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Working Paper 169

Working Paper 169

July 1983

INFORMATION TECHNOLOGY AND TRANSPORT: SEMINAR PAPERS AND SUPPORTING DOCUMENTS

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This work was sponsored by the Science and Engineering Research Council with the support of the Australian Road Research Board

CONTENTS

The following report contains a section that was originally contained in the drafts of this document, and is now available only as an Annex to the main Working Paper 172 on this study:

> WIGAN, M.R. (1983) Information technology and transport: research proposals. Technical Note 126, Institute for Transport Studies, University of Leeds, Leeds, UK.

ABSTRACT

WIGAN, M.R. (1983). Information technology and transport: seminar papers and supporting documents. Working Paper WP 169. Institute for Transport Studies, University of Leeds, Leeds, UK.

For three months of the academic year of 1982-3, the author held an SERC Visiting Fellowship at the Institute for Transport Studies at Leeds University, UK. This was supported by the UK Science and Engineering Research Council, Oxford Systematics (Australia), and the Australian Road Research Board. The objectives of this fellowship were to identify effective researchable projects in the overlapping fields of Information Technology, Transport and Communications.

This document comprises background notes or drafts of conference papers, based on seminars given at the Institute in the early stages of the fellowship. Each of the papers is also separately available as an ITS Technical Note. The chapters cover the following themes: the future impact of computer based technology in engineering; communication devices and information technology; access to electronic conferencing and mail systems; information systems and their role in transport research, from the point of view of research productivity, both for individual researchers, and for research organisations; the application of time use and activity analysis to information technology issues; and the role of information technology in regional development.

A number of research proposals were generated and discussed with members of the ITS staff and others during the period. Detailed discussion of the areas covered is given in the companion ITS document (WP172). More details of some of the research ideas are given in an Annex to that report, as ITS Technical Note 126.

KEYWORDS: TRANSPORT/ COMMUNICATIONS/ TIME USE/ VIEWDATA/ ELECTRONIC CONFERENCING/ DATA BASES/ KNOWLEDGE BASED SYSTEMS/ FAMILY EXPENDITURE/ MICROCOMPUTERS/ UK/ AUSTRALIA/ INFORMATION TECHNOLOGY/

INFORMATION TECHNOLOGY AND TRANSPORT: SEMINAR PAPERS AND SUPPORTING DOCUMENTS

1. INTRODUCTION

For three months of 1982-3, the author held an SERC Visiting Fellowship at the Institute for Transport Studies (ITS) University of Leeds, UK. This Fellowship was sponsored by the UK Science and Engineering Research Council (SERC) and the Australian Road Research Board (AARB), with additional support from Oxford Systematics. The objectives of this Fellowship were to identify researchable projects in the overlapping fields of information technology, transport and communications, and to help to focus and accelerate the ideas within ITS on the establishment of a broader basis of work on the interaction between transport and communications. The tenure of the Fellowship was in two segments, the first, of two months, being in the Autumn of 1982 and the second, of one month, in Summer 1983.

During the first segment of the Fellowship, a number of seminars were held, and research proposals generated and discussed with members of the ITS staff and others. Most of the projects suggested were designed with the extant skills of Institute staff in mind, to form a basis for further research proposals in these areas. Detailed discussion of the areas covered is given in the companion ITS document, Working Paper 172 (entitled "Information technology and transport: what research needs to be started now?").

The present document collates the notes produced at and following the seminars held in 1982/83. Some seminars were internal to ITS, and others were given at conferences elsewhere. Also included here are some of the documents produced in Australia prior to the final segment of tenure of the fellowship at Leeds, drawing on the work undertaken in late 1982 in the first segment.Details of all the seminars and conference papers up to July 1983 are given in Section 2.

2. THE SEMINARS PRESENTED, AND THE CORRESPONDING NOTES

This section records the seminars given at or on behalf of ITS during the first phase of the Fellowship, and other conference papers. The ways these relate to the various Chapters of this Working Paper, to other Technical Notes (TNs) produced by the Institute for Transport Studies, and to the Australian Road Research Board's series of ARRB Internal Reports (AIRs), are as follows.

(1) Time use and activity participation: application of time use and activity analysis to IT issues. (November 11th 1982)

There were several versions of the notes produced for this seminar; that reproduced here, at Chapter 8 (and as ITS Technical Note TN 128) was a preprint of a paper for the World Conference on Transport research held in Hamburg in April 1983. A previous version was issued as AIR 1118-2.

(2) Tools of the trade: the position of the microcomputer in IT impacts. (November 17th 1982)

This was an informal seminar, in two parts. The first covered the key role for microcomputers as devices for accessing IT facilities, and the second gave details of microcomputer performance. Chapter 4 (and TN 125) provides summary notes of the first part, and a reference for the second part.

(3) New media provided through IT: computer conferencing and electronic mail. (November 19th 1982)

This seminar led to a paper on "Access to electronic conferencing and mail systems at Leeds ITS", which was subsequently presented by H.R. Kirby at the 1983 Annual Conference of the Universities Transport Studies Group in January 1983. The paper covers details of packet switching services, electronic conferencing and electronic mail systems, with detailed specifications of the means of access to and facilities provided by each of a number of such systems in Austria, UK, and USA. The first version, TN 104, issued in December 1982, was also available as AIR 1118-1. The revised version (also available as TN 104.1) is included here as Chapter 5.

(4) Information and its role in transport research: database access and IT developments on research productivity. (December 3rd 1982)

This seminar covered the role of information systems and their relationships with transport research, and the facilities now commercially available with advanced IT support. It is reproduced here as Chapter 6 (and as part of TN 127).

(5) Communications, transport and telecommunications interactions: research requirements and applied research needs. (December 8th 1982)

This seminar concluded the first phase of the Visiting Fellowship, and provided a review of the research potential in information technology from a transport standpoint. Details of

this, which were in the original draft of this report (TN 117), are now in Technical Note TN 126, as an Annex to Working Paper 172.

Other notes reproduced here are conference papers presented elsewhere arising out of the time spent on the Fellowship. These are:

(6) The future impact of computer based technology in engineering.

This paper records an address made to a Plenary Session of the 1983 Institution of Engineers Australia National Conference in Newcastle, New South Wales. Although this was the last paper to be prepared of those collated here, it makes a good introductory theme for the whole series, so is reproduced here as Chapter 3 (and as TN 130). It is also available as AIR 1118-3.

(7) Productivity and information systems: text to typesetting: data acquisition to networking.

This paper was an extended version of a document previously prepared by the author, and was made available at ITS's request to help in the discussion of such systems at Leeds. It forms Chapter 7 of this document, and is also available with Chapter 6 as Technical Note 127 (on "Information systems and the transport researcher".)

(8) Information technology and integrated regional development.

During the period of the Fellowship the author made a contribution to the December 1982 IIASA Working Group meeting on Integrated Information Systems for Regional Development. A draft record of that contribution is included at Chapter 9 (and as TN 129); the final version is Chapter 17 of the book "Information Systems for Integrated Regional Development", edited by P. Nijkamp and P. Rietveld, to be published by North-Holland.

Technical Note 130

July 1983

THE FUTURE IMPACT OF COMPUTER BASED TECHNOLOGY IN ENGINEERING

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(Also issued as Chapter 3 of ITS Working Paper 169, and as ARRB Internal Report AIR 1118-3)

This work was sponsored by the Science and Engineering Research Council and the Australian Road Research Board

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ABSTRACT

WIGAN, M.R. (1983) The future impact of computer based technology in engineering. Technical Note 130 (or Chapter 3 of Working Paper 169), Institute for Transport Studies, University of Leeds, Leeds, UK. Also issued as Australian Road Research Board Internal Report AIR 1118-3. 7 pages.

The impact of computers and computer based technology has already had a pervasive influence on engineering, and on society as a whole. The engineering profession has made good use of the opportunities for cost reduction offered by this technology to date, and will make more. The impacts on quality, the economics of small batch production and small markets are considered here.

The major impacts on engineering are likely to be outside these traditional areas of engineering responsibility, and reflect the communications and skills transfer aspects of the new round of convergent computer and telecommunications technologies. These impacts and their likely importance are covered in greater detail here, and the urgent questions raised by the sheer speed of the social changes induced by computing technology are given central place.

KEYWORDS : Communications/ information technology/ transport training*/ digital computer/ Engineering/

Acknowledgments. This is the record of an address to a Plenary Session of the 1983 Institution of Engineers Australia National Conference in Newcastle, NSW. This report was prepared in the period October 1982 to June 1983 whilst the author was an SERC Visiting Fellow at the Institute for Transport Studies, University of Leeds, under the sponsorship of the Science and Engineering Research Council and the Australian Road Reserach Board.

THE FUTURE IMPACT OF COMPUTER BASED TECHNOLOGY IN ENGINEERING

by

M. R. Wigan (Australian Road Research Board)
SERC Visiting Fellow

1. INTRODUCTION

The subjects covered in this address are matters of public concern, and a great deal of lip service has been paid to the impacts and the rates of change of society and professions in adapting to them. There has not yet been any real evidence that the professions have yet grasped the sheer speed with which changes in the social, economic, and professional environments are now taking effect.

I shall concentrate on these factors.

The outline of my theme is as follows:

1) The nature of the computer technology changes on communications.

2) The nature of the changes in automation of skills transfer.

3) The effects on engineering training and execution.

In essence the effects of computer based technology changes ON engineering is my theme, rather than the effects withIN the engineering profession.

2. COMMUNICATIONS

The ability to communicate readily with computers has already become a reality as a result of the spread of personal computers, and the consequent pressures on telecommunication carriers to accomodate them. This has now raised the size of the market for information, analysis, and communication with computers by several orders of magnitude.

The key development to pursue is access to packet switched networks, where the problems of intercommunication are eased for users, and the issues of national, local or international transmissions between different systems become easier for everyone.

The huge size of the market thereby made accessible is already beginning to create products which rely on such

a level of interconnection. Electronic mail and computer conference services are two of these(see, for example Wigan, 1982). When intercontinental links through to private or business phone points can be expected to offer video bandwidth (5MHz as opposed to 4kHz for voice), then other forms of communications also become a mass market reality--price permitting.

The implications for the ordinary engineer are that the access to the tools, the data, or the help that he needs for management or design purposes no longer requires much capital expenditure, nor does it disadvantage those in places inaccessible to all but electronic media.

As the market from which he or she can then draw is world wide, the markets for specialised services will grow with the access to the data networks. In many cases the product can be delivered by electronic means as well. Some management and other forms of training are already operating in this manner.

3. SKILLS TRANSFER

The software side of computing technology advances has not always been as keenly followed up by the engineering profession as the hardware (the computers, data loggers, instruments etc.). The main engineering computer language is still FORTRAN---a language which has proved to be resilient to change, and in spite of its acknowledged deficiencies, is still the major engineering programming language after twenty years.

Many engineers have as a result not yet come to terms with the structured and strongly-typed languages such as Pascal, ADA and Modula, which introduce a new order of thought to the straightforward automation of calculations for which FORTRAN is (in my view) still the best available tool. The revolution in text and logical processing which has taken place over the last ten years has been carried forward on these concepts, and the new wave of logical and expert systems thinking is a comparatively easy step for the Pascal user to take. It is a very large jump for most committed FORTRAN users.

The "new" wave of logical programming tools (typified by PROLOG, which was first produced at Marseilles in 1972) has now converged with the applied tools of artificial intelligence thinking: the "expert" system. These tools are still at a very crude stage of development in application, and only a few demonstration systems have yet become widely available. The real impact is yet to come, as the level of personal computer usage rises, and the investments in software grow.

It is already possible to purchase such small-scale yet powerful systems as Micro Expert (Cox and Broughton 1982) and MicroPROLOG (McCabe, 1981), which enable one to build oneself simple expert "advice" systems on mini and microcomputers.

This opens the way for a considerable improvement in the manner in which decision skills can be codified, captured, and reproduced for wider use. This is a task which computers have been doing for many years through application packages such as SPSS, and is simply this same familiar task ---moved to the next level of the professional domain. The difference this time is that the skill being captured in the computer for subsequent interrogation is that of judgement....a qualitative jump, and one with major implications for many engineers.

The development of small graphics systems such as microPLATO have now made the huge investment made in interactive Computer Aided Instruction (CAI) both accessible and economic. This aspect of skills transfer is more one of the flowering of a long standing investment in CAI materials than one of computer technology--but it is computer technology that is creating the delivery system!

It is no coincidence that each of these issues (and the VLSI infrastructure for them) are the priority areas so urgently being pressed in the UK as a result of the Alvey (1982) report . This report also presses the need for rapidly expanding the pool of manpower in these areas, by investment in education and training in Intelligent Knowledge Based Systems (IKBS), VLSI and man-machine interfacing as the top priority areas on which the others will be built. There is no equivalent official program here as yet.

4. EFFECTS ON TRAINING AND EDUCATION

The speed with which all of the innovations of the last decade or more are arriving in the market place is only in part due to the recent acceleration in computer technology. It is mainly due to the access to the technology, and the delivery system for these products that have both emerged in the last few years.

Those who might think that this would mean a tapering off in the momentum in a short time, as these pent up developments reach their full market place, will be mistaken. The pace of change will accelerate, as the market size has so dramatically increased and the electronic delivery systems are so effective. Looking only a few years ahead, it will be practical to service small markets for many types of products with a world market coverage in view.

This will not necessarily be easily taken up by the engineering profession. Studies at university level have shown that engineering students share attitudes with each other, but not with the rest of the student body (Anderson and Western, 1969). The implications of these findings are potentially serious for the profession - and for the society it serves. Some of the source material is covered by Albertson (1981) and Lay (1982), but the message needs to be made more clearly relevant to the profession as a whole, and to the teaching part of the profession as a matter of urgency.

The systematically different attitudes and value systems identified for the Australian engineering students in the work of Anderson and Western were consistent between Universities. Unfortunately specific investigations of the value systems and attitudes of engineers as mature professionals have not yet made in Australia, and so the essentially undergraduate results of Anderson and Western are the best we have. These can of course be taken only as strongly indicative.

A matter of key concern is the strong observed association between the attitudes of engineers towards the future and their reported prevailing orientation towards convergent thinking processes. Computer technology is making the rate of change of professional knowledge a matter of continuous revision. The strong associations identified by Hudson (1963) from subsequent high achievers - as early as the late school stage - was the breadth of interests OUTSIDE the curriculum. This was a far better predictor of subsequent achievement than intelligence level, and the expectation of young engineers of the rate of changes to be expected in our social future has been shown to be far more convervative than for other professions. Yet the clock moves on apace.

The cumulative effect of the historical sources of attitudes and information for engineers shows an increasing divergence from both the physical sciences and the society in which the engineer operates. The actual sources predominantly used by engineers are very different from those used by the physical sciences (Allen, 1977: Lay, 1982), and the reliance on personal sources of information rather than recourse to recent original sources may well slow down the adaption process to increased rates of change.

One irony of the rapid advance of computer technology is that the access to primary and original sources has already turned upside down the historical level of difficulty in identifying and acquiring solid and very recent material at the frontiers of both practise and investigation, as against the personal collections and reference textbooks so heavily relied upon by the profession (David, 1979). Computer technology in the form of personal computers now combines the ability to accumulate 'personal' collections in the traditional manner with the ability to reach out to make use of the wider data bases and communication possibilities now to hand.

Sociological study of engineers (Holzner, 1972) emphasises the primary thrusts of :

a) Expected application

b) Prompt communication to the user

The high levels of "dogmatism", "pragmatism", and "belief in ability to influence the future" recorded in a fairly recent Delphi study including many Australian engineers (Albertson and

Cutler, 1976) were in potentially alarming contrast with the negative expectations of social changes in work, leisure and travel behaviour that they reported.

It is the wide ranging and rapid rate of change in these factors in the social environment that are becoming the key determinants of the impact of computing technology on engineering. The technical cost-reductions inherent in the technical applications are crucial to the productive capacity of the country, and are increasingly recognised by the engineering profession who must take the lead in this essential technology transfer to our aging industries.

It is, however, the social changes brought on the wave of innovation that will increasingly circumscribe the ability to employ computer technology, and determine the place of Australia in the altered world environment being produced by the current quantum jump in industrial productivity now being grasped in other countries.

There is a crucial need to train engineers to identify the numerous opportunities which are arising daily as more and more fields converge and overlap, and the information tools to grasp these opportunities improve. A heavy emphasis on problem solving at a high technical level will become more and more the province of the few rather than the many.

The engineer has always been - perforce - a user of the results of many fields: he (or she) is now on a treadmill of a personal need to become a "multiple specialist", rather than a "multidisciplinary" liason man in the design and implementation process. This will be the greatest impact on engineering of computer technology advances: not the simple (even dramatic) productivity gains of CAD/CAM and flexible manufacturing. These will but bring the tools to hand.

They must be applied creatively.

5. REFERENCES

ALBERTSON, L. (1981). Reflections in a crystal ball. Australian Telecommunications Review 15(2) 33-42.

ALLEN, T.J. (1977). Managing the flow of technology. MIT Press, Cambridge, Mass.

ALVEY (1982). Advanced Information Technology. HMSO, London, UK. (78pp.).

ANDERSON, D.S. and WESTERN, J.S. (1969). Attitudes of students entering professional faculties. Aust. J. Psych. 21() 291-299.

BUREAU OF INDUSTRY ECONOMICS (1981). The long run impact of technological changes on the structure of Australian industry

to 1990-91. AGPS, Canberra. (380pp).

COX, P.R. and BROUGHTON, R.K. (1982). Micro Expert Users Manual V 2.21. ISIS Systems, Redhill, UK. (49pp).

DAVID, A.(Ed.). (1979). Engineers needs for scientific and technical information. World Fed. Engng. Organ. (London), Committee on Engrg. Educ., Paris, France.

HOLZNER, B. (1972). Reality construction in society. Schenkman, Cambridge, Mass. USA.

HUDSON L. (1974). Contrary imaginations. Penguin, Harmondsworth, UK.

LAY, M.G. (1982). Engineering use of bibliographic data bases. Trans. IEAust, GE 6(2) 39-48.

MCCABE, F.G.(1981).Micro-PROLOGUsersManual.Logic Programming Associates, London. UK (65pp).

WIGAN, M.R. (1983). Access to electronic conferencing and mail systems. 2nd ed. Technical Note 104.1 (and Chapter 5 of Working Paper 169), Institute for Transport Studies, University of Leeds, Leeds UK. (1st edition available as Internal Report AIR 1118-1. Australian Road Research Board.) (20pp.).

6. SLIDES

A) Slide 1: COMPUTER TECHNOLOGY CHANGES ON COMMUNICATIONS

- packet switched networks as highways
- the market size is rapidly becoming global in scope
- computer conferencing is a qualitative improvement
- location is less of a bar to market participation

B) Slide 2: COMPUTER TECHNOLOGY AND SKILLS TRANSFER

- the influence of structured languages
- the arrival of small scale Expert Systems tools
- MicroPlato and distributed Computer Aided Instruction
- time lags in technology transfer of 3 yrs widens the competitive market increasingly to the developing world

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C) Slide 3: ENGINEERING EDUCATION AND COMPUTER TECHNOLOGY

- application packages are increasing in intelligence
- the rate of change is accelerating
- attitudes of engineering students have not been well structured to accept rapid innovation
- information search, acquisition and application is a distinctive, trainable skill
- adaptive , multispecialists may be the only ones able to maintain a single career path before the decade is out.

D) Slide 4: TOOLS AND MARKETS

THE TOOLS ARE TO HAND - THE MARKETS ARE ACCESSIBLE

Will we react to the social and economic environment fast enough?

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COMMUNICATION DEVICES AND INFORMATION TECHNOLOGY

Seminar notes.

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(Also issued as Chapter 4 of ITS Working Paper 169)

This work was sponsored by the Science and Engineering Research Council and the Australian Road Research Board

ABSTRACT

WIGAN, M.R. (1983) Communication devices and information technology. Seminar notes. Technical Note 125 (or Chapter 4 of Working Paper 169), Institute for Transport Studies, University of Leeds, Leeds, UK.

This paper provides notes to a seminar, covering the key role for microcomputers as devices for accessing IT facilities, and microcomputer performance.

KEYWORDS: TRANSPORT/ COMMUNICATIONS/ INFORMATION TECHNOLOGY/ ELECTRONIC MAIL/ VIEWDATA/ MICROCOMPUTERS/

Acknowledgements This report was prepared in the period October 1982 to June 1983 whilst the author was an SERC Visiting Fellow at the Institute for Transport Studies, University of Leeds, under the sponsorship of the Science and Engineering Research Council and the Australian Road Research Board.

COMMUNICATION DEVICES AND INFORMATION TECHNOLOGY. Seminar Notes.

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SERC Visiting Fellow

1. INTRODUCTION

During the author's SERC Visiting Fellowship, a seminar was given in the ITS on 17th November 1982, entitled: "Tools of the trade: the position of the microcomputer in IT impacts. "

This seminar was in two parts; the first covered the key role for microcomputers as devices for accessing IT facilities, and the second gave details of microcomputer performance. This TN provides, in section 2, the slides used for the first part, and, in section 3, notes and a reference for the second part.

2. PERSONAL COMPUTERS AND COMMUNICATIONS

Viewgraphs of the first half of this seminar are given at (A-D).

A) **Communication devices and information technology**

1) Personal computer users are a self selected avant guard for Information Technology impacts on individual behaviour.

2) Once personal computer users become experienced, a strong demand for computer aided communication arises.

3) This has led to Remote Bulletin Boards and program transfer services as well as public networks.

4) Computer aided two-way communications are a key area in assessing the impacts of Information Technology.

B) **Access devices for remote computer communications**

1) TeleText reception

2) ViewData for interaction (uses 1200/75 half duplex modems)

3) Simple printing terminals with modems/acoustic couplers

4) Glass teletypes with modems/ couplers (NO local records after screen has been displayed)

5) Personal computers with local memory, processing power, printing and REMOVABLE magnetic file storage media.

C) **Personal computers as multifunction communication devices**

1) As part of a Local Network

2) As a ViewData terminal

3) As an editing input terminal for ViewData

4) As an automatic message reception device (vide: Telex).

5) As a smart terminal

6) As a local computer

7) As a local printing/ plotting station

8) As a local data entry station (bitpads, digitising, analogue devices, data logging, local monitoring)

D) **Applications of personal computers in asychronous and synchronous communication**

1) Text processing

---this accounts for 66%-75% of small computer time

---wordprocessingis an input deviceforElectronic mail

---storage of text is a key part of program development

2) Intelligent communication

---clock timers and autodial modems provide the ability to send and receive messages, or establish remote access to a system without further intervention.

---storage of the results of on-line data base searches becomes normal.

---similarly for ViewData retrieval

3) Local processing

---data acquisition and reduction before uplink to major systems.

---local use of programs developed: significant power is already available.

3. MICROCOMPUTER COMPUTING PERFORMANCE

The second half of this seminar covered an extensive series of benchmark tests of numerous small and large computers and language implementations. The implications for portability of software, of overall effectiveness for specific applications of small and large machines were covered, and the gains in problem solving performance to be had by adding an Arithmetic Processor chip in support of an 8-bit CPU were given close attention. For details, see Wigan (1982).

The overall conclusion of the report cited is that major tasks can be carried out on 8-bit systems, and that the performance of APU supported 8-bit systems generally exceeds that of almost all 16 bit systems presently available, as long as 32 bit precision is sufficient for the application in hand.

The other - major - conclusion is that the philosophy of manintaining software unchanged and accelerating the hardware to suit problem application and budget is not only desirable but practical. The examples of EBASIC, Structured Algol, and the UCSD P-system were illustrated in specific detail with performance results on small standard problems.

The results confirm that a P-system based approach to software can be made a workable basis for machine independence over quite a wide range of performance levels, within the limitations of the p-system architecture itself.

3.1 REFERENCE

WIGAN, M.R. (1982). BASIC, FORTRAN, S-ALGOL AND Pascal benchmarks on microcomputers, including the effects of floating point processor support. Proc. Nat. Conf. Microcomputing, MICSIG, Australian Computing Society, Canberra, ACT (28pp).

