the era of mass employment in fixed jobs in stable companies, when all the evidence is against this. Telework is a very important aspect of the new styles of working. It is deeply influenced by technology. It most attracts those who are more inclined to be self motivating, self aware and self sufficient. It can lose work from Europe just as easily as it can help to generate new work opportunities.

Our efforts should surely err on the side of innovation and change in the approach to labour law, health and safety regulation and social security provision, rather than striving to conclude that "telework is not different" and "the existing provisions generally apply"?

I do appreciate that from a purist or academic standpoint it is easy (and defensible) to conclude "telework is not necessarily different", but I feel we are missing an opportunity if we emphasize the similarities and advocate the adequacy of the status quo, rather than taking the opportunity to probe for and surface the weaknesses in our inherited "environment for work". Telework is neither the cause of the changes nor is it the only symptom; but it does turn out to be an excellent domain in which to examine the issues and derive new policies.

We will get it terribly wrong if we concentrate on the protection of existing workers in existing "paid employment" against the perils of working at home rather than in an office, but fail to assess and respond to the implications of the "flight of work" from higher cost, lower skilled to lower cost, higher skilled environments. We will get it equally wrong if we "over protect" those who are still in conventional employment against the "risk" that they may have to move into some of the newer work styles - by doing so we would be perpetuating the myth that conventional employment is still the main and most attractive model on which to base our policies for work.

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### Relevance to transport and the environment

In 1994 I led an investigation for the UK Department of Transport into "transport-telecommunication substitution" [2]. The focus was on "local telework" among employed and self-employed teleworkers and our conclusions were approximately in line with those discussed by Jack Nilles elsewhere in this edition - except that our sample teleworkers were from a wider cross section of environments and were not participants in "experimental" projects. As might be expected, the sample had a much higher "prior to teleworking" commute distance than the average for the population as a whole and (in line with the Californian research) had not replaced many of their former commuting kilometres with alternative travel - "elective" teleworkers usually have "less travel" as one of their motivations! Another interesting finding was that the transport and environment benefits of local

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### Horace Mitchell

He has a long background working at the intersection of technology, the economy and society. With IBM in the 1970s he specialized in early uses of the computer in support of managers and organizations, later working on the application of expert systems technology to problems as diverse as matching people to jobs and helping engineers to cope with unexpected behaviour patterns in nuclear processing plants. In the mid-1980s he became an independent consultant, and now leads Management Technology Associates, a "virtual company" that works with governments, organizations and individuals to understand and apply the "open electronic networking" opportunities. Having "opted out corporate employment before it became fashionable", he believes the most profound change accompanying development of an Information Society is the shift from a culture of "jobs" determined by "employers" to "work opportunities" that offer and require individual rather than collective responses. He wants to see society accept and welcome this change and place much more emphasis on preparing and helping people to survive and benefit from it, rather than of putting (as he sees it) rather too much effort into defending the past against the future. He is also keen to see authors "sign" their work with an e-mail address to encourage personal networking – his is 100136.2412@compuserve.com

telework are motivators for teleworkers and for society as a whole, but our study showed that they are not prime motivators for employers – unless "persuaded" by fiscal enticements or punitive threats.

The link with our more recent work on the social and employment implications of telework is that the 1994 study suggested that employees who opt for telework are more likely to subsequently opt for alternative forms of employment contract or relationship – possibly because the "mind set" that finds home-based teleworking attractive also find alternative models of work relationships attractive. For the transport or environment planner, the implications of both sets of research are that:

- Any programmes designed to encourage telework as a transport-telecommunications substitution must address people who are in self employment and other alternative work modes, not just people in employment;
- Such programmes need to educate the employer (or in the case of self employed people, their "work customers" to "allow and facilitate" telework but focus motivation on the worker;
- Any strategy must also take into account the wider implications of telework, in

particular from a global environment standpoint the risk that work shifted from one part of the world to another might generate more commuting than it reduces, or by increasing affluence in the "work receiving" region, generate more total transport kilometres than are being saved in the "work losing" region, unless policies and strategies to invoke transport-telecommunications substitution as a whole are thought through and accepted at the global level.

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### Notes

- 1 This paper is based on research commissioned by the UK Government (Department of Trade & Industry), which was originally undertaken in 1991-1992 and updated in the light of experience and further research since then. On-line discussion of telework issues takes place in the Telework Europa Forum (accessible only to CompuServe subscribers – GO ECTF) and in the Telework@Mailbase discussion list (open to anyone with access to email – contact MTA for "how to join"). Additional material on telework can be found at the website <http://www.mtanet.co.uk/>.
- 2 For a summary see Website <http://www.mtanet.co.uk/>.

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# What about the workers? Teleworking and the trade union movement

Andrew Bibby Independent Journalist, Author and Confirmed Teleworker, UK

Offers some observations on the attitudes of the established trade union movement in Europe to the development of teleworking. Home-based teleworking may be a solitary activity, but teleworkers are, like the rest of us, collective animals with a need to come together, to network, exchange information and ideas and to defend their interests. Gives some possible solutions as to how teleworkers' needs may be met, including trade union involvement, although on first consideration their participation may seem unlikely. Gives details of formal, satisfactorily negotiated teleworking agreements, between trade unions and employers, from across Europe, including the UK. Suggests unions could rise to the challenge of new forms of working, by providing services sought by self-employed members, and that the old concept of solidarity could apply between teleworkers working at home and for their own businesses.

First, an anecdote. Second, an assertion. Third, the main aim of this paper: to offer some observations on the attitudes of the established trade union movement in Europe to the development of teleworking.

But first, the anecdote.

It is Christmas 1995 in the small town (population: 10,000) in the north of England where I now live. The pubs and restaurants are doing a good trade, providing venues for traditional Christmas office parties. But, for the second year running, one pub is host to a slightly different event: the Not-the-Office-Party, informally arranged by home-based workers who want their share of the festivities. All are welcome and about 30 turn up: computer people of various kinds, consultants, writers and editors, a trainer, a child-minder, several graphic designers, photographers and many more. And in between the introductions and the socializing, there is discussion of business tax, of the new local Web site, of VAT ... The evening ends, and the talk is of a follow-up event, a barbecue in the summer.

One pub event does not make a social trend, and for various reasons my small town is in some respects atypical. But my story perhaps makes the point that, though home-based teleworking may be a solitary activity, teleworkers like the rest of humanity are collective animals. Teleworkers have a need to come together, to network, to exchange information and ideas, to obtain professional services...and also to defend their interests. For this is the assertion I want to make: that teleworkers share common interests.

How are teleworkers' needs going to be met, and their interests defended? There are a number of possibilities. First, the services which they require may be (and are being) provided commercially. Second, teleworkers may develop (and already are beginning to develop) their own informal or formal organizations.

And thirdly, teleworkers may be able to turn to the organisations which traditionally have existed to defend workers' interests, the trade unions.

This may seem to some people to be an unlikely alternative. Leaving aside the institutional conservatism of some unions, it

could be argued that unions are by their very nature incapable of coping with recent forms of flexible working such as teleworking. The union movement in its present form emerged from out of the development in the nineteenth century of large-scale industrial workplaces, throwing workers together in an environment where joint interests could be clearly perceived and collective action undertaken with at least some prospect of success. How can this creation of a past industrial age cope with today's leaner, more casualized, more atomized patterns of work?

Certainly, the growth of teleworking poses organizational challenges to trade unions. There are, for example, obvious problems in recruitment, in collecting subscriptions, and in maintaining effective communication with members. There are severe logistical problems with undertaking any form of industrial action. Unions would seem to have good reasons to defend existing work structures and to oppose moves towards teleworking.

But in fact the response of many trade unions has been rather more subtle. The position now is likely to be a cautious acceptance that new forms of working can be of benefit to workers as well as employers. The motion submitted by the Danish Finansforbundet (FSU) and four other Scandinavian banking and finance unions, which was adopted at the 1995 World Congress of white-collar unions affiliated to FIET (Federation internationale des employes, techniciens et cadres) catches this attitude well:

For more than ten years computer-supported work outside the traditional workplace has been a practical option, so-called "telework", "teletravail". There are strong indications that the number of teleworkers will increase substantially in coming years...

Telework may be, on the one hand, a tool for employers to move work to geographical areas, where working conditions, salaries and collective bargaining rights are the poorest. But on the other hand, telework may be an interesting alternative for employees in certain phases of their lives, e.g. in connection with caring functions or as an attractive alternative to physical mobility due to structural changes (FIET World Congress 1995, *motion 44*).

A similar approach is suggested in a paper by a national officer of the UK white-collar union MSF:

Trade unionists are deeply suspicious of any extension of home based working. There is a long and discreditable history of, as well as on-going, exploitation of home workers. Whilst recognising the potential to liberalise the labour market many point to employers as being responsible for the rigidity of the current workplace and are scornful of the idea that they will be interested in liberating people from it ...

MSF has no illusions about this. There are good and bad employers and there will be those who will employ people on poor pay and in unsatisfactory conditions, without safeguards. However, for trade unions, a knee jerk reaction based on the experience of worst cases is not a sufficient response. Nor does it indicate the confidence that trade unionists should feel, in the basis of their record (Bill Walsh, MSF, *Teleworking - A Trade Union Perspective* (1993)).

Across Europe, there is now a considerable body of formal teleworking agreements satisfactorily negotiated and signed between employers and trade unions. In Germany, for example, the German Postal Workers' Union the DPG has recently negotiated a collective agreement with Deutsche Telekom, which will enable staff who undertake appropriate work to alternate between working from home and the office. In Sweden, the SIF union was engaged in 1994-1995 in discussions with the Swedish subsidiary of Siemens Nixdorf, which have led to the introduction of a major teleworking project for many of 200 or so staff who would otherwise have been required to work from a relocated head office outside Stockholm.

In the UK, telework agreements have been made, for example, between British Telecom and three trade unions, the Union of Communication Workers and the National Communications Union (now both merged into a single Communication Workers Union), and the managerial union the Society of Telecom Executives. The Banking, Insurance and Finance Union (BIFU) has negotiated a detailed teleworking policy with finance company Lombard North Central plc.

Interestingly, despite the different contexts, the same key points emerge again and again in these agreements. For example, the DPG/Deutsche Telekom agreement has been reported as follows:

It is particularly important that the status of the employees will not be affected in any way. The tele-homeworkers will remain Telekom employees and will not be pushed into spurious self-employment...

The agreement protects the voluntary nature of telework. No-one may be obliged to

engage in tele-homeworking; the right to return to work on company premises is guaranteed. Social contacts with the company must in any case be maintained... Working equipment will be supplied free of charge by the employer ("German Agreement on tele-homeworking", *PTTI News*, December 1995).

These issues have been formalized by the UK union MSF into a set of Telework Guidelines. They include the following points:

- Teleworkers should be employees of an enterprise, not deemed self employed.
- To avoid isolation, contracts of employment should require home workers to attend the office periodically.
- Teleworkers should enjoy the same rates of pay and employment benefits as office-based workers, including child care provision and family leave. There should be a defined number of working hours and teleworkers should be included in career development and appraisal schemes including training opportunities.
- All computer equipment should be provided, paid for and serviced by the employer ...
- Teleworking should be voluntary and workers should have the right to return to working from the office (*Teleworking - Code of Practice for Employees*, MSF, 1995)

This is all very well as far as it goes. But, as anyone who has examined the development of teleworking will be aware, companies which consider flexible working methods are often interested, in addition, in the possibilities of outsourcing, of reducing their directly employed labour force by putting work out to external contractors and consultants. Much of the growth in telework in recent years has been among the self employed, rather than through the set-piece telework pilots represented by the Deutsche Telekom, BT or Siemens Nixdorf examples.

