TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 25, 15–28 (1984)

Telecommuting: The Employee's Perspective*

ILAN SALOMON and MEIRA SALOMON

ABSTRACT

Available telecommunication technology enables the substitution of commuting by "telecommuting," or working at home, for a wide range of white collar occupations. Research on the potential of this phenomenon along with some ongoing experiments point at an array of social and personal benefits that may be realized by this working arrangement. An assessment of the possible implications of work-at-home on the individual employee indicate that the burden on him or her may be greater than the benefits accrued and, therefore, the journey to work may be a more desirable act than traditionally perceived by transportation planners. This paper focuses on two aspects of the work-at-home arrangement. Previous research on the sociology of work as well as preliminary empirical results indicate that 1) social interaction at work and 2) the need to separate home and work roles are important elements for the individual worker. The fact that work-at-home will affect these attributes, is likely to discourage wide-scale transition to this arrangement, despite the availability of the technology. Most research published to date on the subject is qualitative in nature, as only little empirical evidence is available. The objective of this paper is to stress, based on a wide literature review, the need for a thorough behavioral evaluation of the available technology to provide a sound basis for decision making on implementation of the technology.

Introduction

Telecommunication technologies facilitate interactions between two or more individuals and between individuals and information processing machines located at remote sites. Thus, telecommunication networks should be viewed as an element of the transportation system, having the potential of substituting physical movement by electronic information flows. The major potential benefits of such a substitution are the reduction of congestion, energy conservation, and a reduction of transportation-related environmental pollution. In more general terms, telecommunication technologies have the potential of transforming much of the urban activity system into being footloose in terms of the location of the production system.

The rapid development in telecommunication technologies and information processing in the last two decades combined with the increasing problems of urban circulation and the energy crisis have drawn the attention of researchers as well as industry interests to the possibility of a wide-scale implementation of telecommunication systems in urban

*The views expressed in this paper are those of the authors and do not necessarily represent those of their employing organizations.

ILAN SALOMON is a Lecturer at the Department of Geography and the Center for Urban and Regional Studies, Hebrew University, Jerusalem, Israel. His research includes travel demand analysis, life style and activity pattern analysis, and communications/transportation relationship. He is also a Director of Cambridge Systematics, Israel, Ltd. MEIRA SALOMON is the Director of the computing facility at Mount Scopus Campus, Hebrew University, Jerusalem, Israel. She previously was a Senior Systems Programmer at IBM, Israel in Tel-Aviv, specializing in Information Management Systems.

Address reprint requests to Professor Ilan Salomon, The Hebrew University of Jerusalem, Faculty of Social Sciences, Department of Geography, Jerusalem, Israel.

 0040-1625/84/$03.00

areas. New terms like "telecommuting," "teleconferencing," and "flexiplace" have thus emerged.

In the existing body of research, two alternative hypotheses about the relationship between transportation and telecommunications are evident. One suggests that transportation and telecommunications are substitutional, that is, the more information transmitted via telecommunication facilities, the lower the demand for travel will be. Interestingly, this view was first introduced with the invention of the telephone more than a century ago, and the results, as known, did not support that hypothesis. The alternative hypothesis suggests a complementary relationship: this is supported by evidence of a growing demand for travel between two nodes that have been linked by telecommunication facilities. (For a discussion of the two hypotheses see [1–5]).

It should be noted that even the researchers suggesting the substitution hypothesis do not overlook the issue of trip stimulation and there is wide agreement that the relationship between telecommunications and transportation is a complex one. The disagreements, hence, lie in the extent to which, under specific conditions, there may be a substitution of travel, and in evaluating the social benefits and costs of such a substitution.

This paper focuses on one application of telecommunication technology: the work-at-home option. In this modern version of preindustrial revolution work patterns, a person can avoid the costs of commuting to work. He or she can conduct various information processing tasks using a computer terminal at home. Some applications of this option are evident both in formal arrangements such as the experiments conducted by Control Data Corporation, Continental Illinois National Bank, and others, and in informal arrangements, mainly among academics and freelance professionals.

Presently, we face a situation in which the technology is available, although its wide-spread employment still requires a large capital investment. Some technology assessment has been performed, as reviewed in the next section, and the promises involved in its adoption have been presented. There are also ongoing experiments that are subject to evaluation studies. This may create an impression that the transition to the computerized work-at-home system is just around the corner as is indicated by futuristic literature [6] and in recent popular publications [7, 8].

It is the objective of this paper to raise some of the problems that may hamper the adoption of telecommunication technology for work-at-home arrangements.

In evaluating the benefits and costs of the structural change in work life, it is necessary to identify the incidence of these on three of the parties involved: the individual employee, the employing organization, and society at large. There are, of course, other parties who have an interest and will be affected by and affecting such changes in working conditions. They include many industries such as telecommunications and computers, transportation, construction, office equipment, and others. It should be borne in mind that such interests may have an important role in shaping future changes, but their involvement is outside the scope of this paper.

It is the hypothesis of this work that the incidence of the nonmonetary costs on the individual is relatively large compared to the benefits he or she will accrue and that, therefore, employees' acceptance of this arrangement will be far from enthusiastic.