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ACCESS TO ELECTRONIC CONFERENCING AND MAIL SYSTEMS

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(Also issued as Chapter 5 of ITS Working Paper 169, and as ARRB Internal Report AIR 1118-1)

This work was sponsored by the Science and Engineering Research Council and the Australian Road Research Board

ABSTRACT

WIGAN, M.R. (1983). Access to electronic conferencing and mail systems. 2nd ed. Technical Note 104.1 (or Chapter 5 of Working Paper 169), Institute for Transport Studies, University of Leeds, Leeds, UK. 21pp, £1.00

This report covers the means of using national and international packet switched data communications services, and the supporting software for electronic mail and computer conferencing services. The information required to set up an initial connection between two computer systems through a combination of digital networks is described. Specification sheets are provided outlining the nature of various electronic mail/computer conferencing facilities, with details of how to access these from the UK and Australia, and particular reference to accessing such facilities at Leeds University. Facilities covered include: SSDA (ESRC Data Archive); TELEMAIL (GTE Telenet); SOURCEMAIL / PARTICIPATE (SOURCE Telecomputing Co); EIES (New Jersey Institute of Technology); TELECENTER (IIASA); CONFER/ MERIT (Wayne State University); BTGOLD (British Telecom); OUMAIL / OPTEL (Open University); POST (Leeds University); PRESTEL (British Telecom); MAIL (ACI); MAILBOX (Sharp); NOTEPAD (Infomedia); COM/PORTACOM (Swedish National Defense Institute); MATRIX/MTX (Cross Information Systems).

KEYWORDS: TRANSPORT/ COMMUNICATIONS/ INFORMATION TECHNOLOGY/ ELECTRONIC MAIL/ COMPUTER CONFERENCING/ MICROCOMPUTERS/ UK/ AUSTRALIA/

Acknowledgements. The first edition of this report was the basis of a presentation by H.R. Kirby to the 15th Annual Conference of the Universities Transport Study Group held at Imperial College London in January 1983. The report was prepared in the period October 1982 to June 1983 whilst the author was an SERC Visiting Fellow at the Institute for Transport Studies, University of Leeds, under the sponsorship of the Science and Engineering Research Council and the Australian Road Research Board.

ACCESS TO ELECTRONIC CONFERENCING AND MAIL SYSTEMS

by

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1. INTRODUCTION

The University of Leeds has a direct connection to national and international packet switched data communications services through British Telecom's Packet SwitchStream (PSS) network. (For the meaning of the term 'packet switched', see p2.) The PRIME 750 computer accessible on the TAC (Terminal Access Controller) service on the campus has a direct connection with PSS.

This note covers the means of using this system and the supporting software, and gives specific background on a number of the electronic communications systems which have been used at Leeds as part of a Science and Engineering Research Council (SERC) Fellowship held by the author.

The means used for international communications by computer are to use either a telephone line and a modem or a packet switched network. The conventional modem works by converting the characters transmitted from the computer into two tones of sound, which are then decoded at the other end back into characters. An ordinary telephone line is used, and the usual rate of transmission is 300 baud (about 30 characters per second). It is possible to use 1200 baud with some modems, but the acoustic couplers most commonly available (e.g. built into Texas Silent 700 series portable terminals) are almost invariably set to 300 baud. Improvements in communication quality can often be obtained by using a directly connected modem, without relying on the telephone handset and an acoustic coupler. Such modems are often more expensive, and in many countries are only available from the public telephony/telegraphy (PTT) service of that country.

The pressure from users, particularly of personal microcomputers, has caused a steady shift in position of the PTTs in several countries, and a general move towards deregulation has begun to open up the communications market in UK and in Australia. Recently the largest bulk market consumer electronics and component supplies chain in Australia (Dick Smith Electronics) released a 300 baud direct connect modem with full Telecom approval. This first direct connect modem on the Australian market costs $169 (under 100 pounds) retail including all sales taxes. An even cheaper Prestel adaptor [i.e. 1200/75 baud] for the Sinclair ZX81 was retailing in the UK at 49 pounds from Lion Computers, by December 1982.

There are numerous computer services which offer 300 baud telephone dial up access accounts to users, and Dick Smith

Electronics offers an electronic mail shopping service in conjunction with Bankcard in Australia. There are larger networks linked by dedicated lines, so that users can access their services by means of a telephone call to the closest access point. The Open University in the UK offers such a service, and is conducting trials of an electronic mail service with the UK arm of an international computer operating system special interest user group (USUS-UCSD P Systems user group) through such dial-up access points.

This means of access is far from satisfactory for many purposes, and a number of common carrier data communications services have grown up. The best known of such international carriers are TeleNet and TymNet. These services offer numerous dial up access ports all around the world, and thereby link together local users and remote computer services. Their charges are usually much cheaper than those levied by PTTs for telephone lines over such distances.

This saving in cost comes from the means by which the common carrier data services transfer their data. They do it by means of the technique of breaking up the data into a series of packets of information, encapsulated in full information about the routing , content, and coding of the data in the packet. This enables the common carrier services to pack a great deal of information into the available bandwidth of the communications links available to them.

A number of international data services (such as DIALOG, SOURCE, ORBIT etc) have been built up using these networks as carriers. Once the networks cross borders, problems arise and PTTs tend to wish to operate their own packet switched networks. A series of increasingly compatible standards have been developed under the aegis of the ISO (International Standards Association), often referred to under the generic title of "X25". This standard is actually a family of standards for communication at a large number of layers. The degrees of freedom still left in the communication protocols actually in use by different networks CAN still give rise to some problems in practice, and the various levels of the ISO 7-layer protocol still have a number of agreements to be reached. Tanenbaum (1981) provides an effective specification in an accessible format on the ISO model and its implications. The highest levels in the ISO protocol are being addressed by a group of nations under the EEC-sponsored GLIM (Get Interconnected Local Text Systems) program (Sztajnkrycer and Karmouch, 1982) for linking heterogeneous computer based message systems.

An increasing number of such national networks are now operating, and offer very high data rate lines for intercomputer communications. The North West Universities Computer Group in the UK makes heavy use of 48kbit lines from the BT data service for example, and nearly half of the Universities in the group are now connected to the BT PSS general packet switched data network service .

One of these computers is the Leeds University PRIME 750. This is connected directly to the PSS system with software designed to make the PRIME look exactly like a node of the TeleNet network.

This computer can be used to communicate with other systems in the UK, Europe, across the world, and the details required to do this, and the specifications of a number of communications services in use from ITS by this means are now covered.

2. ADDRESSES ON THE DIGITAL NETWORK SYSTEM

Setting up an initial connection between two computer systems through the network of digital networks requires a substantial amount of information from the the remote site. This is not only the necessary network identification codes and addresses, but also a number of other details such as the various known reliable routes through the interconnected systems which have been found to work to that site to date. There are different site identifiers on different networks, and as there are still quite a number of minor (but sometimes crucial) differences in the implementation of default options between different systems, it is of material assistance to the computer centre to have as much information on these questions as possible when asked to set up the connection initially.

Anyone wishing to use a service at a remote site must obtain authorisation to do so, a username, password and an account number. When making these arrangements a manual for the service in question is required, and it is also helpful to request any available information about the communications software and settings used by the remote site.

The terms required to obtain addresses are not uniform, but can be expressed in the following UK BT-specified pattern.

The Network User Identifier (NUI), is an identification which is required for a user who is NOT directly connected to a PSS system, and who enters PSS through a BT public access point (referred to as a PAD - a Packet Assembler and Dissassembler) via a dial up or leased line to use to gain access to PSS.

For any system which resides on the network as a node on PSS, there is a unique address, the Network User Address (NUA). The NUA is the identity by which other users can identify and direct packets to your system, and is the code against which charges are levied by BT. Most systems with direct PSS access install some additional protection for user identification to ensure that only authorised users are able to access PSS services and thus incur a charge against the site NUA. (This is of course a local replacement for the NUI required by BT for users accessing the service through a BT pad from a telephone line.) For a connection to be made through PSS after the NUI has been accepted, a long string of identifying digits is required. This is made up from two components. The first is the Data Network Identification Code

(DNIC), which specifies the network to which the system is connected. This may be a national network (e.g. Austria has a DNIC of 232 and the BT PSS network has a DNIC of 2342), or an international common carrier network (e.g. TeleNet has a DNIC of 3110). A system can reside on more than one network. This numbering scheme is referred to as the X131 proposal of the Consultative Committee on International Telephony and Telegraphy (CCITT), and this and other points of this nature are fully described in Tanenbaum (1981), to which the reader is referred for further details on the CCITT proposals.

The other half of the address is the Network User Address (NUA). This is the most important item of information to obtain, and uniquely identifies the computer concerned. This code is needed whether access is via dial up line to a network service or if a direct connection to a packet switched network is available. For example, once a connection has been made to TeleNet, TeleNet will expect a response to a prompt of "@" of a string of the form "C201025". This string is a "C" followed by the Network User Address on TeleNet of the Perkin-Elmer 30/32 at the New Jersey Institute of Technology which runs the EIES Computer Conferencing system. The Leeds University PRIME has an NUA of 53265165.

Unfortunately, the combination of DNIC and NUA is not always enough to ensure a full connection. If the routing is through intermediate systems these systems may stop and request identification and passwords from a user trying to route through them. There are often other, qualifying, strings of information which have to be appended to the network address to permit a final connection to be made. This is particularly the case for the systems reached only through the TymNet system: Lockheed DIALOG is a typical case where such additional information is essential.

It is not clear who is responsible, or even who is able to advise, on routings which involve several systems and especially when the additional strings prove to be needed. It should therefore be understood that even if all of the information required appears to be available, that it may still be impossible to make the connection work. It is for this reason that the fullest possible connection information should be requested in the manner described, as it all helps to enable computer staff to set up a connection. Once set up, the reliability of such packet switched connections is excellent. They are also substantially cheaper than anything other than a local telephone connection in conjunction with a modem for direct dialup access to the remote system. The full advantages arise when international links are needed.

British Telecom have a limited on line assistance file to PSS (HOSTESS), under the NUA of A21920101013. This contains DNICs and NUA settings for a number of services. Some details of that service are noted in section 5.10.

3. USE OF DIGITAL NETWORK COMMUNICATIONS VIA THE LEEDS PRIME 750

The details of the connection information needed by computer services to set up a connection are - mercifully - disguised from the PRIME user at Leeds University by a program by C. Boulton called CALL.

This program uses mnemonic names to access a file containing all of the details established as required for a successful connection, through as many networks and stages as has proved be be neccessary. It is invoked by typing /CALL <name> where <name> is specified for each facility in section 5.

The names described in this note and now accessible by /CALL are:

TELEMAIL
SOURCE
EIES
SSDA
MERIT
POST (LEEDS UNIVERSITY)
IIASA
BTGOLD

Other facilities described in this note are:

MATRIX
OUMAIL
COMPUSERVE
INFOMEDIA

and others which one might come across but for which details are not included in this edition are:

HUB
COM
KOMEX

In brief, these services are:

-TeleMail: Electronic mail offerred by GTE-TeleNet
-Source: Information utility offerred by STC Ltd (Readers Digest)
-EIES: Computer conferencing system offerred by NJIT,USA
-SSDA: A simple direct access to Essex University via PSS
-MERIT: Access to CONFER II at Wayne State on the Michigan net
-BLEND: Access to Infomedia's NOTEBOOK system by British Library
-IIASA: Access toTeleCtr conferencing systematIIASA, Austria
-BT GOLD: BT's Electronic mail service ,licenced from DIALCOM
-MATRIX:Conferencing system promoted for DEC 20 etc. installation
-OUMail:Electronic mail service offerred by Open University DEC20
-CompUServe: Information utility, once called MICRONET. Ohio,USA
-POST: A Leeds University utility, access to PRIME PSS PAD
-COM: the teleconferencing service based on the Swedish Centre QZ
-INFOMEDIA: an added value service offerred as result of PLANET.
-KOMEX:anextensivelyused German system fromtheBonnGMD Centre

The Leeds University Library makes regular use of several services for information retrieval through /CALL:

BLAISE
DIALOG
SDC ORBIT
DATASTAR
DIALTECH

Naturally, the passwords and user identifiers are held only by the library, but typing /CALL DIALOG would place you at the point where DIALOG was expecting a username to be typed in. (Note: if this is done, the CALL may be aborted by typing an "at" symbol (and return); the system then gives an "at" prompt, to which one types "D", for disconnect; or, if this does not work, "Q" for quit.)

The CALL program also contains an authorisation procedure for particular users to be connected to particular services. This is a local replacement for the NUI PSS access control facilities.

The Australian OTC MIDAS network facilities provide direct routings through TymNet to the required host system. The OTC sets up the full access procedures on their own node computer, and provides a unique identifier and password for each account and each host. The operation is then reduced to a simple login task.

3.1 Specific systems in use for communications investigations.

Several names of systems have been given above, each of which offer services relevant to the ITS program of research. Section 5 of this note is a series of specification sheets of the nature of some of these services, with special reference to electronic mail and computer conferencing facilities.

Further details of the information retrieval services usually accessed by the Library are covered in another note on "Information systems and the transport researcher" (Wigan, 1983).

4. REFERENCES

SZTAJNKRYCER, F, and KARMOUCH, A. (1982). A proposal for interconnecting heterogeneous CBMSs in the GILT project. IN NAFFAH,N. [Ed.] Office Information Systems, North Holland, Amsterdam, Netherlands. pp 317-337.

TANENBAUM, A. (1981). Computer Networks. Prentice Hall, NJ, USA. (517pp.).

WIGAN, M.R. (1983) Information systems and the transport researcher. Technical Note 127, Inst. Transp. Stud., Univ. Leeds, Leeds. (Also as Ch 6 and Ch 7 of Working Paper 169.)

5. SPECIFIC DATA NETWORK FACILITIES ACCESSIBLE UNDER PACKET SWITCHING SERVICES.

5.1 SSDA (ESRC Social Science Data Archive)

"CALL" NAME: SSDA

PROVIDER: Essex University

HOST SYSTEM: Essex University DEC-10

NETWORK: PSS (UK)

SPECIFICATION: This relies on a notepad program on the Essex DEC-10 to provide a one-way electronic message service solely to the members of the Social Science Data Archive. Only messages TO the Archive may be left.

FACILITIES: Message deposition to SSDA Archive staff only. No provision for responses to such messages.

SPECIAL NOTES: Access details given in the Data Archive Bulletin Number 23, September 1982.

ACCESS:(Australia): MIDAS routing to PSS available. Individual routing codes provided on demand within Australia by OTC.

ACCESS:(UK): Via PSS network DNIC 2342 : NUA 20641141
Via telephone 300 baud line on 0206-864534

REFERENCE: SSDA (1982) SSRC Data Archive Bulletin No. 23, p11. SSDA, Essex University. UK.

DETAILS: Essex comes up with a prompt of : PSS(3) CMD >
respond with : set ho 1
back comes :NODE ON LINE..
type : .log 1762,1762
back comes : JOB XX....at ESSEX..
PASSWORD:
respond with : survey
back comes : MESSAGE OF THE DAY
respond with : .r memo
back comes : TO:
respond with : survey archive
back comes : FROM:
respond with : <your name+address>
back comes : SUBJECT:
respond with : <your message>
to end it :s Control-c
: .k/f
: set ho 3

5.2 TELEMAIL (GTE Telenet)

"CALL" NAME: TELEMAIL

PROVIDER: GTE TeleNet, Vienna, Virginia, USA.

HOST SYSTEM: GTE TeleNet

NETWORK: TeleNet (International)

SPECIFICATION: This is a fully implemented electronic mail system, with local storage and a very large number of access points and of users. TeleMail is the electronic mail service operated by TeleNet, the international common carrier packet switched data service.

FACILITIES: TeleMail supports individual mailing, mailing list, bulletin board, editing and secure distribution systems. It does NOT include a synchronous "Chat" facility, nor does it offer live interaction with helpers online. See Fig. 1 for commands.

SPECIAL NOTES: The normal monthly charge for a Telemail mailbox is $25 US, in conjunction with an hourly connect charge and a few cents a message. This mailbox fee is not applicable to members of the UCSD P-Systems User Group, which offers a mailbox to members at no additional charge, as a specialised information exchange service.

ACCESS:(Australia) : MIDAS routing to GTE TeleNet, then respond to the "@" prompt with "212141".

ACCESS: (U.K.) : IPSS routing is to DNIC 3110, NUA 2020014100

COMMENTS: TeleMail has proved to be a highly effective means of communication between UK, Australia and the USA. USUS has a large number of professional users accessing TeleMail on their own account as personal users of electronic mail, which is also used for debates on UCSD matters and for the collation of Newsletter articles.

USEFUL ID CODES: MWigan - the author at ARRB, and ITS.
MHarper -the Vice Chairman of USUS UK.PRG, Oxford.
SQuinn - Librarian at ARRB, contact for ARRB.
ADMIN - KShillington of TeleSoft in this role .
JBondy - USUS Software library coordinator
ATate - USUS Chairman, Edinburgh University C.C.
HKirby- AssistantDirector, ITS,Leeds Univ.UK.
KCox - Canberra CAE.
WBonham - SAGE Computers Liason with USUS
SOFTECH - SofTech Microsystems Liason with USUS
TWoteki - Membership Secretary USUS, 814 D St Washington DC 20002,USA.

REFERENCES: SMITH, D.E. (1980) TELEMAIL Reference manual. Vol I. The basics. GTE TeleNet, Vienna, Va., USA. (120pp).

5.3 SOURCEMAIL and PARTICIPATE (SOURCE)

"CALL" NAME: SOURCE10

PROVIDER: Source Telecomputing Co., MacLean, Virginia, USA

HOST SYSTEM: Multiple PRIME computers at STC.

NETWORK: TeleNet. TymNet available, but no succesful connection.

SPECIFICATION: Probably the largest common user broad function information utility. Now owned by Readers Digest. Recently grew to such a scale that STC has moved from DIALCOM's system to their own computer complex. Supports users in many countries, using credit card billings.

FACILITIES: Messaging, mailing list and data file filing, bulletin boards, gateway to shopping, stockbroking and other services. general computing facilities, common carrier for added value information providers. Of special interest as a host to PARTICIPATE, a powerful conferencing and interest networking system licenced to DIALCOM and STC by Participation Systems Inc. Draws heavily from the TOPICS system developed on EIES at New Jersey. (PSI is "700" on EIES). See Fig. 2 for commands.

SPECIAL NOTES: This system claims to have over 28,000 members world wide and adopts an agressive marketing policy. Its main competitors are CompuServe (which does not operate outside the US), and I.P. Sharp. Used by suppliers and purchasers of software and hardware products as a trading medium.

ACCESS: (Australia): TeleNet via MIDAS, then NUA of 30124.
TymNet via MIDAS direct to STC.

ACCESS: (UK): TeleNet DNIC 3110, NUA 30124.
TymNet connections unsuccessful via PSS.

NOTES : This large user community has now reached a size sufficient to sustain direct marketing review. Access to specific data sources is given priority by potential users, in preference to messaging services.

USEFUL ID's : TCY396 - W. Bolton, Software Tools RBBS, Sydney.
STC3160 - M. Wigan.
STC304 - Direct marketing Manager, STC, MacLean.
STC301 - User and PR Manager, statistics of ops.
TCA175 - PARTICIPATE specialist, STC, MacLean.
STF004 - PSI Inc.

REFERENCES : STC (1982). SOURCE Users manual. STC, MacLean, Va. USA. (Unpaginated).

PSI (1982) PARTICIPATE Users manual. PSI, Boston, Mass., USA. (Unpaginated).

5.4 EIES {ELECTRONIC INFORMATION EXCHANGE SERVICE} (New Jersey Institute of Technology)

"CALL" NAME: EIES

PROVIDER: Computer aided communications centre, New Jersey Institute of Technology, NJ.,USA.

HOST SYSTEM: Perkin - Elmer 30/32

NETWORKS: TeleNet, UNINET

SPECIFICATION: One of the first of the computer conferencing systems. Provides electronic mail, computer conferencing, interactive subsystem development and user interface customisation and monitoring services. Heavily supported at the development stage by the US National Science Foundation, up to 1980. Now operating effectively on user fees alone. Extensively used as a research tool in education, and as a vehicle for standards and other groups to execute practical tasks.

FACILITIES: As this system is one of the most heavily used conferencing systems, and has an extremely large battery of development, monitoring and support tools, EIES has a huge inventory of facilities. There are over 1000 individual commands, accessible from any point and at any level in the use of EIES, and a complete user-interface customisation and interactive development application language. Significant minor points include the acknowledgement of the receipt of all communications, and an on line directory giving background details of the participants, available for free text searching. See Fig. 3.

SPECIAL NOTES: Hiltz , Kerr and Turoff have carried out extensive work on the EVALUATION of computer aided communication using EIES itself. As EIES has been used a great deal for application tasks for outside bodies, this is a unique resource in that sociological and psychological assessment tools are in continual use. The friendliness to the users is exemplified by the availability of on-line personal aid, and a direct "chat" style of communication. It must also be conceded that the system is not always very user-friendly, and many facilities are hard to use.

ACCESS: (Australia):MIDAS routing toTeleMail,C201025at prompt

ACCESS: (UK): Via PSS network, the DNIC of TeleNet is 3110, and the NUA for EIES is 201025

RERERENCES: KERR, E., TUROFF, M., JOHNSON-LENZ, P&T. (1982). Users Manual for the Electronic Information Exchange System. Computerised Conference and Communications Center, New Jersey Institute of Technology, 323 High St, Newark, N.J.,USA. (80pp).

HILTZ, S.R. and TUROFF, M. (1978). The network nation. Addison-Wesley, London. (528pp.)

5.5 TELECENTER (IIASA)

"CALL" NAME:

PROVIDER: International Institute for Applied Systems Analysis, Schloss Laxenburg, Vienna, Austria.

HOST SYSTEM: PDP 11/70 UNIX

NETWORK: TymNet

SPECIFICATION: A full computer conferencing system modelled loosely on EIES. The whole system is a series of UNIX "C-Shell" small routines, leading to a swiftly modified system.

FACILITIES: Supports messaging, conferences, acknowledgement of receipt of communications . No directory files are explicitly supported by the system, but the moderator concept is implemented.

SPECIAL NOTES: This system is in use within IIASA by about 25 scientists, and by a similar number in the USA, to maintain collaboration and contact in paper production and continuing work.

ACCESS: (Australia): MIDAS system can access TymNet. The DNIC for Austria is 232, and the NUA is 2. DATEXP (the West German Network) also has an X25 link through the Austrian Radio X25 network to IIASA.

ACCESS: (UK): Not yet confirmed

REFERENCE: LATHROP, C.L. and PEARSON, M.L. (1981). TELECTR Users Manual. IIASA, 2361 Laxenburg, Austria.(48pp.)

DETAILS: Access via TymNet not established as yet from UK. The IIASA TPA-70 Gateway permits redirection to a range of different hosts through the TPA70 access control computer at Laxenburg. An initial response code of 4565 is used to access the PDP 1/70 hosting TELECTR. Other codes, accessible from the user monitor, include 4560 for the 9.6kb terminal line to Moscow, 4564 for the Nord in Budapest on the Hungarian Academic Network, 4535 for the IASA VAX 11/780, 4255 for the X25 link to the IBM 3031 in Sofia, and 4569 for access to the user monitor itself. The TYMNET access is usually provided with a direct log on to the PDP 11/70 host for TeleCenter software.

5.6 CONFER II / MERIT (Wayne State University)

"CALL" NAME: MERIT

PROVIDER: Wayne State University, Michigan, USA.

HOST SYSTEMS: IBM 3000 series

NETWORK: TeleNet plus MERIT routing

SPECIFICATION: A user utility system designed specifically for minute and draft development and agreement.

FACILITIES: CONFER II has been designed to facilitate annotation of documents under discussion as a means of accellerating agreement on written materials. The system is offerred on the MERIT network as a product, to be used in conjunction with the messaging and other systems already available on this network, and has not as yet been subjected to similar sociometric asessments as EIES. The monitor function is therefore less fully developed at this stage.

SPECIAL NOTES: CONFER (hosted at Wayne State University on the MERIT network on the Michigan Terminal System) is currently the subject of an experiment by the US Transportation Research Board in using electronic mail for aiding the work of one of the TRB committees. The Committee on Traffic Records has two tasks in hand for the period June 82-83.

1) Classification of vehicles
2) Exposure measures

ACCESS: (Australia): MIDAS to TeleNet, then 31362 after the "@" prompt.

ACCESS: (UK): DNIC 3110, NUA 31362

DETAILS: The use of this routing will bring up the MERIT network with a request for the selection of a host system on that network. The response of "WU" will select Wayne State, where CONFER II is hosted.

5.7 BT GOLD (British Telecom)

"CALL" NAME: BTGOLD

PROVIDER: British Telecom

HOST SYSTEMS: PRIME 750

NETWORK: PSS

SPECIFICATION: DIALCOM's electronic mail system with national and international coverage.

FACILITIES: Specifically a MAIL system

SPECIAL NOTES: This service is operated in the UK by a company under contract to BT to suppy and market this service from UK to Europe as a whole. A link to BT Public Data Service is due for late 1982.

ACCESS: (UK): DNIC n/a NUA 219201004

ACCESS: (Australia): Direct PSS access through OTC MIDAS link, to DNIC of 234, NUA of 219201004

DETAILS: The pricing structure accounts for international transfers.

