Information Technology
Impact on the way of life

A selection of papers from the EEC Conference on the Information Society held in Dublin, Ireland, 18-20 November 1981

Liam Bannon, Ursula Barry and Olav Holst
Editors

Organized by
National Board for Science and Technology, Ireland
and
Commission of the European Communities,
FAST Programme

Published by
Tycooly International Publishing Ltd.
Dublin

Contents

Part II: Information Technology in the Workplace

Part III: Urban Structure, Regional Development and Transportation

Part IV: New Technology and the Changing Role of Women

Part V: The Changing Media — New Forms and Uses

CHAPTER 10

Organizational Communication: The relationship between Technological Development and Socio-economic Needs

Arnold Picot, Heide Klingenberg and Hans-Peter Kränzle

University of Hannover, Federal Republic of Germany

SOME ASPECTS OF NEW OFFICE COMMUNICATION TECHNOLOGY AND THE WAY OF LIFE

AN EXPLORATION is undertaken here of the possible impacts that the new technologies of office communication might have on the structure of organizational communication.* Rapid progress in microelectronics has produced a variety of new technical communication channels for office use. Some of them (such as viewphone, video conferencing, integrated text and fax services) are only expected to enter the commercial arena of office communication in the future. At present, however, new channels are being implemented, or are about to be introduced, such as telecopy services (fax, facsimile), telephone conferencing, computer conferencing, electronic messaging and videotext. Their diffusion, however, is not very far advanced as yet. Some of the new technologies of this latter group are examined here, mainly new electronic channels for written (text) communication. These new media will enrich the spectrum of existing channels in organizational communication (face-to-face, telephone, classic mail, telex and sometimes telecopy contacts).

Availability of more facilities allowing electronic mediation of information will change the patterns of organizational communication. These changes and

*This research is part of an ongoing larger empirical project on office communication, sponsored by the German Department of Research and Technology (Bundesminister für Forschung und Technologie). Co-operation with and support from the participating organizations (Allianz-Versicherung, Olympia/AEG/T & N, and Siemens) are gratefully acknowledged.

their possible consequences deserve scientific attention. Most people spend a remarkable proportion of their lifetime working and communicating in organizations or communicating with organized institutions. It is widely accepted that our construction of social reality, as well as the modes of relating to each other, depend to a large extent on communication experiences made in everyday-life (Berger and Luckmann, 1966). Therefore, possible structural changes in organizational communication patterns, caused by new office communication technologies, could affect the way of social life. Furthermore, the quality of social life also depends on the effectiveness and efficiency of organizations. As far as those are affected by new office technology, indirect impacts may occur on the way of life.

MAJOR PROPOSITIONS ON THE IMPACTS OF NEW OFFICE COMMUNICATION TECHNOLOGY

THE POSSIBLE CONSEQUENCES of the availability of new text-oriented, electronic media can be divided into three contrasting groups. They represent different schools of thought about the functions of technologies and organizations in society.

Proposition I: Revolutionary and advantageous changes in Office Communication

According to this proposition, new electronic text media would not only replace the old text communication channels of mail and telex (thus enabling written organizational communication to become faster and more efficient), but furthermore, this technological development would substitute the new media for a large proportion of oral communication in organizations (especially telephone and face-to-face contacts, regarded as particularly time-consuming and costly). Assuming a task-oriented, rational perspective on organizational communication, a diminution of face-to-face and oral communication in favour of telecommunication and written information is felt desirable since most verbal communication tends to be somewhat lengthy. According to Marill (1980, p. 185):

> *The phone also shares a problem with all speech communication: the information density of speech is very low. Generally, the electronic transmission of speech requires about 60,000 bits per second. These 60,000 bits of speech carry about the same information as 15 characters of written text . . . . But you can transmit 15 characters directly as text by transmitting only 120 bits of information, rather than 60,000 bits of speech. If you insist on transmitting speech, you are transmitting 500 times too many bits. And*

these bits have to be paid for. In a very fundamental sense, speech is not an economic medium of communication. (See also Merrihue 1960, p. 179; Turoff, 1973).

New electronic text media seem to share all the desirable properties necessary to overcome the shortcomings of oral communication. They are fast, they document the information content and they provide these qualities at low costs and over almost any distance between sender and receiver (Uhlig *et al,* 1979; Panko, 1980).

New structural configurations for innovative, organizational decision-making could emerge (Witte, 1976; Szyperski, 1979, p. 161 f). By means of new communication technologies, decentralized autonomous groups could pursue their work effectively without risking organizational disintegration (Witte, 1977 and 1980, p. 1055 f). Thus, organizational functioning could become much more independent from location restrictions (Goddard, 1971), even including 'working at home' (Goldmark, 1972). Eventually, the technological development could lead to a more effective reconciliation of individual needs and organizational demands. Such prospects are, of course, attractive. They nourish expectations of a rapid development of market demand for new communication technologies.

