TELECOMMUNICATIONS AND TRAVEL

Substitution or Modified Mobility?

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1. INTRODUCTION

One purpose of travel is to exchange information. The interaction between travel and information technologies in the last two decades has induced a gradual recognition that both physical transport and telecommunications are subsystems of a communications system.

In the "post industrial" society described by Daniel Bell (1979) or Nora and Minc (1980), manufacturing and service activities are being replaced by information industries. The generation, processing, transmission and management of information already occupied 53.5% of the total employee compensations in the US in 1967 (Porat, 1976). This change in human activities is both accommodated and stimulated by a very rapid development of information technologies.

In this development, four trends seem important: a growing production of information, followed by a growing consumption thereof, a growing popularity of information processing and telecommunications machines, and increasing social costs (particularly energy) associated with travel. Particular interest attaches to the relation between travel and telecommunications. Is substitution or complementarity predominant?

This paper starts from the proposition that human beings are mobile animals. Hagerstrand (1984) has recently stated that "to be immobile is a disaster for the individual". The human drive or desire to move about will, it is hypothesised, offset most, or at least a large share, of the travel that will be superseded by telecommunications. Therefore, the total effect of telecommunications on transport is likely to be a modification of travel patterns rather than a reduction in demand for travel.

As there is scant empirical evidence on the relationship between travel and telecommunications, the approach employed in this (and many other) articles

* Institute of Urban and Regional Studies, The Hebrew University of Jerusalem. The author greatly appreciates the support of the Mauricio Richter Fund for this research.

† This is the prizewinning essay in the Third Essay Competition organised by the Rees Jeffreys Road Fund through the Journal of Transport Economics and Policy.
is to provide circumstantial evidence. An assessment of the relationship between transport and information technology is based on an understanding of travel behaviour, and relies on concepts borrowed from social psychology. The paper stresses the need for research on behavioural factors underlying mobility, as a necessary part of the assessment of the impacts of information technologies on transport. Lack of that research may lead to a society which uses sophisticated technologies entailing high social costs.

The technology of telecommunications and its possible applications will not be described here, as it is documented in a growing body of publications (see, for example, Martin, 1978, 1981). We must, however, note that recent developments in the technology are a decreasing cost per feature and "user friendliness", so that the technology is accessible to a growing proportion of the public.

Section 2 of this paper reviews the types of interactions between telecommunications and transport which have been noted in past research. Decisions on the use of either mode of communications rest on criteria for individual users and business users. Therefore, section 3 analyses the possible interactions in individuals' travel, especially in travel for recreation and social purposes, and looks into the effects of an information society which satisfies many needs by a home push-button. Section 4 describes possible interactions in the business sector. Conclusions and some proposals for future research are given in section 5.

2. INTERACTIONS BETWEEN TRAVEL AND TELECOMMUNICATIONS

The literature so far published has raised two basic types of interactions between the two communications systems. The more popular is substitution. It assumes that the more advanced and widespread the telecommunications system becomes, the smaller will be the demand for travel. For a constant content of communication there will be, under this type, a diversion of traffic from physical movement on the transport system to movement of information on telecommunications networks.

The "telecommuting" concept — that people work from remote sites, eliminating the need for the journey to work — is a common example of substitution (see SRI, 1977; Pratt, 1984; Toffler, 1981). Another is teletext, which provides information services to the home or business without the need to travel to acquire it. A third popular example is the use of teleconferencing, trading-off for business travel.

The popularity of the substitution hypothesis stems from its attractiveness to the general media, and possibly from its promulgation by agencies with vested interests. Darwin (1982) states that "By the time the general business media report on telecommunication and travel, limiting assumptions and conditions of the original research often have been downplayed or even ignored in favor of the dramatic result. For example, an original report may have concentrated on one type of business travel, but later reports simply refer to business travel in general, or worse, just 'travel' " (page 12).