The self employed are not in the same employee/employer relationship with which trade unions have historically concerned themselves. Just the opposite, indeed: the self employed are business people, running their own ventures. So while self employed teleworkers may find the need to join, say, business associations or chambers of commerce, why should they want to become trade union members? - where is the boss, where is the conflict of interest?

Trade unionists are increasingly pondering this themselves but, surprisingly perhaps, refusing to write off the self employed. Here, for example, is a comment of PG Svensson, a board member of the Swedish bank union

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### Andrew Bibby

A British writer and journalist, who has made a particular study of the issues associated with teleworking. His book, *Home is Where the Office is* (published by Hodder, London 1991), was the first practical telework handbook in the UK. His latest book, *Teleworking: Thirteen Journeys to the Future of Work*, was published in November 1995 by the Calouste Gulbenkian Foundation, London. He is currently researching trade union responses to telework for the international white-collar federation FIET. "My interest in telework began some years ago from direct experience since, like many writers, I work from an office in my home. In a global information society, my PC could be – almost – anywhere: it happens to be in one of the northern English valleys where the first Industrial Revolution got under way two hundred or more years ago." Andrew can be reached via [andrew.bibby@mcr1.poptel.org.uk](mailto:andrew.bibby@mcr1.poptel.org.uk), or the URL: <http://www.eclipse.co.uk/pens/bibby/telework>.

### Finansförbundet and himself a part-time teleworker:

The challenge for the trade unions in the future is a situation where you have to go out and engage also those who are no longer employed in the traditional sense. So far the white-collar unions have not wanted to organise the self-employed even though their professional work well fits in under a union branch area. I believe that it will be necessary to change this view if the trade unions want to continue to play a role in the working and community life (quoted in *Twenty Seconds to Work* by Lennart Forseback, Teldok 1995).

Very similar opinions were expressed at a labour movement conference on telework, held in Manchester in 1995. Here, for example, is MSF's Bill Walsh again:

The issue is one of...organising people who have no contracts of employment, who are self-employed and are in fact running their own small businesses.

The first thing unions have to do is to change their attitude towards these people and not turn their backs on them. They need all kinds of help: for example, they need advice on contractual arrangements and on their relationships with the people who provide them with services. They need legal support, insurance, tax advice, pensions, health and safety advice and information.. The trade unions...have head office departments which provide support to people in conventional employment. They now need to expand these services to other groups of people (quoted in conference report, *Working on the Infobahn, Teleworking and the Labour Movement*, 1995).

It is significant that in the months since that conference MSF has set up an internal Teleworking Interest Group (TWIG), which has begun to discuss the sort of information and advice services which it could provide to teleworking members. MSF already has the experience of servicing 2,000 members in its

Professional Sales Association, made up entirely of the self employed.

Other trade unions (particularly in the media and arts fields) have considerable expertise in dealing with self-employed members. For example, the National Union of Journalists (which despite its name operates in two nation states, the UK and the Republic of Ireland) now has about 25 per cent of its fully paid-up members running their own businesses. The actors' union British Equity points out that almost all its members ("at least 99 per cent") are self employed. The UK's latest official Labour Force Survey records that about 280,000 self-employed people (about 9 per cent of the total) declared themselves as members of a trade union or staff association (though this figure should be treated with a little caution, since it may include farm owners in membership of the National Farmers Union, a trade association).

So it may not simply be wage serfs who are signing up for union membership. Unions who rise to the challenge of new forms of working, and of providing the sorts of services which self employed members are likely to require, will find themselves changing. They may take on, for example, some of the attributes of the continental "assistance" tradition (such as represented by Mondial and Europ Assistance), with the provision of 24-hour helplines on legal and other issues.

But there will clearly remain a core philosophical area which will separate unions from simple commercial information and advice services. There is still the concept of solidarity – the idea that individuals who join a union do so not just to help themselves but also to help one another. Solidarity between teleworkers, working at home and for their own businesses? Talk about it over a few drinks together in the local pub, and perhaps the idea is not so impossible after all.



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# The city in 2050: how sustainable?

Andy Lake Home Office Partnership, Cambridge, UK

Looks at the evolution of new ways of working and the development of the information society, so see how these might affect the development of cities, and whether these developments based on the new Information and Communication Technologies (ICTs) will make cities more or less "sustainable". Rather than making speculative predictions, however, the focus is on the variety of factors that have influenced, and will continue to influence, the development of cities. Its approach is somewhat heretical, or at least politically incorrect, arguing that trends to greening the city will be only one among many competing influences, some of which may be profoundly ecologically unsound.

## Introduction

This article looks at the evolution of new ways of working and the development of the information society, to see how these might affect the development of cities, and whether these developments based on the new Information and Communication Technologies (ICTs) will make cities more or less "sustainable". Rather than making speculative predictions, however, the focus is on the variety of factors that have influenced, and will continue to influence, the development of cities. Its approach is somewhat heretical, or at least politically incorrect, arguing that trends to greening the city will be only one among many competing influences, some of which may be profoundly ecologically unsound.

## The city in 2050

Sixty years ago (1936) in *A Short History of the Future*, John Langdon-Davies predicted, among other things, that in 1960 people would work only three hours a day, every one under 21 would be in compulsory full-time education, the family unit would be obsolete and England would cease to be an empire and have the role of a garden and a museum. He also predicted that there would be no war in Western Europe in the next five years, and that Japan would fight the USSR.

A work such as this is interesting, in that you can see why, in the context of the times, the future would have been interpreted as taking such directions. In all probability, however, an observer from 1936 transported to 1995 would not suffer too much cultural dislocation: the demise of Fascism and Marxism might be surprising, but all in all the elements of continuity would probably be more apparent than those of discontinuity. Indeed in some parts of the world there may be a greater culture change in moving from a rural to an urban environment, than time-travelling 60 years in urban Europe.

Given the probability of being strikingly wrong about everything I could predict for cities in the year 2050, I approach this attempt at futurist thinking with some trepidation. The history of the future is littered with

unfulfilled prophecies – multi-level cities, personal jets, robot servants and the like, as well as premature obituaries for the phenomenon of work.

Even worse perhaps are the part-fulfilled prophecies of post-war urban planners. As I write, regeneration plans in Birmingham are seeking, as part of a Millennium project, to bring part of their raised road system down to earth, back to a human scale. I dare say that in 2050, the children and grandchildren of the present generation may be forming pressure groups and making bids for funds to take out all those tram systems restored to UK cities in the 1990s.

## Continuity and diversity

The twin themes of this essay are continuity and diversity. "Futurologists" market themselves by selling a vision of a different world. The twin faults in many of the assumptions that are made are in assuming a starting point that is insufficiently diverse, and analysing historical processes as if they have led to a culmination in the present state of things, rather than that our current situation and preoccupations may be something of a digression. For example, assuming that the future will be "green" may reflect more a political/cultural preoccupation of the 1990s than anything more substantial in terms of enduring social and economic trends.

One example of how present considerations inform theories of historical processes can be seen in the following summary of waves of technical change and their infrastructure characteristics (Table I), based on roughly 50 year "Kondratieff cycles" (based on neo-Schumpeterian economics) starting from the late eighteenth century (Freeman, 1995):

The dating and nature of the latter waves is admittedly speculative. However the sixth wave is a mixture of where we appear to be going at the moment, plus a good deal of where we would like to be. One has to ask what are the prospects for renewable energy if we find we can tap into, by around 2030, huge new and relatively cheap sources of non-renewable energy (whether under the oceans, on neighbouring planets, etc.)?

The other issue in looking at technological history in this way is that we tend to follow

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**Table I**

Summary of waves of technical change and their infrastructure characteristics

Kondratieff waves	Transport communication	Energy systems
1st industrial revolution factor production	Canals Carriage roads	Water power Horse power
2nd age of electricity	Railways (Steel)	Electricity Telephone
3rd age of electricity	Railways (Steel) Telephone	Electricity
4th age of mass production ("Fordism")	Motor highways	Oil
5th age of microelectronics and computer networks	Information highways Digital networks	Gas/oil
6th "green" techno-economic paradigm	Telematics	Renewable energy

very much a Western model, and assume its transferability to other areas of the world. The dating, too, of the cycles is very culturally specific: perhaps referring to a "leading edge" of technological-industrial innovation that, for all its power, directly affects the way of living of only a small proportion of humanity within the 50 years of the cycle. This kind of Procrustean analysis has severe limitations.

Usually it is also very culturally specific, assuming the dominance of Western forms of organization and production. Given the history of the past few centuries, this latter point is to some extent forgivable: but the economic dominance of the West has not by any means entirely shaped the evolution of cities throughout the rest of the world. It is interesting to note that in Marco Polo's time, if one wanted to find the largest cities one would have to go to the Orient. Similarly, the description by Bernal Diaz of the Aztec capital before the conquistadors levelled it, show it to have been one of the wonders of the world, which astonished the author with his European background.

#### Factors affecting urban development

It is not solely the workplace, property prices, and transport networks, (i.e. things which are more easily countable) which have shaped the growth of urban areas: the relationship of the town to its rural hinterland, the power of family ties, ethnic considerations, religion, politics, and other cultural factors all play their part.

To take some examples of this, one can compare the relationship of a French market town in a typical rural area to an English one: patterns of settlement are different, the economic roles are substantially different, and much of this is to do with different patterns of farming and land ownership in the two countries.

Another kind of relationship to rural areas can be seen in the role of worker migration. Just as in the development of many European industrial cities, workers in developing Third World urban centres often retain strong links with their families in villages back home. Family and tribal links are important, and the attitudes of their host environment too: racism and tribalism are frequently transferred to new urban centres and affect patterns of settlement, work opportunities, and the aspirations particularly of minorities. These factors also affect the spread of communications infrastructure, as does, more crucially perhaps, the gulf that exists in most cities between the wealthier and poorer citizens.

Gender roles – a factor affected by religious attitudes, among others – also affects urban development, and transport systems. Cultures where women are expected to stay at home most of the day, and where perhaps they are not expected or not allowed to drive will evolve different types of transport problems and solutions. Or changes in cultural values in such societies will have a transport spin-off effect. In the West, personal control over mobility has been an important instrument of women's emancipation, associated with advances in employment opportunity and greater choice (subject to income) in child-care and purchasing decisions. There is a trade-off here between social equity and participation on the one hand, and the protection of the environment on the other – a trade-off between sustainability objectives.

We need also to look at the changes currently taking place in rapidly developing cities across the world, where for the majority of the citizens involved in those changes the "information society" is barely on the horizons of consciousness.

Assuming the further development of the new information and communication technologies being one of the factors affecting the development of the city, we can then begin to look at how it will interact with some of the other influential factors mentioned above. For example, the interaction of cities with their rural hinterlands may well change, in those areas where there are high levels of commuting. But cities are likely to retain a role as regional or sub-regional centres for a variety of other services. However, the "flight to Colorado" is less likely to be the pattern for settlements where strong family or ethnic associations are still very culturally important. Decentralizing work from Sarajevo would involve more than technological considerations.

#### Diversity and the role of the state

Looking at the past 200 years, the factory model of production has been dominant, but has not been the only one. Arguably it has not been a unitary phenomenon either. Factory and intensive clerical work developed in the West mainly by imitation of (assumed) best practice; in the communist East it developed through state compulsion (building on Tsarist "state capitalism"), accompanied by slogans of modernity such as Lenin's "Communism = Soviets + electricity". In the "Third World", the development of such phenomena has been only sporadic, and remains incomplete.