CONTACT: R Oliphant, Telecom Gold Ltd, Automated Office Services, 42 Weston St, London SE1 3QD, UK. (Tel: 01 403 6777)

5.8 OUMAIL and OPTEL (Open University)

"CALL" NAME: Not yet available

PROVIDER: Open University

HOST SYSTEMS: DEC 20

NETWORK: OU multiplexed linked line system

SPECIFICATION: OUMAIL is a full electronic mail system, under beta test trials with the UCSD p -systems user group before public or general OU student access is provided. OPTEL is a Prestel compatible system with page creatinn facilities, and able to carry CYCLOPS (as is BT Prestel).

FACILITIES: Electronic mail on OUMAIL, keyword searching and IP facilities on OPTEL.

SPECIAL NOTES: OPTEL and OUMAIL are both (at present) free frames. OPTEL is to be used to connect the administration of the 13 OU regional offices (See figure 4).

ACCESS: (UK): NUA 23412301161 (for London DEC 20). The sender should set up his system to forward packets on short time-out and on receipt of any control character. Before logging in to run OUMAIL, type TER HALF to ensure the DEC 20 expects to be accessed by a half-duplex system.

or: Direct modem link to OU network.

300 baud	01-794-0611	to OUMAIL on London DEC 20
1200/75	01-435-9871	" (535?)
1200/1200	01-794-1980	"

ACCESS: Australia: Not yet available.

CONTACT: Dr P.D. Bacsich, Cyclops Research and Development Group, Faculty of Technology, Open University, Walton Hall, Milton Keynes, MK7 6AA. (Tel: Milton Keynes 652070.)

REFERENCE: OPTEL USER GUIDE. (1983). Faculty of Technology, The Open University. Milton Keynes.

5.9 POST (Leeds University)

CALL "NAME": Not applicable

PROVIDER: University of Leeds Computing Services

HOST: PRIME 750 , running under PRIMOS 19.

FACILITIES: A primitive electronic mail system restricted to the PRIME, for sending messages or files to other users.

ACCESS: (Australia): Direct MIDAS routing through TYMNET to PSS, then provide DNIC 2342, NUA 53265165 at ";" prompt.

CONTACT: M. Eggleston

5.10 PSS AND PRESTEL INTERNATIONAL SERVICES (British Telecom)

For an information service about PSS, contact:

"CALL" NAME: HOSTESS

The Prestel ViewData service is accessible from throughout the world via linked packet switched networks. This makes the electronic mail and other services on Prestel and Prestel Closed User Groups accessible worldwide. The MICRONET 800 mass access service for personal computer owners shows signs of becoming the largest user of this service following its launch in January 1983.

The general Prestel access number is:	A2	3411 002002000
for worldwide access to PSS at 1200/1200 baud		(1200/75 baud)
TeleNet access (from USA/Canada) is	A3	11 061700059
- again, at 1200/1200 baud		(1200/75 baud)
EuroNet access number is	2	234306601

5.11 MAIL (ACI)

"CALL" NAME: Not available.

PROVIDER: ACI Computing Services

HOST SYSTEM: HP3000

NETWORK: AUSSINET, a private network operated by ACI Computing Services

SPECIFICATION: The product is the HP Mail system, usually offerred on HP3000 systems. It is very user-friendly, and requires little or no references to manuals by the most unsophisticated user capable of dialling up the necessary number and activating a modem or acoustic coupler. The management of the Files are by InTray/OutTray concepts, which are found by most users to be a natural and easily assimilated system. The similarities with the APPLE LISA user interface bear noting.

FACILITIES: This service is now in use within Australia in conjunction with the AUSSINET document database search and retrieval services offerred by ACI on their private network.

5.12 MAILBOX (IP Sharp)

"CALL" NAME: Not available

PROVIDER: IP Sharp

HOST SYSTEM:

NETWORK: Telex, PSS

FACILITIES: The MailBox system relies on central processing at the Toronto offices of IP Sharp (the international APL timesharing and numerical mass data base access service specialists).

ACCESS: The network is accessed locally by dial up lines, and then passes through local data concentrators in each major node city, before onward transmission to Totonto via Sharps' own leased lines.

Access to the Sharp network through Telex has been long established, and Packet switched access procedures are now also becoming available.

COMMENTS: This system has perhaps the longest history of publicly available use at an International level, and is heavily used by Sharp themsleves. This is a characteristic of electronic mail systems, as the originators appear to have developed the systems from an internal need rather than to seek an external market. Electronic mail appears to be a user-driven service, requiring only user sophistication and access to systems and networks to become viable.

REFERENCE: The nature and character of MAILBOX's use are discussed by Goldsmith (1980).

5.13 NOTEPAD (Infomedia)

This service is offered by INFOMEDIA from San Bruno, California. The system operates on a DEC 20 under TOPS 10, a fairly standard choice for the early, academically oriented systems for computer aided conferencing. The network connection is to TYMNET, which generally makes life much more difficult in obtaining an initial DNIC/NUA/ connection due to the use of additional qualifying strings which can be extremely difficult to find out and validate ab initio.

This is one of the services offering the whole package at a licence fee, and also offers both open access at about $60 US/hr connect time and $1000 US/user for the initial connection. It did not prove possible to obtain a connection to NotePad to assess the virtues or disadvantages, so the DNIC / NUA / Qualifier strings from UK are not quoted.

It may be concluded from the early history of NotePad (Spangler and Vallee, 1978) (it originated with PLANET, one of the very earliest of the conferencing systems) that it is probably fairly functional, but also heavily machine dependent. Only the most recent systems have overcome the intimate link within the operating systems that seemed to be essential initially.

5.14 COM/PORTACOM (Swedish NDI)

"CALL" NAME: Not available

PROVIDER: Swedish National Defense Institute

HOST SYSTEM: DEC10/DEC20 (for COM). See below for PORTACOM.

NETWORK:

SPECIFICATION: The COM system is run on DEC 10 and 20 systems from the Swedish National Defense Institute (Palme, 1981: Palme, Arnborg, Enderin, Meyer and Tholerus, 1981). The key feature of this system, which has gained a substantial market outside Sweden (notably in Germany), is that a portable version has been produced in Pascal, called PORTACOM (Palme, 1982a,b,c), which available for transfer to many other machines. About 5% of the code cannot be transferred to Pascal for this exercise.

COMMENT: The COM system has been assessed in use to a degree (Palme, 1982d,e), and the authors are actively participating in the GILT (1982f) interconnection project for electronic mail and conferencing systems in Europe.

5.15 MATRIX/MTX (Cross)

"CALL" NAME: Not available

PROVIDER: Cross Information Systems

HOST SYSTEM: DEC and others - see below

NETWORK: Telenet

SPECIFICATION: The MATRIX/MTX system is yet another system written for the DEC range of large computers. Unlike many of the others, Cross Information Systems (the authors, in Boulder, Colorado) offer direct connection via TeleNET. The rates are considerably more modest than those for the NOTEPAD services, and the leasing charges for the whole system are similarly modest in comparison.

The whole system is coded in BASIC-PLUS-2, an unusal choice for a conferencing system. However this choice has enabled Cross to offer MTX under RSTS-E, VMS, RSX-11M,RSX-11M+,IAS and TOPS 20.

The system has also been recoded into Pascal for transfer to IBM, DG, Prime, TI, HP and others. Cross claims to be able to provide MTX on any of these hosts in 120 days from an order.

ACCESS: No arrangements could be made to access MTX from either UK or Australia, and so no comments can be offered on the connection routings or the operation character of the services provided.

REFERENCES: Cross provides a series of brief notes specifying the system and its costs (Cross, 1982).

ADDRESS: The Cross Information Company is located at 934 Pearl St-Suite B, Boulder, Colorado 80302, USA. Telephone 303/499-8888

FIGURE 1: TELEMAIL'S COMMANDS AND OPTIONS

Basic Commands

ANSWER	To reply directly to a message.
BYE	To sign off from Telemail.
CANCEL	To destroy a repeated or deferred-delivery message before time of delivery.
CHECK	To access a bulletin board by name. CHECK by itself returns you to your own mailbox.
COMPOSE	To prepare a message.
DIRECTORY	To obtain information about other Telemail users.
DISPLAY	To display the following information: DATE, FILES, SEND COUNTER, TIME, USER CODE.
EXIT	To bypass the Action? prompt and return to Command?
FILE	To store a message under a specified file name.
FORWARD	To send a received message to someone else.
MEMBERS	To display Telemail users of a hierarchy level or list name.
PASSKEYS	To change your password and/or personal ID.
PURGE	To *completely* erase a message.
READ	To display a received message.
RECOVER	To retrieve a message you were working on when a power failure or system outage occurred.
REMOVE	To remove a message from a file.
SAVE	To save a message by name for later editing and/or sending.
SCAN	To receive a summary table of unread messages.
SEND	To post a message for immediate delivery.
UNPURGE	To retrieve a message purged within the last 24 hours.

Editing Commands

COPY	To duplicate lines of text in a new location.
DELETE	To erase lines of text.
EDIT	To create a new message; or, to retrieve a saved message.
INSERT	To add new lines of text within a message.
LIST	To display the text of a message with associated line numbers.
MODIFY	To make character-by-character changes to individual lines.
NUMBER	To redefine line numbers.
TRANSFER	To move lines of text to a new location in a message.

Editing Symbols

<	To delete the character above the symbol.
>	To insert a space before the character above the symbol.
!	To delete the remainder of the line, beginning with the character above the symbol.
+*string*+	To insert *string* before the character above the opening symbol.
string	To overlay the characters above *string* with the characters in *string*.

Special Keys

CONTROL H	To delete a character.
CONTROL W	To delete a word.
CONTROL X	To delete a line.
CONTROL R	To redisplay a line.
CONTROL S	To stop display.
CONTROL Q	To resume display.
BREAK	To interrupt output and return to Command? or Action? prompt.

Compose Options

COMPOSE DOCUMENTATION
To send comments on documentation to Telemail Documentation Supervisor.

COMPOSE HOTLINE
To report system problems to Telemail Customer Service and your ADMIN.

COMPOSE LIST
To request creation or alteration of a user list from your ADMIN.

COMPOSE SUGGESTIONS
To suggest system enhancements to the Telemail Support Group.

Commands can be abbreviated by using only the underlined characters.

Online Assistance

Command? ? (RETURN)
Gives you a list of all commands available on the system.

Action? ? (RETURN)
Gives you a list of available Action commands.

Command? ? XXX (RETURN)
A question mark followed by a space and a command name gives you a brief summary and list of options for that command.

FIGURE 2: SOURCE'S COMMANDS AND OPTIONS

The SourceMail Revision
August 16, 1982

Use this brief guide in conjunction with Section Four of the User's Manual. Many of the commands and options remain unchanged. You'll find that a number of functions are similar to the new Post program which was released last spring: the command P lets you move between internal prompts, for example.

SourceMail's New Look

The first change you'll notice will be the prompts. Several new options have been added, and the acute brackets < > indicate the standard abbreviations for each option command. For example: this is the main prompt in SourceMail:

<S>end, <R>ead, <SC>an, <D>isplay, or <Q>uit?

The address header has also been redesigned to be more compact:

From: TCA123 --EXPRESS-- (22)
On: 20 OCT 1982 At: 18:00 Copy: CC
To: TCA456 CC: TCA789
Subject: MEETING ON FRIDAY
--More--

Sending Mail

>MAIL S

To: (Enter account numbers or mailing list file names, each separated by a space. You can also type one or more of the following option commands placed before the addressee to which they apply.)

CC plus account	= Carbon Copy
BC plus account	= Blind Copy
AR plus account	= Acknowledgement Requested (receipt)
EX plus account	= Express
DA 20 OCT 82 account	= Sends the letter on that date[1]
SU subject line	= Places a subject into the header[2]
ML filename	= Sends to a mailing list[3]

Example: TCA123 CC TCA456 EX SU FILM REVIEWS

An option placed at the end of this sequence will apply to all the addresses (as does EX above). SU must follow all these, however.

Subject: (The subject can also be entered here; limit: 78 characters)

1 — The new format: 20 OCT 82 replaces 01/10/82
2 — The new format: SU subject replaces 'SUBJECT'
3 — The new format: ML Filename replaces (Filename)

Enter Text. (Enter your message. You can add any of the following option commands, each typed on a line by itself. Type .S as the last line to send the message.)

<.H>elp	Displays HELP instructions
<.DI>splay	Displays text
<.DL>isplay TO	Displays the list of addressees
<.DI>isplay SU	Displays the subject line
<.SU>bject NEW SUBJ	Replaces Original Subj with NEW SUBJ
.CC Account(s)	Copies another account number
.BC Account(s)	Blind copies another account number
.AR Account(s)	Asks AR from an additional addressee
<.EX>press	Sends EXPRESS to all addresses
.EX Account(s)	Sends EXPRESS to that addressee
.DA 20 OCT 82	Sends letter on the date specified
<.PA>ssword xyz	Will require a password from recipient
<.LO>ad filename	Adds pre-existing file to text of message
<.SA>ve filename	Saves text of message in a UFD file
<.SA>ve IN filename	Saves text of message in pre-existing UFD file
<.Q>uit	Cancels the message; goes to main prompt
<.S>end	Sends message
<.ED>it	Brings up the system Editor. (With it, you can use all the above options.)
<.SP>ell	Passes the text through an automatic spelling check program.

Reading Mail

>MAILCK

2 Read, 1 Unread, 1 Unread Express, 4 TOTAL

>MAIL
Do you want instructions? N (or Return)

<S>end, <R>ead, <SC>an, <D>isplay, or <Q>uit? R

From: TCA123 —Express— (22)
On: 20 OCT 1982 At: 18:00 Copy: CC
To: TCA456 CC: TCA789
Subject: MEETING ON FRIDAY

--More-- (You can use the following options)

Return or Enter	To read the message
<Q>uit	To go to the main prompt
AG>ain	To display entire message (including header)
N>o	To go to Disposition? prompt
NE>xt	To go to next message bypassing Disposition?
D>elete	To delete message from mailbox
RE>ply	To reply to sender
FO>rward account	To forward message
F>ile	To file message in the MAIL.UFD
F>ile category	To file message in a category of the MAIL.UFD
SA>ve filename	To save message (including header) in a UFD file
SA>ve IN filename	To append message to a pre-existing UFD file
SA>ve TEXT filename	To save only the TEXT in a UFD file
SA>ve TEXT IN filename	To append TEXT to a pre-existing UFD file
H>elp	To display available options
UN>read	To place the message in your unread mail when you next use READ or SCAN.
P	To return to previous prompt

Disposition: (All the above options are available here as well)

Return/Enter	To proceed to next message

Scanning Mail

>MAIL SC
1) From: TCA123 —Express— (22)
On: 20 OCT 1982 At: 18:00 Copy: CC
To: TCA456 CC: TCA789
Subject: MEETING ON FRIDAY

2) From: TCA001 (5)
On: 21 OCT 1982 At: 2:43
To: TCA789 TCA117
Subject: MONTHLY REPORT

R>ead or <D>elete by 1 number: (Available options)

<Q>uit	Returns to the main prompt
<R>ead or Return	Read all scanned messages
<R>ead # # #	Read scanned messages by number
<R>ead - #	Read up to and including that number
<R>ead # -	Read all messages from that number
<D>elete # # #	Delete scanned messages by number

Mail Files and the Distribution List

The name MAIL.FILE for your mail filing space has been renamed MAIL.UFD, or your Filing Cabinet as it is called in the program. Letters can be stored within filing categories (by using the sequence FILE CATEGORY at Disposition:) or individually (by using only FILE at Disposition:). You can search from the main SourceMail prompt, or from Command Level:

>MAIL D
<F>iles or <D>istribution list? F
You have 3 letters in your filing cabinet and 2 filing categories.

Categories are:
FILMS
TELEVISION

<F>iles or <D>istribution-list? D

Distribution List:

SALES-FORCE TCA123 TCA456
EAST-REGION TCA789 TCA897 TCA978
STAFF TCA321 TCA654

(This sequence is equivalent to >TY MAIL.REF. Distribution lists are created using the system Editor. See your User's Manual, page 4-13).

Stringing Commands at Command Level

>MAIL R UN or >MAIL SC UN	To read or scan only unread messages
>MAIL R EX or >MAIL SC EX	To read or scan only express messages
>MAIL R FILE or >MAIL SC FILE	To read or scan letters filed in your MAIL.UFD
>MAIL R FILE CATEGORY or >MAIL SC FILE CATEGORY	To read or scan letters filed by category in your MAIL.UFD
>MAIL FR TCA123	To read mail from a specific account number
>MAIL SU WEEKEND	To read letters about a specific subject
>MAIL DA 20 OCT 82	To read letters sent on a specific date
>MAIL DA 20 OCT 82, 30 OCT 82	To read letters between specific dates
>MAIL D F	To display the file categories in the MAIL.UFD
>MAIL D D	To display the MAIL.REF Distribution List

For on-line information about the SourceMail System, type at command Level:

>HELP MAIL MANUAL

FIGURE 3: EIES'S COMMANDS AND OPTIONS

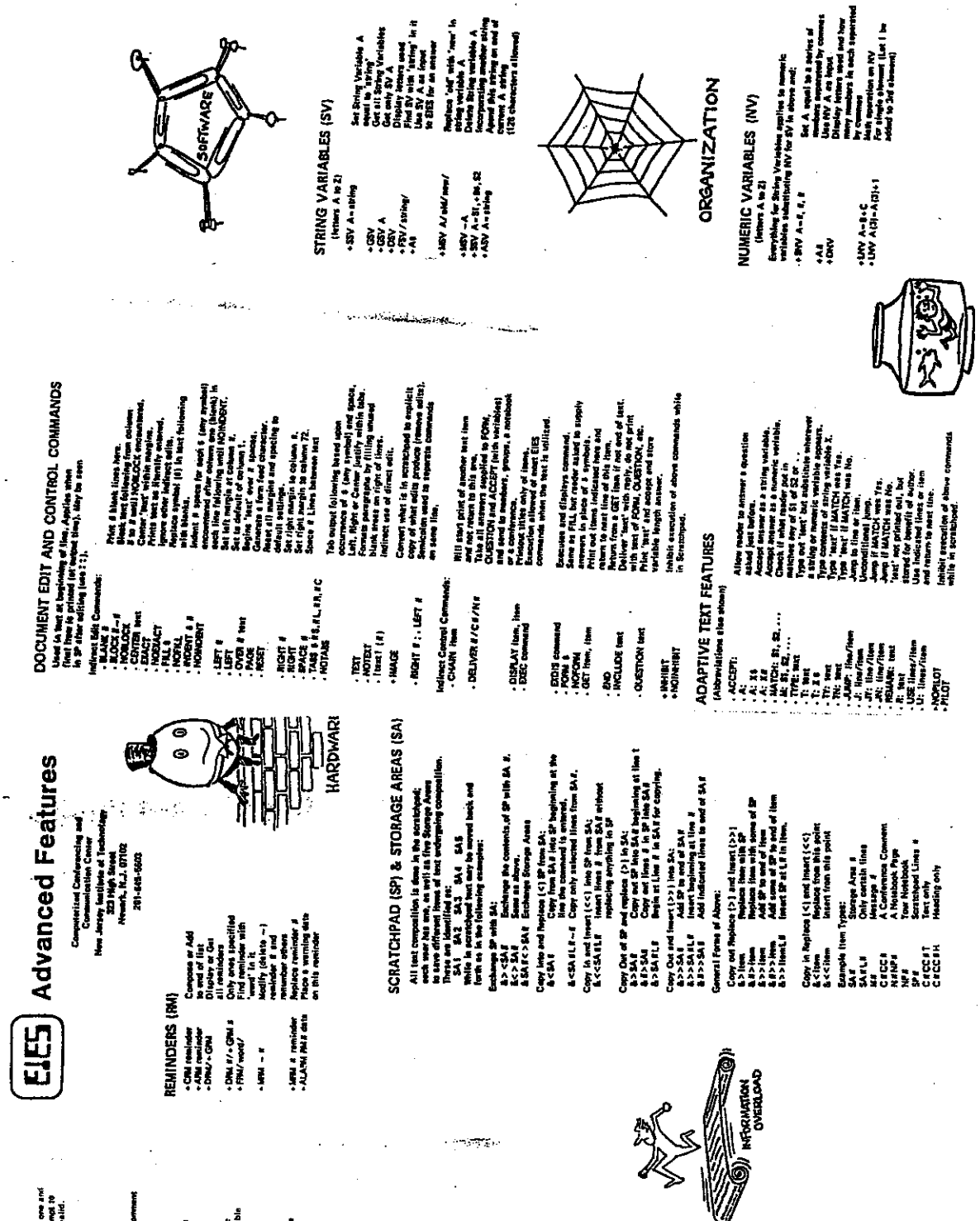
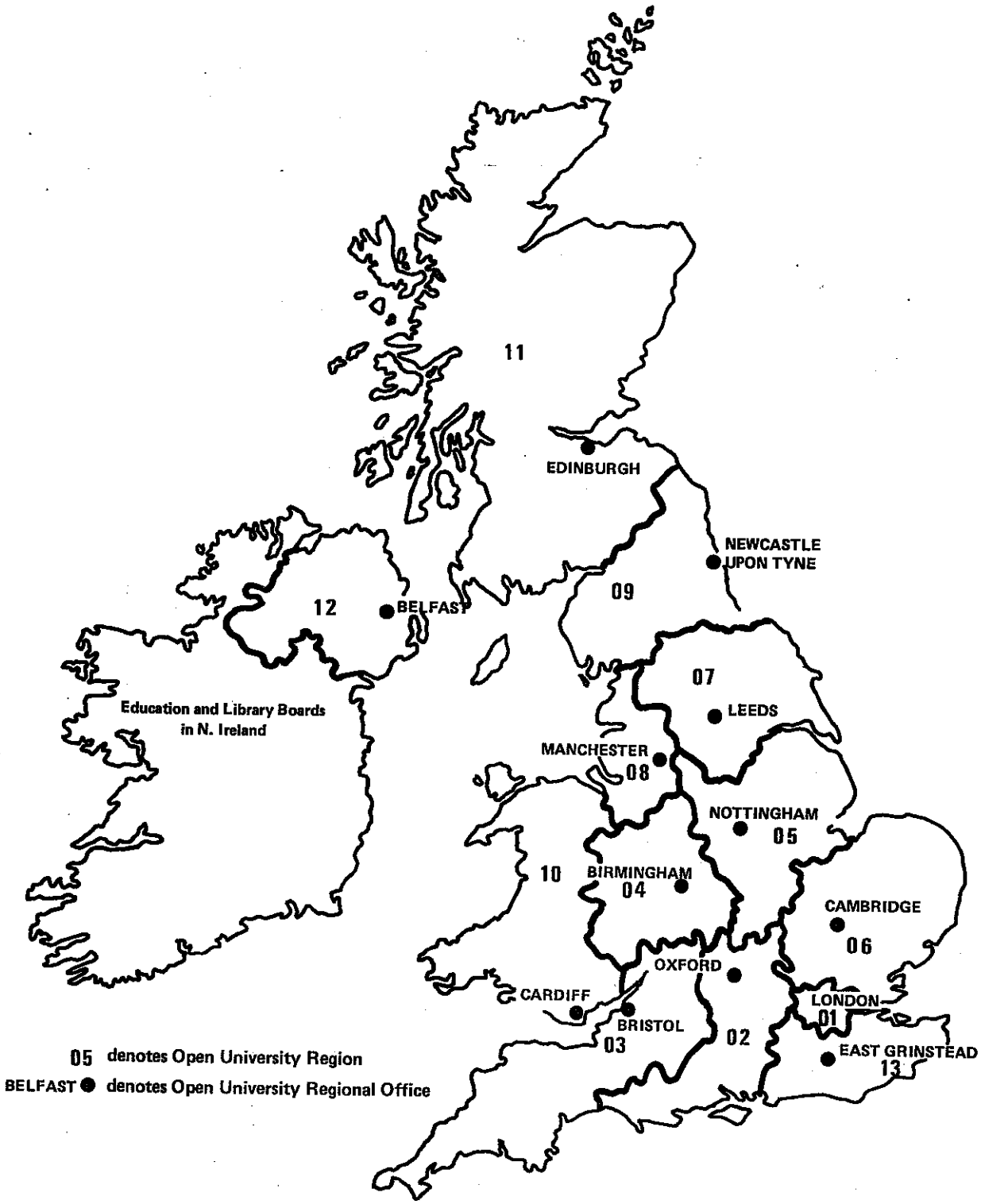


FIGURE 4: OPTEL - OPEN UNIVERSITY ADMINISTRATIVE REGIONS



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INFORMATION SYSTEMS AND THE TRANSPORT RESEARCHER

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ABSTRACT

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This note addresses the use of information systems in transport research at two levels. The first is concerned with the individual user, and raises issues concerned with the process of acquiring information. This part of the note covers the essentials of information and information services in transport , and to illustrate the convergence of information and knowledge based systems. The second level is concerned with the research organisation, and raises issues concerned with computer communications between different devices, eg in the process of going from text to type-setting. This part of the note includes a discussion of relevant commercial considerations.