This hypothesis is based on the premise that it is insufficient to evaluate technologies solely on the grounds of economic viability [9]. It is inconceivable that technological developments such as the industrial revolution or the introduction of automobiles could have been assessed by today's scientists without a profound investigation of their impacts on behavior.

Previous Research

The work-at-home option is one of three remote work options suggested in response to the recognition of the high costs of commuting to work. The other two are intermediate stages of organizational decentralization: the satellite work centers and the neighborhood work centers [10].

A number of studies have, over the last few years, focused on the potential uses of telecommunications and its relationship with transportation. The most comprehensive of these is the Stanford Research Institute [11] study that attempted to quantify, or at least identify, most of the impacts of implementation of telecommunication technologies to substitute travel. Nilles et al. [10] have also addressed the trade-off question, analyzing a scenario of the decentralized work place. MITRE corporation [12] have analyzed a series of measures, including remote work options, with the objective of assessing the potential energy savings. These studies have identified most of the potential benefits involved in the work-at-home arrangement, some of which are noted below.

Working at home offers the individual yet another dimension of flexibility in addition to flexitime. "Flexiplace," a term coined by Schiff [13] relaxes more of the space–time constraints the individual is facing, primarily by avoiding the need for the journey to work. The average American work trip length in 1977 was 9.2 miles [14]. Avoiding 18 miles of travel, often in congested traffic conditions, provides important economic benefits for the individual. The savings of direct expenses and the opportunity to exploit the time saved for other activities are the most noticeable.

For the employing organization, the work-at-home arrangement can mean a reduction in its office and parking space requirements as well as financial savings due to reduced pressure for wage increases to cover growing travel expenses [11].

The most frequently cited benefits are those accrued to the general society. These include the reduction of congestion, conservation of energy, and the decrease of automobile related pollution. Some attempts to quantify these and other impacts appear in the literature [10–12].

Beyond these sets of benefits, there are effects that are more complex and more difficult to evaluate. The option of working at home can permit many individuals who for a variety of reasons could not engage in the labor force to do so. The most prominent groups are the handicapped and mothers of young children. This benefit is incurred by the individual involved, the employers who have a larger pool of workers to draw on, and society at large. The French government is conducting a work-at-home experiment, primarily for attaining this objective [15].

There are many other secondary effects. For example, by not commuting, employees may reduce much of the stress associated with rush-hour traffic. This may result in more productive work, still another benefit for employees and employers.

The promises of telecommunication technology receive a different treatment in a proposed study by MIT's Program for Communication Policy [2]. Rather than assuming a substitution under normal conditions, they argue that in the case of a national energy crisis, available telecommunication facilities may be able to alleviate some damage. They stress, however, that although this is plausible under crisis circumstances, under normal conditions the potential use of the technology as an instrument for the achievement of energy conservation is a different matter. Reliance on the automobile is such that in a normal state of affairs people cannot be expected to forego it.

A new body of literature is emerging from the evaluation of ongoing experiments of remote work options. Most of these are in-house evaluations. The outstanding exception is Olson's study [16] of the implications of remote work on the organization and the

individual. Interviewing 32 employees who are engaged in such experiments, she identified a series of job attributes and employees' characteristics that are amenable to remote work arrangements. She has also identified a series of research questions including the issue of the acceptability of remote work by individuals, management, and organizations.

The Acceptance of Work-at-Home Arrangements

A technological development will be adopted if all the parties involved in the adoption process are enthusiastic enough or, if those who have the power to decide can coerce the remaining parties. For example, it seems likely that if an organization decides to employ teleconferencing facilities to reduce its intercity or international travel expenses, it can do so even if the employees prefer to travel. The result may be an inefficient exploitation of the facilities and consequently a damage to the firm, but the firm has the power to enforce its decisions.

The case of changing the work patterns to employ work-at-home arrangements is totally different, as it affects roughly one-half of the time people are awake. For an existing organization to adopt a work-at-home arrangement, the consent of the employees involved in the program is required. (A different situation is that of a new employee joining an organization that is already implementing this scheme.) In the following discussion, it is necessary to distinguish among various types of jobs as well as various situations. Also, it is hypothesized that the level of acceptance or willingness to work at home is very different across different population groups, as is discussed below. We use the term "population groups" because at this point it is not obvious whether the differentiation should be along occupational lines, demographic, or life style attributes.

At this point we stress, following Olson [16], that the issue of acceptance of the technology has not been analyzed by the three major studies cited above. Yet, the SRI study did use, for the purpose of technology assessment, a scenario suggesting that 50 percent of white-collar employees will work at home. This amounts to some 27 million workers in 1985 figures, or 38 million workers in 1990, taking into account the growth in white-collar employment. The writers of that report did make an explicit note that the likelihood of this scenario is unknown. We contend that the issue of acceptance alone is significant enough to undermine the validity of the suggested scenario.