One issue affecting the development of the information society is whether strong government or a more *laissez faire* approach will have the greater impact. The benefits of strong government are asserted in Singapore, which is bounding down the superhighway with its IT 2000 project. But generally the experience of authoritarian governments implementing modernization, for example in the former Soviet bloc, is that grand schemes entrench worst practice and stifle innovation and initiative.

On the other hand, at the appropriate level, authorities with the funds and the freedom to push through projects which are in their own interest have a higher degree of success. Local authorities wishing to stimulate the local economy and tackle their transport problems may in due course lead to a revival of municipal autonomy. By the mid twenty-first century, in many places, the national tier of government may be seen to be increasingly superfluous, acting mainly as a barrier to local initiative in an increasingly globalized economy.

National government may be at its most relevant when supporting innovation at local level. In France the Government is support-

ing numerous local teleworking projects, with a view to disseminating best practice. This is an approach adopted by the EC, too.

The EC also has a vision. Promoting teleworking in all its forms is one of the main priorities of the European Union: ambitious targets were set in the Bangemann Report, including the desire to have 2 per cent of white collar workers in recognized telework schemes by 1996, and 10 million people in such schemes by the year 2000.

It is one thing to have a vision, another to see it implemented. The indications at the moment are that despite major changes in the world of work, teleworking has not taken off (yet), and has had no appreciable impact on the structure of cities or their transport networks. For most transport planners, it is barely on the agenda.

The role of the state has hitherto often had a profound impact on the development of cities. Capitals, and major administrative centres tend to grow in different ways to other commercial centres. The need to locate, for reasons of influence, physically close to the corridors of power is likely to remain. But if power is slipping away upwards and downwards from the national tier, this may have an effect on existing capitals. New centres of power concentration may emerge.

One interesting irony at the moment, given the EC's promotion of teleworking, is the tendency of UK organizations, including local authorities seeking funds to promote teleworking, to set up office in Brussels. The virtual smoke-filled room may be some way off.

#### Changes in the world of work

Major changes are taking place in the world of work. The most recent survey of businesses' long-term employment strategies, undertaken by the Institute of Management and Manpower plc (1995), indicates that there is no let up in the pace of change. In this survey of the UK's largest employers, they found:

- over 70 per cent anticipate restructuring programmes over the next four years;
- over 50 per cent of employers anticipate that at least a quarter of their workforce will be complementary to the core in four years' time.

Flexible working practices have taken root and appear to be here to stay:

- teleworking and homeworking have been adopted by around a quarter of employers;
- over the next four years, 80 per cent predict an increase in flexible working;
- 68 per cent predict an increase in the use of teleworking.

Given this kind of data, and the current levels of interest in the information superhighway, distance working seems to be poised to come of age. These kinds of trends seem bound to have an effect on the way cities develop into the twenty-first century. As it says in *Mega-trends 2000*, "In many ways, if cities did not exist, it would not be necessary to invent them" (Naisbitt and Aburdene, 1990).

### Cities growing today

Then again, one needs to refer to other kinds of statistics, for example:

- four billion out of the world's population of five billion do not have a phone;
- in Latin America only Argentina and Chile have over 10 per cent penetration of fixed lines;
- China has only three telephones for every 100 people; and
- 600,000 of India's villages do not have a single phone.

Ironically, it may be the case that in 2050, unless communications infrastructure stretches out into the rural areas, it will be necessary to come into the city for "location independent" information society employment for most of the world's inhabitants.

The point is that in moving towards the "global information society", different parts of the globe are setting off from very different starting points. We can be sure that the destinations by 2050 will be many and varied, and in all likelihood embrace extreme inequality – just as it does now.

A recent conference in Manila on managing Asia's cities, the number of "megacities" in Asia – that is, with a population greater than ten million – will double by the year 2020. By 2015, Shanghai, Bombay, Beijing, Jakarta, and Karachi will join Greater Tokyo in having more than 20 million citizens. By 2020 Tokyo, Shanghai and Bombay will have populations nearing 30 million.

An Asian Development Bank study for the conference says that \$1,500 billion will be needed to finance the urban infrastructure over the next decade to cope with this. This being beyond the resources of governments, it will have to come mainly from the private sector. It seems unlikely that, given the scale of expansion, the infrastructure problems will be solved by the year 2050, or that the private investment needed will necessarily make sustainability a high priority.

One also cannot assume from current trends that people in cities in the developing South will make a great leap towards sustainable traffic solutions without going through other stages first. For example, in Egypt, passenger car sales have risen from 20,000 in

1992 to a projected 75,000 in 1995 (*Financial Times*, 1995). People, especially young people, aspire to car ownership for all sorts of reasons apart from the convenience of getting to work under their own steam. Perhaps even more important, the automobile industry is one of the world's largest and most powerful, and will not relinquish its role in the economy and society without a fight.

Currently one of the most ambitious transport projects in Asia is the Ove Arup scheme for an elevated transport system in Bangkok. This is for a dual carriageway, a mainline railway and a high capacity commuter railway running on different levels, with shops and offices beneath at ground level. It is scheduled for completion by the opening of the Asian Games in 1998. If it does go ahead, it will surely still be around in 2050. This highlights another historical factor for the future of "sustainable cities". In 2050, the transport systems existing and the transport solutions being proposed will not necessarily be those that the technology of 2050 could theoretically deliver. Like our cities today, they will be to a large extent the fruit of thinking decades earlier. And the more expensive the project, the more difficult it is likely to be for future generations to reverse it.

### Technological innovation and motor cars

In all probability, cars, of one form or another, are here to stay, and will be around in enormous abundance in the year 2050, and whether or not the oil has run out. It will in fact be a great challenge to policies for urban sustainability when marketable non-pollutant cars are developed. Much of the thinking on tackling urban pollution has to do with demand management, road-pricing, developing public transport and cycleways etc. A more significant blow against urban pollution, however, will come with the locally non-pollutant car, run by some form of electric propulsion.

The motor industry is now investing heavily in research in this field, sometimes pushed in that direction by legislation, but more essentially by enlightened self interest.

It is generally the case that new technologies do not revolutionize society, at least not in the short term. Diffusion of technology takes time, although modern communications reduce the time it takes. Inequality of wealth (whether of individuals or nations) remains a significant barrier to diffusion of new technologies. It is, however, typically also the case that new technologies are absorbed into the existing cultural structures until such time as they begin to transform them, a few generations on.

So, for an electrically propelled car to be widely adopted, one can expect that ease of “refuelling”, whether by, for example, super-fast recharging, or by exchanging lightweight high-powered batteries, will be a prime consideration. In all probability, this would take place at something remarkably similar to a filling station, still run by BP, or Shell, or Q8 – possibly Duracell (now a subsidiary of General Motors or Esso) – so the social and economic structures supporting autonomous motorized mobility could have changed very little. After all, charging up cars outside every house and apartment, with cables trailing everywhere, or storing one’s own (probably highly toxic) batteries, seem unlikely developments. And the production and distribution of energy for car use is too economically important simply to drop out of the picture due to pollution controls or the oil running out.

I foresee, then, no major changes in the demand for cars and roadspace for them, particularly in the new developing megacities, by the year 2050. Urban pollution from car traffic may cease to be an issue, but congestion will be. Without the pollution argument for sustainability, what will impel metropolitan authorities and their citizens to invest in sustainable transport systems? Essentially the pollution will have been shifted elsewhere, and will have less impact on the consciousness of the urban man and woman. It will be in someone else’s back yard.

This does not, of course, mean that urban authorities and national governments should not, or will not, grasp the nettle of “greening” the cities.

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### Doomsday scenario?

Consider the following:

Today’s pioneer telecommuters will be the pathfinders for a whole range of experiments over the coming years, the end results of which will be higher productivity, better management, greater job fulfilment, the blossoming of neighbourhood communities, and the silencing of those drear Dickensian footsteps [trudging to work]. Praise be (Kinsman, 1987).

Cities for a new millennium will be energy and resource efficient, people-friendly, and culturally rich. In Northern mega-cities, such as London and New York, prudent inward investment will contribute to achieving higher levels of employment. In cities in the South, significant investment in infrastructure will make a vast difference to health and living conditions (Giradet, 1995).

The potential for new ways of working to contribute to a better way of life and urban regeneration are well documented.

Another view challenges the necessity for the existence of the city at all. For example, a series of ironic articles in *Personnel Management*, the magazine of the Institute of Personnel and Development looked at the future of 25 years from now under the heading “News from 2020”. The lead article, entitled “Homeworking blamed for the demise of city shops, pubs, and traffic jams”, says:

With two thirds of employees now working from home, the campaign for communal working seeks a return to “traditional values”. It says homeworking is destroying city centre economies, with thousands of shops, restaurants and offices closing down. In a few years time, the idea of a drink with your colleagues after work will be a distant memory (*Personnel Management*, 1994).

This is sometimes referred to as the “doomsday scenario” of teleworking, and although it is perhaps the logical extreme of current developments, most pundits see it as being an unlikely development. However, if developments did move in that direction, what would be the consequences for the city? It has to be borne in mind, that were this flight from the centre to happen on any significant scale, the economic loss for the urban centres, could be to the economic benefit of rural and suburban centres.

Possibly (perhaps after a period of transition), lower central property values could once again make the city centre an attractive environment in which to live. The city, once again, could see greater integration of home and work.

To some extent this is already happening: in cities such as London and Cambridge, the beginnings of moves to convert offices into flats is detectable. Whether such trends develop into anything significant, with local services developing to sustain communities of (possibly home-working) residents, depends on a number of factors, including levels of business rates, planning controls, adequate policing, pollution levels, etc. One use for such conversions is student housing, which is often felt by planning authorities to be more appropriate for intensive mixed commercial/residential areas, with many evening venues for entertainment.

This highlights another function of the city, in bringing people together for recreational purposes. Many activities are less amenable to being delivered on-line (such as restaurants, theatres, ten-pin bowling alleys), although it is very unwise, given the rise, fall and resurrection of cinema-going, to predict

the impact of new tele-entertainment services on existing travel-and-see services.

### The mid-twenty-first century city

The argument thus far has emphasized pluralism, and the difficulty of assuming the dominance of any particular model of urban development given the varieties of input.

However, I can foresee the emergence of a number of different models of urban development, which could be characterized as follows:

- More of the same – cities which are congested, high energy consumers, and with large divisions between richer and poorer sectors.
- Cities which have moved a long way down the path of improving their environment, but where the improvements are concentrated to the benefit of wealthier residents.
- Cities where there is greater equality – either in relative poverty or, as is the trend in some European cities, relative prosperity, but where there is little collective will, or too much institutional or cultural inertia to move towards a more environmentally sustainable framework of living.
- Cities where serious attempts have been and are being made to live according to a “green techno-economic paradigm”.

It is interesting that the way of life of many of those in work in any of these models could be supported by environmentally costly activities located elsewhere. In particular, the greenest of cities could be the fruit of entrepreneurs migrating from unpleasant environments to more attractive ones.

In reality, many cities are likely to be mixes of each of the above, containing both pockets of deprivation and crumbling archaic infrastructure, and elsewhere “ghettos for the rich”, sustainable communities within communities with services supported by residents working largely from home, guarded by remotely monitored CCTV and, as a last resort, barbed wire.

### Conclusions

The essential conclusion of this article is that the city in 2050 will be a wonderfully plural phenomenon. If one takes a selection of cities, the diversity speaks for itself: Los Angeles, Edinburgh, Moscow, Sao Paulo, Lagos, Singapore, Ottawa, Freiburg. Or take an historical sample: Mohenjo-daro, Babylon, Rome, Timbuktu, Potosi. Reasons for the flourishing and decline of cities are also many. Cities within themselves, too are usually very diverse.