KEYWORDS: TRANSPORT/ COMMUNICATIONS/ INFORMATION TECHNOLOGY/ INFORMATION RETRIEVAL/ RESEARCH PRODUCTIVITY/ DATA BASES/ TEXT PROCESSING

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INFORMATION SYSTEMS AND THE TRANSPORT RESEARCHER

by

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SERC Visiting Fellow

1. INTRODUCTION

This note is in two parts.

Part 1, on information acquisition, has as its full title: "Information systems, access, delivery and transport research"

Part 2, on research productivity, has as its full title: "Productivity and information systems: text to typesetting; data acquisition to networking."

The purpose of Part 1 (sections 2-9) is to cover the essentials of information and information services in transport , and to illustrate the convergence of information and knowledge based systems. The purpose of Part 2 (from section 10) is to outline a working basis for integrating the text processing, data base storage and computational tasks of a research organisation.

Part 1

INFORMATION SYSTEMS, ACCESS, DELIVERY AND TRANSPORT RESEARCH

2. INTRODUCTION TO INFORMATION ACQUISITION ISSUES

The three areas covered in this part are :

(a) The mechanisms of obtaining information

(b) The devices available to expedite it.

(c) The convergence between information retrieval and knowledge based systems.

3. INFORMATION ACQUISITION AS A PROCESS

The basic state from which most people start when dealing with a new subject or problem area is one in which they are not aware of the sources of information, the experts in the field , the key documents, or the general state of the art in the field.

However the information is gathered, the process of learning tends to follow the same series of stages.

The initial stage is one of obtaining relevant material, reading it, and talking to experts in the area. This process continues for a while, until a threshold of background is reached and the person feels able to make minor judgements on the worth or relevance of the materials as they are examined. This threshold is a crucial stage, as from then on the process of search becomes much more efficient.

Initially the search process is a dual one: general information being read to gain a grounding and foothold, and specific problem oriented pursuits of questions seen to be relevant ab initio.

The sources of information for the general process can - and should - be as broad as possible. Those for the problem oriented pursuit can be mechanised from the start, but the "BROWSE" process is the most useful initial exercise, although its efficiency rises very quickly as the learning time increases.

Once the "initial judgement" stage has been reached, the "BROWSE" process becomes far more efficient, and the requests that can be given to library services far more effective. Typically the initial stage to "judgement threshold" takes a good 15-25% of the elapsed time in an initial project in an area, the efficient data acquisition stage a further 25%, and the project/reporting the rest. It is rarely as simple as this, as the delays in obtaining physical documents, even after the correct references have been located, can be considerable.... and it is quite common for much of the most useful information to arrive on ones desk in the last few weeks of a project. One of the small ironies is that many information retrieval systems now offer an electronic mail ordering service - but his still does not assure that pyhsical delivery of the document in a reasonable time!

Clearly there are two major areas where a saving in time could lead to large increases in productivity.

(a) Cutting down the initial "search" stage.

(b) Shortening the time to get requests out for key materials.

It should also be evident that the same processes are at work when preparing a project proposal as when carrying one out. This illustrates why the preparation of project proposals in new area - or with a high research rather than developmental content - can be so time consuming. It also illustrates why follow on projects can be so efficient once the perspective and basic knowledge and contacts have been obtained through a first, however small, exercise.

4. INFORMATION SERVICES

The only way of ensuring that the flat part of the rising curve of knowledge is as short as possible is to cast a wide but selective net, and use the judgement of others. The tools for the former are available from information services of various types, and some assistance on the latter is also available from the same source.

The best way of approaching information services is to recognise that information obtained from retrieval services from libraries will inevitably have a large built in lag to them. This can be in publication, in distribution, or in abstracting or translation service input or distribution delays, and often in all of them at once.

The most efficient measure to use initially is to get in contact with people active in the area at the same time as you are. There are directories (and data bases) for current research projects in progress, and these can be the shortest route to locating other active workers. Actually getting in touch with these people can be a real problem, and is not pursued here. However, now that electronic mail and conferencing systems are beginning to become more widely accessible, these methods of contact are becoming relevant.

When they become more widely accessible, international communications of this type will be far easier and considerably faster. Until then, the post will remain the method of choice for distant names, and the telephone for those closer to hand.

The increasing availability of information on microfiche and online in abstract format has also changed the balance between different delivery media through efficient information retrieval processes. Microfiche can be copied and airmailed very swiftly and cheaply, and the US NTIS (National Technical Information System) data base of documents published by the US Department of Commerce is fully supported by microfiche versions of every document with a PB prefix on the reference number. NTIS is one of the data base providers who offer an on line ordering service: a matter of more practical concern to those in the US than elsewhere, due to the postal and processing delays in the use of this service outside North America.

In most countries this means that the majority of the PB references can be in hand within 2-3 days after locating the bibliographic reference containing the PB number.

Abstract services can be very efficient. The use of a number of different words which are expected to delineate the area of specific interest enables a form of browsing to be done through this electronic library.

Typically this would be - say - an authors name, a year, and a couple of words. Say "Mackie, 1981, Economics, Transport". This

would, as a full search, probably bring up only a few documents, but a much more effective narrowing process could be carried out to the same specification. A search on "transport+Economics" (to avoid the many other uses of the word transport, in areas such as electron or fluid transport) would give a great many "hits", perhaps even 7-800. It is also worth noting that US spelling foibles may mean that "transport$" or some equivalent be used, so that ALL words beginning with transport are picked out.

This illustration shows that the electronic system can be used in both a very specific AND a browse mode.

One of the warnings that should be given is that almost all of the multiple data base providers, and SDC and Lockheed in particular, expect users to log on to one data base, and then go on to others ON THEIR SERVICE. The efficient researcher will find out the rates, and switch from one to the other ... .

The tools of this trade used to be a printing terminal, but now smart terminals which are full microcomputers with discs and printers are often used, and the whole search can be logged ... abstracts and all ... on to the discs for local reuse and even as the base for further selective retrieval. This is becoming a real problem for the database operators, and the ability to set up a search off line, dial up automatically, and then transfer the information and logon to the next database ... all under program control ... is now a reality which, on 1200 baud lines is cutting database operator revenues by 30% while at the same time increasing the number of accesses by over 50%! This is beginning to lead to changes in the way in which information services are charged for, and it is thought by expert industry observers that DIALOG, ORBIT - and indeed the SOURCE - are all up for sale at present. The position of the European Space Agencies IRS service is therefore interesting, although one of the largest services used on the EEC EURONET-DIANE Packet Switched Network.

The structure and complexity of the search procedures offered by the on line retrieval services are often complex and require experience and skill to employ effectively. The online database structures which made estimation of search costs easy, and placed a high premium on speed of search strategy development and penalties on learning the system. Courses for information retrieval specialists typically cover more than one day. The charging bases are now changing, and the tools offered for retrieval are also being improved dramatically. One really complex data base system' DISCLOSURE` (all US company accounts and reports in detail) has now been complemented by a very intelligent program on an IBM PC (Personal Computer). The objective of this program is to make the use of an information search specialist uneccessary, as these skills have been built in to the DISCLOSURE II software the same software also divorces the need to be online interactively from the user, as the search process can be set up off line, and the whole task of calling up the remote service, carrying out the search and downloading the results can be left to the IBM PC ('Personal Computer') to do at

the most economic times from the communication and online service vendor rate cards.

It can confidently be predicted that this system will be followed by many more, all more sophisticated and user friendly, as this is a basic trend in small systems software.

Even this is just the beginning, as Expert Systems start to become effective on smaller systems. These are minimal rule based or knowledge-based logical programming languages such as MicroProlog (McCabe, 1981), PROLOG (Clocksin and Mellish, 1981), and Micro-Expert (Cox and Broughton, 1982), and are now being used to make such interfaces even more intelligent, and able to respond to ever more vague queries progressively more helpfully.

The basis of Prolog is that a series of logical statements, (if required, of varying degrees of probability) can be asserted, and the Prolog system then analyses these rules and assertions to produce a result. This process is conceptually identical to matching relations in a relational data base, but with a greater degree of intelligence in the system interpreting the requests. The relational model of data is in fact a special case of the formal logical programming formalism underlying Prolog and its ilk (Lloyd, 1981). The increasing convergence of data base systems and the techniques of making them more 'intelligent' and easier to use is elegantly illustrated by this example.

None of this makes the original documents more readily available, but this is also being tackled by BRS (Bibliographic Retrieval Services) who have produced a microcomputer+hard disc+video disk system onto which the whole of a data base can be downloaded and used locally in a library. Pergamon have done the same for their Video/PatSearch coverage of the US Patent Office files.The data transfer rates possible on the Video bandwidth lines now going in to homes in many countries will very soon make this a reality for many potential users .

5. PRACTICAL ISSUES

This plethora of technology does not alter the users need to apreciate that at the initial stages of learning a broad span of sources are needed, contacts with people can be accelerated and made much more effective by the aid of professionally offered information systems and directories.

The ordinary library contains vast amounts of information, buried under what might seem to be rather eculiar indexing conventions. Do not give up if the author of report you want is not in the catalog ... many libraries (including Leeds) bury whole series under the institutinal Author. EG TRRL may have only one entry for all its publicatins, and retrieval by author name is impossible. These and other quirks of the librarians art can be overcome by the user prepared to use electronic aids in his searching and browsing ... and the libraries can provide expert

aid in this process. However, it is even more important to ensure that you are aware of the hardcopy retrieval conventions operated by your own library.

As an illustratiuon, Leeds has its own indexing system, which does not follow the Dewey codes seen in most libraries. This has both advantages and disadvantages: the largest disadvantage is that this will materially slow up the transfer of existing library catalog cards to magnetic - and thus searchable - media, as the library cooperatives carrying out this gargantuan task must work in cooperation on the same indexing base. However, some parts of the Leeds index are now held on magnetic media, and information technology (in the guise of KDEM-Kurzweil document reader: available in Australia at Leigh-Mardon, Moorabbin, Victoria, and in the UK at the Oxford University Computing Centre) may yet permit conversion of the mass of otherwise unsearchable index cards. Even this, however, cannot make up for any lack of information on the basic index cards.

The obtaining of hard copy, once a reference has been identified, is not limited to the library system within the oranisation. The interlibrary loan system operates between all major libraries and a number of private collections. This too has been affected by the recent moves to control and restrict copies of source material, and the practise of photocopying sort papers for interlibrary loan without losing the full volume is becoming such less likely to last for much longer.

The full recognition of the need to provide a document delivery service has recently been recogised by a consortium of publishers as the ADONIS project, and by the SEC as the hugely ambitious EEC ARTEMIS project (Norman, 1981) both of which are now under way. These projects cover digitalisation of documents, transmission, and videodisc, micrographic, printed, on-line and other means of final provision.

The scale of this type of information transfer is such that electronic sophistication is rapidly becoming a necessity for knowledge workers, not least because the economics of even COM (Computer Output Microfiche) indices are now moving down the scale against online systems. Paper is holding - and will continue to hold - its own in the market, but the scale of knowledge working is now international and the final document delivery, location, and identification processes ae becoming a matter of electronic scale very swiftly. This does however apply mainly to NEW information, as the massive catalogues will not lightly be transferred to electronic media for quite a while yet.

6. DATA SOURCES

It is often overlooked by Transport workers that there is a large and growing library of publicly accessible data held in a library or software databank format. This data ranges from the massive time series databanks on I.P. Sharp's commercial time sharing services to the cooperative data holdings of the Social Science

Data Archive and its collaborators, the Data Archive in ANU Canberra Australia, and the ICSPR at Michigan USA.

It is unfortunate that more transport data sets are not held in these data libraries, but the rich variety of Family Expenditure, General Household Survey and other time series data sets at disaggregate level are a resource worth noting.

Other sources of information include the Department of Transport, the OPCS and the various Counties. Unfortunately, the data sets held by these bodies are not always in a usable or a readable format, and the SSDA does an excellent job in making such data sets available when they get them.

7. CONCLUSIONS FOR INFORMATION ACQUISITION

The major task of a knowledge worker is to obtain information early enough to ensure that his time and effort are well spent, and to ensure that the results of his work are available in a timely and accessible format.

The impacts of information technology on publishing have led to a greater range of tools for both tasks. As the capture from the start of data and text on machine readable media becomes more common, the duties of the knowledge worker to make his text and data accessible, retrievable and identifiable become similarly demanding. The use of effective abstracts on all material produced, the supply of data sets and documentation to archives, and the production and retention of readily copyable forms of report (eg tape or microfiche) all become less and less an option. There is even a major task to digitise all the internal document handling within the EEC Commission, under the name of ARTEMIS (Gurnsey, 1982: Norman, 1981).

Many of the tools created for the information industry are now converging towards computer communication tools, and the balance between online searching for references to reports and to online inquiry networks usig computer conferencing has already started to alter on public networks and informatin providers such as the PARTICIPATE system on the SOURCE.

The online future is not yet here however, as the COMPUSERVE public information utility had (in November 1982) just withdrawn its full text trial for a dozen newspapers in the USA ... but within a few days of that event, Elsevier had committed themselves to a number of journals to go online.

It is clear that knowledge workers will e the first to feel the full force - and benefits - of convergent information technologies, and in the transport field the effects on the behaviour of knowledge workers (especially the tariff responses) will be a matter of genuine importance in short order.

8. REFERENCES (Part 1)

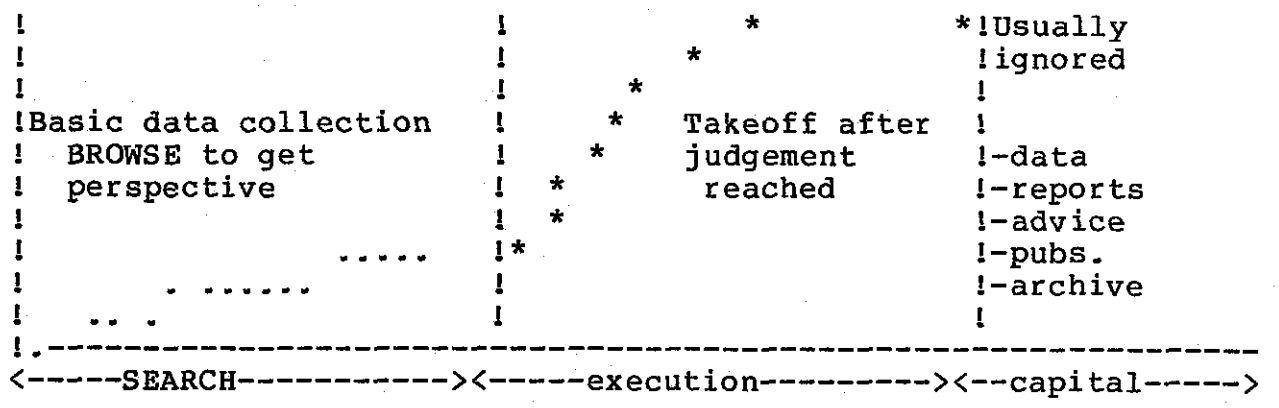
GURNSEY, J. (1982). Electronic document delivery III: Electronic publishing trends in the United States and Europe. Learned Information, Oxford, UK. (54pp.).

LLOYD, J.W. (1981). An introduction to deductive data base systems. Technical report 81/3 (Rev 1982). Department of Computing Science, Melbourne University, Victoria, Australia. (22pp).

NORMAN, A. (1981). Electronic document delivery I: the ARTEMIS concept for document digitalisation and teletransmission. Learned Information, Oxford, UK.

9. SLIDES (Part 1)

Slide A) Time/effectiveness profile for data/information usage



Time through the learning/execution process

Slide B) Structure of the seminar

1. MECHANISMS OF LEARNING
2. DEVICES TO EXPEDITE INFORMATION TECHNOLOGY
3. ROLE OF INFORMATION SERVICES
4. ECONOMICS OF INFORMATION RETRIEVAL
5. INFORMATION TECHNOLOGY CONVERGENCE - the case of document delivery
6. DATA AS AN INFORMATION RESOURCE
7. COMMUNICATION TECHNOLOGY AS A MEANS OF SHORTENING JUDGEMENT/DEVELOPMENT CYCLE

Part 2

PRODUCTIVITY AND INFORMATIONSYSTEMS:
text to typesetting; data acquisition to networking.

10. INTRODUCTION TO RESEARCH PRODUCTIVITY ISSUES

Both the Australian Road Research Board and the Institute for Transport Studies at the University of Leeds are typical of a considerable number of organisations with mixed requirements ranging from text entry to typesetting and printing in house in the text handling area. However, the differences from many other less technical organisations are crucial:

1) Scientific equation setting and figures are important

2) The organisations have a major commitment to data acquisition through instrumentation and microprocessor systems.

3) The scientists and staff involved are well adjusted to terminal input.

4) Distributed computing power is needed, and communications between different systems are therefore important.

5) The opportunities to upgrade access to typesetting equipment , have come at a time when major standards are emerging (as yet , still somewhat erratically) in local area networks, distributed processing, communications word and text processing, graphics, and the support software for all of these.

6) Data base retrieval is widely appreciated, and the utility of access to remote but relevant services, such as IRS in Europe, ORBIT and DIALOG in the USA, is well understood (see also the seminar paper on the sese subjects in ITS WP169 (Wigan, 1983)

7) Members of the staff, both scientific and administrative, are available who have kept in close touch with all of these different strands of development.

This note outlines a working approach to the integration of the text processing, data base storage and retrieval and computational tasks which takes maximal advantage of the investments of other similar organisations, and specifies the principles on which output and productivity can be safeguarded and progressively enhanced at minimum overall cost to the organisation.

11. ELEMENTS OF THE SYSTEM

There are four quite distinct themes running through the information technology applications at both ARRB and ITS.

1) Text capture, processing, typesetting and printing.

2) Direct scientific computational and graphics processing

3) Data acquisition, reduction and interfacing from instruments

4) Communications between staff, different pieces of equipment, and various data holdings (e.g. Accounts and online Project Records at ARRB, and scientific data in both places).

The last item might be thought as of being in three separate parts: the library oriented applications of text retrieval, the administrative use of online project record files (under the ARTEMIS system under QUERY/UPDATE on the ARRB Cyber 815), publication linkage and accounting/mailing list work, and the scientific use of data base structuring of data. This would be incorrect, as online project record retrieval and links with publication systems are strongly oriented to text retrieval and entry (thereby corresponding closely to technical library usages, with a different query language) and the data oriented applications of QUERY/UPDATE are simply a tool for judiciously handling limited amounts of scientific data in relation to computational analysis.

The last entry in this list has therefore been put in the singular, as it is a single task, and this highlights the need for care in ensuring AN optimal allocation of manpower resources if treating these elements as distinct, as this could easily increase the real cost of much of the scientific output.

The time spent within both organisations entering and editing text from a terminal is a major component of staff time. The initial entry of text is the smallest part of this time commitment, and the part best done by professional typists or keyboarding professionals. The major time expenditure is in revisions, corrections and adjustments for different objectives.

For many, the largest single time element is when computer programs are being developed, requiring continual cycling between editors and compilers; in this mode offline input and editing are distinct productivity enhancements for the professionals involved.

For others the greatest effort is in the production and revision of draft reports as they evolve from working notes to typeset papers.

Productivity of both organisations as a whole is completely dependent on the effective use of the time of the scientific staff, as the organisation is devoted to the production and dissemination of information: a heavily manpower intensive task, but the prime direct output of the organisation.

Efficient access to the tools and materials on which the work relies is therefore a central objective of the capital

expenditures of either organisation.

There are numerous cases of tradeoffs between limiting "capital" allocation expenditures (which are subject to extensive delays, and considerable public attention and time expenditure for comparatively small sums) and manpower - the key research investment resource. In this respect there is little difference between the two organisations, except in degree.

The capital funds may be placed into two sections:

1) Equipment for the direct execution of research and the subsequent analysis.

2) Equipment devoted to reducing the overall operating overheads of the organisation.

The former has in the past been a fairly clear cut category, but the advent of information technology and the "soft" multipurpose instrumentation and data acquisition and reduction system has had a wider and more fundamental unifying and productive effect then has yet to be fully appreciated and acted upon in either organisation.

The emergence of powerful small systems to undertake data acquisition, much of the data reduction, and capable of controlling the communication of the resulting data to a larger system has in a large number of sites across the world been quickly derating the importance of the central computing facility, with the virtually inevitable centralised delays and bureaucratic constraints arising from the modes of operation forced on most mainframe installations. This is particularly the case at Universities who difficult servicing problems with the wide ranging and conflicting and peaking demands, and the extremely large differences in sophistication and needs between major goups of users.

Outside extremely processor-intensive mathematical calculations, the central computer is swiftly changing its role to be a central file server, with communications facilities and the ability to handle the larger tasks which still simply take too long on the dedicated small workstations available to date.

The "soft" nature of these local intelligent tools means that even instrument development systems can also be operated both as word processors and stand alone computers for specialised tasks.

The capital investment in equipment to improve overall efficiency has historically been the province of the administrative and accounting sides of most organisations. Neither ARRB or ITS is an exception. However, in the professional community as a whole, this balance has changed quite drastically in the last few years, due to distributed processing. The balance has only been kept at the historical level of centralisation through the build up of data base - oriented applications and data collections and the

host machines for these services.

The communications between the different devices is now a key question. The administrative functions of typing, typesetting printing and publication have been subject to the same technological gale which has raised capitalisation per worker, and doubled the productivity per knowledge worker already in most of the world.

The very same devices and pieces of equipment now required for these prototypical 'centralised administrative services' are now the same as those required for the knowledge worker (scientist, engineer, data base information retrieval specialist, economist etc) for their own work. They are also the essential tools of instrument and data acquisition workers.

These are :

a) A terminal screen (usually with full screen editing)

b) Local processing power (to support editing and processing)

c) Local backup storage ("local" may mean "on a connected network")

d) Special purpose software (preferable transportable)

e) Graphics capabilities

f) Communications with larger (or smaller) systems as data sources

g) Printing (which includes final output typesetting, and , of special importance to scientific organisations, typesetting proofing at high speed using 10+ page/minute Laser printers)

This list covers specialist Word Processors, Typesetting Page makup terminal, typesetters, printers, laser printers, graphics displays, illustrations, data acquisition (as from sensors etc.) and data access (as in both text and numerical data base retrieval), and communications : machine to machine, device to device, system to system, person to person.

Let us look at a pattern of devices which could conceivably meet all of these needs with a maximum degree of compatibility, high degree of modular upgradability, outside support for the software and early availability.

The elements are not unique (and this is noted in the text), but do provide a coherent pattern of capabilities based on a simple recognition of the convergence of the technologies, the creuicial importance of software, and the powerful effect of taking a unified view of the several areas of substantial expenditures of time and money. ARRB is taken as the target organisation for this

exercise, due to some special developments and skills in instrumentation outside the present skills of the ITS, so that the full range of potential integration now possible can be ilustrated.

These illustrations are not necessarily a specific set of recommendations for either organisation, rather a concrete eaxample of what is now possible, and could reasonably be substantially be improved on in the near future.

1) Text : SUN Workstation (mc68000, graphics, UNIX , Stanford TEX and laser printer support)

2) Print: Canon LBP/10/2 Laser printer (plus above IS the IMOGEN typesetter sold by Stanford). The LBP10/2 is fully supported by Canon Australia. CSIRO has several IMOGEN. systems. One is on order for CSIRO in Melbourne. The same laser printer is used by the Symbolics fast LISP machine (10-15 times the speed of most LISPS on the VAX 11/780 on some reports). It is also the printer supported by Wirth's LILITH Modula-2 based workstation and typesetting system.

3) Compute:
Berkeley UNIX 4.2 on a system based on the Motorola MC68000 microprocessor is completely hardware and software compatible with the SUN, which runs the UniSoft port of this particular UNIX release. The SUN is completely compatible with the Callan graphics workstation, and both can emulate a Tectronix 4010--still the current virtual standard graphic output device. The SERC-supported microcoded bitmapped screen PERQ workstation system also has a BSD 4.2 UNIX port, done by Human Computing Resource of Toronto, in addition to other UK ports of UNIX to the PERQ.

4) Graphics:
Are fully supported on the SUN. Canberra CAE are using Sun workstations sharing a single large 40MB disc drive for teaching graphics. There is active local representation for the SUN. The IMOGEN form of packaging (of the somewhat earlier generation of SUN cpu board design) includes a Tectronix 4010 emulation, thereby maintaining the mainframe software standards. Similar comments could be made about the PERQ in the UK.