Proposition II: Modest changes in Organizational Communication

However, one quickly thinks of an analogue to these predictions. The Management Information System (MIS) — euphoria of the 1960s and early '70s — made many similar promises which for the most part remained unfulfilled. That movement was also driven by a rational approach trying to match demand and supply of information in organizations with the help of upcoming new information technology (Argyris, 1971; Kirsch and Klein, 1977; Feldmann and March, 1980). Therefore, one hesitates to fully accept the view of a technological revolution of office communication.

Scepticism derives from two interrelated sources. Social, psychological and related research underline the functional importance of non-verbal aspects in face-to-face communication. Developing of a 'social meaning' and establishing social relations would require such contacts (Watzlawick *et al,* 1967; Argyle, 1969). In organizational communication, requirements of that kind are manifold, such as developing trusting relationships among members, co-ordinating the information for performance of complex and dynamic tasks, creative solving of complex problems, motivating members or evaluating performance.

On the other hand, recent economic theories of organization show that firms are mainly concerned with situations heavily involving these functions and, thereby, with sensitive communication problems. The emergence of business organizations can be explained by market failure considerations. Those economic exchanges (transactions) are carried out within the firm and would be too complex and too expensive for market co-ordination (Arrow, 1974; Williamson, 1975; Picot 1981). Market exchange principally demands the possibility of codifying goods, services and conditions involved. When this is not feasible (or only at extremely high costs), and if the intended exchange should still take place, the parties involved integrate and build some sort of (hierarchical) organization. Thus, the internal organization of business firms handles the more complicated transactions of an economy. Typically, these internal transactions call for an information exchange which only to a lesser degree can be translated into, for example, written codes. Consequently, symbolic interaction and social presence (oral and face-to-face communication) are inevitable and most important requisites for a successful goal achievement in organizational communication. In the field of external communication, the new technologies could also replace the old text media which — according to this theory — cover a larger proportion of the whole external communication. Thus, transactions with the environment could be facilitated.

Given this second proposition, one would expect that new communication technologies will substantially replace existing text communication channels (mail and telex) and will only marginally affect channels of oral communication (telephone and face-to-face). However, to that extent organizational communication could become faster and better organized. Taking the organization as a whole, these changes would be incremental rather than revolutionary. In addition, development of future markets would be relatively slow.

Proposition III: Social and Economic Hazards

Yet, one may also argue that there are dangers involved with the upcoming new communication technologies. The business world could widely adopt the expectations of the first proposition, hoping for a more rational control of organizational behaviour. It could design organizational communication systems, making extensive use of the new technologies and permitting transmission of task-oriented information almost exclusively through new technical channels. The consequences could be harmful in several respects: co-ordination of complex tasks and solving of difficult problems would decline. Even if a Tayloristic redesign of jobs had been undertaken in advance, adaptability to external change would decrease. In any case, social structure of organization and need-fulfilment of members would suffer, since there would be less chance of developing trusting social relations. That is why isolation of individuals could increase. Similar arguments are advanced by Weizenbaum (1980 a and b) on the social impacts of information technology.

RESEARCH QUESTIONS

IN ORDER TO FURTHER EXPLORE the empirical justification of the expectations so far delineated, one should try to answer the following questions.

(1) What general attitudes do managers show towards new office technologies in general? Answers to this question could point to problems or opportunities that the new office communication technology will face when entering organizations.

(2) What determinants influence the choice of communication channels? In accordance with Pye and Young (1980, p. 7), we feel that the "next step forward in the hierarchy of predictive methodologies is to take individual selection acts and seek the empirical determinants of choices." Improving our empirical knowledge about channel decisions will result in a better understanding about the extent to which new channels will replace old ones. Reflecting our previous discussion of socio-emotional and rational functions of organizational communication, it seems useful to subdivide this problem into two components (Communication Studies Group, 1975, p. 18):

(a) cognitive (rational) determinants of channel selection;

(b) affective (emotional) determinants of the selection act.

Answers to these questions will help us to clarify under what task-oriented as well as affective-conditions channels (in particular, new text-oriented electronic media) are likely to be accepted as a communication tool in organizations. Only then can we tackle the next question:

(3) What potential for substitution between channels can be observed in organizational communication and what changes in communication patterns do people demand?

Having shed some empirical light on these questions, we will be able to draw some general conclusions with respect to the three previously mentioned propositions about the impacts of new organizational communication technologies.

DESCRIPTION OF THE FIELD STUDIES

THESE RESEARCH QUESTIONS are included in a larger research programme, sponsored by the German Department of Research and Technology. This project aims at an assessment of the impacts of new office communication technology on organizational structure and job characteristics, evaluating the new teletex technology in several field experiments (Picot and Reichwald, 1979).