People come together in cities for a variety of different reasons, not only to work. Nor is it simply work, or access to work, which affects locational choices.

New ways of working, then, will have an impact on cities in 2050, but that impact will be more pronounced in some sections of some cities than others. New technology is as likely to be a force for continuity in the structure of cities (with more “intelligent” vehicles, telematics for transport systems, and new propulsion technologies) as much as a force for change. The reasons for access to city centres in the wealthier parts of the world may have changed, but the imperatives for access will remain, and, I suspect, personal preference and economic forces will combine to make personal motorized mobility still the first choice, public transport a congestion and poverty related alternative.

If this is not to be the case, governments and municipal authorities across the world must take serious action soon: tomorrow’s urban infrastructure is being built today.

### What is to be done?

I see little evidence from the past that our politicians will be able to deliver urban planning and transport systems that will create a sustainable future. But to be fair, given the range of factors cited above, their influence is limited more by external constraints than by their own vision or competence. But it is clear that we do need to build a framework for sustainability, and I suggest that the following are some of the keys.

- More urban autonomy is vital. Towns and cities themselves, rather than regional or national tiers of government have a better idea of what is in their own environmental interests.
- Local authorities need to build up a comprehensive picture, or register, of environmental interests and indicators to inform policy planning. Democracy is a generally effective mechanism for asserting interests, but one of the key of challenge is identifying “mute interests”, that is interests of importance but without a vote, such as wildlife interests and the interests of future generations. These latter are often the first to go overboard when it comes to any trade-off of interests.
- People must be allowed to defend their identified interests. Politicians and government officers are fond of talking of making “hard decisions”, including on environmental issues. But it is all too easy to create grand schemes which are in the “general interest”, and to go from

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### Andy Lake

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community to community decreeing that their particular interests must be sacrificed for the benefit of the whole. Often it is only that community who value a particular environmental characteristic or resource.

- The role of central (and international) government has to be to support local municipal activity, without being too prescriptive. Local authorities need to continue to network to compare innovative practice. This is beginning now in Europe, but in the UK the achievements are limited by flabby government guidelines, and the restrictions on local government activities and funding.

This is particularly the case with planning guidance asserting that people should work more at home or near home, only to leave it to local councils within their severely limited powers to work out how to achieve this.

Nonetheless I believe that this goal is right, and both urban and rural authorities must do all they can to promote home community-based working. It requires, for many, a transformation of attitudes. For example urban transport engineers in many European cities are working on schemes to improve public transport and promote innovative demand management schemes, and may be involved in EC-backed schemes in transport telematics; however, all too frequently they have not grasped the potential significance of seeking to transport bits rather than atoms.

- The promotion of teleworking, which local authorities can do as both employers and regulators/advisers, and the promotion of telebusinesses, and electronic networking of businesses, should be at the heart of economic development strategies. The effects of such a strategy must also be reflected in land use and transport planning; the old equations relating floorspace to employees to car parking spaces needs complete revaluation in the light of the new technologies.
- At a global level, there remains concern that developing industrial nations will exploit the difference in labour, health and safety, and environmental costs and legislation to undermine the development of the new information-related industries in the industrialized world. There is an urgency in pressing for comparable human rights, social and environmental

legislation across the globe, through mechanisms such as GATT, the World Trade Organisation and the UN. Hope for the economic underpinning of sustainable policies to a large extent may depend on the workers of the world receiving a fair day's wage for a fair day's work, and becoming a valued and active stakeholder in their local environment, which is to be protected and safeguarded for their children rather than to be ravaged for the necessary priority of subsistence.

Ironically, a workforce with well-protected rights and consumerist aspirations may be better situated to press for the safeguarding of (what is left of) their environment, if Western experience so far is any guide.

There is no single solution. Road pricing, carbon taxes, car-sharing lanes and other forms of regulation will all be tried in various places, no doubt. But the necessity is to keep the options for flexibility open, recognizing that the sustainable city will not be a Utopia set in aspic, but will itself evolve, and in all probability be the fruit of complex and often contradictory dynamics. And a dynamic, high technology economy is more likely to create the structures and provide the means for making the more environmentally sustainable choices.

Urban authorities imitating best practice will be a more effective means of diffusing the principles of and technology for sustainability. Green and *prosperous* cities are more likely to be the model for others: nothing breeds imitation as much as success.

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# Urban transport, information technology and sustainable development

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Discusses how four principles of sustainable development could be implemented by the use of information technologies in the area of urban road transport, namely: car pooling; dynamic route choice; extended public transport and a dual-mode system. Says it is important to open a broad public debate on the options and risks that come with IT, as in a democratic society it is the voters' preferences that create the framework for politics and IT development is ultimately a political issue.

## Introduction

The information society that so many talk about so freely, leaves us with a rather foggy image of the future. There are many possibilities. For example, we can think of it in more or less positive terms either as a future society where a good portion of the population is employed in the information sector, a society with a high information content (as economic value) in products, or as a C-community (communication/creativity/culture/cognition/complexity) such as it has been described by Åke E. Andersson. Or we can think of it as a world divided in two: of those that have information technology (IT) and those that do not. But whatever this society looks like – divided or not, just or not, efficient or not – it is sure that information technology and telecommunications are going to play important roles in it.

There is however nothing that guarantees that the move towards this information society is going to prove a positive development on broader human, social or ecological grounds. To ensure that this happens, we are going to have to come up with some kind of commonly accepted conception of what is going to constitute a desirable future – and a desirable development path toward that future.

This is where the concept of *sustainable development* enters the scene. Sustainable development can be seen as an over-arching policy goal. This goal has been defined and redefined on innumerable occasions over the last ten years since it was adopted by the Brundtland Commission on Environment and Development (WCED, 1987). Forty-one of these interpretations were listed in Morita *et al.* back in 1993. A forty-second interpretation is proposed in this article.

In order to realize the potentialities and risks of developments within the transport field, we in our group at the Royal Institute of Technology in Stockholm have felt it is important to engage in open discussions of where we want to go and why: consider, for example, an urban transport system loaded with information technology. What could it look like? What might be its use? What positive and negative impacts could it have? Do

we want it? In what form? Can we resist it? Has this anything to do with sustainable development? And what is sustainable development anyway?

Unfortunately I do not have the answers to all these questions. Instead, I will discuss how four principles of sustainable development can be affected by IT in urban road transport. Examples will be taken from an ongoing scenario study on information technology in urban road transport which is currently being carried out by my institute.

It is likely that what we call the information society will influence the way we organize transport dramatically. This can take at least two shapes: it can lead to changing lifestyles, with quite different travel patterns than those we know today. And it can come about as a result of new transport technology. The scope of this paper is concentrated to the latter of these.

## Four IT/transport scenarios for the future

In an ongoing scenario study at the Department of Infrastructure and Planning, Royal Institute of Technology, we have for the last eighteen months been investigating the prospects for information technology in an urban transport system. We have taken a scenario approach to our work. The scenarios – four in all – are placed in the context of industrialized cities and focus on passenger transport, but they could be extended to include goods distribution as well. It would be less straight forward to apply them to developing regions, since they all are technically rather complex.

A first set of technology scenarios were defined. One hundred experts from around the world were then contacted and responded to a detailed questionnaire coupled to the scenario descriptions. They evaluated the four scenarios (see below) with regard to technical feasibility, customer acceptance, market performance and long-term effects from a large-scale introduction of the scenarios. The scenarios, incidentally, do not exclude each other technically, but they take different paths to fulfilling the basic



transport mission. In actual fact, all four scenarios could be implemented side-by-side – but that would of course be very costly, while the benefit might turn out be limited since the systems and sub-systems would compete with each other. All scenarios include five basic features or building blocks:

- 1 State-of-the-art traffic control centres.
- 2 Route guidance systems.
- 3 Road pricing.
- 4 Smart cards.
- 5 Pocket terminals.

These are, however, used in somewhat different ways in the different scenarios.

Our four proposed “visions of the future” were as follows:

- 1 *Car pooling-scenario*: In this scenario, a traffic control centre matches orders from travellers who want a lift with drivers who want to give one. All communication goes through terminals connected to the centre. A route guidance system is used to direct drivers to the place where passengers wait. The driver is paid by the passenger for each trip with the use of a smart card and a card reader in the car. A card is also used to pay road user fees.
- 2 *Dynamic route choice-scenario*: In this scenario, the cost for each trip is calculated in advance by a traffic control centre. The fees depend on a number of factors (congestion, air quality, place). The driver is given the opportunity to choose between the cheapest and the fastest (more expensive) routes. If one of these is chosen the driver is obliged to follow instructions from a route guidance system and the charge is drawn from the smart card. The driver can also drive freely, but at higher road user cost. A pocket terminal can deliver information about projected costs and travel time before the driver gets into the car.
- 3 *Extended public transport-scenario*: In this scenario, public transport users can use a pocket terminal, connected to a traffic centre, to get information about possible connections between any two addresses in a region. The information contains approximate departure and arrival times, travel cost and changes. From the terminal it is also possible to reserve a cab or a rental car, in which cases a car will be waiting at the PT-destination. Road user charges for road transport are here used to encourage public transport use. Among other features for cyclists, a route guidance system for bicycles is included.
- 4 *Dual-mode system scenario*: The dual-mode scenario includes a fine-grained rail network and electric vehicles that can run

both on rail and on road. Trips can be made in a number of different ways (on road, automatic trips between stations in the rail network or combinations of these). A smart card is used for debiting the use of vehicles. It is also used for identifying users when a vehicle is hired. A traffic centre directs the flows on the rail network. User charges are lower on the rail network than on ordinary roads. Pocket terminals can be used to call for a vehicle when an automatic trip is wanted.

### First reactions to the scenarios

The reactions to the scenarios, as mirrored in the answers to the questionnaire, were varying. For example, one respondent’s comment to scenario 4 was “Too dumb (in 1995) to comment!” [1] and another respondent thought that “Dual-mode is a door-door own vehicle system which is in fact an ideal transport mode”. With this reservation I would nonetheless like to make a few observations on the answers to the questionnaire.

- Many experts thought that the car pooling-scenario would suffer badly in acceptance given that it required that people unknown to each other would have to share a car, and also that everybody that wanted to be a part of the system was identified. The idea of getting paid for picking up passengers was, on the other hand, given rather high ratings.
- The criticism against the dynamic route choice-scenario was edged at the complexity of the system and against some big brother-like control functions. The parts of the scenario that got positive responses were these dealing with traffic direction and parking.
- The use of information technology in the public transport-scenario was appreciated by the experts. The scenario got some criticism for being overloaded, especially some services for bicyclists were deemed as unnecessary. But apart from that this seems to be the way of IT-usage most of the experts liked best.
- The dual-mode system-scenario was criticized for the integrity loss that compulsory identification implies and for being unrealistic and extremely costly. A positive part was the opportunity for fully automated direct trips. A technical feature that was questioned was whether it is possible to balance supply and demand of vehicles.

The experts were in general very negative to all kinds of control and integrity violation suggested in the scenario descriptions. The

criticism is important and points at an often-mentioned risk with IT-development. A recent example from Stockholm can illustrate the fears:

A proposed zone-based system for charging road user fees has been criticized for failing to respect individual citizen's right to privacy. In that system cars that do not have a valid unit for automatic debiting would be photographed and billed afterwards. This is obviously a much lower degree of privacy intrusion than in the scenarios, and still it is criticized on these grounds.

