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Consolidated report on physical and psychological stress at
work and the introduction of new technology in
certain postal and telecommunications sectors

(Belgium, France, Germany, United Kingdom)

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1. SUMMARY

Postal and telecommunications services traditionally come under the same Government administration but gradually are coming to have separate management. Postal services, the main interest of this report, are responsible for mail services and counter services. The focus of all four studies is the impact of new technology on postal sorting in particular. Although the degree of automation achieved varies in each country, the ultimate aim is to make letter-sorting a fully automated process. The studies report information obtained from research on stress and new technology in sorting offices using some or all of the following techniques :

- observation
- interviews
- discussions
- ergonomic measurement
- questionnaires.

All the major advances in technology in recent years have one effect in common - increase in the speed with which information is processed and transmitted. This has resulted in the advent of information transmission services such as teletext, videotext etc.. The effects of the introduction of new technology into postal sorting offices are as follows :

Physical effects : Machinery has caused an increase in noise levels, and temperature, and in converted offices has caused disruption and congestion.

Organisational effects : These are quite varied. There has been a slight drop in employment figures, a change in the skills required by a sorter with emphasis on speed and concentration as opposed to geographical knowledge. Effects have been noted in a work content with a decrease for the sorters in autonomy and discretion in organising the work. Also work

practices have changed. In general there are three to four hour cycles in coding work with ten minute breaks hourly. This routine is departed from only when there is a breakdown in machinery. New technology on the whole does not tend to alter the style of management in an organisation; rather it accentuates the already existing style.

Health and Stress : New technology "per se" does not affect the level of job satisfaction experienced by workers because this is contingent on a much wider range of issues. However, with new technology speed rather than service becomes the essential performance criterion, a factor which many workers have difficulty adapting to. Factors which affect performance are :

- Time and duration of the shift;
- Characteristics of the mail;
- Reliability of the equipment;
- Characteristics of the work force.

Factors that lead to stress in postal sorters are fairly consistent in all four reports. They include the effects of machinery-paced work, bad ergonomics (machine noise, cramped conditions, poor lighting), machine break-downs and associated problems with engineers. Overall postal sorting work in itself seems to generate consistent stress patterns. New technology alters the pattern while apparently not greatly increasing the overall stress levels of postal sorters as a group once the transition is complete and the workers have adapted to the new way of doing things.

2. INTRODUCTION

Postal and telecommunications structures have traditionally been under the same administration mainly because they are government conducted operations with a primary concern to carry communications, be it in the collection and delivery of letters and parcels or the medium through which people communicate with one another verbally (telephone calls) or the combination of the two - telegraph service. Increases in population and rapid growth in national and international industry have greatly increased the need to communicate over great distances and at speed. Hence the pressure on both the post and telecommunication systems to reform their operations and accommodate these demands. The expansion of both industries has resulted in each having separate administrations in many countries although in operation they are still mutually dependent and it is notable that this is happening at a time when the technology overlap between the two is increasing all the time.

2.1. The four countries

The French "Postes, Télécommunications et Télédiffusion"

Responsibility for this sector is vested in the State Secretary for Posts, Telecommunications & Broadcasting. Originally, P.T.T. or Posts, Telephone and Telegraph but in the light of new developments in telecommunications reorganised as Posts and Telecommunications. However rapid expansion in broadcasting caused a reversion to the PTT abbreviation (Postes, Télécommunications et Télédiffusion).

In France automation efforts have been directed at postal sorting. Outward letter-sorting is almost entirely automated and research is focussing on the areas of optical reading of addresses, bringing down noise levels and reducing the cost of machinery. Inward sorting (i.e. the sorting carried-out prior to delivery) has not yet been mechanised. Sorting of business mail (CEDEX) is done by automated machines. Complete mechanisation of other (private) mail

has been delayed because of an inadequate code. However, it is hoped to achieve this in the 1990s.

The United Kingdom Post & Telecommunications System

The United Kingdom situation is quite different. The two sections have recently assumed separate identities; British Post Office (BPO) and British Telecom. The BPO has four areas of responsibility:

- mail
- counter
- philatelic
- banking.

The mail system is the main concern of this report. BPO has had the monopoly for conveyancing of letters (not parcels) since the beginning of the century. Mechanised letter and parcel sorting is being introduced into the British mail system. The result is a centralisation plan consisting of the gradual introduction of mechanised letter offices (MLOs) and parcel concentration offices (PCOs) to replace (dispersed) localised manual sorting offices. The MLO system will be described below. The PCO comprises systems of container tippers, drain conveyors, lifts, chutes and belt conveyors for intra-centre transport. It also has a sophisticated centrally controlled system which monitors the flow of parcels through the PCO (C.C.T.V. and illuminated traffic flow charts). The sorting personnel of both centres consist of postmen higher grade (PHG); firstline supervisors or postal executives grade D (PED) and postal engineers.

The German Federal Postal Administration

Responsibility for both postal and telecommunication is vested in the Federal Ministry for Posts & Telecommunications. It administers

through 17 Head Post Offices and the Berlin Head Post Office & Post Offices. There are central authorities which carry out specific functions. These are :

- Telecommunications Central Technical-Office;
- Federal Postal Central Technical Office;
- Centre of Telecommunications Development and
- Social Welfare Office of the Federal Postal Administration.