5) Typeset:
A CSIRO version of TEX is due to be fully implemented on the IMOGEN is due in July 1983, as CSIRO has undertaken to publish and set 13 Journals in this medium on the III Comp 80/2 and therefore urgently requires the typsetting proofing quality obtainable from the LBP 10/2, and has staff already engaged on completing the necessary work to format TEX macros for

these journal styles. Effort over several years has been devoted to TEX within the CSIRO Division of Computing Research (DCR). As a result a major pool of experience has been built up on this public domain typesetting system and its' device independent file (DVI) drivers. TEX 80 is now operative on CSIRO CDC 815 systems. TEX 82 will be available in June 1983 to be set up on the 815. ARRB also operates a CDC 815, and publsihes an extensive range of reports and periodicals.

6) Typeset:

TEX supports multiple output devices from the Device Independent Files it produces. Thus drivers for Diablo, Canon COMP 80/2 etc are all in hand by CSIRO.

7) Word processing:

The wide range of specialist word processors still offer rather more than the rather limited international de facto standard of WordStar, yet do not really justify their single-purpose application costs - especially when the questions of information systems integration is faced even to the limited first step of typesetter integration into the system. Perhaps the best of the professional word processing systems widely available for general purpose computers has been the LEX system on DEC equipment. This is now available for MC68000-based UNIX systems (1).

8) Data: The ARRB Instrumentation area has heavy expertise in Motorola products, making the MC 68000 the preferred processor for ARRB equipment in future. The standard development systems for such equipment all run UNIX. The SUN uses MultiBus, one of the several standard bus structures which enable ARRB to -this time -build only the essential interface boards and box the systems. (Most instrument and system development systems still use either Multibus or Versa Bus). At Leeds the 68000 is also the preferred basic 16 bit processor supported by the Microprocessor Support Unit, using Whitesmiths cross-assemblers under UNIX on the MSU PDP 11/44 under UNIX. The MSU presently mainly support downloading of cross-compiled Whitesmiths' C, assembled and linked Z80 software integrated with the AMX Run Time Kernal system into minimal S100 terminal stations in departments for instrument and control purposes.

9) Research (Data acquisition and reduction):

The proposed work on image data acquisition applications discussed briefly in ITS WP172 (Wigan, 1983) will require a direct GPIB interface, and possible array processing support. The key local Australian manufacturer (Dindima) of the Arlunya image capture and enhancement equipment is committed to full MC68000 support (for the UNISON), and has confirmed co-operation with the proposed ARRB experimental field

work using this image capture equipment.

10) Communications:
SUN supports EtherNet, which has the best chance of becoming widely used, and UNIX already supports direct communications over such a link: specifically on the SUN. The uucp system is of course also available on both SUN and PERQ, given access to the necessary lines or X25 PADs.

11) Data Base:
While the mainframe will continue to be the major file holder, ORACLE and other high quality relational data base systems are now available on MC68000-based systems (and any other UNIX host, includin VAX or PERQ amongst others), which typically have 10-50 megabytes of on line hard disc storage available on line, quite enough for substantial data bases to be maintained locally.

12) Information retrieval:
The underlying choice of UNIX (on MC68000 or PERQ systems) as a working standard has been given a considerable boost by the very recent announcement of a specific data entry and information retrieval system by the authors of BRS Stairs: BRS of New York have now written a system in C called, BRS/Search which is operative on V7 and SIII UNIX systems: as installed on most MC68000 systems. It includes database structuring, data entry editor, and the usual library-oriented inverted file retrieval query language facilities (2). It is anticipated that any necessary conversion to Bell UNIX System V will be quickly undertaken.

13) Telecomms:
The use of a small system (such as an Australian UNISON MC68000, a SUN MC68000 workstation, or a PERQ) in conjunction with Ethernet and/or direct X25 connections to AustPac, IPSS or SERCNET will provide a powerful communications system on more than just a local scale. The Berkeley UNIX implemented on the SUN is quite capable of operating the IIASA TELECTR teleconferencing system by Lathrop and Pearson (1981), which is programmed in the Berkeley C-shell language.

14) Formatting text:
There is a range of standard UNIX tools which have been used for a long time to produce direct phototypesetter output. The well known NROFF/TROFF/EQN set of tools not only cover the full capabilities of the Graphicset Photosetter (as used by ARRB), but have been available for almost ten years. Numerous services world wide offer the service of typesetting and

publishing up to book level directly from TROFF output.

EQN is of special interest at both ARRB and ITS, as it sets full equations: a task for which TEX is admirably suited, but with a command language which is far more digestible than TEX. The macro command facilities of all of these families of typesetter format drivers mean that a customised command set can be set up for a particular style of publication preparation, and the complex details of leading , kerning, justification, multiple font and bolding variations can thereby be disguised from the user driving the editor which creates the original text.

15) Word processing:
The commercially successful Wang word processing package has been improved as made available of the Fortune (another UNIX based MC68000 system designed specifically for an office environment). Yet further upgrades to this widely-accepted office-oriented product are being completed at the Quadratron Company by Stefan Zimberhoff (the original author of the Wang WP-superset for the Fortune).

The requirements to mount UNIX itself are quite substantial, and at least 10MB of hard disc is a practical working minimum. IDRIS is also C-based, and is very much better set up for smaller machines, although it is running on a number of VAX 11/780 and similar large scale minicomputer systems. The IDRIS operating system is closely compatible with UNIX V6 (rather than the UniSoft UNIX V7 port to the MC68000, or the UNIX III now being done for UNISON by Melbourne University - or indeed the System V version now adopted a a fully supported product by BELL), but has a series of tools of comparable power-in addition to the ability to recompile and execute NROFF/TROFF/EQN if desired.

In the IDRIS domain there is a text formatter written (once again) in C called CTEXT. CTEXT will accept the NROFF etc macros, yet has an additional family of macro capabilities and a complete set to drive VT52, VT100 terminals, Diablo printers, and the VariTyper 5410/5810/5900 family of typesetters and a few others come with CTEXT. The importance of this facility is that a complete customisation of font and device characteristics can be done, and used by the typesetter with out a single command having to be placed in the text (a run time flag is all that is needed).

This list demonstrates that the hardware convergence of the different areas of information technology has already occurred, if a careful and informed view is taken of each of the different streams is taken.

It should not be taken that this is in any way a unique set, simply a workable one. For example, SPRINTER-3 under the portable UCSD P-System is very similar to TROFF/NROFF in its mode of operation, and now supports typesetters and laser printers as

well. A fairlygood case could be made for UCSD as an integrative device, but not as good for the circumstances discussed as UNIX or UNIX look alikes.

When the traffic and transport instrumentation issues are considered in detail, there are further interactions. The UNISON is based on EuroCard modules with positive locking and location: a design most appropriate for electronic devices to be used in the field and in moving vehicles. The UNISON is supported by the Victorian Government, and UNISON themselves have an added-value policy which is to encourage the development of extra modules on the UNISON bus, and to this end offer a low priced option to major government and university departments and bodies to encourage this. ARRB amply qualifies for this program.

An equivalent at ITS has not been successfully located.

The use of a MultiBus or VersaBus based system would not invalidate the integrative theme outlined, as long as principle of the MC68000 and UNIX combination was followed through.

The modules in the system can then be upgraded independently, the hardware is easily supported, the key software is the subject of massive investment and support from CSIRO locally (in Australia: see the previous comment for ITS), and the needs of both scientific production and administrative support can clearly be met by a broad policy on the lines outlined above.

The specific set of devices and manufacturers specified are unique even now, but the fact the a full set of hardware and software tools with local support spanning the whole range of transport research can already be identified is to the considerable financial advantage of organisations working in this field, but only if the opportunity is taken to set out a series of Information Technology policy guidelines on the general lines of the above holistic specification.

If this opportunity is NOT taken then considerable avoidable increases in overall cost must be expected over 2-3 years, and a major source of potential productivity enhancements will be lost.

To date the text input, text processing, printing and publication areas have been only partially integrated into the output and research objectives of either organisation. The impact of information technology advances and staff sophistication in both places has now made it possible to improve this situation with considerable productivity benefits to both organisations.

The programmed replacement of the dying first generation terminals with Z80 microprocessor-based screen oriented editing terminals at ARRB , and the exactly analogous adoption of BBC Micros as standard terminals by the Leeds Central Computing Service, will have a notable impact on personal productivity once the BBC Micros have local storage of a suitable capacity and

speed.

However, the next round of decisions on the text and data access fields will extensively affect most scientific organisations and quite considerably influence the amounts of effort required to learn, maintain, and utilise their overall resources. As is typical of most organisations making moves into areas where information technology is moving quickly, many of these decisions are not as yet widely appreciated as being integrated in their impact by a substantial fraction of the very different kinds of parties involved.

Just as the importance of the need to have a 'standard' screen addressing capability, and the adoption of at least one standard replaceable storage medium in microsystems used for full-screen editing are key underlying organisational decision criteria, the impact of multiple single purpose systems with needless differences in underlying hardware is not always fully understood in time by all of the parties involved.

It is important that individuals appreciate the fundamentally altered nature of the information acquistion and processing tools now available and the close links with other decision and investment areas affected by major information technology changes.

The essential tasks of measurement and data acquisition range from the precise measurement technique by which the data is obtained and the means by which it is interfaced with transducers at one end and to data processing at the other. The equipment itself is far less important than the data acquisition, which is often a research task in itself, and the data processing afterwards is a more a question of the available HPIB bus, RS232/422, or EtherNet connection standards adopted within the organisation. In many cases no such standard is needed, as many data acquisition systems have their contain their own complete analysis modules internally.

The role of instrumentation expertise in this changing pattern is to ensure that the transport research orgaisation is in a position to utilise and apply measurement skills to integrate largely already-available equipment and components without a large start-up time. Future SERC proposals at Leeds should bear this principle in mind.

12. CONCLUSIONS FOR RESEARCH PRODUCTIVITY

This Part has illustrated by example a number of the different areas of activity which are now interdependent in a research organisation, and shown how a systematic review of the information technology aspects of these tasks can clarify a coherent policy for cumulative effective developments without the need to backtrack, to acquire incompatible single purpose system, or to involve the organisation in an uneccessarily large number

of different major new learning curves.

The hidden costs of ignoring these factors are undoubtedly substantial, yet this policy area contains the potential to exploit largest area of productivity gain that organisations such at ARRB and the ITS now have left to develop.

13. REFERENCES (Part 2)

LATHROP, C. and PEARSON. (1981). TELECTR. IIASA, Laxenburg, Vienna, Austria. (48pp).

WIGAN, M. R. (1983). Information technology and transport: what research needs to be started now? Working Paper WP172, Institute for Transport Studies, University of Leeds, Leeds, UK.

14. ADDRESSES

(1) SofTest Inc. 555 Goffle Rd, Rodgewood, New Jersey 07450

(2) BRS Software Group, 1200 Route 7, Latham, New York 12110

(3) EDS/BRS, 481 Main St, New Rochelle, NY 10801.

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TRANSPORT AND COMMUNICATIONS: INFORMATION TECHNOLOGY AND HOUSEHOLD BUDGET INTERACTIONS

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ABSTRACT

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The increasing importance of communications and information technology on and in transport is beginning to make a major impact on transport, on communications and on expenditures of time and money at the personal and business levels. This paper identifies a number of places where transport and information technology have potentially major interactions. The changing balance of household expenditures and industrial output in various components of communications and transport are presented using both Australian and UK data. The major conclusion is that the overall importance of transport expenditures in the economy is remaining fairly stable, while communications expeditures are increasing. The two types of industry are now approaching comparable size, and will, when this occurs force changes which will amount to substitution and competition. Similar findings also apply to household expenditures, with the exception that at lower levels of income the relative importance of communications and transport expenditures are already comparable (1980 in UK), and thus products in the IT area priced to be attractive to below average income households will make significant impacts. This has been confirmed with the combination of very cheap home computers allied to cheap modems and the MicroNET 800 service on Prestel in 1983.

KEYWORDS: COMMUNICATIONS/ INFORMATION TECHNOLOGY/ TRNSPORT/ FAMILY EXPENDITURE/ HOUSEHOLD BUDGETS/ INFORMATION ACCESS

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TRANSPORT AND COMMUNICATIONS: INFORMATION TECHNOLOGY AND HOUSEHOLD BUDGET INTERACTIONS

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1. INTRODUCTION

Transport has frequently been bracketed with Communications in public discussion, but recent changes in the means of accessing and processing information have begun to make widespread impacts on both transport technology and user demands.

The key factors are:

(a) data acquisition cost reductions (leading to major advances in the amount of vehicle movement data which can be obtained and handled).

(b) data processing cost reductions (leading to a quantum advance in the economics of vehicle control, user charging, and vehicle identification).

(c) data access cost reductions which are beginning to deliver a vastly important quantity and quality of information both transport services and their marketing, and on the ranges and quality of alternative end user services which would otherwise have required travel to obtain (shopping being only one of these).

The overall impact of the convergence of communications and transport through the stimulus of computer and telecommunications technology advances also has broader effects at the regional (Wigan 1983a,b) and the international level. The specifically transport issues at an (implied) sub-national level are given primary place in the present paper, and factual data on the trends in industrial output and household expenditure in Australia and the UK are presented to provide a numerate basis for consideration.

The changing importance of the industrial output aspect of these two major and closely complementary industries is illustrated in Fig.1 (drawn from Wigan, 1983a) , where the development of the output of the UK Transport and Communications industries are shown over time. The output of the transport industry has risen by about 30% since 1960, while the output of the communications industry has increased by about 150%. This tells only a small part of the story, as the consumer expenditures and other aspects of the transport and

communications markets have a great deal more to say about the nature of the changes taking place. the fact remains that the communications industry has now firmly overtaken the transport industry in the UK, and the gap is clearly set to widen.

The changes in emphasis on these two aspects of communications (movement and monement of information) are now being reflected in the public and industrial attention devoted to the telecommunications aspects of communications, and the lower levels of concern expressed over transport per se.

2. DATA ACQUISITION COST REDUCTIONS

The implications of (a) are that dynamic road user congestion charging and routing information have now jumped the barrier previously set by the enormous cost of equipping all vehicles with the intelligence to handle and display such information. The microprocessor controlled car instrumentation system is now emerging piecemeal in the market place, and is rapidly turning the road user charging/information/vehicle identification question from one of expensive solely-hardware additions to eventually one of (far cheaper) software changes : a genuinely economic proposition. The capability to inform users dynamically of the congestion price that they are (or would be) incurring was for a long time the major cost bottleneck strangling the most practical (and economically effective) selective area policy option for effective road utilisation and environmental protection (Wigan, 1978: UK Department of the Environment, 1977).

For such a dual policy to be effective, both parking charges and areal licence charges were needed - and the information context of the road use congestion charges was the largest single contribution to the economic benefit. The major costs were concerned with the licence issuing, enforcement, and monetary transfers. The microprocessor oriented active instrumentation systems now emerging offer the opportunity to achieve all of the "information" benefits -without the monetary transfers or the enforcement superstructure.

The networks of data links now becoming a widespread reality are beginning to offer not only high speed data paths from many points to many others, with full public access, but even video bandwidth two-way linkages are close to the same takeoff point. This means that the opportunities for distributed road pricing, road user advice, and communications have now converged to make effective use of the road system an economic and practical proposition within a short handful of years. The considerable increase in the adoption of microprocessor controlled distributed instrumentation systems for ordinary cars is now providing the only missing link in this web.

The impact that the adoption of this stance could have on urban network utilisation is substantial.

If monetary transfers are regarded as essential, permanent transponder systems in the roads or on the view side are then needed together with vehicle identification. The emergent attitudes towards data privacy are likely to inhibit, if not prohibit, this. Who would like to have detailed (urban) movements continuously recorded? - apart from enforcement officers and vehicle fleet operators of all types.

This discussion has up to this point been restricted to the private passenger vehicle in its emphasis: this is misleading, as the far smaller fleets of freight and passenger service vehicles have in general a much higher value, and can justify investments in vehicle electronics and communication systems at a considerably earlier point in the development of this applied field , and before mass-market prices (or mass market acceptance) could be expected for the larger private passenger vehicle fleet.

This has substantial public sector importance, as the key determining factor in road structural design expenditures is the need to sustain the massive axle loads now on modern trucks. Small increases in the load carried above the legally permitted limits (to which designers perforce must look to when designing the road itself), have a very large effect on the remaining life of the part of the road in question, as the damage potential of an axle varies in approximate proportion to the fourth power of the loading. When axle loads of 8-12 tonnes are in question-and overloading is common in Australia to up to about 50% above these permitted limits- the importance of surveillance is hard to underestimate.

Here, too, information technology is bringing into existance a complete framework of detection, enforcement-and even possible taxation. The ability of the microprocessor based dynamic weighing systems to accurately assess axle loads on a continuous basis is at present limited to about 4-6 km/h : however, the implications for road user damage cost recovery are apparent, in the context set out above for private passenger vehicles.

The combination of such a system, developed to a stage where the dynamic axle loads can be picked up automatically on each lane of the road, a vehicle identification number picked up from an interrogation signal from the monitoring system so triggered, and an automatic transfer of a fine (perhaps we should call it a tax?) onto the ledger of the licenced operator could become entirely automatic in countries with a greater density of data communication networks and population than those of Australia.

Similarly, automation and continuous central acquisition of vehicle movement data at marginal cost (another side effect of the trends specified above) provide an economic means of continuous monitoring of flows and their composition - something that labor costs have precluded for some decades.

The age of the automated helot is now arriving, and here is one application (to classified vehicle monitoring) where it will be greatly appreciated.

It is important to note that these options are technically feasible now, but that the inertia of political and investment processes mean that implementation - even if it were to be considered to be desirable - must be viewed as requiring at least a decade. The promulgation of innovation through the vehicle fleet requires this order of delay, although the usage patterns of older vehicles indicate that an effective on the road impact could be acheived in rather less if road/tonne/km were taken to be the criteria (Thoreson and Wigan, 1980).

3. DATA PROCESSING COST REDUCTIONS

The control and adaptive response possibilities of the advances listed above are already apparent from microcomputer based Dynamic Traffic Control Systems such as SCOOT and SCAT (Robertson, 1982). The transfer of control application to a wider scope depends only on the increasing quantities of relevant information acquisition and processing systems which will increase very much faster than the technology, as the various control implications are linked together.

The impact of the ability to set such systems to pick out specific vehicles or locations of special interest would swiftly become a major political issue. The heavy - and increasing - use made of video monitors may become a matter for greater concern when image processing and recognition systems become economic for such applications. The UK Home Office has been reported to have already tested an automatic vehicle number plate detection system, linked to a "wanted vehicle" file. This level of monitoring and response capability will ease the im,pact of the suspected intrusiveness of vehicle identification and charging systems, such that the accountability of such a public and large scale system may become politically and publicly preferable to the unpredictable tracing that would arise if the potential capabilities were realised by Police and other official bodies simply as a surveillance enforcment tool.

4. DATA ACCESS COST REDUCTIONS

The complementary issue to the effects on vehicles and vehicle movements is that the effects of higher quality and quantity of information on those who use the vehicles. The freight transport system is less affected by this class of question, as the decision to travel is one set by the need to move a physical item from one place to another. However, one of the key costs in road (and other) freight opearations of any complexity are the documentation costs and delays. These arise in a visible manner more commonly in international trade, but they are still a major cost at any scale of consolidation of freight movements.

The areas of greatest vulnerability are those where "search" behaviour is required by individuals looking for the best price in a set of near-substitutable items. The range and quality of information available on public transport services has been demonstrated to have some effect on usage, while fare and service structures restricted with better marketing has had far more. In this case the movement possibilities have been the subject of attention. In future the destination possibilities will become of far greater importance.

Evidence is building up from studies of time allocation trends by age, lifecycle stage, and vehicle access to identify these markets, especially for recreation and personal business, and a slight change of emphasis in the treatment of travel time as just one of the activities in which people spend time in over that day is emerging from transport analysts as these points become more concrete (e.g. Wigan, 1983c).

The key problem is that the equipment to access these emerging systems such as VideoTex are still expensive, and is not yet just a software change to an existing household piece of equipment yet. The essential problem of road pricing in the late 1960's was that of the cost of the single - purpose add-on hardware. It is so different here- and helps to explain the slow rate of penetration of Prestel in UK homes. Business organisations are, however, very rapidly becoming terminal oriented for a variety of reasons. Consequently the business impact of Prestel (and internal dedicated VideoTex systems such as IVS purveyed by Aregon) has been much more effective.

The key finding to date for UK Prestel experiences is that the interactive capabilities (e.g. travel bookings) have cut internal (and public) costs of obtaining and locating volatile competitive services such as ferry seats. The most recent development in this line is the provision of a two-way link through Prestel directly into the PanAmerican Airlines main booking computers in New York, with others to follow. The transport industry shares the volatility of seat (and cargo) capacity utilisation with the entertainment industry, and similar moves by the entertainment industry are now taking place.

This enrichment of choice, and increased efficiency of utilisation, is but a harbinger of the future. The impressive intercontinental linkages of packet switched networks, Gateway systems on the British Telecom Prestel service computers, and support in two continents is brought simply to the desk of a travel agent with a modified TV set and a 12 digit keypad to obtain responsive communication.

This push from business for internal costing reasons will first be integrated with personal business first. Banking and EFT (electronic funds transfers) are responding to the poor accessibility to such service now available to many

people (due to the match between opening hours, location, and the times at which people can get to these services).

This thrust (from the banking side for cost reasons) is likely to be effective for the same reasons that the UK Prestel travel booking services have worked out. The provision of "teleshopping" has not yet been very effective, as access instruments in the home are essential, and until this has been corrected will probably continue to be the case. The French are taking large scale action to replace the telephone directory service by placing terminals in most home to access a suitable computer based service. This will at a stroke place "telematique" in the same category as the microprocessor equipped car : i.e. awaiting only software (and data communications network support) to be exploitable for a wide range of uses.

In the case of home access to information services, one segment of the workforce is already responding. Large firms such as Xerox now have the key members of their staff working from home terminals, thereby breaking the "neccessary" link between presence at workplace and communication with colleagues. It is particularly important to note that this initiative (in the case of Xerox) is specifically linked with new centres for innovative business, and to small scale initiatives where the executives concerned are freed to build up businesses on their "own" account -- while still executing substantive and often senior tasks in Xerox. The breaking of the time and location nexus for such duties is the key item to observe, and the message for transport and communication planning abundantly clear.

The many experiments with visual, rural and computer text based conferencing have shown that it is social and not technical and cost factors which have slowed penetration. The key change will come when terminals (under various guises: home computers, enhanced video games, "smart" telephones or VideoTex adaptors for TV sets) become commonplace in the home. The "cost reduction" applications already seem to be effective and economic in business applications of VideoTex will then be possible, but may result in a similar level of trip making, but to more satisfactory destinations. One might hypothesise that the duration spent at given activity destinations might lengthen, and the ratio of (activity : travel time) diminish as a result.

The "journey to work" and "in course of work" has been found by some workers to be the most energy - intensive (and this in real terms, under the most pressure for alternatives), and the increasing emphasis on service industries and on information oriented products leads to the conclusion that these types of journey are the most likely to be reduced (or at least affected). The time profiles of involvement in various activities then become valuable tools, and some are given in Wigan (1983b).

The freight system will also be affected by the enhanced ability to allow "search" for consumer products to be done with

less travel (as discount warehouses already illustrate), and to permit direct delivery from factory or warehouse to purchaser. This has already happened to some extent, and it is the extension of price competition to a far wider catchment that will have the impact. This has already been seen in US recruitment for "home- based" skilled workers, and in the UK in the almost exclusively home-based female professional workforce of the 600-strong F-International Systems Consulting Group.

At an international - or continent wide - level, the increasing importance of travel costs (and time) in what is now becoming a global market for most products, will force much of the underlying growth in demand for travel into other channels. This will be due not only to price relativities, but to the elapsed time and quality of the telecommunications products.

It is therefore of crucial importance that transport and telecommunications planners get together with social planners and ensure that the huge capital investments now being progressively committed within the communications sector are brought into the most effective employment at a social and national level. This is just as important for recreational and social interchange as it is for freight movement , aircraft service provision, and business communications.

The convergence in transport and telecommunications technologies has not to date been matched by any significant convergence in the medium and long range planning goals of the major disciplines involved. Too much time and effort has been spent on the chimera of "Transport substitution", and not enough on the common determinants of the markets for movement and communication services.

5. COMMUNICATIONS COSTS AT PRESENT: SOME AUSTRALIAN AND UK DATA

The basic trends in expenditures on transport have already shown signs of change. This section covers some of the practical perspectives which can be derived from data available today. Much of this information is necessarily some years old. The Australian material is based on the 1974-5 Family Expenditure Survey, and the next is not due until 1984. This makes comparisons with the annual publication of detailed UK FES data rather difficult. However, the patterns of household expenditure in Australia already contained a number of important indicators. Fig. 2 shows the weekly dollar expenditure of households at different income levels on a range of commodities, including both postage and telephone and transport elements.