A change in a person's work patterns, which impinges on the work-home relationship, is, in effect, a change in life style. Changes in life style, as defined by Salomon [17] are major life decisions that are deeper in their nature than a simple change in work location. This leads us to develop the hypothesis that only a limited degree of acceptance can be expected from the larger groups of white-collar employees, namely those who hold rather routinized clerical jobs. Among higher level nonroutinized occupations, the acceptance may be greater but, numerically these are smaller groups.

Prediction of the acceptability is a complicated task when such profound changes are involved, and the technology is rather unfamiliar. At this point of time, three possible approaches can be used to deal with this question. First, it is possible to evaluate the few available observations and, through in-depth interviews, to identify the factors influencing employees' acceptance, as was done by Olson [16]. A second approach is based on an attitudinal survey among employees who currently are not engaged in such work arrangements. The major shortcomings of this approach are that the concept of work-at-home may be totally hypothetical for the respondents and, in addition, attitudes are subject to change over time, even *if* the respondent does not experience the new arrangement, let alone *when* he or she does.

The third approach is a suggestive one. It relies on the theories developed in the

sociology of work in which a variety of issues concerning work life have been studied. An assessment of the way in which certain job attributes will be affected by the new technology can suggest the types of responses to the option of working at home. The latter approach is used in this work and it is also supported by some empirical findings based on a small attitudinal survey conducted at the computer center of a major Northeastern university. Given the sample size (39 observations) only a few results are significant enough to be reported at this stage.

In this paper only two aspects of work life are investigated: the social interaction at work and the relationship between work and nonwork activities. Other important work-related aspects like supervision, promotion, and the employee–organization linkages (including the legal aspects) are also likely to be affected by the work-at-home arrangement. Nevertheless, we chose not to include them in the present paper as they pertain more to the organization's perspective than to the individual's work pattern, on which this paper focuses.

Another important employee-related issue that is not dealt with in the current paper, but is likely to attract considerable interest in the future, is the effect on labor unions. The physical separation of workers may impinge on the power of the unions and they might intervene in the process as well. As the telecommuting concept is technically feasible primarily for white-collar occupations, only these are discussed below.

In assessing the future acceptability of a new technology, by any one of the three approaches outlined above, one cannot ignore the role of the present value system on the outcome of the assessment. It is plausible that values will change over time and that the current assessment may thus become obsolete [18]. For example, Toffler [6] describes the work-at-home concept under a different set of values from that which we presently observe. Moreover, Gordon [19] argues that technological developments are, in and of themselves, agents of value changes, or possess the potential of becoming such agents. Promotional efforts by interested parties can definitely lead in that direction. The assessment given in this paper is based on the authors' understanding of current workers' values.

THE WORKPLACE AS A LOCATION FOR SOCIAL INTERACTIONS

The office is an obvious place for a social network to be developed. Literature devoted to management problems, especially in industry, often stresses the workers' need for better group relations and the need of management for dealing with workers through the "work group" [20].

The "work group" was characterized by Braude [21] as having "intimate face-to-face contact in a work situation." The social aspect of the job has different meanings to different individuals. For some it is the "coffee break" or lunch time that they spend together. For others it can be the occasional "small talk" that breaks the routine, or the heavy academic discussions that follow a job meeting.

In observing interactions among workers one can distinguish between the following:

- purely professional interactions
- socio–technical—interactions among workers on the same level who share responsibilities for a job, but are also tied by the bonds of friendship
- purely social—interactions among workers who do not have common duties.

An early study [20] compiled a survey of 150 studies conducted between 1920 and 1954. They found that the social interaction aspects of the job were ranked, on the

average, as seventh among nine major job related factors. Also, they determined that social interaction has a strong contribution to both job satisfaction and dissatisfaction.

The social interaction aspect was found to be more important among workers of routine duties and those holding jobs that provided little satisfaction from the work itself. In this case, it is the purely social aspects of interaction that play the major role.

Studies of work groups found that in highly cohesive groups, member workers derive great satisfaction from a sense of belonging, and share feelings of team pride, which in turn increases morale in the work places [20]. Small cohesive groups were also found to be the most effective and satisfying work unit. Both absenteeism and turnover were found to be lower in such groups when compared with larger or less cohesive groups. Likert [22] has demonstrated a positive correlation between motivation, productivity, and work-team cohesiveness. In small teams, he found that informal productivity standards are set by the team and members attempt to meet them. It becomes important to the individual to assess his or her own productivity in relation to other members and the group's standard, even when these exceed the management productivity requirements.

The social role of the workplace is of less importance in managerial and professional jobs. Workers of this type ranked achievement, advancement, and the work itself as the factors that contribute most to job satisfaction [20].

Consideration of these findings with regard to a theory of "hierarchical needs" will further the understanding of the sociological consequences of eliminating the social role of work by implementation of the work-at-home option.

Maslow's "Theory of Human Motivation" [23] suggests a hierarchy of five levels of needs, listed in sequence from lowest to highest:

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 by the surroundings
5. Self-actualization—needs for growth of potential skills and ability

This model suggests that, at any given point of time, an individual is attempting to fulfill one of these needs. Only when it is fulfilled will the individual move to the next higher level and attempt to fulfill it. Motivation is thus derived from the wish to satisfy the needs. Once they are satisfied, they are no longer a motivating force in individual behavior.