The second type of interaction is that the two systems complement each other. Complementarity is interpreted in two ways, which in fact comprise two distinct
types of interaction. The first, according to Meyburg (1983), is that one system increases the efficiency of the other. For example, roadside emergency telephones, which may reduce fatal accidents, increase the efficiency of the transport system by reducing its social costs. A more sophisticated use of telecommunications technology, with a similar purpose, is the experimental Electronic Road Pricing (ERP) system in Hong Kong (Dawson, 1984). That may solve the technical problems which for many years have hindered the collection of congestion charges which would make possible an efficient use of the road system.

Under this type of interaction the amount of travel is affected indirectly by the volume of the flow of communications. For example, unnecessary trips will be eliminated as better coordination is achieved (Campbell and Thomas, 1981).

The second type of complementary interaction, more consistent with the economic sense of complementary products, is that an increased use of one system causes increase in the use of the complementing system. For example, the introduction of a telecommunications system which makes possible the generation and maintenance of social or economic interactions between individuals or businesses located in different places may increase the travel between the two locations (see, for example, Clark and Unwin, 1981; Johansen and Bullen, 1984).

The literature on the interactions between transport and telecommunications tends to emphasise one type and either ignore or attach little importance to the others. Despite sporadic evidence, we lack knowledge and understanding of the contextual circumstances which give rise to particular interactions. Therefore, any attempt to generalise and state that the effect of information technology on transport is of a single type is at best premature, if not false.

Not only are the interactions different in various contexts: there are also methodological problems in measuring them. Ideally, a time series analysis of traffic statistics on both communications modes could reveal the types of interactions taking place. But aggregate statistics are influenced by a myriad of intervening factors, so this course is not promising. Studies of disaggregate data can lead to a greater understanding of interactions between the two systems, but in limited contexts. The analysis of individuals' choices between the two modes of communications is complicated by the problems of measurement of the content of the information transmitted by each mode. Hence, despite the greater promise of this methodology, it still does not yield generalisations.

For reasons we will discuss below, the impact of telecommunications technology on the transport system is usually assessed from a largely technocratic perspective. More attention is now being paid to the social, economic and psychological attributes of behaviour as agents in the interaction of travel and information technologies.

Modification of travel patterns is suggested as a truer proposition than substitution. Transport professionals looking at the possibility of eliminating the journey-to-work as a benefit to society may hold a limited view. A reduction in the peak traffic volumes usually associated with work trips is a social benefit which transport planners and economists have long striven for; but associated social costs must be assessed too. There may, for example, be a generation of alternative energy-consuming trips, a reduction in public transport revenues, and consequently increased government spending, or an unfavourable impact on
those whose mobility depends on these services. So, while some substitution may in fact take place, the system-wide effects may be a series of modifications of existing patterns. This is not to underrate the importance of modifications. It is intended to emphasise that the nature of the changes needs to be studied, and must not be presumed to be positive or negative.

In analysing travel patterns it is necessary to distinguish between two types of decision makers. Most travel is performed by individuals who decide for themselves when, where, how and in what frequency to travel. This category includes all personal trips, and even the journey-to-work. The timing and destination of this journey may be determined by external factors, but still it is the individual who decides to make the trip and chooses a mode, route and time of departure. The second category covers what is generally called business travel, and the travel decisions are often made by an employer or an institution. We would argue that the factors affecting travel decisions vary widely between the two types of decision makers, and this difference is relevant to the subject at hand. The weight assigned to financial savings is greater in the institutional utility function, whereas social and psychological factors may be of greater importance to individuals. We will deal with each type separately.

This paper focuses on trip-making behaviour and the potential substitution of trips. There is another intervening factor which in the longer run may determine the outcome of the interactions between transport and telecommunications. That is changes in land use (Goddard, 1980; Mandeville, 1983; Kellerman, 1984). If in fact there is decentralisation of activities and residences (which is doubted by many — for example, Pye, 1976; Gottman, 1983), the net effect might be an increase in vehicle-miles travelled. The necessary travel from remote locations for face-to-face interactions may offset the superseded mileage. The effects of land use are not elaborated in this paper, but they should not be overlooked.