Below the 18 Head Post Offices, Post Offices and sub-Post Offices are responsible for everyday postal services. There are also offices with special functions :

- The Postal Cheque Offices;
- Postal Savings Banks;
- The Central Telecommunications Licencing Department.

Under the Basic Law the Federal Postal Administration has the monopoly of short-distance conveyance of mail. The Federal Postal Administration has been for some years endeavouring to rationalise the labour-intensive letter post service by introducing new technologies, specifically the introduction of mechanised sorting. Its overall aim is the implementation of a network of interconnected letter sorting units. Unlike the United Kingdom postal administration there are no specific efforts to have centralised parcel centres. But great emphasise is being placed on improving the speed of mail conveyancing by rail with the introduction from 1980 of the fast overnight mail service network.

The Belgian Postal System

The postal system in Belgium is under the direction of the Ministry for Communications together with the Telegraph and Telephone service. These two departments have separate administrations. The postal section also has a special contract with the Soci  t  

Nationale des Chemins de Fer Belges (The National Society of Belgian Railway) whom they have made responsible for the distribution of parcel post and transport between sorting centres. The Belgian Postal officials introduced technology in 1958 by installing first generation electro-mechanical sorting machines. They have moved in gradual stages with technological changes and in 1983 had in operation automatic sorters, second generation coding machines, computers to manage the sorting operation (recording operational time, number of letters processed etc.) and interconnection systems.

2.2. Research Strategies

In the French study, two geographically and organisationally divergent sorting offices were selected for study. These were the Paris-Bonvin and the Poitiers sorting offices. The work the study undertook was mainly ergonomic in nature, employing the following strategies : analysis of activities; observations and interviews; and measurements (which quantify the information obtained). The information then sought falls into four major categories :

- Physical environment (light, noise and heat measurements);
- Analysis of activities (coding desk activities - throughput, eye movement);
- Interviews (attitudes of personnel);
- Physical effort (the number of bins and trays handled per unit of time and their weight) and movement from place to place (the number of movements by operators and numbers of bundles of letters removed from destination boxes).

The Welsh (UK) report conducted research in three sorting offices :

- A purpose built office, 1976, (i.e., to accomodate machinery) with 190 sorters (40% of whom were manuals only) and 40 first line supervisors;
- The oldest of the three, a converted manual office mechanised in 1970 with 60 sorters (20% manual) and 15 supervisors;
- Mechanised in 1981 and also converted from a manual office, a sorting centre employing 65 sorters (20% manual only) and 17 supervisors.

This has traditionally been a predominantly male area of employment.

As a means of gathering vital information, the researchers developed questionnaires from the issues highlighted in interviews with the sorting workers, from observations made by unions and management and from visits by the researchers to the offices. The six sections of the final questionnaire reflect the issues of greatest concern to the study :

- demographic and factual questions;
- satisfaction and demands of the postman's job;
- measure of overall satisfaction;
- satisfactions of the supervisor's job;
- stress and anxiety measure;
- leisure satisfaction scale.

The German researchers studied a varied selection of sorting offices :

- A classic example of a manual sorting office;
- One that was comparable in terms of structure and volume of postal traffic to the above but recently mechanised (1980);
- An example of an office with a video coding station (the most modern form of automatic sorting);
- Three sorting offices using the older technology i.e. mechanised in the 1970s, two of which were purpose built and one which was converted from manual sorting.

A substantial number of employees in the German sorting offices are women, particularly those on part-time evening shifts.

The investigation methods used were individual interviews with employees and discussions with experts. The diagram indicates the exact methods used and the issues focused on :

METHOD	FOCAL AREA
Individual interviews	Stress, strain
Group discussion	Strain, stress, assessment of job
Discussion with experts	Organisation Technology Assessment of job
Observation	Job evaluation
File and documentary analyses	Technology Organisation Staffing and mail traffic structure Health Developments Plans

The Belgian researchers concentrated their efforts on one of seven mechanised sorting centres. The centre employs 650, one hundred of whom are sorting operatives, engaging in both manual and mechanised sorting. Both men and women are employed on coding. The researchers' aim was to compare manual with mechanised sorting, to elucidate which constraints and staff pressures are attributable to the introduction of new technology, with particular attention to :

- work organisation;
- rest periods;
- error checking;
- production needs;
- the working environment.

Their analysis involved interviews, gathering statistical data on the operation of the services and continuous observation of sorting operators' work over several months, followed by a fatigue questionnaire.

3. NEW TECHNOLOGY IN THE POSTAL AND TELECOMMUNICATIONS SYSTEM

3.1. Technology and Post and Telecommunication Services

The function of the postal and telecommunication system is the transport of information; in the former, carrying information in the form of letters from one location to another to save the sender from physically having to travel that distance to deliver it personally and in the latter to carry intelligible sound and picture images far beyond their natural limits of audibility and perception. The function of technology in the postal system is to facilitate the speed and accuracy with which the items of post are collected, sorted, transported and distributed. While the function of technology in the telecommunications service is to facilitate the speed and quality with which information in the form of sound and image is transported from one location to another.

At the root of technological developments in post and telecommunications services are major advances in the field of electronics. The transmission of information has been transferred from the analogue form - electrical impulses corresponding to the sound waves generated by a person's voice to digital form - sound waves translated into binary code as used by computers resulting in a much higher transmission speed. Other major developments include the advent of coaxial cable, microwave transmission systems and optical fibres - electrical impulses are modulated on beams of light, transmitted along microscopic strands of pure glass fibre, which carry signals in digital form at high speed. Each of these technical inventions allows the transmission of signals at a phenomenal speed.