It can be seen that the group of professionals, managers and office workers, for whom work at home is most appropriate, can fall into two levels of the hierarchy, based on findings on their job motivation [24]:

1. Low-level office workers, typists, and routine workers who see the social relationship of work as an important factor in their job satisfaction and motivation belong to the third level in Maslow's hierarchy—the Belongingness level.
2. Managers, professionals, and technical workers belong to the fourth level—self esteem.

Working in isolation from the social group, a result of the work-at-home option, may affect these two groups in different ways.

Elimination of the social role for the former group will result in dissatisfaction and low motivation as shown in Herzberg's findings. Higher turnover should be expected as a result of this dissatisfaction.

For managers and professionals, the social role of the work place is usually regarded as incidental. Yet, it is still regarded by one sociologist as an important attribute by which people "enhance their self-esteem as persons of competence, and satisfy their needs for companionship, affiliation, and belongingness" [25]. The question of whether "electronic socialization" or other new frameworks for socialization are viable alternatives is still unanswered [26]. For the professional and managerial group, we believe that the elimination of social contact at the work place might be directed along either of two paths:

1) The need for belongingness will become unsatisfied. This will cause the individual to move down in Maslow's hierarchy of needs from the self-esteem level to the belongingness level. In this case, the worker might "lose" his current motivators—achievement, status, recognition, and appreciation and become more concerned with satisfying his or her needs for affiliation and belongingness. If these needs can be satisfied within the family or the community, the worker's home environment and neighborhood may become more important to him than the organization [27]. In the case that these needs cannot be satisfied easily within the immediate environment, frustration and dissatisfaction should be expected. Such reactions are suggested by Dunnette [28] in his analysis of work and nonwork in the year 2001.

2) The social role of work was not so important, and eliminating it will not change the individual's level of needs. In this case, work-at-home will be most satisfying.

Renfro [29] has pointed at some examples that strengthen the second thoughts on bringing the office home, based on these issues, among others.

Mitchell [24] has sketched some possible future scenarios embodying different social value systems for the United States, based on Maslow's theory. All three scenarios described assume a shift of varying degrees toward the higher levels of needs, with more jobs becoming amenable to remote work options. The implications of these changes on the current issue depend on which of the above reactions is more likely to occur. This, in turn, gives rise to distinguishing the specific conditions that may determine the reaction of workers.

The "social–technical" type of interaction that characterized some of the social roles of work, provides yet another function besides satisfying social needs. "On-the-job" learning is based on observing and consulting fellow and senior workers. Being exposed to coworkers and observing how problems emerged and were solved are of major importance to learning and gaining experience. Working from the home will eliminate this opportunity and will especially affect junior workers who depend very much on these interactions for their career advancement.

Interaction at the work place is also, from the individual's perspective, an important instrument for growth and promotion. Although formal means of interaction and evaluation by management are available through telecommunication facilities, they do lack the personal face-to-face communication and visibility often needed for a proper mutual understanding between the employee and the manager.

WORK–NONWORK RELATIONSHIP

Working at home is likely to affect the individual's relationship to nonwork activities, such as family life, leisure, shopping, and the like, and to work itself. Work and family life today are not only physically separate entities, but each also gives rise to distinctly different role behavior that may have little in common [25]. It is not only that the two different environments require different behavior, but that they also offer the individual a chance to express different aspects of his or her personality.

Work, as a social institution for purposes of production or economic activity is, according to Dubin [30], physically, temporally, and functionally segregated from other

social institutions. Parker and Smith [31] suggest that there are three types of work–le is relationships: extension, opposition, and neutrality. The first is typified by a similar cont of work and leisure, a weak demarcation of their boundaries; work is a central life inter and it leaves a strong imprint on leisure life. By contrast, opposition is the case wh the content of the two is deliberately different, the demarcation of boundaries is stro and there is, in many cases, a strong love–hate relationship to work so that it becon difficult to identify the central life interest. The nonwork activities are strongly mark by the imprint of the work activity, though in a negative manner, unlike the case extension. Neutrality refers to the case in which work and leisure contentment are usua different, the central life interest is nonwork and work does not leave an imprint leisure. Parker and Smith suggest that most people in routine clerical and minor prof sional jobs maintain the neutrality relationship between work and leisure.

While it is plausible that for the extension type relationship the option of work at home is very attractive, it is doubtful whether this is the case for the workers w have the neutrality type relationship. These, who comprise the majority of the whi collar labor force, do separate work and leisure and may not like to physically carry wo into the household environment.

Hall [32] who studied the role conflicts of married women, defines a role proc as a "set of structural demands being placed upon the individual in a given social positio Based on one's perceptions of these demands and one's own personality, an individ defines the demand he or she should try to meet and behaves accordingly. Hall stres that role conflicts result from the fact that multiple roles (demand and expectations) oper at the same time.