Teletex Technology

Teletex, as a new electronic communication service of Western European and many overseas countries, will be officially available during the next 3 years, starting from 1982. The teletex system belongs to the family of electronic mail or electronic messaging systems. It integrates features of an electronic word processing device with an advanced and comfortable electronic telex machine. Its main characteristics are:

(a) by means of electronic storage and automatic dialing, the functions of word processing (typewriting) and text communication operate independently;
(b) accessability and compatibility to the national and worldwide well-established telex system, increasing the new service's attractiveness as a communication tool for the business world and public administration;
(c) high transmission speed (2,400 bits/sec), more than 30 times faster than the old telex system and transmission of a keyboard's standard repository of symbols;
(d) simple standard layout (CCITT standards), with a mandatory printer and a modest storage capacity, so that the device could be affordable on a large scale (quick market penetration and surmounting critical mass limits); screen and other additions optional.

Teletex does not yet provide integration with other computer services nor allow device-independent operation. However, other electronic mail/message/conference systems do not as yet offer (inter)national compatibility of equipment and networks.

Sample

The field study consists of 4 sub-organizations in two large private companies (insurance and electrical manufacturing), with some thirty locations spreading all over West Germany and West Berlin. Eighty teletex stations (preliminary versions of the teletex technology only allowing internal organizational use between one organization's stations) were installed, supplemented by telecopy (facsimile) facilities.

Six hundred and forty users, having access to these stations, take part in the investigations, about 40 per cent thereof being technical and scientific personnel and 60 per cent holding positions in business, finance and other administrative functions. A breakdown by hierarchical level shows that approximately 50 per cent are lower level managers, 40 per cent middle level managers, and 10 per cent high level managers. One hundred and fifty operators, mainly secretaries, are included in the study.

Method

In order to answer our questions and control other factors as precisely as possible, a rather complex package of research instruments had to be developed, containing some 20 different tools. These range from expert interviews and various questionnaires for managers and secretaries, on simple structured, self-report measures (checklist crossing in order to assess certain frequencies of information and communication) to objective measures (counting of mail, telex, teletex contacts, etc). More detailed information about the research instruments is available on request from the authors.

RESEARCH RESULTS

THE FOLLOWING RESULTS represent the initial analyses of the data collected in the field. As collection of data was completed only very recently, the preliminary character of the reported findings should be stressed.

Attitudes towards New Office Technology in general

Based on attitudinal questionnaire data (n = 629 users and 147 operators), we found an interesting contrast between a favourable general attitude towards technological innovations in offices (Proposition I) and a sceptical view of the specific personal consequences to be faced when technological change in offices occurs (Proposition III).

On the one hand, a large majority of managers and secretaries (about 80 per cent) articulated a positive opinion on new office technology in general, especially on its contribution to more effective task performance. The majority (52 per cent) do not fear substitution of their labour or major deskilling of jobs. At the same time, higher educational requirements were expected to be needed in order to cope with technological changes (70 to 80 per cent).

On the other hand, there exists a widespread fear of unfavourable consequences for the personal work situation. Most respondents (about 60 per cent) were afraid of an increasingly impersonal work atmosphere, an increase in written communication and growing bureaucratic structures, all caused by new office technology.

These findings seem valid since they were obtained in an organizational environment already well-equipped with decentralized office technology, allowing individuals to base their judgements on analogous experiences.

Following the first preliminary results from a factor analysis (PCA with VARIMAX-rotation),* no clear attribution was to be found as to whether the

*All factor analyses were computed by the SPSS subroutine 'FACTOR'. Further details about these analyses are available on request from the authors.

expectation of increasing written communication would be related to the expectation of increasing impersonal co-operation or rather to the expectation of better task performance.

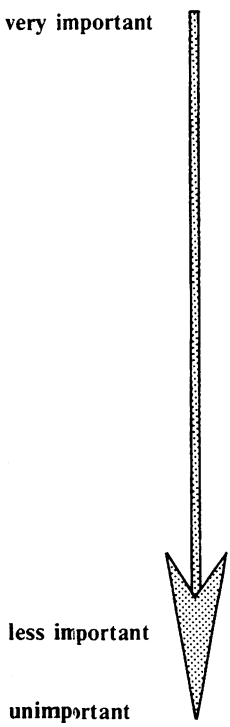
Choice of Communication Channels

Cognitive Determinants of Channel Selection

As a first step, we put together a list with possible work-related problems faced by organizational communication. These requirements had been collected from textbooks and discussions with practitioners. The list was extensively pretested, leaving 21 items which seem to have general significance as criteria shaping the process of organizational communication. Then, we asked managers to evaluate each requirement's general work-related importance on a 3-point scale. The results are summarized in Table 1.

Table 1

General evaluation of communication requirements by users (3-point scale; n = 477)



1.0	
1.1	unambiguous understanding of content
1.2	speediness
1.3	certainty of exact wording/certainty of information reaching the wanted receiver
1.4	availability of channel/capability of quick response/ capability of quick feed-back/transmission of difficult content/short composition time
1.5	easy processing by receiver/short transmission time/ resolving disagreement/capability of documentation
1.6	identification of sender/transmission costs
1.7	comfort/circular letters/transmission of small information volume
1.8	transmission of large information volume/protection from faking
1.9	confidentiality
2.0	
3.0	

Unambiguity, speediness, exact wording and 'reaching somebody' seem to be the most important criteria to be met in order to solve communication problems in organizations. On the other hand, confidentiality and protection from faking do not play the role one would expect given recent public debates in Europe.