Overall, these recent advances in addition to previous developments (computerisation and mechanisation in general) have resulted in the availability of a variety of services in telecommunications and posts.

3.2. Telecommunications Services

Cable T.V.

This wideband cable system using copper-coaxial cable networks aims to expand the availability of television and radio, particularly through private suppliers.

Systems to transmit T.V. via satellite are currently in experiment.

Viewdata systems :

Interactive e.g. Bildschirmtext (BTX) and Prestel : a cable distributed viewdata system in which public and private information suppliers rent storage capacity on central videotext computers having large memory banks owned by the Postal Administration to which there is general access via the telephone network, acting as a computer (two-way).

Passive e.g. Videotext, Ceefax and Oracle : a one-way (i.e., information centre - it can be read from but not written into) information system broadcast via radio waves. The signals are received on a domestic television. This system has a much smaller capacity than interactive systems.

Telex : An information transmission service that operates both nationally and internationally using digital electronic transmission systems.

Teletex : A memory to memory transmission system (using electronic data) which is much faster than the telex. But different countries wish to develop teletext in different ways. This paperless-letter transmission facility which transmits complete documents in a matter of seconds is not fully utilised.

Telefax : This is a facility (service) that transmits information on a A4 page in one minute (1981). A type of telecopier, it is cheaper and quicker than an express letter.

Teleconferencing : In using this service people in dispersed locations can conduct a meeting or conference by interlinking via vidio-telephone systems.

Telegram Service : This system has recently been computerised to provide a more efficient and speedier service in some countries, while in other countries the service is being dismantled.

Telephone Service : New technology has had its most pervasive effect on the telephone services. All four studies report a move from mechanical and electromechanical switching (connecting calls) to electronic based systems and also from the use of analogue to digital (pulse coded) form of transmission, which has provided a superior quality service. In addition to this improvement the ubiquitous use of computerisation has provided a host of additional services in this area which are being introduced gradually. These services include :

- computerised records' services;
- telephone enquiries' services;
- directory services;
- cable connection services;
- telephone faults' services;
- accounts services.

A more radical development is Germany's Intelsat 5 series - a satellite system that allows the transmission of 12,000 telephone

calls simultaneously. Efforts to introduce Intelsat 6 which will have a capacity to transmit 60.000 - 80.000 calls are underway.

3.3. The Postal System

The postal system can be divided into two major areas or functions: -the mail service and the counter, including banking, service. In general, the nature of each of these services has not changed as a result of new technology; it is rather the efficacy and ease with which they take place. However electronic payment systems with a single credit card are currently being designed, particularly in France.

The Mail System : The function of any mail system is the collection of items of mail (letter and parcel post) from various centres, sorting these items according to their general destination, transporting the sorted items to centres where they are bundled according to their specific destination, and delivery. This is a labour intensive job. A variety of machinery, e.g., conveyor belts and fork-lifts have been employed to ease heavy manual labour elements. Technology however has had its main impact in letter sorting.

The Sorting Centre : Manual letter sorting typically involves workers sorting items into bundles according to general location and class e.g., country, province, city etc. and resorting by placing in pigeonholes, according to more specific destinations. With the advent of coding machines, letters are automatically sorted when the code at the end of the address dictates to the machine the exact pigeonhole (box) the letter should go after it passes through the machine. A variety of machines is available to facilitate the sorting process.

Postal codes in Belgium, France and Germany are numerical. Codes in the United Kingdom combine alpha and numeric representation, which

is more complex to use but permits maximum automatic sorting, including inward sorting.

Initial Sorting : segregates long and short letters, parcels, machinable from non-machinable items and rejects.

Conventional Coding Machine : The letters pass in front of the coder sitting at a coding desk, either coming past horizontally or dropping down vertically. The operator keys in the appropriate code and the letter is imprinted with a machine-readable code and passes on to be automatically sorted according to the code. Such coding desks can be grouped into lines side by side all facing the same direction, or they may be placed in a single file, one person behind another, which can accentuate the isolation of the operator.

Video Coding Machine : Here addresses of mail items are scanned and displayed on visual display units. The keyed-in code is assigned to the items, they are imprinted with the code and on the basis of this information, sorted into appropriate boxes of the primary sort unit. The video machines have the advantage that they can be at some distance (even on a different floor) from the actual flow of the letters and therefore can be in a quieter working environment.

Automatic Address Reader Machine : The address reader is used to machine-read the bottom two lines (at the bottom or penultimate line only) of addresses on machine readable short letters. Letters for which the despatch information (postal number) has been recognised are imprinted with a machine readable code (the post code/internal reference number) and distributed to the correct boxes adjoining primary sorting section. Letters for which the addresses have not been recognised are diverted, uncoded, into a rejection box and forwarded to the coding or manual sorting area.

Final Sorting Machine : The code on each letter as it passes through this machine is determined by a sensing head which lights

up previously imprinted code-bars with an ultra violet light. This information is transferred to a computer which determines the relevant sorting bar numbers and outputs the information to the sorting machine coding unit. The destination data for each item is passed via a light-barrier continuous-impulsing device until the item has reached the last sorting gate. Thus the letter automatically ends up in the correct destination box.

From the sorting box the items are bundled and sent via conveyor belt to a tying machine and from there to despatch chutes according to their destination.