3. INDIVIDUALS' TRAVEL

Transport analysers usually start from the premise that people travel to fulfil needs. The needs are satisfied by performing an activity at some destination, and travel to that destination involves costs which have to be paid in order to be at the destination. As different activities satisfy different needs, the analysis of travel often distinguishes between trip purposes: work trips, shopping, personal business, social and recreational. We expect the elasticity of demand with respect to generalised costs for each type to be increasing in the order presented above: that is, the work trips are the least elastic and recreational trips are the most elastic (Manheim, 1979; Nash, 1982). Given that there is a need to travel, the process of choice of mode, destination route, time of day and other aspects is a common research topic.

The need is usually presented through trip generation models. These generally "explain" trip rates by purpose or by origin as a function of a series of correlates such as income, household size, automobile availability, employment and so on. Even behavioural approaches, which have gained interest in travel analysis in recent years (see Levin and Louviere, 1981; Supernak, 1979), have not dealt with the psychology of trip generation. The needs were accepted as axioms. Policies
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geared to reducing the social costs of transport were oriented to improve the use of the system by encouraging modal shifts or temporal changes to reduce peak loads. Reductions of mobility were not assumed to be politically feasible policies in the US (Altshuler, 1979).

Transport research has too often focused on individual trips, categorised by purpose. The journey-to-work is probably the single most researched type, followed by shopping trips. The least researched are trips for social and recreational purposes. The reasons for these differences are obvious. Work trips form the largest regular patterns of traffic flows, with relatively fixed directions and timing. They are also an important cause of congestion; the transport system is therefore most sensitive to changes in work trips. Shopping and (even more) recreational trips are more spatially and temporally diversified and more complicated to understand and influence, though they are more sensitive to costs.

An underlying assumption of these models is that travel is motivated by ranking needs. Maslow's theory (1954) of motivation comes to mind, as it suggests that people have five levels of needs which they attempt to satisfy. As each level is fulfilled, people are motivated to act on the next level. The levels are:

1. Physiological—biological needs;
2. Safety — needs for security;
3. Belongingness — needs for affiliation and close relationships;
4. Self-esteem — needs for achievement and self-respect from the surroundings;
5. Self-actualisation — needs for growth of potential skills and ability.

Under this scheme we may categorise travel for the generation of income and shopping as being instrumental in satisfying the basic needs of human existence, namely the first two levels. Travel for recreational purposes clearly falls in one of the last three levels.

Let us first look at current studies to deduce the likelihood of substitution of travel for each purpose.

Travel for work

Under a scenario assuming that 50% of the white-collar employees will work at home, the concept of telecommuting, moving the workplace into the home, was suggested to eliminate as many as 19 million of the work trips made in the USA in 1970 (SRI, 1977). Salomon (1984) has criticised the assessments of SRI (1977) on the scale of changes in the transport system forecast under the suggested scenario. Moreover, the likelihood of that scenario has been criticised by writers who have considered the social-psychological aspects (Albertson, 1977; Salomon and Salomon, 1984; Shamir and Salomon, 1985; and, on the managerial and organisational aspects of remote work, Olson, 1981). It is impossible to predict whether or not large enough masses of white-collar workers will work at home to make a visible change on the transport system. Yet it is safe to state that this substitution will not occur simply because the technology is available. More complex issues are at play.

A second type of remote work which has not yet received much attention is
the neighbourhood work centre (NWC). The idea is that people will perform their work in an office, possibly shared by a few firms, in the neighbourhood, thereby substituting a short trip for a long one and yet overcoming the social, psychological and legal problems associated with working at home.

The technical issues involved in NWC are solved. The problems in implementation and adoption of this concept lie in managerial aspects, zoning and economics, and possibly also social aspects. The impact of this concept, if adopted, on the transport system has only been analysed by SRI (1977) and by Oberman (1981). Both, assuming a substitution for part of the work trip (reducing it to 2.5 miles one-way instead of an average of 9.4 miles), suggest a significant reduction in vehicle miles travelled (VMT) and reduced consumption of energy.

Some 7.3% of the work-related travel in the US in 1977 was not the journey to work itself, but rather travel in the course of work. The average length of these trips was 11.9 miles (MVMA, Motor Vehicles Manufacturers Association, 1981). A large proportion are delivery trips, which, as shown below, are likely to increase. The remainder, travel by individuals during work, may be partially eliminated, though distances to be covered from the employee’s (suburban) home to work-related (central) destinations may be greater than today.