In the next step, we asked users to rate the six channels available to them (telephone, face-to-face, mail, telex, telefax and teletex) on a six-point scale (**1** being the highest rating), considering each channel's capability to fulfil the criteria mentioned above. Initial, and as yet preliminary, factor analyses of the data for each channel show that there might be four major factors involved when evaluating task-oriented functions of communication channels:

Factor A: *Promptness,* comprising items: speediness, comfort, capability of quick response and transmission of small information volume.

Factor B: *Complexity,* comprising items: resolving disagreements, transmission of unambiguous content, transmission of difficult content and certainty of reaching the wanted receiver.

Factor C: *Confidence,* comprising items: confidentiality, protection from faking and identification of sender.

Factor D: *Accuracy,* comprising items: exact wording, capability of documentation, easy processing by receiver and transmission of large information volume.

These factors explain between 90 and 100 per cent of the answer variance, depending on the type of channel. Their order of contribution to variance explanation changes from channel to channel; factor C, however, never exceeds a third rank.

It is our contention that managerial promptness, semantic complexity, interpersonal confidence and administrative accuracy represent four basic problems to be overcome by organizational communication. According to these factors, we listed the communication requirements and their mean ratings with regard to each channel. This should allow us to find out possible channel preferences with respect to the four basic dimensions.

Table 2 condenses the results and also shows the order of channel preference found when communication problems associated with one of the factors occur. When looking at the rankings, the distances represented by the differences of the means should be kept in mind. These rankings reflect managers' perceived effectiveness of channels with respect to each of the four basic communication issues. Tasks whose complexity or whose social characteristics (such as leadership) demand clarification and development of interpersonal relationships (Factors B and C) seem to require face-to-face contacts. In situations involving urgency, comfortable transmission and less complex contents (Factor A), the telephone is preferred, followed at some distance by electronic text media and face-to-face contacts. In communication situations where the information is well defined and subject to more or less programmed documentation or processing on the receiver's side (Factor D), text media are preferred, followed by face-to-face contacts and the telephone.

Table 2

Task-oriented evaluation of communication channels (6-point scale)

channel / item/factor		telephone (n = 326)	face-to-face (n = 316)	mail (n = 337)	telex (n = 328)	fax (n = 332)	teletex (n = 324)
speediness		1.3	4.1	4.2	2.2	2.1	2.2
comfort		1.4	3.6	3.5	3.0	2.6	2.9
transmission of small information volume		1.7	4.7	3.5	2.0	2.4	2.5
capability of quick response		1.4	2.9	4.5	2.5	2.5	2.5
short composition time		1.3	3.4	3.9	2.8	2.7	3.0
short transmission time		1.6	4.4	4.2	2.4	2.4	2.3
A "promptness"	**weighted average**	**1.4**	**3.8**	**4.0**	**2.5**	**2.4**	**2.6**
	rank	(1)	(5)	(6)	(3)	(2)	(4)
resolving disagreement		2.1	1.2	4.0	4.0	3.8	3.7
unambiguous understanding of content		2.6	1.6	2.6	3.2	2.7	2.8
transmission of difficult content		3.0	1.5	2.8	3.8	3.0	3.1
certainty of reaching the wanted receiver		1.6	1.3	2.9	3.1	3.1	3.0
B "complexity"	**weighted average**	**2.3**	**1.4**	**3.1**	**3.5**	**3.1**	**3.1**
	rank	(2)	(1)	(3)	(6)	(3)	(3)
confidentiality (during transmission)		2.9	1.3	2.3	4.4	4.2	4.1
protection from faking (during transmission process)		3.6	2.2	2.1	3.2	2.5	2.8
identification of sender		2.8	1.5	1.9	3.0	2.5	2.7
C "confidence"	**weighted average**	**3.1**	**1.7**	**2.1**	**3.5**	**3.1**	**3.2**
	rank	(3)	(1)	(2)	(6)	(3)	(5)
capability of documentation		5.1	4.9	1.5	2.1	1.6	1.7
certainty of exact wording		4.0	3.2	1.6	2.2	1.7	1.7
easy processing by receiver		4.3	4.2	2.0	2.4	2.1	1.8
transmission of large information volume		4.3	3.2	2.2	3.3	3.1	2.2
D "accuracy"	**weighted average**	**4.4**	**3.9**	**1.8**	**2.5**	**2.1**	**1.8**
	rank	(6)	(5)	(1)	(4)	(3)	(1)

Scale: **1** = very good . . . **6** = very bad

Though these results are produced by quite different methods, they are consistent with other theoretical and empirical literature in the field (Short *et al,* 976, p. 62 f; Johansen *et al,* 1978, p. 390 f; Schulman and Steinman, 1978; Johansen *et al,* 1979, p. 21 f; Rice, 1980).