The benefits of the work-at-home opportunities for married women are often not Being able to work and to maintain home responsibilities and child care simultaneou were cited as a major promise of the work-at-home arrangement. Observing these in vi of Hall's role conflict model it seems that working at home is likely to increase t woman's role conflicts. The overlapping in time and space among the roles of employ mother, housekeeper, and wife should lead to a greater conflict. Competition for t woman's identity among these roles is illustrated in Figure 1, where the shaded a represents the balance between the subidentities. In terms of space and time, compressi the employee's subidentity into the remaining subidentities is likely to increase the confli not only in a psychological sense, but also in an inability to perform the necessary functio of each role when these are temporally and spatially interwined.

In a review of similar studies, Hall reveals that men have roles of subidentiti similar to women. husband, father, home-maintenance worker, and employee. At prese men show few problems with role conflicts because, as opposed to the women's cas they do not operate simultaneously Work-at-home will introduce the subidentity confl for men as it will eliminate the sequential operation of the various roles.

The differential separation of roles along gender lines is also noted by Pleck [3 who claims that there is an asymetrical boundary between work and nonwork. For wome this boundary is permeable only in the direction of nonwork responsibilities that en and affect the work life, while the reverse is true for men. It is acceptable for men have their work interfere with family roles.

Changing the physical location of work to the home, where the day-to-day insta taneous home responsibilities occur, will require a change in the permeability of t boundaries for both heads of household. This is a major change from the current norm for most people.

The evidence on the separation of work and nonwork gives rise to the question

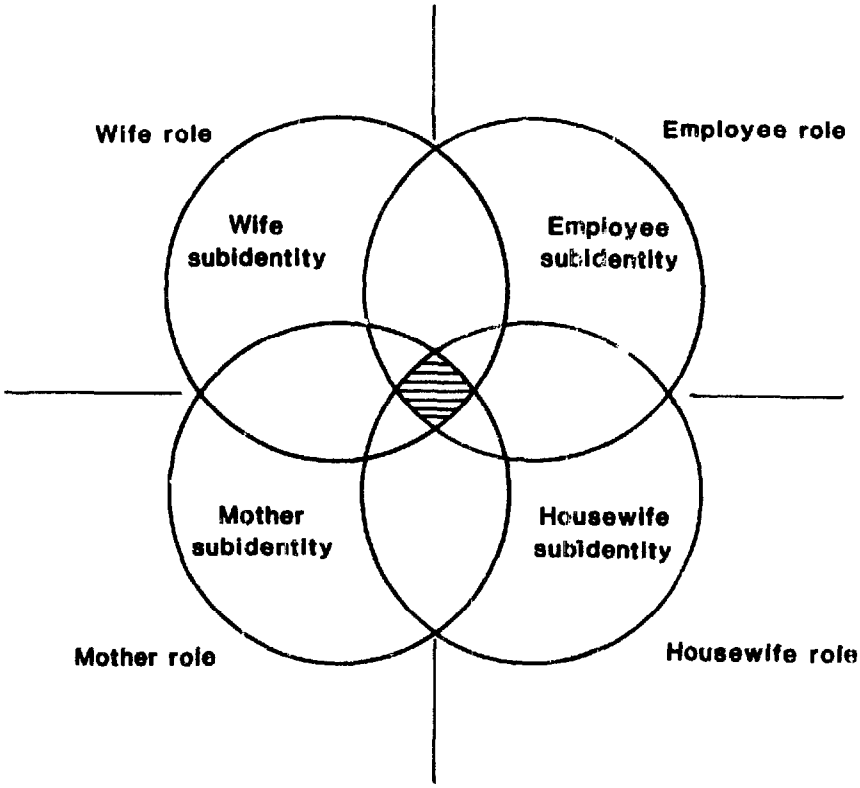

Fig. 1. Hypothetical model of roles of a married woman. *Source* **Ref. 32.**

the nature of transition time between work and nonwork roles. Is the transition necessary only in a temporal sense, or is it the combination of temporal and spatial change?

Albertson [25] in her study of the social aspects of work-at-home, points out that the journey to work provides a transition time between the two roles. This issue is further discussed below.

Working at home will obviously result in increased interaction among family members. They will spend more time together and will share household and family responsibilities. Hiltz and Turoff [26] have discussed some researchers' views on this issue. For example, Day [34] argued that having the husband, wife, children, and pets in the same environment is likely to be more of a strain than most people can survive. Another observation, by Snyder [35], points out that experience with flexitime programs, which increased the presence of the head of household at home, led in "most cases to problems of alcoholism, physical conflicts, and divorce." A study by Nord and Costigan [36], on workers' adjustments to a four-day work week found that after one year, participants in the program reported more unfavorable effects on their home life.

An individual working at home is likely to spend, in a normal schedule, some sixteen or more hours a day within the house. This in itself is a situation that may stimulate additional travel for other purposes as, for most people, such a confinement is probably undesired. The development of shopping malls substituting shopping centers came to fulfill a need for some type of social interaction. The suggestion that people will spend more and more time at home, working via the telecommunications network and entertaining themselves with computer games or cable TV overlooks the fact that individuals do need to interact with others and with the surrounding environment.