Shopping and personal business

Shopping trips are the second category which technically are amenable to replacement by telecommunications. They accounted for 10% of the motor vehicle miles travelled in the US in 1977 (MVMA, 1981). I am not aware of any studies which explicitly deal with the effects of telecommunications on shopping trips, yet the potential substitution is mentioned in most studies or essays dealing with future use of telecommunications. Some speculations can however be made. The first type of shopping to be superseded is that which is already done by telephone and catalogue, and that will not affect the transport system. It is plausible to assume that, when more information on products and prices becomes available through the use of teletext, this type of shopping will become more popular.

The travel eliminated by this substitution will be partially offset by travel generated by delivery systems, which may be more efficient than individuals’ travel. The likelihood that other types of shopping will be superseded by tele-shopping varies across individuals, and could probably be explained by two factors on the demand side. The first is the activity pattern. The more occupied a person is, the more likely he or she will be to use time-saving techniques, of which tele-shopping is one. The second factor is personal attributes, or particularly attitudes towards shopping and products. The need “to touch the apple” (or the shirt or the book) is a reflection of a desire for specialty shopping, browsing and a personal interaction. Therefore, I doubt whether the concept of “non-store retailing” (Rosenberg and Hirschman, 1980) will eliminate a large share of shopping trips. The development of shopping malls with attractive environments, replacing the strip-development shopping centres, is an indication of the demand for recreational attributes of shopping. The “ego-intensive”
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shopping noted by Rosenberg and Hirschman (1980) is accommodated in new
malls, according to Hiller (1983). He further notes that the expenses involved
in the logistics of mass teleshopping are high enough to throw doubt on the
chances of its wide-scale implementation. A study of the attributes of telephone
shopping compared with store shopping would be helpful in assessing future
shopping patterns.

Trips categorised as personal business constituted 12.9% of total travel in the
US in 1977 (MVMA, 1981). Some of these are clearly not replaceable — for
example, visits to the hairdresser or to the dentist. But many of these trips are for
transactions which involve only a transfer of information and money. The growing
availability of Electronic Funds Transfer (EFT), with the acquisition of
information from newspapers and possibly books, means that financial trans-
actions and advice are accessible through a home computer terminal. No evidence
is available on the replacement of personal business trips by telecommunications,
but trips of this type are the most likely to be replaced. Yet, again, it is difficult
to assess how many will be eliminated. However, it is not very likely that legal
advice and similar activities will be sought through a teleconference system, as

Recreational and social travel

The three trip purposes reviewed above fall, as has been noted earlier, in the
first two levels of Maslow’s needs hierarchy. Trips for recreational and social
purposes present a more complex phenomenon. Generally speaking they satisfy
one of the last three levels of need, but it is difficult to classify each trip to a
specific need. The relationship between recreational travel and telecommunica-
tions has been neglected (Darwin, 1982), even though it constituted 24% of
total travel in the US in 1977 (MVMA, 1981), being second in volume only to
work trips.

Thus substitution is likely to affect in varying degrees travel for work, shopping
and personal business. In contrast, an analysis of the effects of telecommunica-
tions on recreational and social travel must consider the greater likelihood that
more travel will be generated.

One approach starts from available data on the specific purposes of recreational
and social trips. Very broad aggregate data in MVMA (1981) show the distri-
bution given in Table 1.

Of these, the first three categories are not likely to be superseded. Not even
the avid advocates of teleconferencing suggest that social interactions can be
maintained through that medium. Telecommunications are obviously no sub-
stitute for pleasure driving and vacations.

The category “others” presumably includes travel for purposes such as active
sports, spectator sports, cultural events and entertainment, which are differenti-
ally subject to substitution. It is helpful to quantify their relative importances.
Noortman Van Es (1978) reports time allocation of residents of the three largest
metropolitan areas in the Netherlands as shown in Table 2.