Affective Determinants of Channel Selection

The affective side of channel selection was covered by a pretested list of sixteen adjectives, covering affective as well as cognitive components of attitudes. We asked managers to rate each of the six channels with respect to these items on a five-point scale; we also asked them to fill-in the questionnaire in an emotional, affective way. After analysing the data in factor analyses, we came up with the following results, almost identical for all sub-organizations investigated.

There are five basic factors (dimensions) describing and guiding emotional judgements of communication channels in organizations. These factors are the same for all channels, explaining between 87 and 100 per cent of the answer variance. Their order of contribution to variance explanation changes from channel to channel:

Factor I: *Stimulation,* comprising items: active, creative, happy and energetic.
Factor II: *Comfort,* comprising items: simple, quick and comfortable.
Factor III: *Dependability,* comprising items: exact, secure and reliable.
Factor IV: *Formality,* comprising items: standardized, bureaucratic and regular.
Factor V: *Privacy,* comprising items: confidential, personal and secret.

We suggest that these factors represent relevant, mainly affective aspects of channel evaluation.

Table 3 shows the weighted averages of the mean ratings of related items for each factor. For instance, the value of 3.3 for mail in Factor II (comfort) is the weighted average of the values this channel received for the adjectives simple, quick and comfortable in both organizations. With a value of 3.3, this channel is perceived to be somehow 'not comfortable' — on our 5-point scale, **5** represents the lowest value (not appropriate) and **1** the highest value (appropriate). Thus, values indicate the extent to which related emotional aspects are attributed to communication channels. The circled figures indicate the ranking of a channel with respect to the evaluation features represented by a factor.

Whereas face-to-face communication ranks highest, associated with 'stimulation' and 'privacy', the telephone is highly preferred for 'comfortable' communication. Text media score highest when 'dependability' and 'formality' are involved. One should note the remarkable distance between text-oriented media and oral media on the factors of 'stimulation' and 'formality', also the leading position of the telephone on the factor 'comfort'.

Finally, users were asked for an overall affective judgement (on a six-point scale, **1** ranking highest) how much they liked using each channel, regardless of

Table 3

Affective evaluation of communication channels (5-point scale; n = 241)

Factors		Channel	telephone	face-to-face	mail	telex	fax	teletex
I	**stimulation**	weighted average	2.6	2.3	3.1	3.3	3.5	3.1
		rank	(2)	(1)	(3)	(5)	(6)	(3)
II	**comfort**	weighted average	1.4	2.4	3.3	2.4	2.1	2.3
		rank	(1)	(4)	(6)	(4)	(2)	(3)
III	**dependability**	weighted average	2.5	2.1	1.9	2.0	1.9	1.9
		rank	(6)	(5)	(1)	(4)	(1)	(1)
IV	**formality**	weighted average	4.0	4.1	2.9	3.1	3.2	3.2
		rank	(5)	(6)	(1)	(2)	(3)	(3)
V	**privacy**	weighted average	2.3	1.5	2.0	3.8	3.9	3.3
		rank	(3)	(1)	(2)	(5)	(6)	(4)

Scale: **1** = appropriate . . . **5** = totally inappropriate

the task or situation involved. In all organizations, the telephone and face-to-face contacts were most popular, ranking highest with an overall mean value of 1.6 and 2.0 respectively. There is a remarkable affective gap between these two channels and the group of text-oriented channels, the first being mail (4.0), followed by fax (4.1), teletex (4.2) and telex (4.6).

It is interesting to note that the telephone ranks highest above face-to-face contacts. This may be due to its easy availability, combined with its effectiveness for prompt and varied day-to-day communication. (See also the importance of the telephone with situations involving Factors A or II.)

Potential Of and Demand For Substitution

In order to assess the potential of substitution between channels in organizations, we first need information about the distribution of channel use. Using a self-reporting measure, we studied some 16,000 contacts. Roughly, we found the following structure:

We therefore investigated the possibilities of substitution between channels using different approaches. We asked managers to give general judgements on a possible replacement of their oral and mail channels by other channels. Preliminary analysis of the data (though still needing some additional checking) indicates a perceived potential of substitution, represented in Table 5. The figures in that table cannot be added by row since, for instance, a face-to-face contact replacable by mail can, in many cases, also be replaced by telephone. However, managers' judgements show that electronic text communication media (teletex, fax, telex) could replace at least 5 per cent of face-to-face contacts, 12 per cent of telephone contacts and 18 per cent of mail contacts. Thus, new text-oriented channels could play a major role replacing telephone contacts — especially if the high absolute volume of phone contacts is kept in mind — and in replacing traditional mail. But it must be noted that substitution could also work in the other direction (moving from written to oral or from telephone to face-to-face communication).