In summary, the body of research reviewed indicates that the impacts of work-at-

home on the household's life style are not all favorable. Adding yet another function to the physical space of the home could cause more tension, which may outweigh the expected benefits for the individual.

THE IMPORTANCE OF THE JOURNEY TO WORK

The segregation hypothesis, claiming that individuals play different roles in different social institutions, raises a question about the nature of the transition among the roles. If there is a need for a transition time between roles, one can hypothesize that the journey to work fulfills that need.

There are some indications in past research that may support this hypothesis. Young and Morris [37] analyzed the evaluation of travel time by individuals and found that the peak satisfaction in work trips is associated with a travel time of about 10–20 minutes. They suggest that "some amount of time spent travelling may also be necessary to achieve a separation of work and home activities."

Nilles et al. [10] have reported that 60 percent of their sample (of 200 telephone respondents) have agreed that commuting is a useful interlude between work and home. One-third of the respondents do not view commuting as "a necessary evil," and two-thirds of the sample do not think they spend too much time commuting.

Ramon [38] has found that individuals' preferences for distances to various activities depend on the nature of the activity and that people do not want a close proximity to their workplace. Although this may, as is the case in Young and Morris' work, indicate a desire to avoid the disamenities associated with employment sites, it also indicates a desire for a spatial/temporal segregation, to allow a transition of roles.

The social–recreational nature of activities ongoing in commuter trains, particularly in England, probably would not have evolved if it were not for the lengthy commutation time However, when established as a daily activity, which certainly does provide a transition period, it raises a question of whether or not people would be willing to forego it.

Through in-depth interviews with long-range (100–200 km one way) commuters in France, Delesalle and Poggi [39] have identified a series of positive elements such commuters attribute to their trips. They use the time for social interaction and as a source for new social networks, they rest, they value the "time for being by themselves," and they work. The commuters see some of the time "lost" by the long trip as "recuperated" through the benefits they find in the trip. It is important to note that the majority of the sample (of 32) have been commuting there for more than three years, indicating that that pattern is preferred over relocation. Although this is rather the unusual pattern, it shows that an adaptation to recover positive gains occurs when individuals do not wish to reduce the spatial separation between work and home. It should also be noted that such adaptive patterns are possible where commuter-rail service is available and it does not pertain in a similar manner to auto trips.

A number of researchers have looked on the journey-to-work in the context of multipurpose trips [40–42]. The fact that many work trips do include additional purposes presents another aspect of the possible desirability of work trips.

Viewing the journey to work as a positive or desired element in a person's activity program is a strong suggestion. Future research on this question may qualify it in particular situations. One can, for example, hypothesize that there is a minimum distance in either time or space that is a threshold level. Beyond it the trip costs exceed its benefits, but under it the transition in time/space is insufficient. The situation is probably such that most commuters are not located at the optimum, if such an optimum exists. It can also be assumed that the modes of travel serve the desired elements of the trip in different

manners. Transportation planners may, if they consider the desired elements of the work trip, identify means by which travel can better serve its purpose as a transition instrument.

Some Empirical Indications

A very small survey was conducted among the employees of a computation center at a major northeastern university. The survey consisted of 20 items in which the respondents were asked to rank their attitudes or opinions on a variety of issues concerning work. In addition, some information on the respondents' characteristics was collected. A total of 39 responses were collected. Obviously, this is too small a sample from which to draw conclusions that are statistically valid. At best, it can provide some indication on attitudes toward work at home among employees in occupations that are natural candidates as "early birds" of this type of arrangement. It must be noted that such an indication of attitudes toward hypothetical situations may be very remote from actual behavior, and, hence, the results cannot be seen as predictors of the acceptability of the concept.

Of the 39 respondents, 55 percent were males and 45 percent females. In terms of occupations, 74 percent were computer professionals, while the remaining 26 percent were managerial and clerical staff. Half of the respondents were under 40 years old, 32 percent between and 40 and 50, and 18 percent were more than 50 years old.

Given the small sample size and the structure of the preference ranking questionnaire, the results were aggregated to distinguish between respondents who provided positive and negative attitudes. The indifferent responses were complementing the shares to 100 percent.

A number of questions addressed issues relating to the employees' attitudes to social relationships both within and outside the work place. Respondents were asked whether they would miss social interaction at work (in contrast to other interaction at work). Seventy seven percent responded that they would miss it if they worked at home, and only 13 percent thought they would not.

The relationship between subjective motivation and the employee's observation of how well his or her co-workers were doing was examined. Only 26 percent replied that their motivation depends on the co-workers' efficiency, while 71 percent replied that it did not affect their motivation. This finding implies that remote work will not reduce motivation on account of the employees' assessment of their peers' efficiency. This is somewhat in contrast to what past researchers have found.

Interaction with co-workers was found to be an important element for 80 percent of the respondents, while only 10 percent found it to be unimportant.