It is not clear to me how this criticism should be interpreted. The arguments can just as well be based on a negative view on road user charges as such, that is the perhaps justifiable fear that the resulting tolls will substitute yet more big investments in road infrastructure. It is also difficult to know how numerous the critics are. Most travellers would, after all, get into the city incognito, since the normal way of getting there would be by using a car equipped with a special unit for automatic debiting or by public transport.

Another notion that can be made is that it may be easier to design less control-demanding systems on a smaller scale. Car pooling, without organized passenger-debiting, route guidance and matching, is already common in the USA. An easier way of implementing advanced car pooling would perhaps be to start from there, introducing the matching system at large companies' computer networks, or in locally based networks with a limited number of subscribers. Such a system would use IT as in the public transport scenario, i.e. for information rather than for control. This would lead to a higher degree of built-in social control in the system, possibly rendering compulsory identification of users superfluous. On the other hand, small scale is not a guarantee for integrity. I believe that today's large telephone networks provide me with a higher degree of integrity (unless I am wanted by the Swedish security police), than old-time switchboard operators did.

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### Information technology and sustainable development

It is obvious that IT will have a strong influence on future transport patterns, just as all societal changes have. It is however impossible to say what this influence will be like. Below I will present four principles of sustainable development and discuss these in relation to information technology and urban transport systems. Examples will be taken from the scenario study described in the previous section.

The examples must be read cautiously, since any scenario that manages to get substantially implemented will have secondary effects that are very difficult to foresee. These effects can be on the relation between transport modes, but they can just as well be on spatial development such as urban sprawl and the location of activities. For example the car pooling-scenario could make passengers change from public transport to car pooling, thus eroding the bases for public transport and leading to a higher amount of car traffic.

Sustainable development can be divided into four principles (Gudmundsson and Höjer, 1995), two of them relating to sustainability and two of them to development. These principles are:

- $S_a$  – Preserving natural resources for future generations.
- $S_b$  – Preserving the option value of human and man-made capital for future generations.
- $D_a$  – Improving quality of life for individuals.
- $D_b$  – Securing fair distribution of quality of life between individuals.

The natural resource principle can be divided into four criteria, dealing with non-renewable resources, renewable resources, biodiversity and ecosystems used as sinks. For transport the dependence on non-renewable resources at both the production phase and during the actual transport activity (traffic) indicate unsustainability. The pressure on renewables in terms of over-harvesting is close to zero, since renewables are hardly used at all in transport. Biodiversity suffers from landscapes being fragmented by roads. Ecosystems are used as sinks for a number of pollutants stemming from transport. This leads to a heavy stress on ecosystems.

There is nothing in information technology that triggers a major shift from non-renewables to renewables. Neither is there anything that says that pollution will fade out with increasing use of IT. However, the efficiency improvements that many hope will come with IT, both in terms of better planned routes and in terms of more efficient flows, can lead to a lower degree of negative impacts on these criteria. The scale of this change depends on secondary effects as well as on the degree and way of implementation.

Some completely new systems, using other fuels and possibly other raw materials in production, might be made possible with information technology. The dual-mode-scenario is an example of this. Here the effects do not come directly from the use of IT, but rather from the introduction of a completely new system where IT is one important

link. The type of power-plants used for electricity-production will be crucial for the overall effect of any electricity-based transport system. So, here other technologies will be at least as important as IT for total effects.

The second principle, preserving the option value of human and man-made capital of transport, is concerned with keeping the service that is provided by transport. This service is naturally nearly related to the accessibility to services and products and thus it includes possibilities to exploit remote resources and options to choose among a wide variety of goods. If this service can be provided by means that have smaller negative effects than transport, then we must take these other means into serious consideration, before we take major decisions on transport infrastructure enlargements. Thus, this principle is very closely related to the IT-use that is not discussed in this paper – the exchange of transport for telecommunications.

This second principle must not be taken as an excuse to lead society into a social trap where increasing capital resources are tied up to maintain mobility with decreasing marginal return. But it can be concluded that IT used for increasing physical mobility only, does not seem to be compatible with this principle. On the other hand, efficiency increasing combined with higher prices (possibly with the use of automatic fee collection), may be exactly the force that takes us out of the trap. Moreover, if IT can make the use of transport infrastructure more efficient and thus make further enlargements unnecessary, then resources might be made available for keeping existing infrastructure in good shape – which is another aspect of this principle.

The third principle deals with improvements of quality of life. The main negative effects of transport on well-being are casualties, noise, congestion and local air pollution. The benefit is a high level of mobility and a high variety of goods. It can be questioned if the current balance between cost and benefit is the one that gives the best overall life-quality.

The most obvious advantage with IT in respect to the above mentioned effects, is the possibilities for efficiency improvements that it holds. In principle, the same amount of traffic should be able to pass with less emissions, purely by controlling the flows with IT. These gains are most evident with the use of IT as in the dual-mode scenario, where IT is used to actually introduce a new transport system, with very low emissions. However, with electric vehicles or low-emission vehicles the benefits from the use of IT compared to non-IT diminishes in this respect. Another important example is of

course the substitution of physical mobility for access through telecommunications. In this case we would eliminate the negative effects of the trips that used to be taken completely.

But whenever the effects are reduced or even eliminated, one must be careful not to introduce *new* negative effects. We can see that these new technologies can influence the quality of life by introducing changes in the quality of transport. Among the most hotly debated parts of this change (in Sweden, at any rate) are the eventual impacts in terms of losses of privacy and personal freedom of choice. Other possible jolts are changes in travel costs and (as in the dual-mode-scenario) physical alterations that might be made in the urban environment. When it comes to the exchange of transport for telecommunications, it is also important to take the alternative use of time into account. (Time “lost” in transport can be highly valued by some. It may be the only time of the day when you can read, contemplate, exercise or get impressions from people other than those you already know.)

The last principle that needs to be considered is that of fair distribution of quality of life. It relates to the same elements as the previous principle, but here the question is one of the actual distribution of benefits and costs. Our test scenarios provide us with two examples that differ in principle. In car pooling and dynamic route choice, car drivers are given the opportunity to pay extra charges and continue the driving as before. Those who can afford this will also get the advantage of more room on the roads. The distributional effect of this will depend on how the collected fees are used. This is partly true for the dual-mode scenario as well, but here the public gain from the new network is (potentially!) strong. In the public transport and dual-mode scenarios, more resources are spent on systems that offer a general improvement in accessibility. The welfare implications in terms of mobility and accessibility, will thus be distributed among a larger part of the population, by the very implementation of the system.

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## Conclusions

Information technology is of course tightly bound up with many features of daily life and to the development of urban structures. Therefore it is important to open a broad public debate on the options and risks that come with it (*if*, and it is a very big *if* indeed, we can figure out a way to do it with real public participation and inputs and not, what I would call, “managed participation” or

“rote participation”, which unfortunately is what we see in most places most of the time under this otherwise glorious and generous label). The four scenario descriptions mentioned here had this in mind.

In a democratic society, it is the preferences of the voters that create the framework for politics. The development of information technology is ultimately a political issue, since it is likely to have a considerable influence on many people's lives. It is now in good part guided by international companies in whose interest it lies that people get a positive view on the IT-features they provide. But seen from a broader sustainable development perspective, this could lead towards a too short-sighted and narrow-minded development.

The concept of sustainable development should make us think more deeply about the long-term consequences of our choices. One way of doing this is to design scenarios of some crucial sectors of society.

So companies' influence on people's preferences affect and emphasize *short-term utility*, while if we take sustainable development as the goal this obliges us to consider things from a broader perspective and to emphasize long-term utility. The positions taken by politicians, short-sighted or foresighted, may have far-reaching consequences. They affect decisions on infrastructure investments, thus setting the boundaries for implementation opportunities for many IT systems.

Hopefully, the use of a set of solid explicit principles for sustainable development as a high-level policy goal can reduce the risk that important effects will be omitted in the decision making process. The idea of organizing the four principles in two sustainability principles and two development principles may help here, since it can help us spot the conflicts between short-term and long-term effects. This is a major objective of the concept.

Until quite recently the main thrust of public policy was to try to handle all traffic problems by building new infrastructure, but awareness of the limitations of road building has become widely spread the last few years (OECD, 1995). With the development of information technology and telecommunications, a new dimension has been introduced to transport and traffic planning. Road transport informatics (RTI) or Advanced Transport Telecommunications (ATT), is said to aim at higher efficiency, fewer accidents and lower environmental deterioration. But if the effect of building more roads is more traffic, why would increased efficiency on the roads be all that different?

The answer is that impacts from information technology depend on how IT is implemented – and on how it is connected to road user charges. If IT is used as in the dynamic route choice-scenario, i.e. for sheer efficiency improvements, but without the road user charges, then we may expect continuing increases in traffic volumes (the same “rose”, just another name), and thus in negative eco-impacts and, in many ways, on well-being. If this is going to be the strategy, then IT offers no advantages except more efficient traffic flows.

It may even lead to increased shares of car-traffic and to overall higher traffic volumes. This would bring society even further into car dependence.

The other scenarios represent different ways of changing the *character* of urban transport. Therefore the effects will be the same whatever charge is used, if they are implemented and adopted. Parking policies, traffic light adjustments, driving restrictions and changes in user attitudes are examples of other factors that can change the competitiveness between the modes. However, road user charges will be among the most efficient means of control, and thus the level of such charges will be crucial for the effects of using IT in urban transport systems. Other factors may be more important in an implementation phase.

The potential for privacy invasion in an IT intensive scenario is getting debate as well. We must not lose sight of the fact, however, that in this new world of end of century telecommunications, anyone who carries a mobile telephone can be traced as long as the telephone is in use or in stand-by mode. And the market for mobile telephones is of course exploding. This might suggest that the privacy debate is exaggerated. At the very least, it means that all new systems must be designed very carefully so that control mechanisms are not built into them unnecessarily. But the arguments from the critics should be observed closely. The privacy argument has become an argument against road user fees, but few would use that argument against mobile phones.

Finally, the theme of this special issue is “Information Society and Sustainable Development”. In this short article, I have only discussed the implications on sustainable development from the use of more advanced information technologies in the urban transport system. A question that quite possibly has even greater potential for changing the impacts of the transport system on sustainable development concerns teleworking – a topic which, happily, is well treated elsewhere in this special issue.

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Mattias Hoejer  
*Urban transport, information  
technology and sustainable  
development*

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Practice  
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### **Mattias Hoejer**

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It is my view as a non-specialist in this particular area (but as an active practitioner for several years), that telework and its many variants are going to have vast implications for how accessibility can be achieved. But for the scale shift from physical transport to electronic communication that is needed to move towards more sustainable transport to take place, *prices for transport are going to have to rise* (and further that the cost for each trip must become visible). This indeed could prove the most important contribution of information technology both to the transport system and to the more sustainable planet and life styles that we now need to move towards (instead of away from).

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### **Note**

- 1 The reader may be interested to know that this comment came from the guest editor of this

special issue who, we are pleased to report, was somewhat more helpful in commenting on the other proposed scenarios.