4. PHYSICAL ASPECTS

The introduction of mechanised sorting has a number of environmental effects.

Noise : In the Belgian report it is stated that workers are exposed to noise risks if they are exposed to impulse noises higher than 80 dbA, and thus most of the machinery should be reconsidered, especially the binding machines and also the interior architecture. In Belgium manual and mechanised sorters are juxtaposed with little distance between them. Hence the former are all subjected to the ambient conditions generated by machinery. Noise levels of 101-112 db (at peak times) were recorded in a French sorting office. In the German sorting offices, a list of stressful factors for manual workers and video-coding operatives shows that the manual workers are more disturbed by noise than the video coders, who may be in a separate area, on the stressful factor scale. The later generation of machines tend to be quieter.

Heat : In the Belgian sorting office two sources of heat made working conditions very uncomfortable :

- the windows were only $1\frac{1}{2}$ metres away from the coding operatives. These windows were stuck and the blinds defective and air conditioning was inadequate. Under direct sunlight nothing could be done to mitigate the situation;
- a second source was the overheating of equipment.

It is quite obvious that uncomfortable temperatures are not solely attributable to the introduction of machinery but rather to existing ergonomic conditions in centres. Also, where machine heat is unbearable, air conditioning can reduce high temperatures.

The Structure of the Work Setting : Three of the four reports refer to the cramped conditions caused by putting new sorting equipment in old manual sorting offices : "the most intractable problems are posed by the elderly conditions of the buildings and the physical working environment" - Belgian report.

Lighting : The French report refers to the provision of lamps (with three levels of strength) to supply adequate lighting. However the workers prefer natural light and only resort to artificial light during night shifts, claiming that the lamp light hurts their eyes. Direct sunlight was troublesome at some workstations near windows in one French centre. Individual adjustable lighting is critical in avoiding possible reflection problems with, for example, window envelopes.

Standing : One of the biggest advantages of code-sorting over manual sorting is that the former is done while sitting down while the latter often involved standing. All four reports refer to complaints by manual sorters about the length of time they had spend standing and the U.K. study shows that although the code-sort workers were not entirely satisfied with the seating they preferred this arrangement to standing.

Complaints : A host of complaints result directly from the physical aspects of the job and have been referred to in all reports : for example - that they are seated for long periods, concentrating hard and working at great speed in an environment which has significant physical deficiencies : "the operators are obliged to adopt rigid postures thus eliminating relaxation of effort either physical (posture) or motor (arms or oculomotor)" - French report. Complaints include :

- eye trouble
- headaches
- neckpain

- shoulder pain
- back pains
- wrist pain
- forearm pain
- finger pain
- disturbed sleep
- tiredness
- nervous irritation.

Handling : The mechanical sorting of long letters has eliminated the physical handling of mail for the sorters. "Manuals had to hold between 3-5 kg. of letters at a time in the hand and sort while standing" - German report.

Centralisation : One disadvantage of mechanisation was noted in the U.K. report. Mechanised sorting is carried out in a large centre whereas manual sorting, in the past, took place in many small centres dispersed about the country. This means that workers who lived near the old manual sorting office now have to travel some distance to work. This is sometimes difficult as the job has irregular hours and public transport is not always available.

Conclusion :

The two major physically related stress factors associated with manual sorting - holding heavy bundles and standing for long periods while sorting have been eliminated by mechanised sorting.

Most of the uncomfortable physical conditions associated with mechanised sorting are most prevalent in centres that have been converted from long established manual offices.

"Employees at new work stations in letter-sorting voiced far fewer complaints of the troubles and health disorders typically associated with work, whereas among those at the remaining manual sorting work stations such complaints were still very much in evidence" - German report.

Conditions such as noise, heat, seating are seen to be modifiable. The French report notes, for example, that "studies have been undertaken at national level in the areas of physical environment (temperature, noise, light),... postural aspects - and design of equipment". In short, the uncomfortable conditions in manual sorting are seen to be permanent and unavoidable while those associated with mechanised sorting are assumed to be temporary and modifiable.

5. ORGANISATION FACTORS

5.1. Introduction

It is difficult to escape the conclusion that the reasons for introducing new technology in the postal sector have not been clarified or made explicit in any of the countries studied, neither in general nor to the workforce involved. In Belgium, it was implied that the objectives were :

- to improve working conditions by eliminating unpleasant handling operations;
- to improve productivity and thus reduce the cost price of the service;
- to make better use of the physical locations of sorting centres;
- to guarantee, even enhance, the quality of service provided to the general public.

In Germany the Minister concerned stated that the first priority was to reduce costs; which in turn might also lead to an improvement in the quality of service provided.

However certainly amongst employees there seemed little sympathy for or understanding of the justification for new technology in the postal sorting area. Perhaps it is just as well then that the unobtrusive but pervasive influence of trade unions which comes through in the reports was on hand to moderate the worst features of the transition.

While trade unions in general continue to exert a "holding influence" on new technology introduction, they also had specific roles in its implementation. For example, in the U.K. prior to establishing a mechanised letter office (MLO), a committee was

set up consisting of management, supervisory staff, trade unions and engineering staff. The proposed changes and their training implications were discussed and subsequently monitored as well as the problems which were specific to the area in which the MLO was being established. In all countries when the new technology had been installed, both management and unions seemed to apply a fair amount of flexibility and discretion in bringing about a "workable" situation. In Germany it was reported that "not least through the efforts of the unions", working conditions in all areas of sorting had now greatly improved.

