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## Concluding Remarks

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## Concluding remarks

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The composer of concluding remarks may attempt a summary of the proceedings in all their diversity, or he may discern a common thread. The former seems inappropriate when so many contributions are themselves reviews of a major field. I shall try to draw a moral, compatible with most contributions though not always explicit in them.

My contention is threefold: that the demand for telecommunications is still growing, that there are no obvious physical impediments to growth, but that there are organizational difficulties of several kinds.

Most of the contributions have indicated, in one way or another, that there is room for growth in an existing service, or room for introduction of new services and facilities, or plans for development of bigger or more comprehensive systems.

It is also clear that such expansion can be accomplished with relatively modest use of material, energy, and human labour per unit of provision. A reducing real cost per unit has long been the trend in transmission: it is now beginning to occur in switching. Indeed, the reduction forecast is so radical that technological unemployment is emerging as a problem. One finite natural resource, the radio frequency spectrum, will be under some pressure, but with extension to higher frequencies, frequency reuse techniques, and the further development of closed media for much fixed communication, there is no immediate limit. Ultimately, there must be physical limits to growth, but in telecommunications they still seem to be a long way off.

The main uncertainties before us are those of human organization rather than technology. They may be discerned on the planes of the users of telecommunication services, the administrations who provide the services, and the larger society within which both are embedded.

We may ask of the actual and potential users: do they want any more telecommunication? Can they use it beneficially? Can they even tolerate some of the possible excesses? There is no categorical answer. It depends on the type of message, the control facilities provided, and on how individuals and social groups attempt to use the service. There is a good deal which the system designer can do to make a service an aid rather than an oppression, and it is important that we do it.

For the telecommunication administration, perhaps the principal problem is the inertia of a large interdependent network of equipment and services. To obtain the greatest benefit from new developments, careful and coordinated planning is necessary, yet this seems at times to be intractably difficult and painfully slow. To the working engineer, it may appear as the main impediment to innovation.

The final problem, that of matching needs with resources, takes us into national and even international politics. One of the first and most serious problems raised in our opening session was that of technological unemployment. New electronic switching systems will need far less manpower than older electromechanical ones, and already there are problems of contraction

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in the U.K. manufacturing industry. Yet an overall view of telecommunications still shows a massive growth potential. Cannot we match the increasing demand for service with the decreasing unit costs, and maintain a reasonably smooth level of industrial activity? The difficulty is that the nature of the skills and resources required is changing: some individuals, companies, and even national economies may find it difficult or impossible to accommodate them, or at least to do so without assistance. It will need great managerial skill and political will to tackle this problem. We must hope that they will be forthcoming.