Table 5

Subjective assessment of potential channel substitution (n = 96)

Replaced channel \ Replacing channel	telephone	face-to-face	mail	telex	fax	teletex
. . . percentage of **face-to-face** contacts could be replaced by . . .	28%	—	13%	2%	2%	5%
. . . percentage of **telephone** contacts could be replaced by . . .	—	20%	16%	9%	5%	12%
. . . percentage of **mail** contacts could be replaced by . . .	15%	13%	—	7%	10%	18%

These findings are corroborated by a more detailed substitution analysis. Managers were asked to thoroughly describe their recent channel uses and to account for possible substitution through electronic text channels. Initial and still very incomplete data analysis shows that about 8 per cent of more than 1,000 face-to-face contacts analysed are perceived as suitable for new electronic media (teletex and/or fax). Managers mention the following main reasons for denying the possibility of greater substitution: discussion needed, group meeting necessary, exchange of difficult ideas or acquisition of background knowledge.

Average number of contacts per day:	30
External/internal contacts:	43% intradepartmental, 45% interdepartmental, 12% external
Distribution over channels (before implementation of teletex):	39% telephone, 42% face-to-face, 16% mail, 3% telex/telefax
Contacts perceived as urgent:	40%

A break-down by channel and communication partner for one sub-organization is given in Table 4, other sub-organizations showing similar patterns. These findings underline the enormous significance, both relative and absolute, of oral communication in organizations, previously reported by Mintzberg (1973, p. 38 f) and Weinshall (1979, p. 3). If the high proportion of telephone and face-to-face communications indicate that the majority of communications within the organization are concerned with handling difficult problems, then the findings seem consistent with Proposition II. However, according to Proposition I, the high volume of oral communication could also point to a high potential for substitution, if a high proportion of tasks, currently handled by oral channels, were efficiently replacable by new text media (i.e. strongly related to Factor D).

Table 4

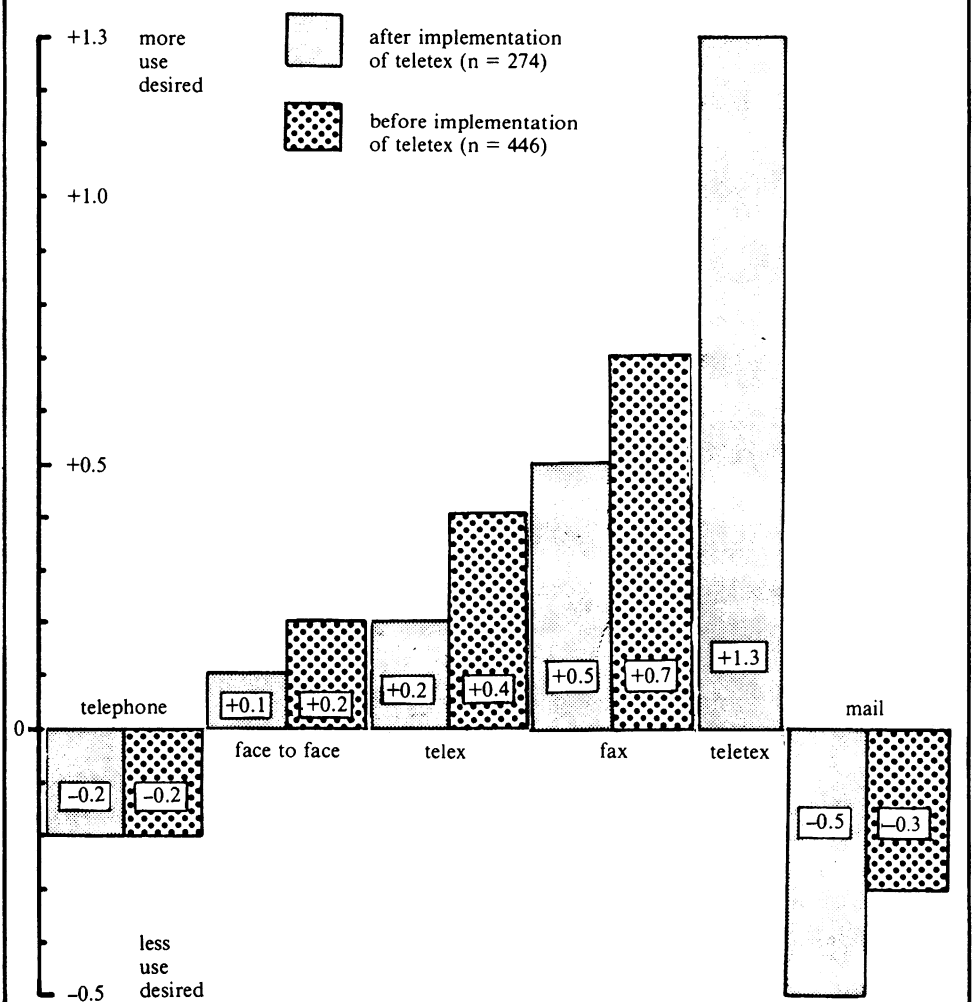
Breakdown by channel and communication partner (manufacturing departments of one organization, n = 9,204 contacts, n = 165 users)

Contacts \ Channel	telephone	face-to-face	mail	telex	fax	
Intradepartmental	22%	73%	5%	0%	0%	100%
Interdepartmental	53%	28%	15%	3%	1%	100%
External	46%	11%	32%	10%	1%	100%

A comparison between actual use of communication channels and desired use can serve as an indicator of managers' demand for substitution. As Table 6 shows, respondents will want more face-to-face contacts, a decrease of telephone and standard mail communication and an increase in use of fast, new electronic text media (the latter reflecting some good experiences with the

Table 6

Mean differences between actual and desired use of communication channels



new channels). However, no overwhelming demand for further expansion of the new media is seen when looking at this result in combination with the foregoing analysis.