However, in all cases trade unions have not yet been involved as early as they would like to be in the change cycle, that is, at the decision and design stages. Neither of course, has the customer or "end user".

"... new technology should be introduced not only for commercial profit but also to improve services and working conditions". PTTI studies (Geneva) Winter 1979. pp 5/12.

5.2. Structure

The switch to digital exchange equipment in France has resulted in a drop in personnel from 15 per 1,000 subscribers in 1975 to 8 per 1,000 in 1982. In Germany there is a forecast of 6,800 job losses by 1990 due to modernisation of telecommunications equipment. Coupled with this in Germany a network of inter-connected mechanised letter-sorting units is planned leading to c. 74 units by 1990. The advent of OCR (optical character recognition) equipment is forecast to lead to dramatic reductions in the workforce. Hence it is being resisted, by U.K. trade unions in particular.

Despite all this, the experience to date is one of gradual, incremental introduction of new technology. In Belgium it has been

progressing since the early 1950s. This is accompanied by some transfers, some redundancies but by and large stability in the numbers employed. In France between 1978 and 1982, the number of established staff in the postal service has been rising as have the proportions of established female staff and females working on the operational (as opposed to the general services side) of the post office. In short, the introduction of new technology in the postal service has not yet led to the large scale reductions in employment that were anticipated.

This has been achieved in part through trade union pressure and guarantees such as the German one of redeployment in other areas. In Germany also, mechanised letter-sort work is by consent whereas in the U.K. it is a prerequisite for promotion.

However, this stability is being bought at a price, for several reasons. The price is being paid largely by the employees themselves.

It may seem a simple matter on an organisation chart to transfer a "standard post office person" from one slot to another in the organisation. However in the case of a transfer from manual to mechanised postal sorting, the clusters of skills and personal capacities required for the two jobs are quite different. If training is adequate the required skills can be developed. To the extent that this is not the case, the cost of the mismatch is borne at least in part by the employee, in the form of stress. Personal capacities cannot be changed except perhaps within very narrow limits. Added to these two are the social and domestic circumstances of the employee which may or may not be adjustable (for example, location of home).

The clusters of skills and capacities required respectively for manual and mechanised sorting are indeed quite different. The former relies on in-depth personal knowledge and long experience of

particular geographical areas. These areas have a myriad of associations for the sorter and in a very real sense actually constitute his personality.

On the other hand, mechanised sorting requires relatively high levels of short-term memory, perceptual and fine motor skills and learned reactions to numbers in the abstract. It is important to note that these three capacities all decline markedly with age as does the ability to learn new skills. The technology in question therefore inherently discriminates against age. This is reflected in all reports by the difficulties of older employees in adapting to or coping at all with technology in its present state of design. These difficulties are further compounded in the U.K. case where ability to operate the new equipment is a requirement for promotion.

The new technology in its present form is telling the long established experienced postal sorter that most of the things that made his life meaningful up to now are worthless and given the manner of its implementation in many cases, it is telling him this in a very blunt way indeed.

All four countries report an excessive emphasis on speed in training for the new technology and the admonition to "code what you see". This substitution of speed for accuracy in sorting runs directly counter to the traditions in all four postal services. Thus a further problem is unnecessarily added for those transitioning from manual to mechanised sorting. There were "across the board" reports of old hands refusing to forsake the personal pride they took in giving good service.

Given this it is hardly surprising that training for manual sorting consistently gave greater satisfaction; and that training in mechanised sorting was for older workers a period of great pressure.

Add together these problems to a fundamental lack of clarity on all sides about the reasons for the new technology as well as confusion about whether efficiency or service was the criterion to work to and you have quite a portfolio of stress generating ambiguity.

5.3. Work Content

The French report states that in the development of the technology little consideration has been given to :

- effects of job content

- the organisation of work in space or time

- characteristics of the work force.

These sentiments are echoed in the other reports as well. In fact, so little pre-planning was done that in some cases major problems were created by the fact that different processes (machines) got through the work at greatly differing rates. Coupled with, in many cases, less than ideal reliability of the equipment and the problems of getting engineers to sort things out expeditiously. The machinery in itself is in many cases the source of much frustration.

Nearly all sorting offices still have a mix of manual and mechanised sorting. Thus manual sorting and "residual" tasks are used as a "relief" from work at the coding desks. Jobs are rotated, sometimes hourly.

Although many of the back-breaking aspects of lifting parcels have been eliminated by conveyors and other machines, a considerable amount of lifting work remains. Other than manual sorting and coding desk work, most other work is of the "machine minding" variety.

One consistently highlighted difference between manual and mechanised sorting is the degree of autonomy in manual sorting and the amount of discretion available in organising the work. In contrast, coding work was dictated down to the point where operators had to "code what you see" - even mail which was incorrectly coded or addressed. In this sense, coding work is a step backwards from participation towards the "treadmill" approach to work. (PTTI studies number 25 Winter 1979 "...the worker must in any circumstances be able to remain in control of the pace of the machine. Machine paced work is unacceptable"). All operators try to achieve minimum hourly rates of throughput and these are often exceeded by the operators. All countries report the emphasis on speed in coding as the least satisfactory aspect of the work. Short delays and interruptions caused typically by letters jamming at various stages can be a major problem in disrupting operators' rhythm, and maybe leading to a compensating speed-up.