Respondents were asked to evaluate the importance of keeping work-life and home-life separate. Two-thirds replied that it is important to maintain a separation, and only 26 percent thought it is not important. This finding is consistent with previous research that points at the different roles individuals play in each setting and how they move from one to the other [10, 25].

The effects on relationships within the household are of particular importance. Asked about the impact of working at home, 31 percent thought it would improve their relationship with their spouses, while 35 percent thought it would worsen it. The very same question with regard to the relationship with their children generated a different picture. Here, 53 percent thought that working at home would improve the relationship, compared with 18 percent who thought the impact would be negative. One possible interpretation is that by working at home, people expect to engage in disputes over roles in the household and, therefore, over one-third of the respondents think the relationship with their spouses

would degenerate. On the other hand, such disputes are not likely to arise with the children and the majority of the respondents would like to spend more time close to their youngsters.

Overall, the feelings of the respondents toward working at home, as expressed in their reply to the question of "would you be happier working at home?" vary widely. Some 30 percent felt they would be happier, 35 percent felt they would be less happy, and the remaining 35 percent did not express feelings in one way or another.

In the most direct question, respondents were asked if they would like to work at home. Only 34 percent replied positively, compared with 45 percent who responded negatively. This is the weighted response to feelings toward both work itself, and the social implications the respondent considered. There is, as can be expected, a difference in the distribution of responses to this question as a function of travel time to work. (The median travel time is about 30 minutes.) Respondents who have shorter travel time divide 28 to 48 percent between those who favor work at home and those who do not, respectively. By contrast, of those residing further than 30 minutes away, the distribution is 43 and 31 percent respectively.

Interestingly, asked whether their job could at all be carried out at home, only 60 percent of the respondents replied positively and 29 percent thought it could not. In our judgment, all but 6 to 10 percent in the sample could have carried out their work from home.

To summarize, it is clear that some of the differences in views stem from the fact that the subject matter of this study is quite abstract for many of the respondents, who have not experienced it; some were not even aware of such possibilities. However, some of the differences should be attributed to differences in the tastes or preferences of individual people. Given the sample size and the information gathered on the individuals, it is not possible to do much analysis of the preferences by the individuals' characteristics.

Conclusions

The major purpose of this paper is to draw attention to some of the possible effects of work-at-home on the individual. The paper certainly does not offer very conclusive results, or a prediction of the degree of acceptance of the work-at-home option. But, based on the literature reviewed and the few empirical indications, it does raise some points for consideration in policy decisions concerning the adoption of the technology:

1. The distribution of effects among the parties involved is uneven. The individual employee, it seems, is called to carry much of the nonmonetary costs, while most of the benefits are accrued to the firm or the general society.
2. Different population groups are likely to vary in their willingness to accept the new arrangement. Those having an "extension" type relationship between work and nonwork, namely, professionals and managers, are assumed to be more likely to accept it voluntarily. Others, who we believe comprise the majority of the white-collar labor force, are less likely to accept the arrangement.
3. The journey to work may have a positive or desired role rather than being burdensome as it is traditionally perceived by transportation planners. The work-at-home arrangement will eliminate the realization of such positive aspects, whereas the neighborhood work centers may provide the desired separation.

To support policy decisions, additional research is called for. The primary direction of future research should, in our view, aim at the quantification of the above results. For example, an identification of the groups most likely to accept the work-at-home arrange-

ment will provide information on the magnitude of future implementation potential. A continuous monitoring of ongoing experiments for periods of more than a year is likely to yield more knowledge on the adaptation to the arrangement by different population groups. Another direction for research is the issue of the transition between roles and the extent to which journey to work attributes can be identified as fulfilling the transition need.

Beyond the specific notes discussed above, it is necessary to stress again that a technology assessment is incomplete if behavioral impact and acceptability are not addressed. The availability of a technology in itself is a necessary but insufficient condition for its wide scale adoption.

The authors wish to thank Shalom Reichman and Boaz Shamir of the Hebrew University for their useful comments.