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# Oxtail: a true story

**Noel Hodson** Telework Practitioner, Specialist and UK Co-ordinator of EC Telematics Forum, Oxford, UK

**Describes the tribulations that befell a university-city's Traffic Engineer throughout his career, ranging initially from the conflict between the many cyclists, pedestrians, motor cars, to the polluted traffic-choked city centre that quickly evolved, aggravated by a motorway system that added thousands more heavy trucks an hour on to the ring road. Reveals how advice was always sought from a most unlikely source, and with hindsight shows that the advice given was not always good. Perhaps a cautionary tale?**

*A true story of one man's heroic quest to find his soul through chickens, goats and renewable, urban, modern, sustainable transport policies.*

Long ago, in the secret heart of England, holy monks settled in marshland scored by myriad rivers and streams, hard by a place where oxen might cross the waters in safety. They built Rewley Abbey, a scholarium, placed advertisements on the from page bottom right hand corner of national newspapers – *Improve Your Memory, Speed Reading in Fifteen Minutes, Speak any Language of Your Choice in Just Ten Minutes a Day*, and, *How to Run the Country* – and went into the education business. Safe from warriors and landlords in their damp fastness, the monks prospered and a city grew up around the Abbey. The city was called Ox-Ford.

One thousand one hundred and fifty-five years later, the City of Oxford appointed an eager, young applicant with an engineering degree from Aston University and a PhD in Town Planning from Reading Polytechnic, one Horace Yasucovitch Michael Ivanski Emmanuel Silverstson, or Hymies for short, as the City's traffic engineer. Hymies was happy and the City was pleased.

But, as one peerless Hilary term drew to a close, the responsibilities of the job started to take their toll and so Hymies sought guidance from his Rabbi, Ibn Ben Noyberger; a man of deep wisdom with snow white beard; who having coincidentally just returned on the *Queen Mary* after flying out on a jet aeroplane called a Comet to stay with his wife's sister's second cousin in Poughkeepsie, New York, had quietly learned much about transport.

"O Rabbi (Hymies used the Roman form of address as Oxford always requires), O Rabbi, to coin a phrase (which indeed he was, decades ahead of his time), I'm suffering from work related stress disorder" he shuddered; and the Rabbi could see from his pale and sweating countenance and the dark shadows under Hymies' eyes that this was indubitably so. He nodded, not unkindly, for Hymies to continue his story.

"The City is torn between 'Town', the traders, shopkeepers and citizens; and 'Gown', the dons, the colleges and the students. In years gone by, they fought and killed each

other..." (the Rabbi knew this to be true) "...and they still seem to be at war – so I can never please both sides," sighed Hymies heavily.

"I plan the transport to the best of my ability. I work hard. I try to do the best for everyone; but they complain all the time. All the time. It is killing me Rabbi. What should I do?"

"Tell me how it is with the transport now," suggested the Rabbi; for he wanted more time to examine the soul of this honest, hardworking, God fearing member of his congregation – to decide the best for his eternal development.

Hymies was eager to unburden himself, "Many of those from the University cycle everywhere. There are bicycles of every shape, size and colour, ridden by young, old, middle-aged, men, women, youths, ladies, fat, thin and some who are ... just right" he added meditatively. The Rabbi chussed him along; reminding him of his lovely wife and young children. Hymies shook himself and resumed. "The streets are full of bicycles, mostly University people. The citizens, mostly they walk. They complain they must walk. They come to shop at the covered market, they buy bags of food – and then walk to the bus stops. They say the bus stops are too far. Everywhere they walk they bump into bicycles. And they complain. Mostly to the Lord Mayor – Good John, the People's Friend. Then Good John shouts at me to get the University bums out of the sodding way (sorry Rabbi) of his upright and right-voting citizens."

"In turn," Hymies rushed on wildly, "everywhere the bicyclists go, they are hampered by overburdened pedestrians, blocking their way. The cyclists complain all the time too. They write sarcastic letters to the *Oxford Times*. They write witty, humorous, mocking letters to the *Guardian*, the *Observer* and the *Telegraph* – which get published and poke fun at Good John. They attend our public planning meetings which I Chair, and confuse me by quoting archane laws in Middle English, Latin and Greek. Worst of all..." , breathed Hymies, "...they write powerful letters to politicians – including the Prime Minister – in fact..." , Hymies's voice rose hysterically,

too upset to notice the Rabbi rocking slowly, his piercing gaze rapt on Hymies's hidden soul "...in fact, ...in fact... one of the cyclists is the Prime sodding Minister," he yelled. Then got control of himself and started to calm down.

"But whoever they are. They complain. There's a particular young lady student who complains more loudly and arrogantly and effectively than the rest put together". He ruminated darkly, "Her name's Margaret something or other ... and she needs watching that one. God help the country if she ever goes into politics. But they all complain. And I get it in the neck. Then there are the conspicuously wealthy in their new motor cars, Morris Oxfords, Austin Sheerlines, Morris 1000's and the odd Rolls Royce which have to thread their way through the cyclists and the pedestrians and the buses, of course. They complain - and come the St Giles Fair which blocks off half the main roads, they all complain all the more. The pedestrians complain about the cyclists and car drivers and complain they should have cars. The cyclists complain about the pedestrians and the cars and complain they should have cycle lanes. The drivers complain about the pedestrians, the cyclists, the buses, the road markings and the weather. It's Hell out there Rabbi - its just sheer Hell. Hell for me, Hell for all the road users, Hell for the residents, Hell for the shopkeepers. Just Hell, Hell Hell." Hymies nearly broke down - but didn't quite cry - not yet awhile.

"Hymies, Hymies," comforted the Rabbi, "don't distress yourself. There is an answer. But first we should speak of metaphysics. This is a most important situation with wide, wide ramifications." The Rabbi paused and almost frowned, then he continued. "We are here dealing with a university town. University, smooniversity, schooniveristy" he murmured, pleased to make rhymes which only he knew were valid or nonsense and which nobody ever had the temerity to question. "University" he suddenly said strongly "comes from universe. Universe is the whole of creation. We are dealing here, Hymies, with the whole of creation. Did you know that?"

Hymies had not known that and stayed silent.

"Universe means one-turn, Hymies. Did you know that? The whole of creation arose out of one-turn. Of what, Hymies? What do you think turned? It was what we choose to call God, Hymies. It was God who turned. Before the beginning of time. In the era when there was no-thing, there was also no resistance, no impedance. The energy that was God flowed, from nowhere to nowhere, in

no-time and there was no-thing. How does that feel to you, Hymies - stop for a moment and feel how that feels. Flowing along, anywhere you please, free, infinitely powerful, with infinite potential and unimpeded. It feels blissful, Hymies. It is what we call bliss. This is what all road users seek - unimpeded bliss. And bliss is not all that it's cracked up to be. So the energy created a resistance, it impeded it's own progress, Hymies. It made one turn, back on itself. And where it met its own infinite energy, a whirlpool arose and everything within the whirlpool began to spin. And each spinning zone was matter. And the Universe emerged and there was no longer nothing. Your problem Hymies, is of infinite importance and is taking place here in this special place, in this university town for cosmic purposes".

Hymies found no response to his sudden importance in logological affairs. A wiser man would have enquired further. Hymies put his metaphorical and metaphysical head in the sand and said nothing.

The Rabbi stopped rocking. "What you must do Hymies is this."

Hymies pushed his lower jaw back up to meet his upper jaw and listened attentively. He started taking notes.

"You must work even harder and ensure that the Oxford car factory builds more and more cars and cars that will last forever. This will not be easy - but you will do it. Then every citizen will have their own car. Believe me Hymies, this will happen. So you must start now to build a huge multi-storey car park in the centre of Oxford and all the citizens of the new car owning democracy will come in their thousands to enjoy the pleasures and sights of Oxford. Marginalize the bicycles. If they are stolen - ask the police not to look for them. If their front wheels are buckled by cars - sue the cyclists for damaging the car's tyres. Herd the pedestrians on to narrow pavements, harried and oppressed by the motor cars. If they step off the pavements, arrest them for jay-walking. If they don't step off the pavements, accuse them of obstruction. This is what you must do. Now get on with it and come and see me in ten years time."

Hymies never questioned the wisdom of what his Rabbi told him to do. He left with a new certainly and confidence in his step, to follow the Rabbi's advice.

Ten years later, Hymies was a shadow of his former self He no longer looked young. He no longer acted young. He no longer felt young. He looked wretched, he felt wretched, he was a persecuted wreck of a man. But as he sat in front of the Rabbi again, the Rabbi could see a soul that had grown and, with the right

conditions, which would one day flower. Had he asked Hymies if he wanted to flower, at the price being asked. The answer may not have been wholly in the affirmative.

"The traffic problems in Oxford are terrible," he bemoaned; without a trace of blame for the advice he had taken and followed – dare we say – religiously.

"Everybody complains more than they ever did before. There is nowhere to cycle, nowhere to walk that's free from the cars. Huge snorting European sized lorries lumber through the narrow streets, stinking of diesel fumes. Even bigger buses queue in endless lines to get up the High Street. Every side street is blocked by badly parked cars and motor bikes. The noise is awful. The air is awful. The journey times are twice as long as ten years ago. And everybody has a car. And they use them for tiny journeys. They're unfit, off work sick all the time. Their children have asthma and the fumes are eating away the Colleges' walls. And they all blame me. I'm a failure. A laughing stock in my own city. It is terrible, terrible," he moaned – and nearly wept. But Hymies hung on. He would not weep yet.

The Rabbi, jet lagged as he was having just returned from the new State of Israel where he had spent a rugged week on his brother's uncle's son's fruit-growing Kibbutz on the borders of wild desert lands, was nevertheless eagle eyed in his attention. His eyes, even sharper than ten years earlier watched carefully. He saw the universe swirling in Hymies' soul; which became the centre of that universe. He put up a solicitous hand to his less old than he was friend and told him that it would all get better – quite soon, but not until he had taken more action.

"Hymies. You have done well. You have followed my advice perfectly. All will be well, in God's good time. What you must do now is this. The City bus service needs to be thrown open to free competition. Companies will give cheaper fares with single manned buses. Let the free markets rage through Oxford. Make Cornmarket the main shopping area, a pedestrian only zone – but let in the cheap private buses to ferry the good citizens from shop door to home. Hire teams of grim faced, merciless traffic wardens to levy crippling fines on illegally parked vehicles. Say you will create bicycle lanes – but on no account do that. Create bewildering one-way systems in the city centre, make them mazes which would phase the Minotaur. Build a multi-lane highway right around the city at huge expense and make sure it is linked to the national motorway network. Encourage out-of-town shopping at dozens of sites on the ring road. Fit all official vehicles with nerve

shattering sirens so they can beat their way rapidly though the densest traffic. Continue to ignore the railway that has a route, largely unused, straight into the heart of the City. And ignore the wonderful canal that used to carry millions of tons of goods to the centre. Now go and get on with it, Hymies; and may God go with you."

Hymies, tired but unbowed, thanked the Rabbi and sallied forth to do more battle.

Another ten years passed. Hymies was now well into middle age. He still had his lovely wife and had seven children. Three strong boys and four beautiful daughters. He still had his job as Oxford's Traffic Engineer and there was no reason for life not to be good. As he dragged himself wearily; heavily and finally in the Rabbi's room – Hymies looked spectacularly and truly awful.

The Rabbi was well rested and alert from his recent trip to St Petersburg and Moscow, where he had had the very great pleasure of riding in an open horse drawn sleigh wrapped in great blankets. A system he would recommend to Oxford if only it ever snowed there.

As Hymies started to speak to the Rabbi – at last he wept. "Every road is full of traffic all day long. The motorway system brings thousands of heavy trucks an hour thundering round our ring road. The noise is intolerable. Some of them wander into the City for a detour and some sightseeing. They shake the foundations of the old colleges and the fumes have eaten away half of the stones facing New College. Criminals drive in, commit their crimes and are a hundred miles away before they are discovered. The privatized buses vie with each other for passengers in the pedestrianized shopping areas. There are so many and they leave their engines running – last year a child in a buggy chair died from exhaust fumes. They only have the driver, so as they manoeuvre round they cannot see what's around them. Old people too slow to jump aside are being knocked down daily. The bus drivers take the fares, all following traffic waits while this is done. It takes three times longer to enter or leave Oxford by car than it did when I started the job. Parking is impossible. Drivers fight in the streets for places. Cyclists are unprotected – accident rates have soared and many of them are deliberate, through road rage. Children must wear smog masks in the summer because the air is dangerous to breathe. This is all my fault. This has all happened during my time here as Traffic Engineer."