The other main difference between manual and mechanised sorting is the amount of social interaction possible during manual sorting. In mechanised sorting on the other hand, the operator is isolated and in any case is not given time by the machine to indulge in interaction with his fellow workers, except that is, when the system jams or breaks-down. Thus to some extent the operator is relying on technical deficiencies in the machinery to break the monotony of his work. It is pointed out in the Belgian report that 10% of letters have to be reprocessed because of errors, rejects or other problems - which is the equivalent of one entire session of work for one operator.

5.4. Work Practices

The maximum time on coding desks seems to be three or four hours per shift. A ten minute break in each hour appears to be the norm. The point was made that fixed hourly breaks make for an increase in stress towards the end. Other breaks due to reprocessing and

feeding machines also provide breathing spaces... as one report put it... "thus regulation is 'naturally' arrived at". In the case of manual sorting, sorters get up frequently to perform other small operations and these "buffer tasks" constitute welcome breaks. The importance of these informal breaks is emphasised by the fact that coding workers from the Poitiers office maintain that without them, they would be unable to cope due to the consistently high work load in that office. This confirms the French opinion that the determination of work cycles is based on "exclusively technical considerations".

The inference to be drawn from the U.K. report is that 50-75% coding work plus manual sorting is an optimum mix. The consideration which seems to be peculiar to the U.K. situation is the amount of overtime worked in sorting offices which is way above the national average. It is not a situation which trade unions or employees find acceptable.

In Germany in particular the proportion of women workers working part-time in sorting centres is extremely high - nearly 98% of the part-timers in some cases. The German case is singular in that the women volunteer for the coding work as they like the clerical status of coding work. Manual workers categorisation could be better paid. Almost all postal employees in Germany are union members.

In summary, what appears to happen is that the work practices associated with new technology are quite inadequately thought-out to begin with. However a process of adaptation occurs so that a workable pattern of work practices grows up which is tolerated by the system. For example, there is an unwritten rule in German sorting offices that women may swap positions. Thus strategies for regulating workload emerge through flexible work organisation and pliable management, supervisor, worker and union relations. Together, people make an unworkable system workable.

5.5. Management Style

There are two issues here. The first concerns the manner in which decisions are taken to install new technology. The second concerns how it is managed once it is installed.

It seems quite clear from all reports that there was no participation by anyone other than top management in decisions to implement new technology. Nor did there seem to be any rational discussion of the benefits or otherwise of the changes involved. In the absence of a concomitant democratisation of management style, centralisation into a few large sorting offices will inevitably accentuate any existing authoritarianism in the system. It certainly is not conducive to greater participation unless existing structures are fundamentally participative; and unless these structures are appropriately developed to ensure that people are managing the technology and not the other way around.

That having being said however, it does appear from reports that considerable flexibility was used during the transition. However, and perhaps this is a salient point, this flexibility was of the informal kind. It is quite clear that the organisations' systems (training and placement are two examples) were too rigid and undeveloped to use the technology in the most human way. It devolved upon the supervisors and workers on the spot to make the system workable.

And herein lies the importance of management or supervisory style. The U.K. report in particular notes the fact that the style of supervision was the critical element in satisfaction with the workplace as a whole... the role of supervision was the dominant one in the feelings people expressed about their job. Similar themes emerged from other reports. The Belgian report for example asserts that "flexibility" maintains a "human face" on this work. The worry is expressed in the German report that although a

democratic management style is optimum, what actually prevails is a style which oscillates between "laissez-faire" and "autocratic".

It has been said that technology itself is neutral. Rather than determine a style of management, it tends to accentuate the already existing style. If management is autocratic, technology can provide it with the tools for a deeper and more pervasive form of autocracy. If on the other hand the initial style is democratic, technology will enhance and further liberate people's capacities.

In this context it is important to know what kind of controls are inherent in the new letter sorting technology and how they are used.

In manual sorting a "spot check" system operates but there are no hidden performance checks. A typical check on manual sorting is a spot check on speed and a monthly check on errors. Mechanised sorting equipment on the other hand has built into it the ability to continuously measure individual productivity and error level but not the number of rejects. Productivity on machines other than coding is not inherent in the machine itself.

However, in France there is no specified throughput for coding work: but operators themselves use an implicit norm of 1800 items per hour because this standard obtained in training. In German sorting offices individual code sort performance is not monitored. In the remaining two cases, the use of such information seems to be very much a function of prevailing supervisory style.

Thus, overall, it is the management style and not the technology which determines the extent of pressure on the workforce. Although the characteristics of a technology can unwittingly or otherwise provide an autocratic organisation with dangerously obtrusive tools.

On the other hand, the monitoring capacities of coding equipment can be and are used as feed-back mechanisms by individual operators and in fact in some sorting offices this information is used by the operators as a form of competition amongst themselves.

6. HEALTH IMPACT INDICATORS

6.1. Introduction

Going on the assumption that by and large, the postal service recruits the type of people it needs, then the obvious places to look for manifestations of stress are in the areas of Job Satisfaction, Performance and Absenteeism. If the right people have been recruited, decrements in these areas indicate problems in the working environment.