The surprising observation that may be drawn from this Figure is that the very lowest income households spent more per week on communications than even the highest income households. The substantial elderly population in Australia which has arranged its affairs to minimise income and maximise capital holdings in their retirement so as to qualify for a state pension when in a position of modest (or greater) wealth has some effect.

Even allowing for this distorting influence, the importance of communications relative to some of the transport expenditures shows a considerable importance even in 1974-5. The comparatively low levels of petroleum prices in Australia at that time (and subsequently, though modified to a degree in the last few years through the 'import parity pricing' policy), also work to elevate the communications expenditures in the family budget.

Fig. 3 (drawn from Morris and Wigan, 1979), explores the overall vehicle costs and communications cost in greater detail. The components of the vehicle and communications costs adopted in this reference are slightly different from those used for Fig. 3, as the data for Fig. 3 were derived from the partially disaggregated matrix tapes produced by the Australian Bureau of Statistics. The communications costs still follow the same trends, with the greatest relative importance in the budget at a whole for the lowest income groups.

Fig. 4 (drawn from Wigan, 1981) breaks down the communication/transport relationships within the 1974-5 ABS FES data in greater detail. The ratio of transport costs to total communications expenditure follows the same pattern, with the lowest income households predominating.

Fig. 5 expresses the communications and energy aspects of the family budget as percentage shares for households of different ages. The results already discussed are amply supported by the rapid climb in the importance of communications expenditures as the age of the household head increases. The importance of all forms of energy consumption as a proportion of the family budget follow much the same trends.

Fig. 6 shows the same picture as Fig. 5, but in terms of actual dollar expenditures. The decline if car usage is now clearer, but the real increase in communications costs is still pronounced.

The picture in Australia in 1974-5 is therefore one of low income older households as the greatest users of communications. Much has happened since then. The adoption of the world parity pricing policy for oil, and a marked change in the overall economic and employment outlook have both raised pressures to encourage the incipient trends just discussed.

In order to obtain a time series view it is necessary to return to UK data. The National Accounts (HMSO, 1975) provide a useful basis for examining the overall trend patterns for the primary transport and communication consumer expenditure headings. Fig. 1 showed how the underlying trends of industrial output have progressively moved against growth in the transport industries, and in favour of growth in the communications industries. Industrial output is only a fairly small part of this overall change, and some results are now given to assess this.

Fig. 7 shows how consumer expenditure moved from 1971-81, indexed in terms of constant 1975 UK pounds. Expenditure on railway travel has remained quite stable over the whole period, while air travel has more than doubled in real terms. Some - if not most - of this growth is due to the development of the holiday travel market into a mass market product. This is significant, as the consumer impacts of information technology are focussing increasing pressure on leisure expenditure and leisure time. The impacts on time use are the subject of separate investigation, and are covered by the 1983 BBC Time Use and Activity Survey as a result of the emergent competition between viewing and video/computer/games time. Viewing time is for many people second only to work and sleep in terms of the numbers of hours spent (BBC, 1965).

Similar competitive trends in expenditures are apparent within both transport and communication sectors. Fig. 8 shows how stable postal expenditures have remained, in the face of rapid growth in expenditures on telephones, telegrams, - and radio and TV rental. The growth in expenditure on telephone use is consistent with tah in other countries, but the growth in telegram expenditure is not: Telecom Australia has recently effectively discontinued this service. The close match of telephone usage expenditure with radio and TV rentals is more than an accident due to the complementary nature of increases in real income with increases in leisure equipment.

The overall pattern of UK expenditures by household income are given in Fig. 9 for 1980. The longitudinal patterns are placed in a clearer perspective by the patterns of expenditure across different income levels. The amounts of expenditure on communication headings may very well have risen by a considerable amount in real terms since 1971 - but it is still not a very important part of the household transport/communications budget for high income households.

In 1980, the average UK household income was at roughly the point where the car and motorcycle purchase expenditure curves cross the communication expenditures line. This suggests that the functional role of postage and telephone expenditures is increasingly important for an increasing proportion of UK households, and the 1974-5 Australian observation that communications costs can exceed at least a number of transport expenditure components is more than confirmed, as for the lowest income levels communications expenditure exceeded the toal expenditures on motor vehicles.

The sheer size of the budget share spent on motor vehicles suggests that a little more detail on the time trends would be useful here. Fig. 10 contains this data for the major components of motor vehicle expenditure. The generally fairly stable trend of most of these components belies the large changes observed in the UK car market over the decade. The sums involved are large by national budgetry standards, and "comparative" stability in household expenditures at this scale still has substantial

impact. These Figures demonstrate that the general trends in industrial output are generally being reflected in household expenditure patterns.

The overall comparative stability of the transport expenditure headings, and the aggressive growth in the communication expenditures means that if present trends continue, the absolute size of the communications share of the household budget must soon begin to affect the transport expenditures. The relative scales of expenditure demonstrated in Fig. 9 indicate that products in the competitive overlap area between transport and communications should start to be able to make a competitive impression on both if the pricing places the relevant product or service within the finanical respources of the average household.

Practical confirmation of this observation has very recently been obtained from the MicroNet 800 Prestel service aimed at the estimated 1-2 million home computer owners in the UK. This service has just been launched, and apprears to be priced in the right zone: in few months it has increased the nunbers of home based Prestel access systems by over 30 times.

These comments should be taken in conjunction with those at the end of the last section, where the complementary nature of most of the transport/communication innovations was identified: such observations must be qualified once the budget shares of the two types of partially-substitutable product become of comparable size. The entertainment and educational are likely to react first, for different reasons. the one that they will have in common is that the activity involved is the objective of the exercise, and the location at which it may be carried out is quite unimportant if the entertainment/educational goal is met.

The massive cross substitution which took place in the 60s and 70s between the cinema and television as entertainment media not only showed one style of entertainment losing a competitive fight , but demonstrated a clear destination substitution effect. People stayed at home instead of travelling. Future competition between transport and communications is therefore probable on the basis of the interacation between time and money budget constraints.

Just as transport has a large place in household budgets it also has a large place in public expenditure. Public transport is very expensive to provide, and motor vehicles are costly to operate and own. Equally, the inelastic response to petrol pricing leads Treasuries to raise substantial sums of revenue from private transport ownership and use. This would suggest that communications of other varieties will become of progressively greater interest for their revenue raising power (as well as their capital hunger).

Fig. 11 shows the recent history of this aspect of transport and communications as revenue sources - and sinks.

The lines above the median division refer to areas where the Treasury is gaining revenue from the nominated sources, while below the line are the subsidies. Communications services have figured - briefly - on the subsidy side of the UK ledger in the mid-1970s: at present it is producing revenue, at an increasing rate. The overwhelming importance of both private transport expenditures and (the lesser) of public transport subsidies are all too clear.

6. CONCLUSIONS

Different aspects of transport, information technology, data and communications have been considered, and a few of the links drawn between new capabilities and linkages and the transport interactions. To provide a sense of perspective on the present stage of importance of present levels of communications and transport expenditures detailed Family Expenditure, National Accounts and other data from both Australia and the UK have been considered. The overall conclusions are that the present complementarity is at least in part due to the small relative size of the communications aspects - but that as communications output and expenditure are both growing swiftly while transport output and expenditure are both static, this may not remain true for very long.

7. REFERENCES

BRITISH BROADCASTING CORPORATION (1975). The peoples activities and the use of time. BBC, London, UK.

CENTRAL STATISTICAL OFFICE (1982). National Accounts. HMSO, London, UK.

DEPARTMENT OF EMPLOYMENT (1980). Family Expenditure Survey 1980. HMSO, London, UK.

DEPARTMENT OF THE ENVIRONMENT (UK). (1977). A study of some methods of traffic restraint. HMSO, London. UK (128pp.).

MORRIS, J.M. and WIGAN, M.R. (1979). A family expenditure pespective in transport planning: Australian evidence in context. Trans. Res. A(13) 249-285.

ROBERTSON, D.I. (1982). Research on strategies for traffic control and management. Proc 11th ARRB Conf. 11(1) 83-90.

THORESON, T. and WIGAN, M.R. (1980). Vehicle population dynamics: tracing, forcasting and assessing changing population characteristics. Proc. 10th ARRB Conf. 10(5) 206-234.

WIGAN, M.R. (1978). A comparison of the costs and environmental impacts for transport policy assessment. Environment and Planning A (8) 125-147.

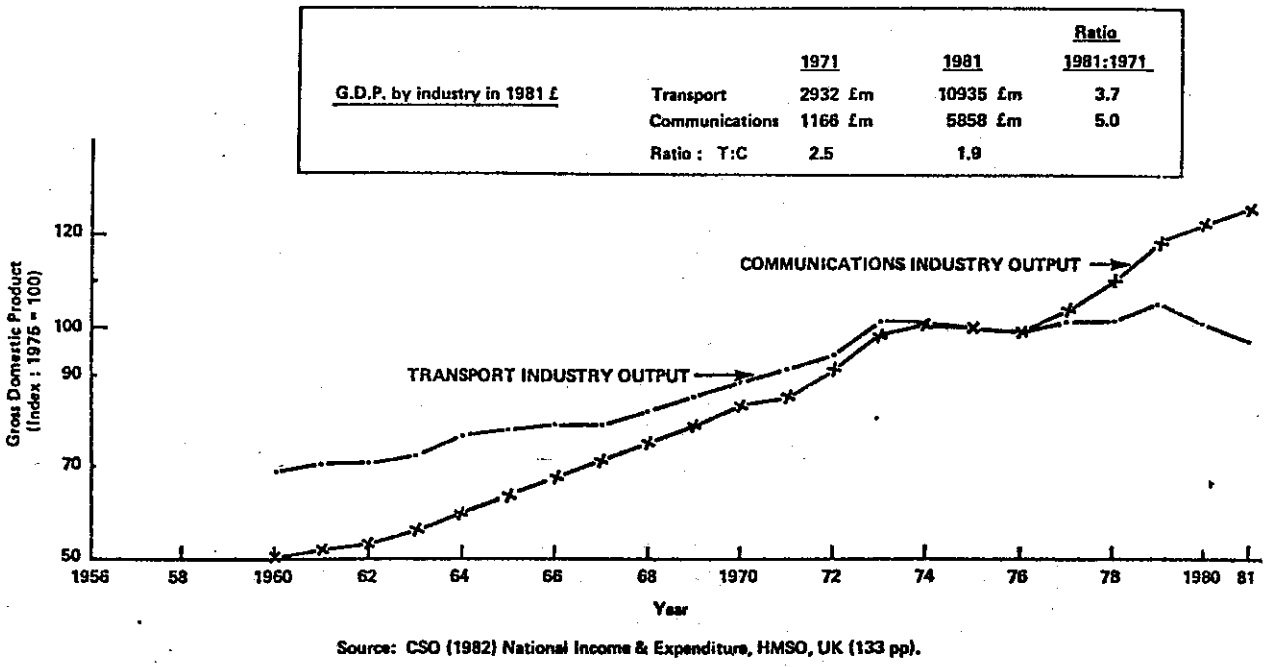
----------(1981). Lifestyle impact of changes in real transport costs. Internal Report AIR 380-1. Australian Road Research Board, Vermont, Victoria.

----------(1983a). Information technology and transport: what research needs to be started now? Working Paper 172, Institute for Transport Studies, Leeds University, UK.

----------(1983b). Information technology and regional information systems. IN :NIJKAMP, P. (ed.) Information systems and regional development. North-Holland, Amsterdam, Netherlands. (In Press).

----------(1983c). The travel and activity structure of Australian cities: perspectives from transport planning surveys. Proc 8th ATRF (1)...

----------(1983d). The effects on transport demand of increased and economic access to information. Internal Report AIR 1118-2. Australian Road Research Board, Vermont, Victoria. (8pp).



Source: CSO (1982) National Income & Expenditure, HMSO, UK (133 pp).

Figure 1: Trends in industrial output of transport and communications industries in the UK in constant money terms

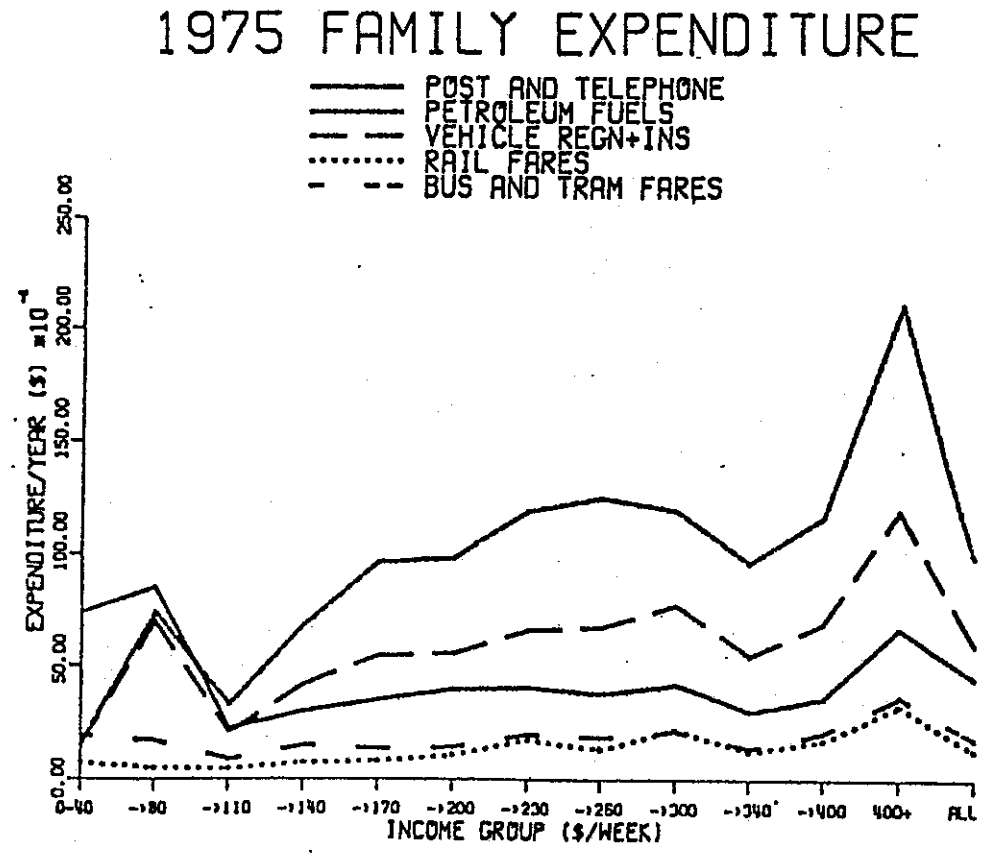


Figure 2: 1974-5 Dollar expenditures of Australian households on communications, transport and other components of household expenditure by income level of the household

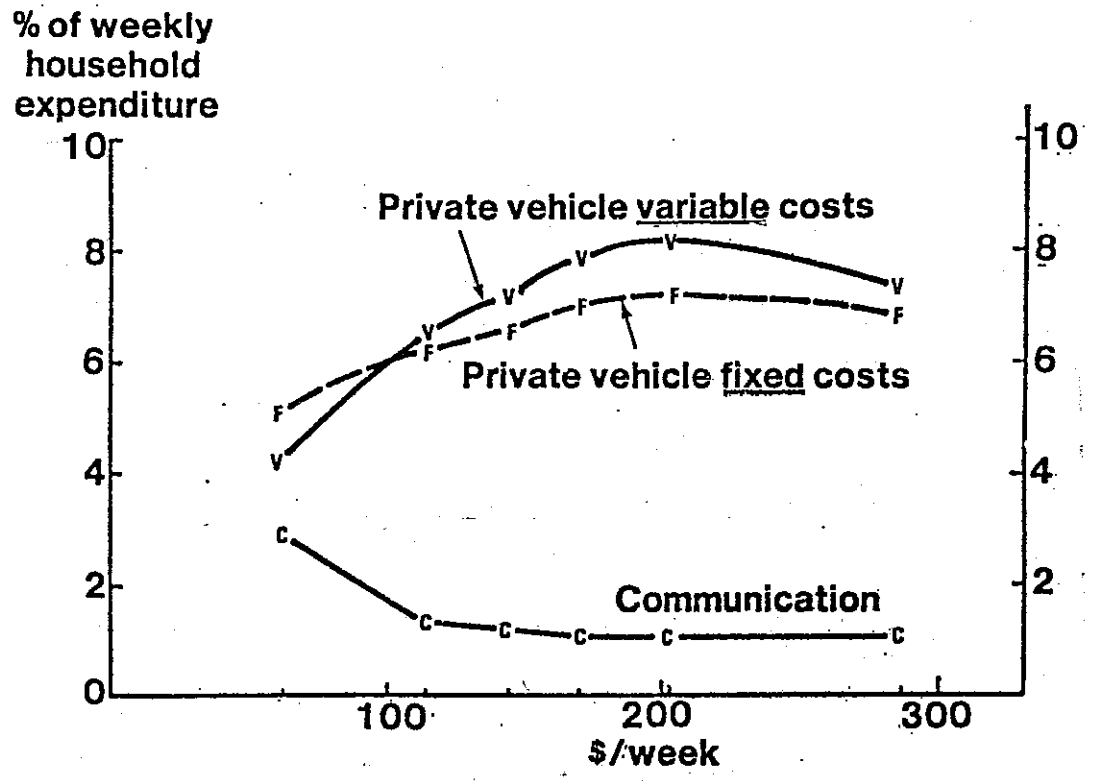


Figure 3: Private transport and communication expenditures by income (1974-5 Aus)

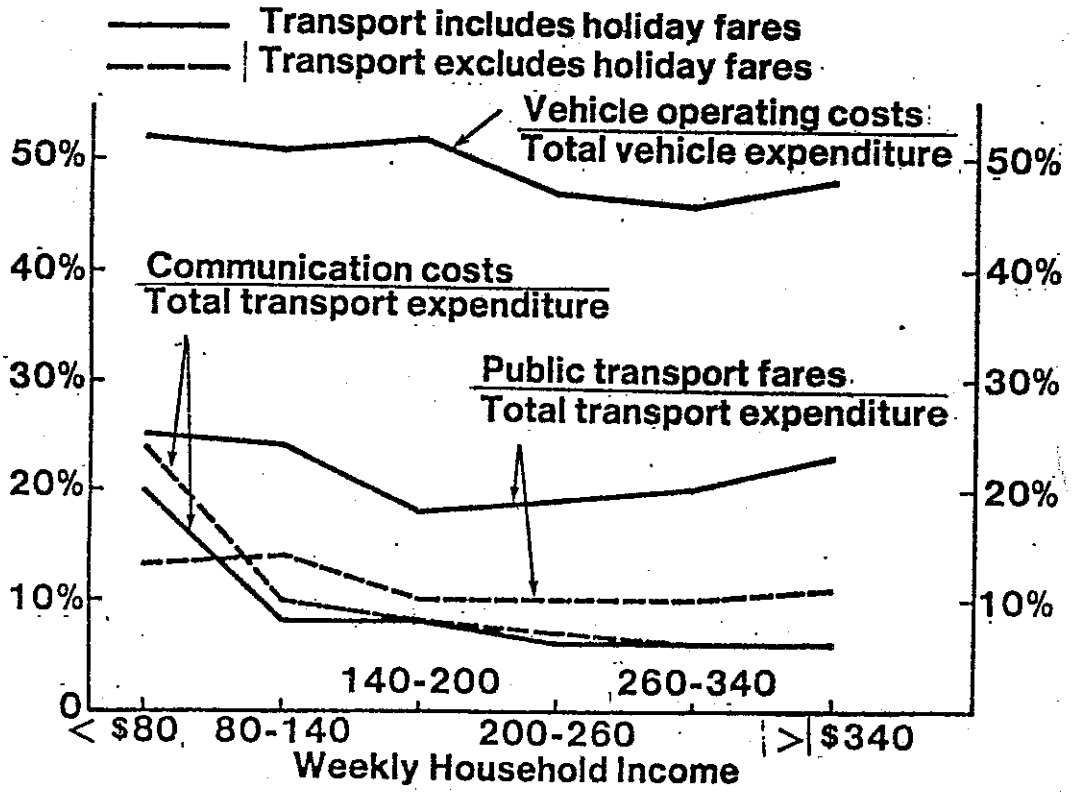


Figure 4: Transport components of Australian household expenditure 1974-5

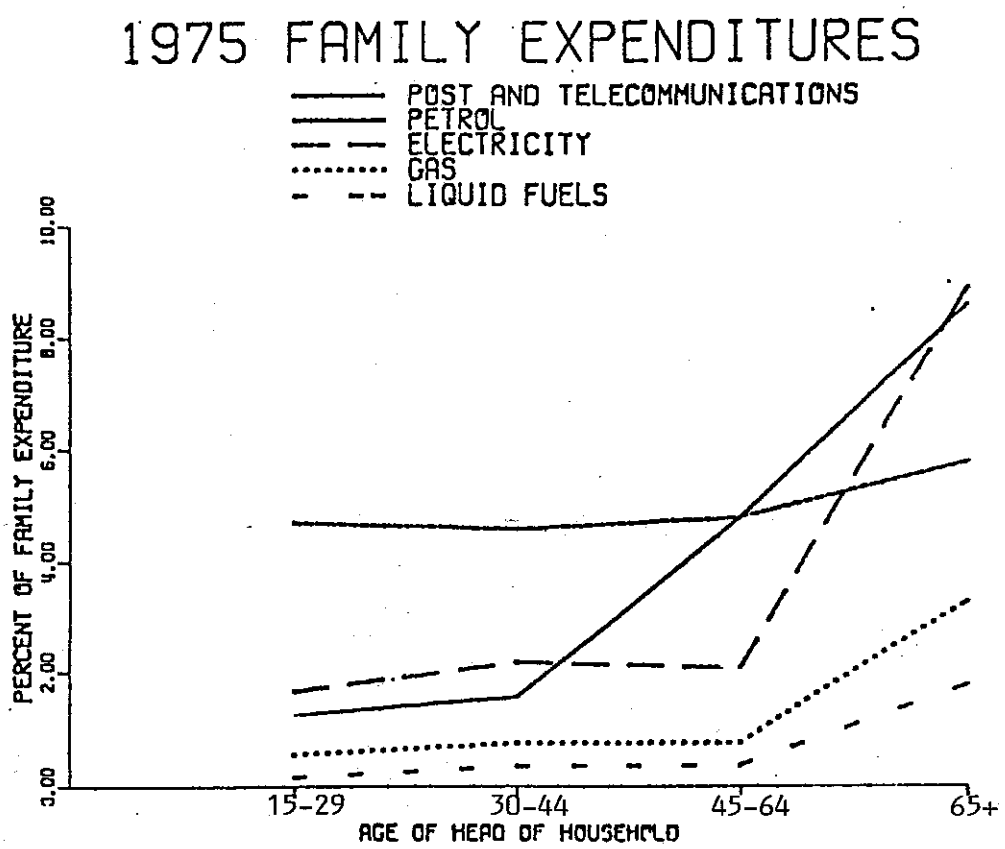


Figure 5: Percentage shares of 1974-5 Australian household expenditures for energy and communications headings, by age of household head