DISCUSSION

WATZLAWICK, BEAVIN AND JACKSON (1967) show convincingly that any human communication process addresses aspects of information content as well as aspects of social relations between sender and receiver. Proportions of content-oriented (task) problems and of relation-oriented (interpersonal) issues vary, depending on contingencies. Furthermore, the authors distinguish between two basic modes of communication: digital (coded) communication, mainly using languages and writing as tools, and analogue (symbolic) communication, working with non-verbal signals as a means of message transmission, such as gestures, facial expressions, voice modulation, physical and environmental symbols and other associative analogues ('metacommunication'). Whereas many matters of content (not all!) can be transmitted by coded communication, most aspects of interpersonal relationship (not all!) require symbolic communication. Coded (digital) information can be telecommunicated in cases where the contents are not too complicated. Analogue communication eludes telecommunication for the most part and, thus, demands the social and physical presence of partners.

Reviewing our research experience, we feel that these concepts provide a good basis for interpreting our results. The findings about choice and substitution of channels seem also to support assumptions underlying other authors' view (Short *et al,* 1976). Referring to these theoretical and empirical foundations, one can predict impacts of new electronic text media confronting socio-economic needs of organizational communication.

Telecommunications technology in general and new text-oriented media in particular can primarily take over those transfers of information which can be coded and whose content is not too complex. New technologies can transmit those communication problems faster, cheaper and probably more reliably than channels previously used for that purpose. Hence, they could replace old text-oriented channels (mail and telex). As far as telephone and face-to-face contacts were used for handling such kinds of information exchange, they could also be replaced.

However, theory suggests, as does our data, that this type of information exchange does not prevail in organizational communication. The core of intra-organizational activity comprises processes heavily concerned with complicated contents and/or with social relations, such as co-ordinating complicated tasks, solving complex problems, developing innovative strategies, monitoring and evaluating barely tangible performances and motivating people. These and similar activities involve complex contents.

Moreover, they affect and require trusting social relations. Consequently, they cannot be properly maintained by using telecommunication technology. In this context, it seems worth noting that in Japanese companies — whose efficiency is, *inter alia,* attributed to a high degree of mutual trust and the sharing of beliefs (Ouchi, 1980) — face-to-face communication is reported to be remarkably high (Pascale, 1978).

Thus, the new text-oriented and technically powerful communication technologies will only, to a minor degree, keep the promises initially expressed in Proposition I because much of the work-related, information activities cannot be properly handled by the new media. Our data on general attitudes towards new office technology show that some fears of the kind suggested in Proposition III do exist. An overenthusiastic deployment of the new technologies, without taking account of the social character of organizational structure and performance, could be harmful. This would not only hinder individuals' need satisfaction, but in many cases the organization's viability would be endangered due to the rigidity and sterility of its communication structure and its lack of ability to adapt to change. These problems can be avoided if an open, participatory planning and implementation strategy concerning the new communication technology for organizations is adopted. Favourable attitudes towards new office technology as such seem to guarantee a fruitful process of communication development.

Thus, in conclusion, Proposition II seems to provide a good description of the possible impacts that new communication technologies might produce. The extent of channel subtitution previously outlined will surely lead to improved organizational co-ordination and performance. The organization's information-processing capacity increases, thereby facilitating growth and regional expansion of activities. Some characteristics of office jobs will change, along with the changes in text-oriented communication technology and its integration with EDP. However, as far as communication technology is concerned, if the social and economic needs mentioned are taken into consideration, there will be evolutionary, rather than revolutionary, impacts on our way of life.

References

Argyle, M. (1969) *Social Interaction.* Methuen, London.

Argyris, C. (1971) *Management Information Systems: The Challenge to Rationality and Emotionality.* Management Science, Vol. 17, pp. B 275-B 292.

Arrow, K. J. (1974) *The Limits of Organization.* W. W. Norton, New York.

Berger, P. L. and Luckmann, T. (1966) *The Social Construction of Reality.* Doubleday, New York.

Communication Studies Group (1975) *The Effectiveness of Person-to-Person Telecommunications Systems.* Research at the Communications Studies Group. Long Range Research Report 3, University College, London.

Feldman, M. S. and March, J. G. (1980) *Information in Organizations as Signal and Symbol.* Paper presented at the annual meeting of the Western Political Science Association in San Francisco, March 27-29.

Goddard, J. B. (1971) *Office Communications and Office Location: A Review of Current Research.* Regional Studies, 5, pp. 263-280.