Still Hymies betrayed no sign of blame for the advice he had followed. Even *in extremis* his code and faith was unshaken. The Rabbi looked with both his earthly and his mystical



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Noel Hodson

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gaze. The first saw a sad and defeated man. The second saw a soul about to bloom. He, the Rabbi would provide the final intelligent, intensive energy for the buds to start opening. But he waited.

"It is all my fault and my friends and neighbours know it" wept Hymies. "Oh, they say nothing but in that nothing is the biggest guilt trip on the planet. I, the Traffic Engineer of Oxford for more than 20 years, have brought us to this chaos. Magdalen College say traffic pollution costs them over two hundred thousand pounds a year in maintenance. St Johns' bursar (the Rabbi knew that you could walk to London on land owned by the fabulously wealthy St Johns College – or at least you could if you find a safe way across the raging city ring road -- and that therefore the bursar was an important man on the earthly plane), the bursar says they fight a continuous war against exhaust fumes eating away the eight hundred year old stone work - eight hundred years it lasted for before I got this job – and I destroy it in 20", he sobbed and hid his face.

The Rabbi leaned forward a little. "Hymies" he said quietly. "This is what you must do". As he spoke, the Rabbi watched Hymies straighten and hold himself up with pride. He saw his soul open and burst into flower as Hymies arrived at the end of his implicit, tacit quest. With that special vision given to some masters in the spiritual realm, the Rabbi could see forward a few months, and the whole of Oxford was rejoicing as they carried Hymies shoulder high round the City.

"You must ban all the cars and buses to the edge of the ring road. You must make protected space for the cyclists and the pedestrians. Let the University cycle and walk and let the City cycle and walk in exhaust gas free streets without fear of being crushed by angry vehicles. The cyclists and pedestrians can mix freely in the centre. They will sometimes fall over each other – but they will do so thankful it was not a Mack Truck that hit them, they will embrace each other. You must build carefully planned cycle and walking to

allow people to move within, in and out of the City. You must equip the residents with bicycles, roller skates, and small electric cars and the visitors with cycles of different design. You must work with the merchants and local transporters to ensure that goods are delivered to the shops and residents in small, non-polluting vehicles. And finally you must work with the residents and merchants in order to restore the economic life of the City. Your guiding principles are first to eliminate unnecessary traffic and congestion, reduce travel distances, and substitute non-motorized for motorized transport wherever you can without destroying the economy of the city and its resident, Second, to reduce the weight of everything being transported – most is the weight of vehicles not the goods or people who are travelling, and in reducing weight you will greatly reduce energy consumed. And third, to immobilize all energy sources so their exhausts can be more easily cleaned – do you really need and want to cart one-and-a-half tonnes of car and 150 pounds of fuel with you when you travel the five miles from home to the library – no you do not – so find a way to leave it behind".

The Rabbi stopped speaking for a moment.

"Do this and it will make you and all the people of Oxford rejoice".

Hymies did as the Rabbi had told him and within a year he became the hero of Oxford. The University awarded him an honorary degree and the citizens, marking their pleasure at the clean air and safe travelling, carried him shoulder high round the Bodleian Library. Even College Bursars were rumoured to have been observed smiling – though this was never scientifically proven.

Needless to say, Hymies lived a long and useful life, had many grandchildren and, when it was time for his soul to unravel the no-thing that comprised his mortal frame, he travelled most sustainably on into the next realm in a state of unimpeded bliss.

The End.

# Sustainability in an information society: view from the European Commission

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Refers to the European Commission's support to an expert "working circle" charged with the task of clarifying the potential contribution of advanced communications to sustainability. There is growing public and political awareness that our economic prosperity and growth is unsustainable. The new constraints are environmental, associated with material use and transfer. Re-materialization, in the sense of reducing the amount of material extracted from, synthesized and dispersed into the environment per unit of GDP is therefore now the key to long-term sustainability. Warns that sustainability will not be achieved by Government-led legislative action alone, nor by European-level action alone; a much broader commitment to a common purpose is necessary – perhaps co-operation for a global information society?

The potential contribution a rapid transition to an information society can make to sustainable employment and growth has been extensively rehearsed in the Commission's White Paper on Growth, Competitiveness and Employment[1] of 1993. There is less discussion and understanding about the contribution that can be made to sustainability in environmental impact, materials use, energy use and transport, but the potential is not less important.

Two recent initiatives at European level will help to raise the issues in policy debate and research:

- 1 The Information Society Forum[2], set up as an independent advisory body by the Commission, has chosen to focus on "sustainable development, infrastructures and technology" as one of the six themes of its first report.
- 2 Building on exploratory research in 1994 and 1995, DGXIII of the European Commission is supporting an expert "working circle", which has been charged with the task of clarifying the potential contribution of advanced communications to sustainability. An attempt is also being made to explore the degree of common interest in industry and sustainability lobbies to work together to a common agenda and goals.

The background against which these groups must work is one of a growing public and political awareness that our economic prosperity and growth is unsustainable, even though we are not hitting limits to growth in resource depletion, the major concern of the 1970s. Energy resources are not infinite, but neither are they running out. In addition, our energy use affects the overall energy balance of the planet by less than 1 per cent. The new constraints are environmental and associated with material use and transfers: we have increased natural material transfers in the environment by over 100 per cent and released into it tens of thousands of new chemical and biochemical products, with often surprising results.

For example, ozone layer depletion is an artefact of industrial chemical use and release; greenhouse gas accumulation is a "material transfer" problem, more than an "energy use" problem; dioxin and DDT

legislations are responses to industrial and medico/agro-industrial material use.

"Rematerialization", in the sense of reducing the amount of material extracted from, synthesized, and dispersed into the environment per unit GDP, is now the key to longer-term sustainability.

## Dematerialization and the information society

Dematerialization can be realized by process improvement, product improvement, product to service conversion and structural change. All can be influenced by the information and communication revolution, but in different ways and to different degrees.

Process re-engineering management has been given a major stimulus by the emergence of multi-media information infrastructures. All the *Fortune* 500 multinationals have been through at least one "re-engineering" exercise in the last five years under competitive pressures to improve their use of skills and resources. While dematerialization and energy saving have not been goals, benefits have been realized and the business benefits and methodologies of re-engineering have been recognized and tested. If these proven techniques can now be applied with the goal of reducing material use and transport, further incidental business benefits will almost certainly emerge.

Product improvement has been driven by market forces and material technology: new materials, better suited to the product's function. But, the "information content" of products in terms of their market value has risen faster than their material content has fallen. Over 50 per cent of the market value of a car is related to its "information" content – through research, design, production and retail management. Even for a packet of pasta, most of its retail value is information related. In terms of their market value, most products can be substantially dematerialized.

With advanced communications, other products become services. A newspaper becomes an on-line news service; an instruction manual becomes an interactive technical advice service; cinema film reproduction and cinema chain management becomes a "video-on-demand" service in the home; a post-

operation recuperation institution becomes a medical surveillance service in the home. The dematerialization is evident.

Structural changes in the way markets are organized, in the way our transport infrastructures are organized and used, in the way we work and live; these are the hardest changes to stimulate. But it is here that the greatest benefits in sustainability are to be realized. The emergence of information infrastructures as the new element in economic and social development changes all the ground rules of an industrialized materialist society.

### Occupational and sectorial views of dematerialization

#### Information management

In the 1990s, most people work in information management: bankers, business executives, accountants, salesmen, secretaries, graphic designers, researchers. Of all activities, information services ought to be the easiest to dematerialize – but we tend to see only the tip of the iceberg: the piles of paper on desks. The bulk of the material iceberg is made up of the office desk, the PC, photocopying machines and photocopies, archives, the office building itself, with its marble hall, its restaurants, parking, the executive cars ... It is no good simply trying to get rid of the paper. It is not enough to dematerialize the French telephone directory through Minitel. Any real dematerialization must also cut into the bulk of the iceberg: it must “dematerialize” the office – at least per unit of business turnover. This may sound an incredible goal, but it can be done, and has been done – teleworking and “hot desking”; the office as a meeting place and occasional base for a nomadic and decentralized workforce is both an attractive business proposition and real dematerialization.

The champions of this idea are of course the IT companies: Digital, Apple, IBM, and others: Digital has pioneered the flexible office concept; IBM has saved millions of dollars in city-centre office rentals[3]. The insurance and the retail banks show another approach. The move to replace local branch offices, with a larger network of Automatic Telling Machines, is already a substantial dematerialization of the retail branch network. The move to direct banking over the phone or Internet takes the process even further – here you already have a “Factor of 10” in dematerialization of a business process.

#### Material goods wholesale and retail

If information management is an “easy case”, let us look at some tougher problems. The “end-point” of material production is retailing

– buying food, cleaning products, clothes, shoes, and “do-it-yourself” products account for over 90 per cent of everyday purchases. Again, we tend to see only the tip of the material iceberg – the food itself or the pair of shoes, and since you cannot dematerialize food or shoes, the immediate reaction is that there are no opportunities for dematerialization. However, this is not true for the bulk of the iceberg.

Recent trends in retailing has increased the material iceberg of retailing: large hypermarkets, with large car parks have considerably increased the traffic associated with shopping – people “commute” to hypermarkets in the same way they commute to work. The stores themselves, with their car parks, restaurants and access roads, use more materials (building, plumbing, wiring and packaging) per unit sold than ever before. Even worse; this has not been associated with any reduction in traffic and infrastructure associated with provisioning the stores. Global provisioning, with over 10,000 separate items has increased customer choice, but has increased material use and the environmental impact of the production, wholesale and retailing process.

How can information infrastructures reverse this trend? Are we addicted to ever widening global choice? Are there ways to dematerialize some of the retailing iceberg? Better organization of provisioning chains is one: it makes no economic sense to truck potatoes from Germany to Italy, to truck them back as crisps and chips. It makes no sense to fly fresh flowers from Israel to Amsterdam auctions, to fly the flowers back to Italy, or even to Tel Aviv for retail.

Video auctions and better logistical management, through better information to all parties concerned can catalyse a considerable rationalization. At the customer’s end, tele-shopping can preserve or expand choice and substitute delivery of a 20kg part-load to a home for a 20km round trip of one or two people in a 1000kg vehicle, with all the parking and building space implications that go with it. Of course, tele-shopping may never substitute for the social experience of “entertainment shopping”, but it is already making big inroads into “chore shopping” in California.

#### Transport

The second most important purchase people make in life is a car (or a sequence of cars). Can you dematerialize a car with information and telecommunications? Better design can help – lighter bodies, more efficient engines, but the gains are more than off-set by the still growing level of car-ownership – technological

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progress has made cars more affordable faster than it has dematerialized them.

Perhaps more radical progress can be made by concept changes: new types of vehicle that fill the gap between the car and the bicycle; new ideas for resource sharing that fill the gap between ownership and rental – perhaps smart cards to allow self-use of minicabs in cities; that fill the gap between public and private transport. However, no single organization, whether a vehicle manufacturer or a city transport authority, can act alone to make these concept changes viable. Collective and co-operative action by public and private-sector bodies is the only way to structural and conceptual change.