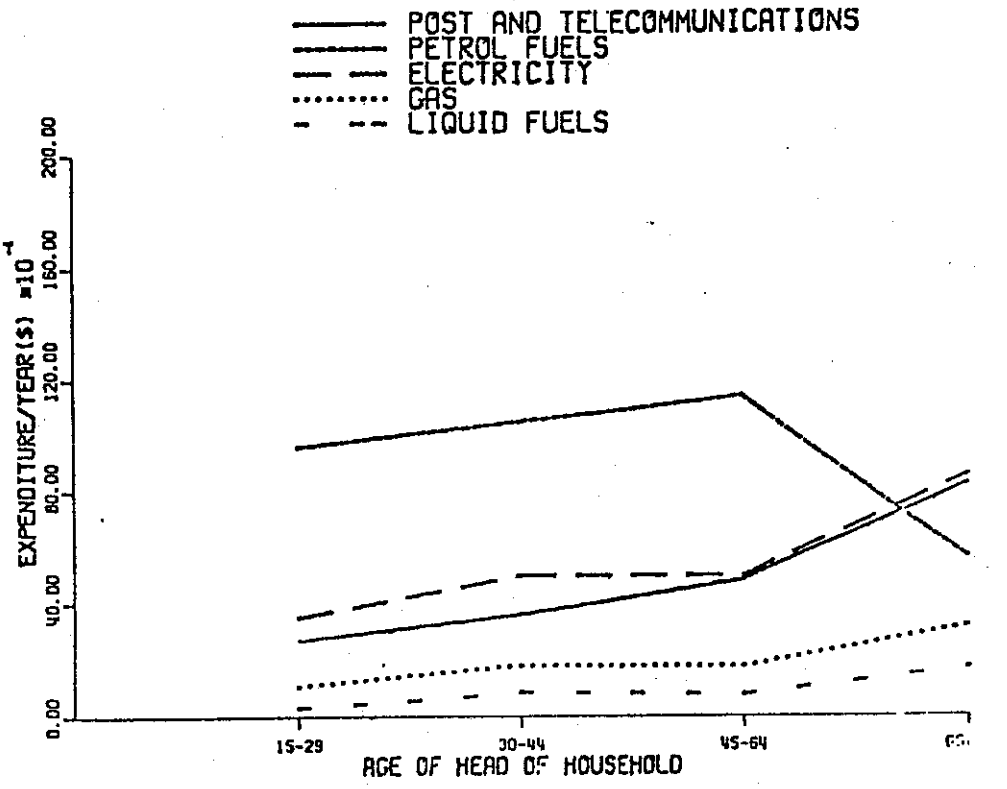
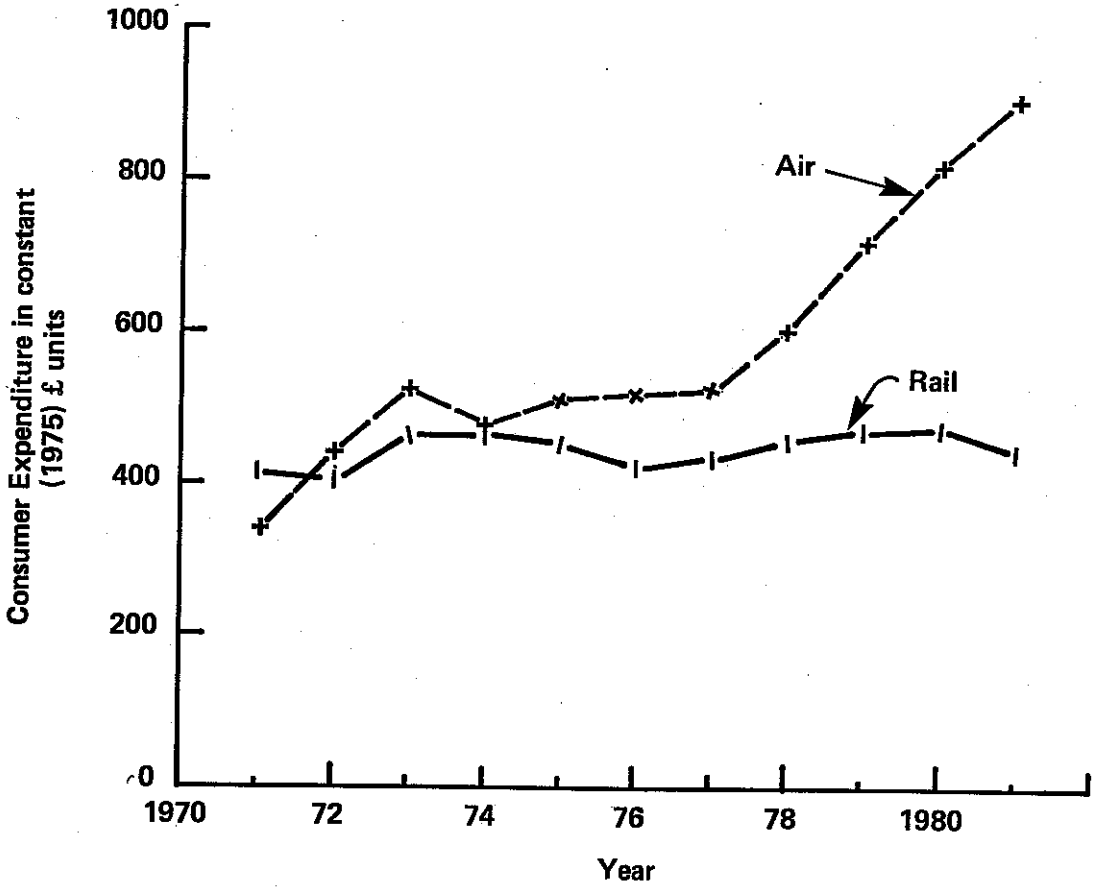
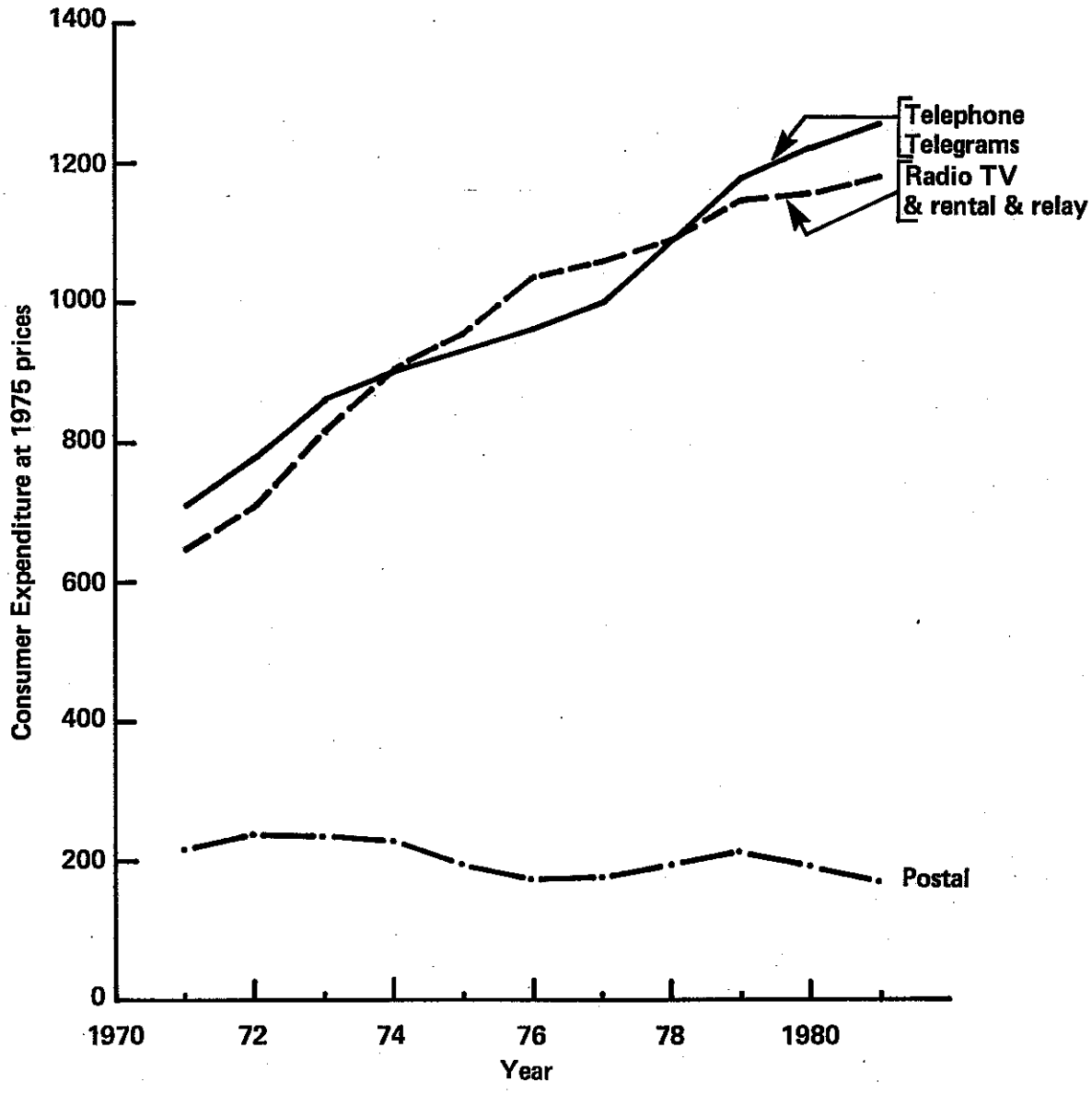


Figure 6: Actual dollar expenditures over 1974-5 for Australian households for energy and communications headings, by age of household head



Source: CSO (1982) National Accounts @ 1975 prices
HMSO, UK

Figure 7: Time trends of UK consumer expenditures on transport



Source: CSO (1982) National Accounts (1975 prices)

Figure 8: Postal and other communications trends in UK 1971-81

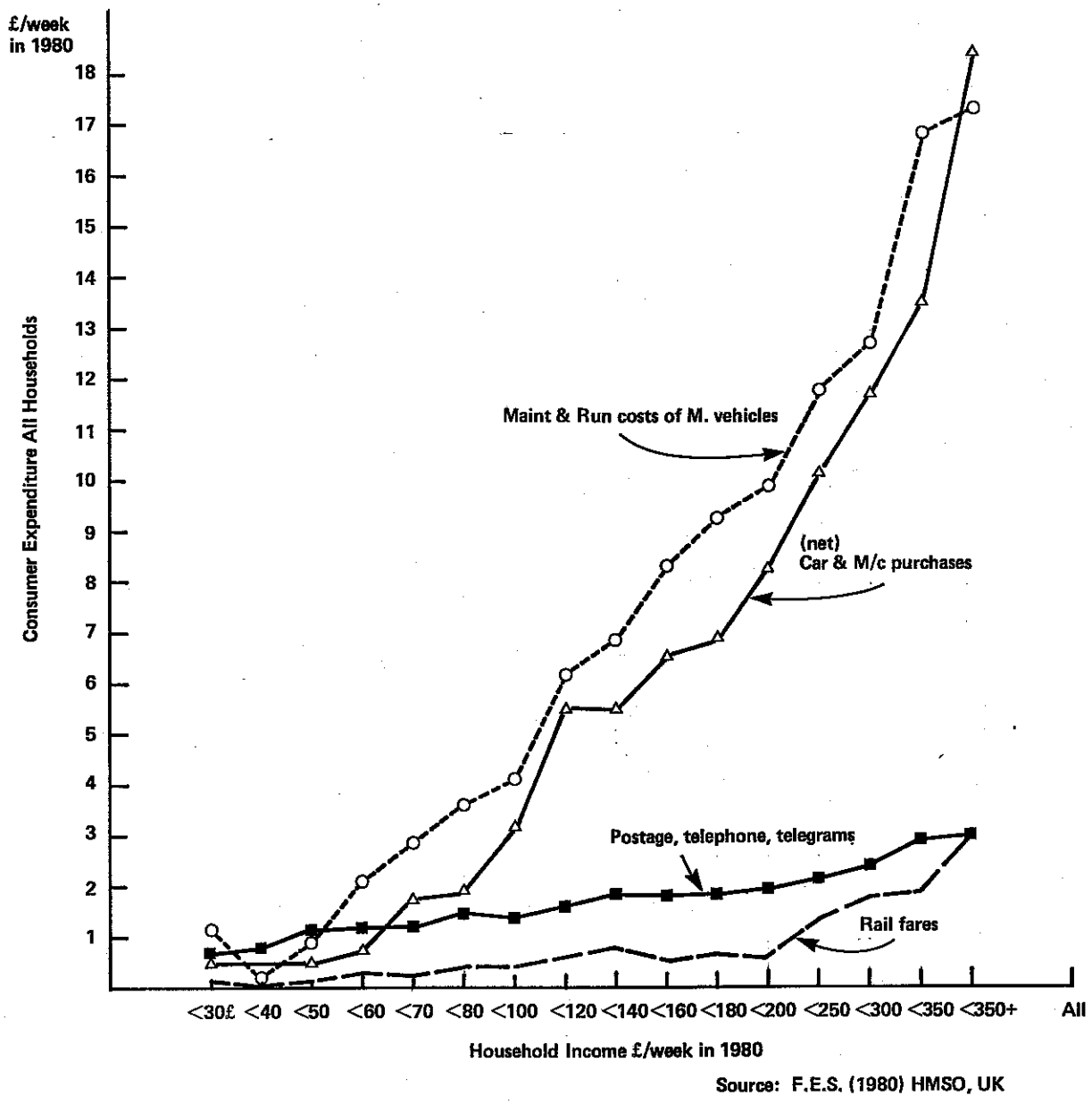


Figure 9: Household consumer expenditure on communications and transport - as a function of income (UK)

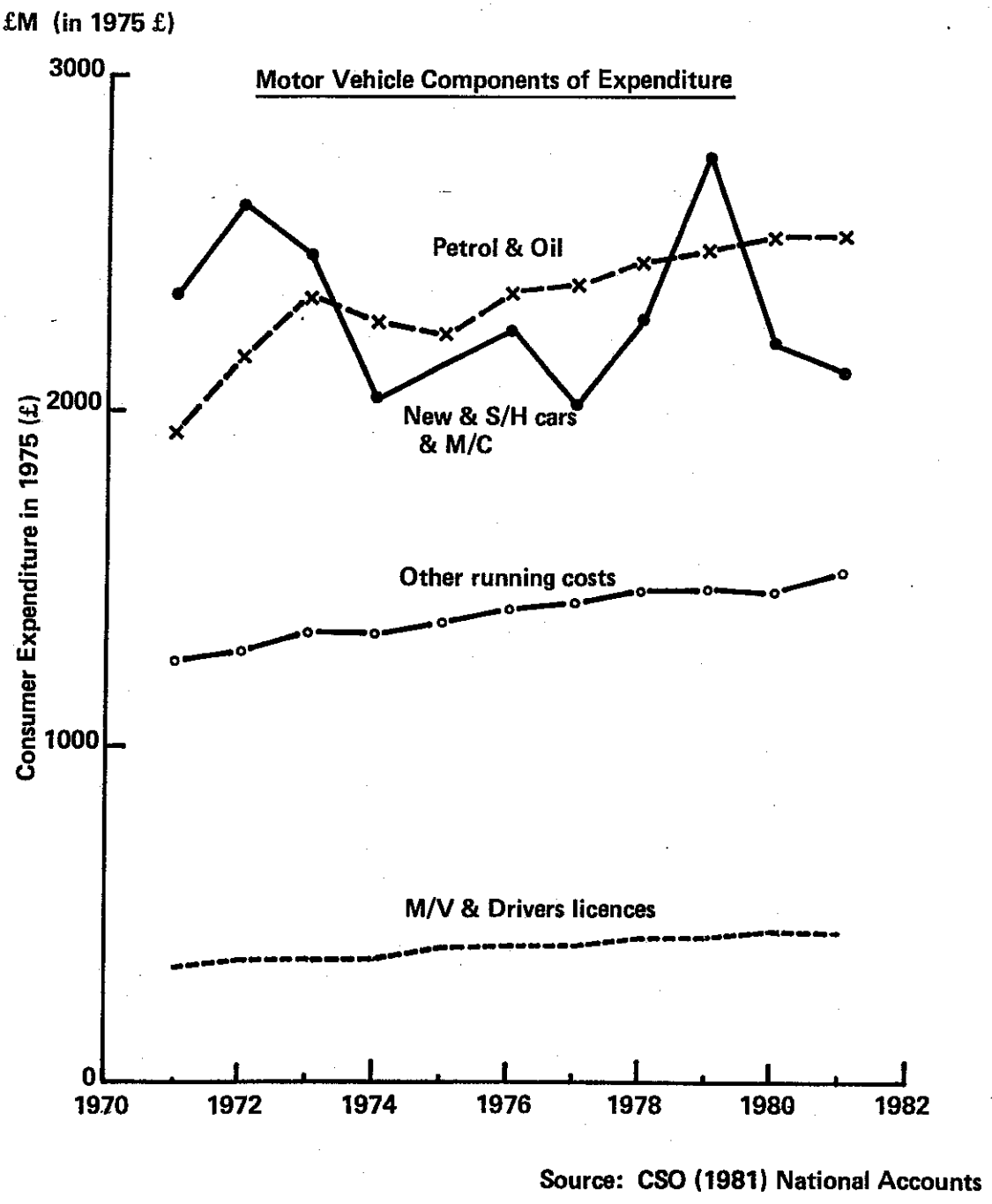
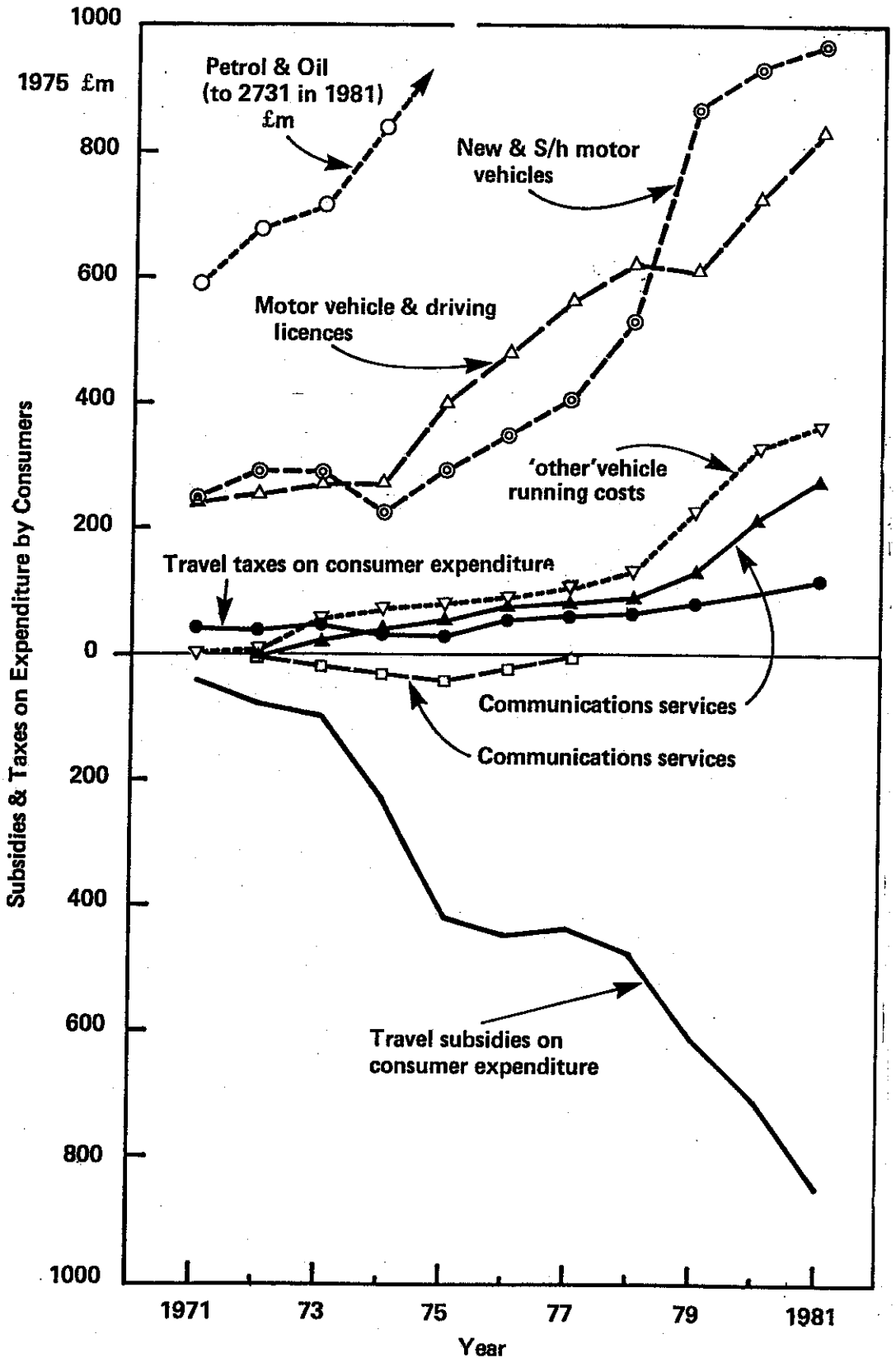


Figure 10: Time trends for motor vehicle components of expenditure (UK)



Source: CSO (1981) National Accounts

Figure 11: Patterns of subsidy and revenue raising over time in the UK for the transport and communications sectors

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INFORMATION TECHNOLOGY AND INTEGRATED REGIONAL DEVELOPMENT

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1. INTRODUCTION

Information systems for integrated regional development have become subject to the rapid convergence of technologies epitomised by the phrase 'information technology'. This Chapter places some of the recent and emergent tools of information technology in context with the patterns of information management and production developed by regional planners. These developments fall into several categories:

(a) The range of opportunities to process and draw from data assemblies has increased by several orders of magnitude.

(b) The need to integrate data collections of national statistical bodies with monitoring statistics has become a matter of urgent concern.

(c) Communication and data capture techniques have undergone (and will continue to undergo) fundamental changes that will affect both the execution of regional planning and development and the management of the process.

(d) The public has, simultaneously, increasing expectations of both more efficient developmental planning and greater restraints on the access to and security of information on individuals.

Treatment of the developments will follow the same general path as these descriptions. First to be treated will be the tools of the trade, in the currently conventional sense,followed by some of the implications of data networks and knowledge-based systems. Next, the needs for raw data input, its timeliness, and its nature will be considered, in conjunction with the balance between data reduction and presentation and the need to synthesise such complex and extensive material into a problem-specific form: albeit with or without a specific regional, econometric, or other forecasting framework.

Thirdly, the impacts of the recent expansion of networked communications on the nature of both regional development and regional development planning and management will be explored. Lastly, the potential and actual problems of public demands for security of data held in public-authority and other data banks, and the increasing need to hold down the costs of information collection will be discussed.

2. TOOLS OF THE TRADE OF INFORMATION TECHNOLOGY

The traditional tools for regional analysis have been heavily influenced by input-output analysis, sectoral studies, and other tools broadly following the accounting matrix format. The

problems of subregional (and subnational) input-output table production are well documented, and a wide variety of empirical and other devices for creating subregional tables have been tried. All rely, in the end, on data availability - and many have had to depend on the triennial or decennial intervals of national input-output table production. Certainly all have had to accept the considerable delays inherent in the collation, production, and public release of these macroeconomic statistics.

Regional models that include the dynamics of the housing, transport, employment, fertility, and economic activity components of the system have become increasingly frequent in the literature. Once again, these systems are demanding in both the quantity and the often 'novel' nature of the time series data required.

The microscale aspects of regional information systems have developed swiftly from the early land-parcel inventories to highly complicated geocoded, spatially oriented data bases. The more complex of these systems integrate the classifications of land use and physical planners with plot and dwelling details, with public utility access points, lighting positions, water and sewerage locations, rating values, and other location-specific variables. Such systems, Amsterdam being an example documented by van Est and Smit (1980), also expanded to cover road accidents, traffic flow, and other activity variables. These comprehensive systems now form a convergence between the macroeconomic and the spatially specific microeconomic lines of work.

Local government authorities (of the fairly small scale of the West Sussex County Council in the United Kingdom and the Sydney City Council in Australia) initiated such systems because of a revealed need in a specific section of their area of responsibility: road inventory and land-use parcel control, respectively; and then the integration followed.

Larger bodies, such as the Greater London Council, undertook the production of separate (and major) information data bases, such as the GLC's complete, detailed inventory of the regional road system in the late 1960s, but then let the investment collapse by not updating and maintaining them.

As an illustration of the accumulating problems of integrating and updating accumulating data bases, the detailed land-use recording systems for London over the last decade or more were inconsistent between different London boroughs, but were also updated sufficiently often to remain in use, and of real value - for example, in the 1974-76 GLC Regional Freight Policy development. At the same time the GLC regional accident location data base was being set up and used, and two regional transportation surveys were carried out, as well as at least one major housing and one recreational survey. Each of these information systems was a major consumer of updating resources and and was spatially oriented on a different regional basis, but was only marginally integrated at that time.

This pattern of multiple and overlapping spatially

oriented regional information systems is not uncommon. However, the integration of these systems has had to await the widespread understanding of large-scale data base techniques, and the development of organisational structures geared to such data access. This integration has taken place over nearly two decades, and the current round of integration now well under way demand that the statistical and analytical tools in use by professionals by available with a smooth interface to these data bases. As is usual, only when serious attempts are made to make full use of the putatively available data banks do the real requirements for such data sets and analytical systems integration emerge.

A typical example of the convergence of tools and interfaces, in yet another of the London information bases, is the SIR (Scientific Information Retrieval) data base system for scientific information retrieval. This is used to control the transportation planning data bank. It covers all of the normal data base processes and also interfaces to SPSS (Statistical Package for the Social Sciences) with the same syntax philosophy. This convergence is now being taken the obvious next step, with microcomputers being viewed as 'smart' terminals to such large-scale data base computer systems, and SPSS syntax for smaller-scale statistical analysis has already become a marketable microcomputer-based product.

The present round of enhancing the capability of integrated data bases and application systems is taking place with unprecedented speed. The packet switched data networks (typified by EURONET within the European Communities) are rapidly transforming the patterns of data acquisition and access across the world. The convergence of telecommunications and computing technologies has at last become a market reality and is beginning to reach the general professional consciousness in many disciplines as various Videotex systems come into public use.