Participation in community life may be partially replaced by two technological
products. Community programmes broadcast on cable television, which provide
TABLE 1

Recreational and Social Travel

<table>
<thead>
<tr>
<th></th>
<th>% of Trips</th>
<th>% of Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visiting friends and relatives</td>
<td>43.5</td>
<td>47.1</td>
</tr>
<tr>
<td>Pleasure driving</td>
<td>2.0</td>
<td>3.3</td>
</tr>
<tr>
<td>Vacations</td>
<td>0.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Other</td>
<td>54.0</td>
<td>47.1</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
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</tbody>
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TABLE 2

“Other” Recreational Activities

<table>
<thead>
<tr>
<th></th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation in community life</td>
<td>1.3</td>
</tr>
<tr>
<td>Culture, visits</td>
<td>11.88</td>
</tr>
<tr>
<td>Active recreation</td>
<td>4.05</td>
</tr>
<tr>
<td>Travel to these activities</td>
<td>3.4</td>
</tr>
<tr>
<td>Reading and TV watching</td>
<td>25.75</td>
</tr>
</tbody>
</table>

Source: Van Es (1978), Table 10.

information and possibly some sense of belongingness to a community, may reduce the need to attend meetings. Furthermore, two-way cable TV will allow interaction between audience and studios and may accommodate more of the need for meeting people. However, it is not known whether such “sterile” substitutes for mingling with people do achieve a sense of belonging to a community, let alone self-actualisation. From the small amount of time allocated to community life only marginal changes, if any, in travel could be expected.

The change can, however, become visible where activities bring many people together simultaneously. If, for example, technology is substituted for travel to church, Sunday morning traffic will be affected.

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Attendance at entertainments occupied, according to Robinson (1981), 17 minutes per day in 1975, a decline of 4 minutes compared with 1965. In a different source (Robinson, Converse and Szalai, 1972) the allocation to entertainment and cultural events consumes 6 minutes per day in a sample of 44 US cities, compared with 38 minutes spent on social activities away from home (page 114). It is plausible that some travel to entertainments will be superseded by telecommunications. The big TV screens now available for homes, cafes and pubs provide a better setting for viewing some events (including spectator sports) than the regular TV screen, and therefore may replace a trip, or a section thereof. Other technological improvements may accommodate some more travel to such events. Yet, again, the case is of only marginal importance because of the low travel volumes concerned.

Active recreation is another category for which telecommunications cannot be substituted, as the activity itself requires an outdoor environment. Telecommunications will provide some new options for spending leisure time at home: new games, possible interactions with other players, an abundance of reading material and more. The question then is reduced to what will be forgone in an individual's activity pattern when these new options are available.

There are three possible effects: substitution for other in-home leisure activities, substitution for out-of-home activities, and a utilisation of newly available leisure time. New leisure time is assumed as a result of the overall expected (though not yet realised) decrease in work time (Robinson, 1981) and of the additional time made available by the elimination of work trips when and if telecommuting becomes popular. A quantification of trade-off between leisure activities within a constrained time budget can be helpful in assessing this effect. For reasons discussed below, it is suggested that substitution for out-of-home activities will not be the main effect, so the impact of telecommunications on recreational travel will not be a substitute for it.

Linked purposes

If trips continue to be viewed as being made for a single purpose, as they were for many years, Maslow's classic theory provides sufficient explanation for people's mobility. However, recent studies of travel have emphasised the need to deal with the activities people perform rather than with the travel as an independent entity (Carpenter and Jones, 1982). Moreover, there is evidence that between 25% and 50% of the trips are linked: that is, more than one destination is visited (Hanson, 1982). Both the context of activities and trip linking are relevant to an understanding of the impact of information technology on people's spatial behaviour.

One implication of linking is that, if the "major" trip purpose is superseded through telecommunications (for example, by telecommuting), the secondary purposes of the journey-to-work (Hanson, 1980; Oster, 1978; Damm, 1979) will also have to be satisfied. Advocates of technology will suggest that most other purposes (for example, shopping, personal business) will also be accommodated by telecommunications. The sceptics will argue that, despite some substitution, the net effect will be a modification of travel patterns, as the destinations for

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the secondary purposes will no longer be determined by the primary purpose. This will inevitably happen if the two telecommunications systems are not implanted simultaneously.