References

1. Pool, I., The Communication/Transportation Tradeoff, in *Current Issues in Transportation Policy*, A. Altshuler, ed., Lexington Books, 1979.
2. Solomon, R., Telecommunications in an Energy Crisis, A Draft Proposal, Program on Communications Policy, MIT, Cambridge, Mass. (1980).
3. Khan, A. M., Transportation and Telecommunications: A Study of Substitution Simulation and Their Implications, Report #121, Canadian Transport Commission (1974).
4. Clark, D., and Unwin, K., Telecommunications and Travel: A Rejoinder to C. E. Miller, *Regional Studies* 16 (2), 139–140 (1981).
5. Miller, C. E., A Comment on Telecommunications and Travel, *Region. Sci.* 16 (2), 137–138 (1981)
6. Toffler, A., *The Third Wave*, Bantam Books, New York, 1980.
7. Newsweek Cover Story (February 22, 1982).
8. U.S. News and World Report (June 28, 1982).
9. Polishuk P., Review of the Impacts of Telecommunications Substitutes for Travel in *IEEE Transactions on Communications* Com-23 (10) (1975).
10. Nilles, J. M., Carlson, F. R., Gray, P , and Hanneman, G. J., *The Telecommunication–Transportation Tradeoff: Options for Tomorrow*, John Wiley & Sons, N. Y., 1976.
11. SRI, Technology Assessment of Telecommunications/Transportation Interactions, vols, I–III, R. Harkness, ed., Stanford Research Institute, Menlo Park (1977).
12. Oberman, R., Initiatives for Conserving Transportation Energy Through Telecommunications, presented at the annual meeting, Transportation Research Board, Washington, D. C. (1981).
13. Schiff, F. W., Flexiplace: An Idea Whose Time Has Come, presented before the Engineering Management Society IEEE, Washington, D. C. (1981).
14. Motor Vehicles Manufacturers Associations, *Facts and Figures*, Detroit, Mich., 1981.
15. Akoka, J., personal communication, 1981.
16. Olson, M. H., Remote Office Work: Implications for Individuals and Organization, Center for Research on Information Systems Computer Application and Information Systems Area, N. Y. University, Working paper #25, 1981.
17. Salomon, I., Life Style as a Factor in Explaining Travel Behavior, Ph.D. Dissertation, Center for Transportation Studies, MIT. (CTS-RAMP-80-11) (1980).
18. Fowels, J., The Problem of Values in Futures Research, in *Handbook of Futures Research*, J. Fowels, ed., Greenwood Press, Conn., 1978.
19. Gordon, T., The Feedback Between Technology and Values, in *Values and the Future*, K. Baier and N. Rescher, eds., The Free Press, N. Y., 1964.
20. Herzberg, F., Mausner, B., and Peterson, R. D., *Job Attitudes: Review of Research and Opinion*, Psychological Service of Pittsburgh, Pittsburgh, Pa., 1957.
21. Braude, L., *Work and Workers—A Sociological Analysis*, Praeger Publishers, 1975.
22. Likert, R., *New Patterns of Management*, McGraw-Hill, New York, 1961.
23. Maslow, A., *Motivation and Personality*, Harper, New York, 1954.
24. Mitchell, A., Alternative Futures: An Exploration of Humanistic Approaches to Social Forecasting, Stanford Research Institute, Menlo Park, 1967.

25. Albertson, L. A., Telecommunications as a Travel Substitute: Some Psychological, Organizational and Social Aspects, *J Communication* (Spring 1972).
26. Hiltz, S. R., and Turoff, M., *The Network Nation*, Addison Wesley, Reading, Mass., 1978.
27. Bass, B., and Kyterband, E., Work and Organizational Life in 2001, in *Work and Nonwork in the Year 2001*. Dunnette, N. D., ed., Brooks/Cole, Calif., 1973.
28. Dunnette, N. D., (ed.) *Work and Nonwork in the Year 2001*, Brooks/Cole, Calif., 1973.
29. Renfro, W. L., Second Thoughts on Moving the Office Home, *The Futurist* XVI (3) 43–48 (1982).
30. Dubin, R., Work in Modern Society, in *Handbook of Work, Organization and Society*, R. Dubin, ed., Rand McNally, Chicago, Ill., 1976.
31. Parker, S. R., and Smith, M., Work and Leisure, in *Handbook of Work, Organization and Society*, R. Dubin, ed., Rand McNally, Chicago, Ill., 1976.
32. Hall, D. T., A Model of Coping with Role Conflict: The Role Behavior of College Educated Women, *Admin. Sci. Quart.* 17 (4) (1972).
33. Pleck, J., The Work-Family Role System, *Soc. Probl.* 24 (48) (1977).
34. Day, L. H., Factors Affecting Future Substitution for Travel, Paper presented at the Joint Meeting of Operation Research Society of America, Institute of Management Scientists, San Juan, Calif., (1974).
35. Synder, D., Cited by Hiltz, S. R. and Turoff, M., *The Network Nation*, Addison Wesley, Reading, Mass., 1978, p 480.
36. Nord, W. R., and Costigan, R., Worker Adjustment to the Four-Day Week: A Longitudinal Study, *J. Appl. Psychol.* 58 (1) (1973).
37. Young, W. and Morris, J., Evaluation by Individuals of their Travel Time to Work, *Transport. Res. Rec.* 794 (1981).
38. Ramon, H., Sociological Aspects in the analysis of Travel Behavior in an Urban Area—Jerusalem as a Model, unpublished Ph.D. Dissertation, Departments of Geography and Sociology, Hebrew University, Jerusalem (1982).
39. Delsalle, C., and Poggi, D., Les Grandes Migrations Quotidiennes Logiques—Processus et Vecus, Institut de Recherche des Transports, Paris, 1981.
40. Hanson, S., The Importance of the Multi-Purpose Journey to Work in Urban Travel Behavior, *Transportation* 9, 229–248 (1980).
41. Oster, C., The Second Role of the Work Trip: Visiting Non-work Destinations, *Transport. Res. Record* 728 (1979).
42. Damm, D., Toward a Model of Activity Scheduling Behavior, unpublished Interdepartmental Ph.D. Thesis. MIT, Cambridge, Mass. (1979).

Received 8 October 1982