The tools of this altered environment are:

(a) packet switched networks as common carriers;

(b) Videotex as a 'simple' mass data base access protocol and physical terminal device;

(c) cabling of large areas of domestic housing with video-band width linkages and response;

(d) remote data bases (with searching software) as a large-scale commercial market;

(e) local networks of large and small computers;

(f) small computer systems with vastly enhanced local processing power, and tens of megabytes of storage in local small systems at low cost;

(g) graphics and color graphics processors of very high resolution at mass-market prices;

(h) the first tools (fairly primitive but still practically usable and widely available) for building 'expert systems' as an aid to data structuring and retrieval.

These developments have occurred at a far greater pace than previous rounds of innovation. Integrating these new types of products, developing and setting up management structures and modes of operation that make effective use of them, and consequent changes in service levels, reaction times, and consultation and management strategies for regional planning and development are going to last into the late 1980s, at least.

By that time the tools will have developed substantially in power, but the fundamental changes in philosophy, in data access and use, and in data collection and availability are already clear and unlikely to be augmented by further large changes before 1990. The infrastructures now committed to be in place (cellular radio, video-bandwidth cabling with response capacity, satellite routings, and direct reception) require about this period of time to become fully operative, and are therefore being largely discounted in this discussion.

Social adaptation could well take place faster than professional adaptation. The weight of early and expensive centralised and centrally controlled statistical collection and planning systems has already built up expectations of power and control balances, which are now being destabilised by the swift devolution of the power to access, hold, present, and process information and by the escalating need for more information to be reduced to a decision-making framework and for quicker and more direct response based on the broadening scale of integrated responsibilities and information.

The early introduction of Videotex systems as a 'home service' by British Telecom was a clear marketing error. The businesses that could really use the synchronous timing of access and updating that Videotex provides, such as travel agents, with their need for large amounts of rapidly updated information on time-sensitive commodities and to book confirmations at the same time, have long been heavy users of telephones. The airlines (in particular) have an essential interest in a single, continuously updated data base of seat and type availability. It is not surprising that the travel industry has taken to Videotex with enthusiasm.

The French alternative to creating access to a large market has been to install massive numbers of terminal devices in specific areas as a means of both cutting the cost and increasing the market. This is bearing some fruit already since, with the regionalisation of French government many regions are reque'sting such pilot 'Telematique' installations for their own areas, thereby accelerating the penetration of data access to more people and places and increasing the ability to garner information economically.

The implications of this are crucial for regional and development planning: the public Videotex systems have quickly made direct connect, autodial modems a cheap consumer product,

and as the home computer market had become orders of magnitude larger in the UK than the present Videotex market the communications aspects of Videotex have been supported by very cheap modems in the UK Micronet 800 service recently launched by British Telecom. This move has, at a stroke, given the UK public direct access to the world communication networks, as the Gateway systems to Videotex are now rapidly becoming established as a new and easy way of extending simple user access to information providers' own computers and data banks.

The common problems of data communication rates, protocols, and modem frequencies are all handled by the packet switched network services of the various Post, Telegraph and Telephone Authorities (PTTs). The Bell 103 US standards for 300 baud modem frequencies are quite different from the European/Australian conventions of CCITT V21. Such essential conversion problems have proved to be time consuming and annoying even to sophisticated users, but the happy synergy of the Videotex 1200/75 baud communications standard and the advent of publicly-accessible packet switched networks as common data carriers for both national and international communications have protected users from many of these real barriers to increased acceptance and usage.

The communications phenomenon of the late 1970s was not the commotion about common carrier rights on PTT lines, but rather the prompt and effective emergence of community bulletin boards on microcomputer systems, accessed via modems at 300 baud over ordinary telephone lines and set up as soon as the technical capability existed in the 'hobby' community. History is now rapidly repeating itself, with networks of professionals looking to this technique to expand their own interchanges, the demand of the microbiologists of Australia being merely one example of many such recent initiatives. This market is now being pursued by more and more purveyors of electronic mail services on the packet switched networks, led by Telenet and Tymnet, presently amongst the largest international common carriers of such services. The stimulus for this came from the users whose own systems were operative and who wished to communicate with others, especially after tasting the joys of text capture and processing on their own machines, and to capture and exchange data and programs with each other without the problems of finding an acceptable floppy-disc format or of physically bringing two machines together for file transfers.

The mass-market equivalent of this type of service is usually thought to be Videotex, but an equally important delivery system is Telesoftware. This technique uses standard television transmissions with additional digital information packed on to the carrier. The Teletext, Ceefax, and Oracle services in the UK are typical such systems, but designed for the ordinary text-readng user (with pages on the weather, news, airline flights etc). Selectivity is built into the command for a page and as the information issued is a fixed block sent repeatedly (although the broadcasting authority may alter the contents between scans), obtaining a page is a slow process. However, this time is not subject to any communications charge, and it is hardly surprising that Teletext adaptors have been sold to many

time more homes than have the Prestel Videotex services of British Telecom.

Teletex is often confused with Teletext but refers to second generation Telex services using full computer based communication speeds and going away from the old five bit Baudot codes used for Telex services.

The use of available TV bandwidth for downloading computer software is increasingly being exploited. The British Broadcasting Corporation is now on the point of making Telesoftware available, without extra charge, to the many BBC Micro users, through Ceefax adaptor. The difference between the ordinary Ceefax service and the new Telesoftware service is that the full video bandwidth available out of normal transmission hours is to be utilised, instead of the small fraction available (during the scan blanking interval) during TV transmission times. The obvious expansion of this market as cable TV and wideband satellite links begin to spread is clear, and in the UK the BBC has already indicated a practical interest.

The integration of Videotex and Telesoftware is remarkably promising, whatever the means of delivery. The Austrian experimental Videotex service now being operated and developed with the participation of the International Institute for Applied Systems Analysis (IIASA) in Laxenburg and the University of Graz uses British Telecom's Prestel technology, but allied to an 'intelligent' Videotex terminal (the MUPID colour computer), so that the full Telidon dense-graphics mode may be adopted as far as the user is concerned. The response time of the small-scale services (including games) currently available for downloading (automatically, and transparent to the MUPID user) is excellent, yet the response interaction with host computers on the Videotex network is maintained. In this special case the Telesoftware is sent down the Videotex modem link, but the principle is clearly identical.

This broad-based push toward communications has led to electronic mail services over public telephone lines, and provided - and continues to provide - an efficient and much used means of exchange of programs, data, and text. Some magazine publishers use community bulletin boards as a standard means of accepting material for publication, and have automatic downloading and typesetting interfaces on their own systems to complete the published task. Such cottage industry applications are swiftly being supplanted by large-scale commercial services. There are major projects under way in Europe - such as GILT (Get Interconnection Between Local Text systems) - to build links between different computer conferencing and message systems by developing interchange standards (Palme 1982, Sztanjkrycer and Karmouch 1982, Hange, Bringsoud, Engebretsen, Johnsenand Sinealand 1982).

The ground swell of demand has now been merged with the Videotex and PSS systems and the steady emergences of new (if possibly temporary) standards (such as NALPS) to rationalise the gorwing diversity, and new products will condition the whole planning and participation process. The billion-dollar industry

that provides data base information has already felt the sharp impact of distributed local-processor power with local storage and telecommunications linkages.

In parallel with these rapid developments, computer-aided group communication has been developing as an efficient and cost-effective tool. Electronic mail is an easily understood concept, but as the analogies to the telephone system become more apparent than the analogies to the physical mail system, the need arises for directories; for diiferent levels of privacy and immediacy in communication; and for the ability to merge the text capture, text-processing, and publication processes into what appears to be a unitary environment from the other side of the terminal.

Developments in computer, audio, and video conferencing have taken place at different rates. Video conferencing and audio conferencing are specifically synchronous: all parties must be coordinated on-line and only the spatial problems are overcome by this need for timimg and coordination. Much work need to be spent (e.g. the South Pacific experience with PEACESAT (Semahu 1982)) on setting up timetables for these coincident timings to work. Nevertheless, such audio links have proved to be of considerable value in large regions such as South Pacific, and even in small parts of this region such as Hawaii which suffers from communication problems between the islands, although the archipelago is only a few hundred miles across.

The best tribute to this form of communication is that the suggestions that new satellites to replace ATS-1, which is used by the PEACESAT consortium, would require more advanced and expensive reception equipment have raised widespread conern from the Pacific nations, who have come to realise some of the potential of ATS-1 through PEACESAT. Currently the need for asynchronous communications is being attacked, and computer networking over radio links, with a simple form of electronic mail, is now being set up.

Video conferencing systems have received what might reasonably be regarded as an unreasonable amount of attention. Certainly the concept of the videophone put forward by Hugo Gernsback (1911) in some of the earliest 'modern' science fiction this century has been followed more because of technical capability than of market need. Extensive work has been done on the advantages or otherwise of synchronous communications to link more than one person.

The audio conference, where many speakers can share the audio parts of a conversation (usually by means of an audio bridge device supplied by the PTT), has become increasingly enthusiastically supported where the facilities have been made available. However, in most cases it is still necessary to make prior arrangements to set up the technical links, thereby vitiating some of the potential.

The extension of the synchronous aural conference to include visual information is an appealing idea, but requires a bandwidth of several megacycles as opposed to the few kilocycles

needed for audio exchange. To date this has meant that the prior coordination efforts have made video conferences most suitable for regular meetings, and limited the ranges of application because of the need to reach the studios where the facilities are offered.

The delivery of the signal by direct satellite links will sharply alter these limitations, and make the video conference station a portable (or at least transportable) device requiring less spatial and termporal restrictions. The Satellite Business Systems studies of video conferencing (Hansell et al 1982) consequently produced rather more positive results than had previously been obtained when these types of services were tested.

The asynchronous aspect of computer-aided communications is considerably underestimated. The term teleconferencing is currently used in a generic manner to cover video and audio conferencing - basically the synchronous modes - and the asynchronous systems of electronic mail and computer-aided conferencing are played down.

The spatial separations inherent in regional planning and coordination make the use of such systems between deiverse organisations of considerable value. Communications for the massive Australian Northwest Shelf for natural gas have been materially assisted by computer conferencing services as it has required at the smallest scale coordination over the several thousands of kilometers between the Shelf and Perth within the state of Western Australia, as well as the transcontinental and international distances also involved in the network. Organisations such as IIASA are not the first to carry out distributed management of scientific (as distinct from engineering) projects (Vallee and Gibbs 1976), although the IIASA Telecentre System has been actively used for some time for this purpose (Pearson and Lathrop 1981).

The tools of the trade of information technology for integrated regional development are therefore becoming available in forms that link data gathering, data processing, data publishing, and delivery of subsequent results for decision support and monitoring. In the next section the means by which these links can be made usable will be considered.

3. USING THE TOOLS OF TRADE

The primary problem in using large-scale data systems is grasping the nature and structure of the systems used to organise the information. The underlying structure of many of the data base systems now available has become extremely complex, and requires special skills in information retrieval to drive them usefully or efficiently. This has certainly slowed down the penetration of the use of such systems, and the costs (in both communications

and data base services) of learning on-line have inhibited many from looking in this direction. There are now new tools to service this specific need.

Substantial numbers of investors in the United States have automatic programs to 'wake up' their home computers, dial an access number of an information utility, call up the Dow-Jones stocks data base, request the results, load them down on to the floopy disc of their own computer, merge the results with data sets collected previously, analyse the stocks, and store the results before putting the computer back to sleep again. Bibliographic data base specialists, such as Dialog and Orbit, have noted the sharp decline in connect-time sales with the introduction of 1200 baud access lines, as users switched over to off-line preparation of their enquiries and immediate downloading of the results on to local discs for review and reuse. The reaction of at least one of these specialists, BRS (Bibliographic Retrieval Services), has been to accept this trend and offer a microcomputer with a 20 megabyte hard disc and their BRS/SEARCH software tailored for this task, and offer a service of regular bulk downloading of the necessary updates from their data bases. This trend can reliably be expected to accelerate with the spread of TV cable services. This combination of technologies is particularly relevant to regional planning.

Another recently demonstrated major trend has been in improving the quality of access to some of the extremely complex data bases. For example, use of the massive Disclosure data base, which comprises all available company reports for the US, requires substantial training of information retrieval specialists. This is becoming increasingly uneconomic. Disclosure, Inc., is one of a number of information providers who have turned to expert systems techniques, and have created a micro-computer program that makes the information retrieval specialist unnecessary and follows fairly quickly on the lead of the RITA Expert System development RAND Corporation to provide a means of building computer based intelligence into terminal interactions (Anderson and Gillogly, 1977). This type of development is the harbinger of many more such highly intelligent and intensive-access demands for information. Recent privacy laws will make it difficult for official national statistical bodies to resist these developments in easing user access to complex primary data sources for long, especially as a number of them now use the I.P. Sharp personal computer and many others to make their own time series of data available to their end users, in an environment with integrated analytical tools: APL and MAGIC, to pursue the (now far from unique) I.P. Sharp example.

This tend in increaing machine intelligence at the user enquiry interface has gained fresh support and momentum from the steady improvement in the usability of the 'knowledge-based systems' programming languages developing in the course of work on artificial intelligence. These have made accessible some of the methods of formalising queries based on logical deduction from assertions and conditional statements that can be made about the situations under study. The best known language of this type is PROLOG (Programming in Logic) (Clocksin and Mellish 1981), and it is increasingly being used to link relational data base and

logical deductive retrieval processes together into a single system.

This quintessentially academic language is being used effectively in applied environments already. British Telecom is using it to ease the interaction with its own Strategic Planning model, and numerous data base workers are now forging the links between relational data bases and such semi-intelligent front ends as British Telecom (BT) has undertaken to build (Probert 1981).

A special feature of this BT approach is that it was recognised from nearly the start of the program that the normative numerical models underlying the different segments of the BT long-range planning system are not the key areas for attention. The user interface has been given particular attention, and the use of expert systems techniques for aiding the analyst and his senior management to gain in understanding from the use of the model system has led to the need for a system that can extract the lessons from the extremely large number of variational runs of the forecasting system which have already been built up, and at the very least draw the user's attention to areas of significance and association with the queries he has just initiated.

The cumulative effect of these movements - at user interface and at data base structuring levels - is to shrink the gap between insertion of new data into data base and the response to queries of the system that take account of the new material. The pressures already being induced by cheaper and better graphic systems to provide wider-bandwidth displays and responses to planning requirements may lead to larger amounts of information being provided at a more limited level of analytical reduction and synthesis - but at a very much earlier date after data collection than is presently the case. This will switch attention from.

This is unlikely to reduce the need for strategic economic analysis and forecasting, and may even increase the recognition of the need for it, but the expectation that high-density graphic displays of physical, economic, social, and demographic factors will be readily available can be counted upon to increase the pressure on regularly updated information and the linkages between different administrative sources of input.

The implications of extensive cross-linkage of different computer systems through packet-switched data networks are important for regional planning and a strong catalyst for integration of the processes involved. The use of distributed computer processing power is already well established over such networks and is heavily used over dedicated lines between numerous academic centers in many countries. The parallel development of remote access to major data bases and searching systems over these networks has been a specific goal of the EEC Euronet. The development of distributed data bases, reliant on such networks for their integration, access, and processing, is the one that has greatest importance for regional planning.

The simplified access systems provided by Viewdata systems offer a highly effective way of expanding the services based on such systems, and - through the Gateway into other systems and to other types of services - the ability to gather data as well as request it. This 'response page' aspect of Prestel has been used by BT to offer a gateway service from Prestel directly through to the on-line booking computers of Pan Am and other major travel carriers. The exploitation of this capability for gathering data will no doubt follow.

In summary, the tools now available and coming into wider use provide:

(a) Distributed data access,

(b) Distributed data base retention,

(c) Graphics-aided responses,

(d) Interactive data-gathering capability,

(e) Electronic mail,

(f) Asynchronous communication, such as computer conferencing,

(g) Intelligent tools for information extraction and aid and interpretation of results.

4. IMPLICATIONS FOR DATA COLLECTION

The expanded use of distributed data management systems will facilitate a greater decentralisation of data acquisition without the loss of central coordination. It will also provide (potentially at least) the ability to redistribute the processing and input of information as a result.

In densely populated countries the expansion of video-bandwidth cable networks will provide novel, interactive and friendly means of collecting data from households, business enterprises, and organisations. The Videotex systems growing up, slowly, may yet offer further opportunities. The far greater present success of Videotex as a system for operations of closed user groups and data capture is both a sign that this is a real posibility in the technical sense - and that it may not prove practical for household-based information, for lack of penetration. Videotex is not the only interactive data collection system in prospect, however, and planners should expect others to emerge.

The technical opportunities for altering the approach of regional management and planning to data, from the slow reduction of mass cross-sectional data collections to the tracking of changes, and thus from a normative planning stance to a

monitoring and control position, are becoming extensive. This does not mean that the political is likely to emerge to make such a change practical rather than merely possible.

The ability of Viewdata systems to 'narrowcast' information to a special interest group is of particular importance when the enormous diversity of regional planning needs is considered. Rice and Paisley (1982) report a typical case, where a farmer information system was set up and assessed in operation in the US. The significance of information access and immediacy in a farmer's everyday life already was a marked finding: the key result was that the farmers used the system, quickly and effectively, and the technique of Videotex delivery was appropriate, but it was also vulnerable to narrowcasting radio services when they started at a local level. The point of greatest of greatest interest is that the monitoring process and data collection system were built into the information delivery system. This found will accelerate.

The key point for Regional data providers is that this high level of distributed access to their databases can also work in the reverse direction. It may already be more economic to permit remote users to specify forms of analysis on line, and the central database computers only then produce the results. The privacy of individuals from record linkage can be properly controlled, and major.

5. IMPLICATIONS FOR REGIONAL MANAGEMENT AND INTEGRATED PLANNING

Modern information technology offers many perspectives for an appropriate use of all pertinent and available data for regional planning (see also Section 3). Some examples will clarify this relevance of spatially oriented information systems for regional management and integrated planning.

The lowest level of geographic detail in regional planning is exemplified by the land-parcel and public services inventory. It is when such geographically specific data become fully captured on electronic media that regional planning gains greatest benefit.

The diversity of information flows of crucial interest to regional planners includes flows of goods and of financial services and transactions. The flows of financial transactions are quickly becoming technically within the scope of semi-automatic data capture - but this would of course be resisted by the emerging interbank and common-carrier data networks. The place of the law and of regulation in this domain should be pursued by national statistical authorities, as their roles change over the next decade.

6. SOCIAL ACCEPTANCE

The increasing intrusiveness of coordinated data banks and the steadily increasing ease of obtaining sufficient computer processing resources to trace individual links through large data collections are contributing to a real sense of loss of privacy by individuals, business organisations, and the community. These pressures have become concrete in the form of data privacy laws, licencing of data holdings, and, on the other side of the fence, freedom-of-information acts. The nature and tensions in the changing balance between these opposing forces of retention of privacy and increased ease of correlation and coordination of electronically captured and tranmitted data will be crucial for all aspects of planning.

The technical capabilities of data capture and record linkage that have already emerged are far beyond the general understanding of most of the population, and add a considerable burden of loss of confidentiality both to individuals and to organisations. In some countries these issues may be regarded differently, and the implementation issues will then dominate the discussion. In others the social balance will be sufficiently disturbed by them that such developments will not proceed far without the need for wide public endorsement. For example, the balance between the bank and individual interests in electronic transfer of funds has, for example, yet to be shown to offer much to the individual, but it undoubtedly has a great deal to offer to both banks and government.

A trend has become apparent in some countries, Japan being amongst the first to experience it, of an increasing resistance to government survey data collection. This social factor will become more acute if the new opportunities for data collection and use for integrated planning are not to be barred. In this connection it is important to note that Japan has long had very large-scale planning data banks. The key areas where public attitudes may debar technical advances are:

(a) in barring continuous monitoring of activities and consumption;

(b) in blocking access and record linkage at the data holding site, thereby stopping arms length on line analysis of unit record level data with practical protection of individual records.

Both these issues are subject to careful and well judged professional explanations of the implications of these developments.

7. CONCLUSIONS

The technical trends in computer and communications developments are altering the economics of large-scale processing, of immediate data reduction and acquisition, of presentation aids, and of management opportunities for coordination and decentralisation. While all of these trends may be seen simply as increasing the support for present means of servicing integrated regional planning, it is highly unlikely that the social, managerial, and operational changes that they will bring will leave the processes of regional planning untouched.

REFERENCES

ANDERSON, R.H. and GILLOGLY, J.J. (1977). RAND Intelligent terminal agent (RITA) : design philosophy. RAND Report R-1809-ARPA.

CLOCKSIN, W.F. and MELLISH, C.S. (1981). Programming in PROLOG (Berlin: Springer-Verlag).

GERNSBACK, H. (1911). Ralph 124C 41+. Modern Electrics (April 1911-March 1912). First book publication by Stratford, Boston USA in 1925).

HANSELL, K.J, GREEN, D. and ERBRING, L. (1982). Videoconferencing in American business: perceptions of benefit by users of intra-company systems. TeleSpan Newsletter special supplement, 31 May.

HAUGE, J.O., BRINGSRUD, K.A., ENGEBRETSEN, J.E., JOHNSON, O.M. and SMAALAND, K.(1982). Interconnection of text systems. Office Information Systems ed. N. Naffeh (Amsterdam: North Holland) pp. 277-285.

LATHROP, C.L. and PEARSON, M.L. (1981). TELECTR users manual. IIASA, Laxenburg, Austria. 48pp.

PALME, J. (1982). The GILT CBMS interconnection standards - Introduction. Report, Stockholm University Computer Center (QZ).

PROBERT, D.E. (1981). Towards expert systems for telecommunications policy analysis. Proceedings of BCS Conference on Expert Systems (London: British Computer Society).

RICE, R.E. and PAISLEY, W. (1982). The Green Thumb Videotex experiment: Evaluation and policy implications. Telecommunications Policy 6(3):223-235.

SEMAHU, S. (1982). PEACESAT AUSTRALIA Project. Report, Department of Electronics and Communications, La Trobe University, Victoria, Australia.

SZTANJKRYCER, F. and KARMOUCH, A. (1982). A proposal for interconnecting heterogeneous CBMSs in the GILT Project. Office Information Systems ed N. Naffeh (Amsterdam: North-Holland), pp. 317-338.

VALLEE, J. and GIBBS, B. (1976). Distributed management of scientific projects. Telecommunications Policy 1(1):1-64.

VAN EST, J.P. and SMIT, L. (1980). Geocoding: The Spatial Dimension of an Information System. Report Research Centre for Physical Planning PSC-TNO, Delft, 1980.

GLOSSARY

Audio Conferencing -	use of a telephone network bridge to permit multiple locations to participate in the same discussion : usually requires special equipment if there are many people at a single location in the conference.
CEEFAX -	the UK BBC TELETEXT SERVICE.
Computer Conferencing -	use of a computer to provide a public and moderated forum for discussion, communication, annotation and messaging.
ELECTRONIC MAIL -	the facility to remotely access electronic mail boxes from a terminal, and to manage messages between mail boxes.
TELESOFTWARE -	computer programs delivered via radio or television channels.
GATEWAY -	a term used to describe the facility to access other complete computer systems and services from a Prestel terminal.
GILT -	Get Interconnection Between Local Text Systems : a European project to cross connect different electronic mail and meassage services.
MODEM -	Modulator DEModulator : a device for converting digital computer signals into audio signals and back again. Modern communication standards are used to define the frequencies of these tones used.
NALPS -	North American Line and Picture Standard : an alternative to the earlier PRFSTEL standards.
ORACLE -	a commercial TV network TELETEXT service.
PRESTEL -	a UK designed first generation VIDEOTEX Service, widely used in other countries. Includes a mosaic character set to build up printing and text.
PSS -	Packet Switched Services : a network of data handling facilities which breaks down messages to small packets, transmits them through a network, and reasonables them at the other end.

Offers great efficiency in the use of communication links and networks.

TELE CONFERENCING - a generic term covering audio, video and computer conferencing.

TELEIDON - a Canadian designed second generation VIDEOTEX service.

TELEMATIQUE - a French word coined to cover integrated computer, communications, and information services.

TELENET - an international provider of common carrier data communications services.

TELESOFTWARE - computer programs delivered via radio or television channel.

TELETEX - not to be confused with TELETEXT : a second generation TELEX standard to permit high speed computer - computer communications.

TELETEXT - a non interactive form of VIDEOTEX, where frame selection for viewing is made from the same restricted keyboard as VIDEOTEX.

TYMNET - an international provider of common data communications services.

Video Conferencing - use of a studio with two way video cameras and screens in addition to audio facilities.

VIDEOTEX - a generic phrase applied to interactive mixed graphics and text services offerred with a simplified keyborad restricted to the characters and number on a telephone dial to access specific frames of information.