Goldmark, P. C. (1972) *Tomorrow we will Communicate to our Jobs.* The Futurist, April, pp. 55-58.

Johansen, R., Vallee, J. and Collins, K. (1978) Learning the Limits of Teleconferencing: Design of a Teleconference Tutorial. In *Evaluating New Telecommunications Services,* M. C. J. Elton, W. A. Lucan and D. W. Conrath (Eds.). Plenum Press, New York and London, pp. 385-398.

Johansen, R., Vallée, J. and Spangler, U. (1979) *Electronic Meetings: Technical Alternatives and Social Choices.* Addison-Wesley, Reading, Mass.

Kirsch W. and Klein, H. (1977) *Management-Informationssysteme II.* W. Kohlhammer Stuttgart.

Marill Th. (1980) *Time to Retire the Telephone?* Datamation. August, pp. 185-186.

Merrihue, W. V. (1960) *Managing by Communication.* McGraw-Hill, New York.

Mintzberg, H. (1973) *The Nature of Managerial Work.* Harper Row, New York.

Ouchi, W. G. (1980) *Markets, Bureaucracies and Clans.* Administrative Science Quarterly, Vol. 25, pp. 129-141.

Panko R. R. (1980) *The EMS Revolution.* Computerworld, August 25, In Depth, pp. 1-12.

Pascale, R. T. (1978) *Communication and Decision-making across Cultures: Japanese and American Companies.* Administrative Science Quarterly, Vol. 23, pp. 91-110.

Picot, A. (1981) *Transaktionskostentheorie der Organisation.* Mimeo. Universität Hannover, West Germany.

Picot, A. and Reichwald, R. (1979) *Untersuchungen der Auswirkungen neuer Kommunikationstechnologien im Büro auf Organisationsstruktur und Arbeitsinhalte – Phase 1: Entwicklung einer Untersuchungskonzeption, Eggenstein-Leopoldshafen.* Fachinformationszentrum Energie, Physik, Mathematik GmbH.

Pye, R and Young, J. (1980) *Do Current Electronic Office System Designers meet User Needs?* Paper presented at Stanford University, International Symposium on Ofice Automation, March 26-28.

Rice, R. E. (1980) Impacts of Computer-mediated Organizational and Interpersonal Communication. In *Annual Review of Information Science and Technology,* M. Williams (Ed.), Vol. 15, Knowledge Industry Publication, White Plains, N. Y.

Short, J., Williams, E. and Christie, B. (1976) *The Social Psychology of Telecommunications,* Wiley & Sons, London.

Schulman, A. D. and Steinman, J. I. (1978) Interpersonal Teleconferencing in an Organizational Context, In M. C. J. Elton, W. A. Lucas and D. W. Conrath (Eds.) *Evaluating New Telecommunications Services,* Plenum Press, New York, London, pp. 399-424.

Szyperski, N. (1979) Computer-Conferencing — Einsatzformen und organisatorische Auswirkungen. In O. Grün and J. Rössl (Eds.) *Computergestützte Textverarbeitung,* R. Oldenbourg, Munchen, Wien, p. 151-174.

Turoff, M. (1973) *Human Communication via Data Networks.* Computer Decisions, pp. 25-29.

Uhlig, R. P., Farber, D. J. and Bair, J. H. (1979) *The Office of the Future: Communication and Computers.* North-Holland, Amsterdam.

Watzlawick, P., Beavin, J. H. and Jackson, D. D. (1967) *Pragmatics of Human Communication.* A Study of Interactional Patterns, Pathologies and Paradoxes. W. W. Norton, New York.

Weinshall, Th. D. (1979) General Introduction. In T. D. Weinshall (Ed.) *Managerial Communication: Concepts, Approaches and Techniques.* Academic Press, London.

Weizenbaum, J. (1980a) Where are We Going? Questions for Simon. In T. Forester (Ed.) *The Microelectronics Revolution.* Basil Blackwell, Oxford, p. 434-438.

Weizenbaum, J. (1980b) Once More, the Computer Revolution. In T. Forester (Ed.) *The Microelectronics Revolution,* Basil Blackwell, Oxford, pp. 550-570.

Williamson, O. E. (1975) *Markets and Hierarchies: Analysis and Antitrust Implications.* Free Press, New York.

Witte, E. (1976) Die Bedeutung neuer Kommunikationssysteme für die Willensbildung im Unternehmen. In H. Albach and D. Sadowski (Eds.) *Die Bedeutung gesellschaftlicher Veränderungen für die Willensbildung im Unternehmen, Schriften des Vereins für Socialpolitik,* Neue Folge, Bd. 88. Duncker & Humblot, Berlin, pp. 305-320.

Witte, E. (1977) *Organisatorische Wirkungen neuer Kommunikationssysteme.* Zeitschrift für Organisation, 46, pp. 362-367.

Witte, E. (1980) Kommunikationstechnologie. In E. Grochla (Ed.) *Handwörterbuch der Organisation.* C. E. Poeschel, Stuttgart, col. 1048-1055.