From all reports it would seem that absenteeism is relatively high in postal sorting work. The French report states for example that between 20% and 25% extra staff have to be carried to cope with fluctuations in traffic and with absenteeism... in 1981, people in the postal service in France took an average of 14.47 days off in the year; and in fact the figure for the Paris area is much higher. A substantial number of the workers in the Paris sorting area are assigned from either the provinces or the overseas departments and in 1981 45,2% applied for transfer to their home region. The German report notes in particular the higher levels of absenteeism amongst part-time workers. Beyond that however it is not clear from the report what role new technology plays in this. In Germany for example sick leave figures for those engaged in mechanised sorting have not increased since the introduction of new technology. On the other hand the U.K. report states that manual sorters and those working least on code sorting take the least amount of time off. The implication would seem to be that code sorting is more stressful overall.

6.2. Job Satisfaction

On the question of job satisfaction several essential themes come through :

- the physical prevention of communication and social interaction in code sorting leads to a reduction in sociability with a marked decline in overall job satisfaction;
- the ergonomics of the code sort area in particular have a consistent negative effect on job satisfaction in all four countries;
- there is a consistent correlation between job satisfaction and the quality of supervision;
- in all four countries experienced sorters in particular have problems in adjusting to the simple criterion of speed when for them quality service is an inherent part of job satisfaction;
- age plays a crucial role in modulating satisfactions and stresses. (For example, older part-time workers are far more satisfied than younger part-timers).

However, while this might indicate a drop in job satisfaction with the move to mechanised code sorting, the issue is not that clear cut. The French report states that all the Paris operators prefer code sorting to manual sorting but those working longest on coding (2½ years) are finding it increasingly difficult; and the U.K. report confirms that while mechanised sorting lacked variety of work and social interaction, it could present a sense of challenge in terms of skill and concentration. In Germany sorters opted for the high prestige of "machine" working rather than the relatively more highly paid jobs in manual sorting.

Other variables entered the job satisfaction picture as well : in the Welsh case, distance travelled to work is negatively correlated with job satisfaction while length of service is positively correlated.

This report finds that the only group who really achieve overall satisfaction are the supervisors: and they in turn find their subordinates to be the least satisfactory part of their job. The report feels that manual and mechanised technologies produce clear differences in levels of job satisfaction. However, given the variety of conflicting indications from other reports, it must be assumed that the new technology "per se" does not constitute the problem: degree of job satisfaction is contingent on a much wider range of issues. The relationship between new technology and job satisfaction (and therefore stress) cannot be isolated from the characteristics of the working environment as a whole including critical factors such as management style. The transition phase is not a full basis for conclusions about the impact of new technology as such in postal sorting.

6.3. Performance

With the new technology speed seems to be the essential performance criterion. So much so in fact that some French workers (and presumably others as well) depart from the routines learned in training in order to increase their work rate; and workers in all countries use a mix of coding and non-mechanised buffer tasks in order to get relative relief and maintain performance levels.

Overall the factors which affect performance and which therefore must be assumed to be stressful are :

- time and duration of shift
- characteristics of the mail
- reliability of the equipment
- characteristics of the workers.

Most reports reveal an increase in the number of rejects as the shift goes on. The obvious explanation for this performance decrement has to be an increase in tension which, due to stressful factors, builds up with the duration of the shift. These stressful factors are threefold :

- the elimination by automation of opportunities for relaxation;
- pressure of distribution deadlines approaching and organisational factors such as fixed hourly breaks which can further accentuate the "treadmill" character of the work;
- persistent and intrusive cluster of environmental factors such as noise, in particular, as well as poor lighting and ventilation combined with adverse ergonomic conditions.

For the workers, familiarity with the area (even in numerical coding) obviously makes some aspects of the work easier. For example, in the Paris office, those who had been there more than two years settled into the work. At the same time, in all studies, older and more experienced workers find it more difficult to bring themselves to reject coding anomalies, consequently their speed is affected - they sacrifice quantity for quality.

Plastic and glassine window type mail places much greater stress on sorters visually, as do hand-written envelopes and envelopes with structured backgrounds. It is doubtful whether the problems of mail sorters are adequately accounted for in decisions about mail specifications; at least not to the extent that are sorting machine requirements.

6.4. Stress

The pattern of stressful factors which emerges is fairly consistent over all four reports :

- in general, stress is inversely related to the degree of control individuals have over their work. However, even when they do control the pace of the work they can be "driven on" by fortuitous environmental factors such as the machines themselves and the noise and heat. Thus the environment tends to accentuate existing tension tendencies in individuals. Without adequate relaxation provisions this tension building is cumulative throughout the course of a shift;

- in all cases unnecessarily bad ergonomics lead to stress; in many cases due to factors which, with very little foresight, could have been avoided. In a similar but broader context environmental factors generally such as machine noise and restrictive working conditions are significant stress factors. This is particularly true of the cases where new machinery is installed in old buildings leading to undue machine noise and cramped working conditions;

- a substantial amount of stress is caused by machine break-downs and anomalies and the consequent problems in dealing with "bureaucratic" engineers. With the advent of mechanised sorting, the postal engineer now finds himself in the "front line", a position to which by training and tradition he is often not yet fully adapted;

- one of the most consistent mistakes made by organisations is a failure to realise how interested the "ordinary" worker is in the basic objective or rationale of the organisation in which he works. It is chronically stressful to work in an organisation which does not make sense. In the present context, the introduction of new technology is rarely either justified or explained beforehand. In fact, it is cogently suggested in the German report that when all factors are taken into account, the new technology is not in fact economically viable, and the cost reducing effects are not considered proven in the other

studies. Couple this with what many workers, particularly the most experienced ones, see as a significant deterioration in service and you have a chronic and significant source of stress. People are quite prepared to put up with a lot in the short term when what is happening makes sense in the long term. However if in their view, changes are seen as pointless or even detrimental it becomes very difficult for them to invest themselves to any great extent in their work. Management and supervisory staff do not have a monopoly on concern about the strategic issues in organisations; except perhaps in the classic authoritarian view.