**When all needs are satisfied**

Let us now leave the analysis of individual trip purposes and assume that information technology, through telecommuting, teleshopping, teletext and educational services, provides the individual with all the "needs" that justify current travel. In this "Information Society", should we expect that individuals will be homebound and cease to travel? This society is often described in popular futuristic literature: and Toffler's *Third Wave* (1981) is the best known example. The professional literature provides us with two relevant futuristic descriptions. In one, three trips are made: a work-related trip (not made via the home teleconference system), a social visit, and a visit by children to a friend's house to be tutored together by the home computer (Mason, 1984). A more extreme deterministic role is given to technology by Lehman-Wilzig (1981), who eliminates all travel. Intuition and theory suggest this is not likely to happen.

The arguments in support of the proposition presented earlier on human mobility can be broadly grouped as "push" and "pull" forces acting on the individual whose needs are all satisfied at home. The following arguments are based largely on contributions from psychology, but come also from travel behaviour analysis and other fields. A very preliminary search into psychological literature has shown its importance to the basic questions raised in this article.

The suggested scenario is not a very probable one, though often described in popular writings. It is not clear whether the third and fourth of Maslow's needs (belongingness and self-esteem) can at all be satisfied in the absence of face-to-face interactions. The scenario is useful, though, in investigating, from a basis of psychological theory, the proposition that travel motivation is not only a result of needs. Exploration triggered by curiosity or boredom can be a motivating force for travel when people are homebound by a technology that provides all their needs. Curiosity and boredom, according to Berlyne (1974), cause an arousal if too much or too little information is supplied. I suspect that the information society may be accused of both. On the one hand, it provides ample information, all of which reaches the user through machines: screens, electronic sounds and even machine-generated voices. That may be a source of boredom, even if the content is rich.

The human information-gathering mechanisms are of two types. The first is active search for information, in which people perform some action in order to find and obtain some knowledge, and the second is passive exposure to information. The active search will certainly require less effort and costs in the information society. The role of the passive exposure, with its wide variety of sources, may be reduced. Its importance may at present be underestimated. Much of the information (and arousal) may be generated by such sources as: advertisements on media, billboards, window shopping, recommendations from friends, and the incidental sight of people or events in the street. All information in the homebound society will be transmitted through electronic means. As McLuhan
and Fiore (1967) say, "the medium is the message". It is necessary to consider the effects of condensing the variety of information agents into a stream of electronic signals received at home through basically similar media. The reliance on screens and electronically generated voices is likely to cause boredom, if not stress, and thus a "push" out of the home. Robinson (1981) argues against the plateau hypothesis, raised in the 1950s, that there is an upper limit to TV watching. It may, though, be raised again if a TV screen becomes the important source of information.

**Exploration and variety**

On the other hand, despite the richness of information available at home through telecommunications, it is not obvious that the information will be relevant to the consumer's needs, and will satisfy his or her curiosity. One can think of many types of information which are not structured and therefore are less amenable to being stored in data banks, and yet are very important for the individual's sense of satisfaction. Familiarity and acquaintance with the environment and the community serve as examples of knowledge which is obtained through physical visits, rather than through videotext and community cable television. The increased leisure time which may become available through the avoidance of work and shopping trips may be directed to an exploration of the environment by means of physical movements. Day (1984) asserts that "both curiosity and boredom lead to autotelic behaviour – exploration of the environment for no reason other than the gratification obtained by the interaction". Therefore a plausible hypothesis is that there may be a modification of travel patterns rather than substitutes for travel.

Beyond the exploratory motivation, Maddi (1961) notes the importance of varied experience, which the "complete home environment" will probably not provide. The more a person is homebound, the more likely is it that a need will arise for variation.