Shared-use may be the single most effective way to dematerialize personal transport, but it still presumes that physical transport of goods and people is necessary. Virtual presence at a distant location, with high-resolution colour, and 3D imaging, CD-quality sound and even manipulative remote control is within our technological grasp, but will be expensive for many years to come – but no more expensive than buying and running a car. Can people and businesses be persuaded that high-quality and high-functionality virtual presence is as much or more a status symbol and expression of their individuality as owning a 3-ton Mercedes? Video-conferencing will not eliminate use of a car; but it can dramatically reduce it.

But beware: not all uses of informatics and telecommunications will contribute to sustainable development. The transition to an "information society" may well offer new opportunities for dematerialization in the transport sector, but it can also make things worse. If telematic systems for route guidance and anti-collision assistance only result in more cars on roads; if better designed and cheaper cars make individual car ownership viable for more of the world's population, the net effect will be to accelerate our rush to a precipice of social and environmental crisis.

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Are self-interested concerted actions the way forward?

Achievement of sustainability cannot be imposed on our societies by Government decree. We are all familiar with the political difficulties of following up the Rio Earth Summit through supplementary energy taxation and legislation on recycling and waste. Genuine and substantial progress towards sustainability requires that all major interests push in the same direction. We all "own" the problems of unsustainable use of materials and abuse of our environment. We must all contribute to the solutions.

No one individual organization can act alone: no individual or retailer can decide to introduce tele-shopping; no flower producer in Israel can decide to offer his products in video-auction rather than in Amsterdam; no individual or company alone can make any impact on congestion in city traffic by tele-commuting. Only collective commitment and action by substantial groups of organizations – in both the public and private sectors can be effective.

And everyone must benefit, not just in the longer term through a better preserved environment, but in the short term in business efficiency, competitiveness and in individuals' "quality of life".

This was the goal behind the consultation by DGXIII on a draft "Memorandum of Understanding": can we find a set of common principles and goals, which businesses, public authorities, non-government organizations, and even influential individuals can sign up to – voluntarily? A framework for co-operation that reflects their own short-term interests, as well as longer-term societal interests.

The essence of European action is co-operation: common objectives and a framework in which diverse interests can pursue their own interests in the common good. The frameworks of European research and technology development, and the Information Society Forum are there to be used. However, these frameworks must be filled by concrete proposals from the "champions" of new ideas: the Commission itself cannot be the driving force, except in very specific areas such as the single market, or European Monetary Union where all member states agree on the goal and it can only be achieved by coherent legislative and policy action at EU level. Sustainability will not be achieved by Government-led legislative action alone, nor by European-level action alone. A much broader commitment to a common purpose is necessary. Perhaps co-operation for a "global information society" is the context we need.

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### Notes

- 1 "Growth, competitiveness and employment: the challenge and ways forward into the 21st century", *Bulletin of the European Communities*, Supplement 6/93, December 1993.
- 2 A forum of 128 people from all walks of life, called together by the European Commission in July 1995 to advise the European Parliament, the Council of Ministers and the Commission.
- 3 Telework 94 – "Telework new ways to work", *Proceedings of the European Assembly on Teleworking and New Ways of Working*, Berlin, 3-4 November, 1994.

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# Who said we wanted an information superhighway?

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Looks at the possible directions in which the information superhighway could take us, considering both the benefits of increased knowledge and subsequent increased participation and also the dangers such as the excess of raw information. Suggests that this information needs to be structured and packaged if it is to have a positive effect. Considers these points in a global sense in terms of humanity as a whole.

Maybe what we need is knowledge-based country roads

The growing number of mega-mergers in the information and entertainment field across the world demonstrate the potential companies see in developing the information superhighway. The speed of developments is dizzying. Even those in the field know they are not keeping up. Our imagination and creativity have lagged far behind our technologies. We can today find a way to do almost anything we can imagine. We must learn to ask what is really worth doing in a world where environmental limits increasingly constrain our sustainable options.

As societies develop effectively unlimited productive and destructive technologies, we face two very different scenarios for the future. One of them will enable people to participate more fully than ever before in the decisions which concern them. It will provide them with knowledge about their real choices. It will permit them to be part of collective decision making in ways undreamed of in the past: the phrase "government of the people, by the people and for the people" could take on new meaning. For example, a citizen's group is coming together in April of this year to design an "economic bill of rights" and the potential of the Internet may mean that its voice will be broadly shared.

A growing number of people share this more inclusive dream. But it would be naive to assume that this is the "probable" direction for the information superhighway. There will have to be many profound shifts in our mind-sets if we are to benefit from the potential rather than be overwhelmed by the dangers. These dangers include a growing gap between the rich and the poor as those with poor educational skills and lack of access to computer systems are further isolated from the mainstream.

This trend is already underway. A recent four-part *New York Times* article showed how people are having to fight harder and harder to maintain their standards of living. One of the profiles discussed a family with four children and four part-time jobs which still provided a much decreased income: this strategy was essential because good jobs with

benefits could not be found. I talked frequently with individuals graduating from high-school and college. This fear is unfortunately all too justified. MBAs are driving taxicabs. Skilled workers are serving at McDonald's and other low-wage jobs.

But the discussion is not limited to the USA alone, it is rapidly becoming global. The problem is that decision making is lagging far behind understanding. Even when the issues reach the election process, the rhetorics are so confusing that the public cannot really understand what they are being asked to decide.

What are the dangers? The first is the most obvious. The amount of information available continues to increase at incredible rates. This is normally seen as a benefit. I, on the contrary, see this as a profound problem because when information doubles, knowledge halves and wisdom quarters. We are overwhelmed by the sheer weight of data. Both individuals and organizations fail to make the time to process it. We see decisions being made without reflective thought.

Raw information is not useful. We need to find ways to structure information so people can access it. The user needs to be able to find what they need, when they need it, in a form and at a level which is useful to them. People should think through questions rather than throw more and more data at them. Failure to do so increases the danger that we shall continue to persist with obsolete policies rather than commit to re-examining them.

We need to invent new ways of packaging knowledge and wisdom so that it is accessible. This is an area which has preoccupied me for years. It is surprising to me how little attention we have paid to this area being content to use obsolete forms of communication.

The second problem is closely related. Most of those controlling information systems are specialist professionals. They tend to use their own unique jargons which are not understandable by the general public. All too many of them look down on the average citizen and assume that the only hope for the future is for the "experts" to take control: all too often one hears "Joe Blow cannot hope to understand these complex issues." My belief

is that it is only as committed citizens become involved that we can hope to make significant progress.

People who are concerned with achieving fundamental change seem to moving in two directions. Some are becoming more didactic as the gap between what "should be" and "what is" widens. Some, like myself, and the group of people behind this special issue of *World Transport Policy & Practice*, are spending more and more time drawing citizens into the dialogue. Throughout the world efforts are being made to discover how people with radically different views can learn to hear each other. I am convinced that it is only as people talk at significant levels that appropriate directions can be discovered.

Perhaps our most serious problem is that the very rhetoric of the information superhighway draws our attention away from the design level which is most crucial. How can we structure information so that it serves communities, whether they be geographical, professional or linked by a shared interest? I believe that the challenge of developing communication systems within communities poses more complex, and immediate, problems than the information superhighway. Such efforts as the "Freenets" in place in many communities offer opportunities to explore positive directions.

The interstate highway linked existing road structures, ensuring rapid movement between them. The pattern with the information superhighway is very different. We are building it before we have a local knowledge system in place. We therefore risk reinforcing an already existing pathology of looking outside our own systems for the ideas we need rather than finding competence within our own communities: we look for experts in a world where the very concept of "expertise" is obsolete. We also risk drowning people in entertainment, consumerism, gambling, violence and, indeed, pornography which will be the core directions of the commercial offerings now being developed.

Decisions about the information superhighway are not therefore only, or even primarily, professional but rather philosophical and even theological. What sort of society do we believe will ensure a high quality of life?

There is an even more basic question. It is time to ask what sort of society will ensure survival. Our current information systems are based on controlling access to information and knowledge flows. We must revolutionize our thinking so that everybody can find the knowledge they want at the time they need it in a medium which they find attractive and a level they can comprehend.

We need an accessible knowledge system based on the fundamental values of honesty, responsibility, humility, love and a respect for mystery. It is only in this way that we can hope to think clearly about the radically new questions which have emerged as a result of our effectively unlimited productive and destructive power. This knowledge system will help people resolve their individual, family and value questions on the basis of current reality rather than an imagined past.

Decisions about how we use the potential of communications and the computer will shape the twenty-first century world just as our decisions about the automobile faced the twentieth. We need a far higher standard of understanding if we are to prevent unintended consequences as severe as those which were caused by the dominance of the automobile. It is the responsibility of everybody who cares about the future to understand this issue which will play a pervasive role in shaping the universe of our children.

A lot of the material I raise above is common to the other essays which appear in this volume, although it is in no sense a summary of what has been said. There is, however, a further issue to which Eric Britton referred in his introduction to this journal. Why, if we know so much, are we so ineffective in changing the nature of the debate in societies around the world?

I was brought up against this issue sharply in January of this year. In 1965, I produced a series of interviews for the Canadian Broadcasting Corporation, which they have decided to rebroadcast as part of their thirtieth anniversary celebrations. I did not know whether to be pleased about how much I and my colleagues knew back then, or to be frustrated by how little I seemed to have learned since. Confronted with the unwavering evidence of the recorded past, I was forced to ask what I had been learning over the last 30 years. I decided that although I have some greater clarity in terms of the directions which I believe are needed, it is all, realistically, only incremental to what I and many others knew way back then. What I think I have gained, perhaps, is a far clearer sense of what is going to be necessary if we are to have any chance of changing the dynamics of the culture before it collapses around us.

In a profound sense, we need to "be" the change we wish to bring about. We need to alter our behaviours so we model what we want to see happen. It is not enough to talk about the new behaviours that are needed: what we need is to act in ways which people can perceive and copy.

Those of you who remember the Old Testament know that Moses brought his people to

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the promised land but was not permitted to enter it. We, on the contrary, seem to me to be blocking ourselves from the new behaviours and directions which are required.

We face insurmountable opportunities. To deal with them we must change in four areas:

- 1 *Communication skills*. We need to think about the message that those with whom we are talking can hear and perceive – rather than what *we* think is most crucial.
- 2 *Collaboration*. We need to recognize that we are all part of a much larger movement, and that, while our particular area is most critical to us, it is only a small part of the overall dynamic. We also need to face the fact that our understandings are limited and partial. The Internet provides the potential for new, powerful, lateral forms of organization which rely on the exchange of knowledge. They can bypass governments which, in most cases, are determined to maintain their power.
- 3 *Commitment*. We need to recognize that fundamental change is essential if we are to preserve the quality of life for the “seventh generation.” Indeed, our own lives

will be negatively impacted unless we take advantage of the potentials of our time. It was argued at the time of the American Revolution that people had to be prepared to pledge “their lives, their fortunes and their sacred honor” to the cause. We need the same level of commitment now, but it is our lives, and not our deaths, which are required.

- 4 *Courage*. And in the end we need to have the grit to stand for the moral virtues but to recognize that they have to be used as a compass and not as an anchor. None of us know what the future will, or should, bring. We have to invent it together.

The Internet provides the potential for a new form of collaboration towards a creative and successful future for the planet. I personally live in two universes. I know how negative current dynamics are and how powerful the forces of inertia are that are holding us back from change. The “probable” future is disastrous. I also know that, if there are enough people who want change and are ready to do their part, it could be achieved with extraordinary rapidity.