In general, the stress factors listed in the German report paint a picture which is representative :

Stress Factors in Manual Sorting Centres :

- pace of work towards the evening;
- regulations on working hours;
- noise caused by typing machines, radio and over-crowding;
- office climate : too warm in summer, too cold in winter; draughts;
- dust;
- ergonomically poor design of equipment (especially sorting cases);
- insufficient space;
- unduly long periods of standing (long letter sorting);

- proportional manning levels "wrong"; in short letter sorting, this resulted in more than 10,000 sorting movements per shift;
- awareness that supervisors are looking over shoulder;
- inappropriate break-times.

The resultant symptoms of strain essentially involved fatigue, sometimes so great that the required output could be maintained only with difficulty, the effects of intense concentration (especially at the final sorting case), considerable sleep disturbance, footpains, eye problems, backache and swollen legs. There was general agreement on the "league table" of stressful factors : the lightest work was considered to be facing, followed by pre-sorting. There was somewhat more strain involved in working at the final sorting case, more still in long-letter sorting and most of all at the bagging point. Almost all employees, both part-time and full-time, complained of muscle, shoulder, back and arm pains.

Stress Factors in Mechanised (Conventional) Coding Centres :

- noise nuisance (letters and coding are in one room) - and machine noise affected the coding rhythm
- sequential arrangement of coding desks affects communication;
- a feeling of being driven on by the machine to increase output, although coders actually had control over the pace of work : with conventional machines the following letter can often be seen in a preparation panel;
- the proportion of non-coding tasks within one shift may be considered insufficient;

- high degree of concentration;
- machine breakdowns;
- anxiety about output.

Stress Factors in Video Coding Centres :

The principal factors were named by the operators in a German office who work no more than two 50-minute sessions on coding per shift as :

- pace of work;
- expected and/or unexpected fluctuations in the volume of mail;
- pressure of time, especially towards the end of the evening shift;
- work on the tying machine;
- changing over programmes in final sorting;
- too few breaks;
- physical work;
- height of the final sorting compartments (the shorter employees have problems);
- checks (now indirect);
- lack of feed-back (positive or negative);
- high degree of dependence on machines;

- unpredictable frequency of break-downs (several times per week, or none at all for months);
- problems of office climate;
- noise from the tying machine;
- scarcely legible addresses.

The resulting stresses in coding work are essentially induced by the extremely high degree of concentration involving various degrees of fatigue and in most cases sleep disturbances and gastro-intestinal complaints.

Stress Factors in Mechanised Long Letter Sorting

- the machine needed more frequent maintenance;
- the pressure of time had become greater;
- in clearing the mail, the entire volume was concentrated on one person;
- performance measures were thought to be unfair, since they were in principle carried out at times when the volume of work was low;
- dust pollution was a major problem;
- clearing mail from the conveyor, which has to be classed as highly stressful from the physical point of view as well, was used in the rotation of jobs to counterbalance coding.

Surprisingly however the degree of strain involved has to be classed as no more than moderate. There were reports of

considerable stress towards the end of a spell of coding as a result of concentration and once again complaints of pains in the cervical and lumbar-vertebrae regions of the spine particularly after a spell of work clearing the "long conveyor". All in all however the verdict was positive; the new long-letter machine was seen as a blessing.

7. CONCLUSIONS

It appears that decisions to implement new technology in postal sorting are taken without consultation with the people who are to operate the technology. This has a number of effects :

- stress resulting from ambiguity about the reasons for introducing the technology;
- stress resulting from ambiguity about whether "service" is any longer a criterion to work to;
- organisational and technical hitches which could have been avoided if those with experience at operational levels - the workers - had been consulted;
- doubts for which there is perhaps a realistic basis that the new technology was not justifiable even on economic criteria let alone more significant ones.

It should be noted that this lack of consultation at an early stage occurred despite the existence of regulations on consultation in some countries. It is not revealed in the reports whether consumer interests were consulted.

Organisational and environmental problems meant that the transition and early stages of the new technology result in considerable disruption and stress particularly for older and more vulnerable staff. Although considerable efforts go into technical and organisational measures, the implications of the new technology for staff appear not to have been thought through at all.

However, a "settling down" then occurs, particularly in cases where management style is flexible and conducive to local resolution of the problems created by the transition. Most offices then revert to what

might be called "normal" stress levels resulting from residual organisational environmental and ergonomic factors. Averaging the results of the four studies would indicate that these remain chronically at a fairly intrusive level.

The essential point remains that it is not the technology "per se" but the organisational and management style behind it, that determine its impact on the workforce. Man is almost infinitely adaptable. However until some standard measure of the condition (physical and psychological) of the workforce is devised, it is difficult to monitor the real human cost of organisational decisions, to know how profoundly his adaptability is being challenged. In the meantime, the individual worker and family pay the price for organisational incompetence. As all four reports indicate, the price can often be a high one.



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