A prolonged stay at home may also be a source of stress. Commonly, we see the home as a source of security and an escape from the stress of the outside world. However, if all activities are performed at home, two types of stress may evolve. One is a result of the lack of variation in a closed environment. The travel which people perform today between activities satisfies the need for variation in sensory stimuli. If that is curtailed to the home environment, the stress-reducing reaction is likely to be a trip out of the home. A second type of stress may result from conflicts between members of the household. Performing different roles within a constrained environment can cause intra-personal role conflicts for individuals (Hall, 1972). Those conflicts can enhance inter-personal conflicts on the allocation of space, time and tasks between the household members, and result in stress. Wallenstein (1982) foresees that competition for home-based terminals may also be a source of conflict. The present spatial separation between work and home allows individuals, according to Albertson (1977), to practise different aspects of their personality in each setting without conflict. It is suggested that in the information society stress serves as a push to travel more for discretionary purposes.
Wallenstein (1982) raises yet another reason for a push out of home. Information supplied through telecommunications systems would create opportunities for "central thought control and programmed responses". Moreover, the information sought by individuals may be monitored. To avoid a self-inflicted brainwash, individuals are likely to search for alternative, informal sources of information, through movements which will enable them to gather information both passively and actively.

Recent contributions to the analysis of travel behaviour have raised the hypothesis that people do not always act as cost minimisers, in the sense that they are trying to avoid trips that are not necessary. Matalon (1978) has argued that the functional approach is insufficient to explain trip-making behaviour. Reichman and Salomon (1983) developed the hypothesis that there are cases in which distance is invested with a positive utility, and therefore people may not always prefer to reduce trip length or to eliminate a trip altogether.

In summary, theory, supported by indirect evidence, leads to a tentative conclusion that movement in the environment is a basic human activity that fulfils a variety of roles. Therefore, the technological developments that can pack all conventional needs (income generation, shopping and information services) into the home will not necessarily result in large reductions in travel.

4. BUSINESS TRAVEL

For business trips the arguments raised in the preceding section are not all applicable. The traveller is still the same mobile human being, yet the decision to make a trip may be not an individual's choice but an organisation's decision. This section, based on a synthesis of recent research, will briefly present the most important possible effects of telecommunications on business travel.

The new technology of primary relevance is teleconferencing, which can be audio-only, audio and visual combined, or computer conferencing. The primary expected travel impact is its substitution for intercity travel, which may harm the business of airlines and other common carriers. Teleconferencing can also be used in cities, but it is not likely to affect the volume of travel in urban areas.

Only a few studies have analysed the pattern of communications in the business sector. Studies associated with efforts to decentralise office activities from London (Goddard and Morris, 1976; Goddard and Pye, 1977; Pye, 1976) serve as cornerstones. Based on actual detailed communications diaries and previous psychological experiments, they assessed the potential trade-off between travel and telecommunications, taking into account economic considerations, including land rent and labour costs. A general conclusion from these studies is that 34% of the meetings recorded could have been performed by audio-only conferencing, and an additional 10% by a video system. This means that, leaving aside economics and the attitudes of users, some 50% of communications still do require meetings. From a travel perspective, the potential changes and savings for the transport system are not too promising. But a reservation must be made that the British studies on this subject may not apply in other (non-European) settings.

Charles (1981) reviews the various approaches used to justify investments in
teleconferencing. Savings in travel cost are the most common argument. The reasons are numerous. Awareness of travel costs for business has increased, especially since the energy crisis of the 1970s; the loss of time associated with travel is recognised; and there is the practical reason that travel costs, unlike many other benefits of teleconferencing, can easily be quantified (Johansen and Bullen, 1984).

Cost efficiency can be measured as cost avoidance or cost savings. Cost savings are actual savings accrued through substitution for trips which currently take place. Cost avoidance means the ability to communicate through telecommunications without generating a trip, thus saving hypothetical dollars (Gold, 1979). For a given volume of information that has to be transmitted, teleconferencing may provide substitution and actual savings. However, the “trip not made” cannot always be accounted as a saving, as it may not represent a necessary transfer of information. A growth in information flows in the future cannot be attributed to a need to travel that was superseded. The availability of greater amounts of information and, still more, the access to facilities to disseminate that information, are in themselves causes for transmission of information. If the information is superfluous, there is no saving of trips.

Weil (1982) hints at the oversupply of information which, at least in part, is generated by industries trying to promote the information society. This view raises a problematic relevant issue. It is insufficient to view only the cost side of transfer of information: organisations need also to evaluate the benefits accrued from having it. There are, of course, measurement problems which make a structured benefit-cost analysis difficult (Atherton and Wills, 1979); but, at least in a conceptual framework, the cost savings and cost avoidance need to be weighted against the value of information. If benefits are small, then, evidently, the transmission of the information entails excess costs.

There are other complications in the economics of information and telecommunications. This paper does not deal with these, but they should be evaluated in attempts to understand the relationship between travel and telecommunications (see, for example, Parker, 1976). It must be realised, though, that the decision to use teleconferencing systems is not based solely on tangible economic gains, but also on non-monetary benefits such as prestige.

Gold’s (1979) study of attitudes towards intercity travel indicates that many travellers do not view business travel as all evil. In fact, many even prefer not to reduce their current level of job-related mobility. If that is true, will travel be superseded?

In an effort to justify investments made in teleconferencing systems, employers are prone to require a reduction in travel expenses. Indications of the process are cited by Gold (1979). The reduction may be subject to the condition that no damage is done to intra or inter-organisational communications or productivity. This will be known only after implementation. Yet, as indicated by Elton (1979), each of two complementary services tends to enhance the use of the other. Consequently, businesses which communicate through any electronic means are likely to generate new travel, to satisfy the need for some face-to-face negotiation when the total quantities of information flows have grown. Therefore, the net effect on the transport system may be close to zero.
CONCLUSIONS

Much popular attention has been attracted to the substitution effect on the transport system to be expected from increased use of telecommunications. It is dramatic, and it is in the interest of industries to emphasise it. Yet scientific research on the interactions of the two communications systems must not take only the technocratic viewpoint. This paper, and many other recent analyses, have stressed the need for a humanistic, behavioural approach. This approach leads to a number of conclusions.

First, there are social and psychological reasons for doubting the likelihood that telecommunications technologies will be adopted as a substitute for travel, or that their products will eventually become a substitute. Other behavioural aspects (managerial, economic and political, for instance) may point in the same direction: this paper did not deal with them, but they should not be overlooked. Secondly, one particular type of travel, that for recreational and social purposes, may increase when more leisure time is available.

Thirdly, the analysis of total human activity may lead to different conclusions from the analyses of single trip purposes which prevail in the literature to date. If we assume a scenario in which most needs are satisfied at home through telecommunications, it is possible to speculate on the effects of the technology on human spatial behaviour.

The human being, as a "mobile animal", is likely to generate new travel if all conventional needs are satisfied at home. Thus the net effect is a modification of travel patterns rather than a reduction of volumes. The modifications may in themselves be beneficial from the transport point of view, if for example they lead to greater use of non-motorised modes, changes in the timing of trips, or spatial changes which reduce congestion.

The assumption of a mobile human being should also be tested. Past studies of trip generation have not shed light on the phenomenon of travel beyond its functional role in bringing people to their destinations. Some studies of trip generation in the context of recreational travel (Stopher and Ergun, 1982) and of vacation travel (Iso-Ahola, 1983; Dann, 1981), and some studies of mobility (Reichman, 1983; Houseman, 1979), provide a starting point to the analysis of why, if at all, people travel if they do not have to. It seems that psychology can be instrumental in this research.

A second type of travel discussed in this paper is business-related trips. On these, two conclusions are pertinent: first, that travel can be reduced through organisational mandates, which may be issued in order to justify sunk investments in teleconferencing systems; secondly, that increased interaction through telecommunications is likely to enhance the need for face-to-face interactions. Therefore the net effect of the technology may be neutral.

A further theme which was glanced at in this paper is the value of information. Movement of information which is generated by the mere existence of information technologies is not replacing present travel, but may affect future travel. This depends on whether society will enter the information age without controlling the social costs associated with oversupply of information. Policies today seem to assume that information is a necessary good for progress. Notwithstanding this assumption, which is a subject for a different paper, it is
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suggested that caution should be used in urging potential effects on transport as a justification for large investments in telecommunications.

Overall, the conclusion of this paper is that the substitution of telecommunications for travel is of minor importance because, even if it happens, it will be offset by the human desire to exercise mobility.

REFERENCES


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