

FEASIBILITY STUDY ON TECHNOLOGICAL PROSTHETICS  
AIDS FOR THE PARTIALLY SIGHTED

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Aids for the Partially Sighted

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During the past few months a feasibility study on aids for the partially sighted (as a prototype study of the application of technological prosthetics) has been carried out. The work has now been completed and a final draft of a report is almost complete.

Scope of the Feasibility Study

A study by the World Health Organization indicates that blindness and partial sight is a serious economic and social burden on a global scale. While for developed countries, there is a "blindness system" which represents the community's response to part of the problem, this is not necessarily paralleled by a similar recognition of the social and economic benefits to be gained by programmes to rehabilitate the partially sighted. There are now available technological prosthetics (closed-circuit television systems -CCTV) which enable a large fraction (probably over 80%) of such individuals to read and write, in addition to relatively sophisticated optical aids which while cheaper are less effective.

The feasibility study has been designed to:

- (i) show where the existing data on the incidence of partial sight is adequate for analysis to determine the size of the problem for developed countries;
- (ii) show whether data from trial results of both CCTV and optical aids can be manipulated to provide measures of performance, both absolute and relative;
- (iii) show whether a concentration of the available data in (i) and (ii) can be used to indicate specific relations between types and severity of eye conditions, measurements of remaining vision, etc. and the functional performance of subjects with particular prosthetics.

### Results

Data on the incidence of partial sight has been examined for two countries only at this stage, the USA and the UK. Results are sufficiently promising from the USA (less so for the UK) to provide a good basis for further cross-checking with data from other countries, should it be decided to proceed to the study proper. It was hoped to include data from the D.D.R. in the feasibility study, but it has not yet been possible to establish the necessary contacts. Data from Sweden has just come to light which is

very promising.

Based on UK and USA statistical information and trial data from four trials, including one from the F.R.G., the following preliminary results have been obtained:

- (1) Size of the problem. About 8 per 1000 of the population of a developed country such as the USA are handicapped to the extent that they cannot read or write with normal optical aids (spectacles, etc.). Only about 0.6 per 1000 are functionally blind, i.e. they have no remaining vision.
- (2) Trial data show that about 80% of all partially sighted individuals could initially read or write with a well-designed CCTV system, and that this percentage increases with familiarity with the equipment. The sustained success rate with optical aids is about 20%.
- (3) There are no specific limitations in terms of ocular pathology for CCTV aids. Tentative thresholds in terms of visual acuity measurements for optical and CCTV aids can be developed, but are unimportant compared with the functional needs of individual subjects.
- (4) The reasons for the high success rates obtained with CCTV relative to optical aids seem to consist of a complex of technical and ergonomic factors. For instance, while optical aids for near-

vision can have very high magnification power, this is at the cost of a critical focal length and (usually) a small field of view. This combination makes the reading process slow and fatiguing. CCTV enables the user to adopt a relaxed posture without the need for a fixed working distance, and the screen size is sufficient, even at high magnifications, for the user to see a word in its context. Other important contributing technical factors are: contrast enhancement, contrast reversal and variable magnification.

#### Social and Health Care Implications

It would be unwise to draw conclusions of this nature on the data so far examined, but there are some indications that particular areas would repay study in a full analysis of the system as a whole, in its technological, social, regularity and economic aspects. The present data show promise, for example in providing an approximate breakdown of the social problem into its educational (children and students), economic (wage earners) and purely social medicine (retired pensioners) aspects. Regulatory definitions of blindness and partial sight so far examined are such as to mislead policy makers on the size and nature of the social and economic problems. There are also indications that the

organization of low vision care would repay study.

### The Next Steps

To the extent that the future of the project depends on external funding, the feasibility study will be a valuable back-up for fund raising activities, since, on what is admittedly a small sample, it has demonstrated that there is a health care problem of considerable magnitude to be solved, that the data for analysis of the problem exists, and that technological solutions are effective and practicable.

Should the full study be undertaken, the next steps are as follows:

- (1) Examination of basic statistical data to provide cross-checks from other countries, including particularly the non-market economies.
- (2) Inclusion of data on CCTV systems in an operational environment (cooperation from several manufacturers has been obtained and joint activity with the research department of the American Federation for the Blind and the Swedish Institute for the Handicapped is envisaged).
- (3) An examination of the operation of health care systems in the partial sight/blindness areas, including clinical, social security and regulatory aspects in both market and non-market economies.

- (4) A prototype cost-benefit analysis on the provision of CCTV and optical aids, with a possible extension into technological prosthetics for the functionally blind.
- (5) Examination of design parameters of technological prosthetics in relation to functional need and performance, to provide guidance on future development.

An outline of the feasibility study report now in the final drafting stages is attached.

## Outline of Feasibility Study Report

### I. Introduction - Aims of the Study

Technological prosthetics as an area for systems analysis; reasons for selection of visual impairment as the study area; the technological perspective; aims and limitations of the feasibility study.

### II. Definition of Blindness and Partial Sight

The measurement of visual acuity; international and national definitions of blindness and partial sight (WHO activities and UK and USA definitions); functional definitions; other factors in the definition problem.

### III. Statistical Data

Size of the severely visually impaired population; US statistics; UK statistics; the relation of age to severe visual impairment; conclusions as to value of the statistical data.

### IV. Prosthetics for the Severely Visually Impaired

The relevant eye conditions and their treatment; optical aids; electronic and electro-optical aids; other aids.

V. The Effectiveness of Low Vision Aids

Clinical trials; analysis of results from the Krieger trial of 917 patients (optical aids), the RANDSIGHT trial of 81 CCTV subjects, the Heidelberg trial of 48 patients using CCTV, and a comparative trial using both CCTV and optical aids by Mear et al; study of CCTV systems in an operational environment.

VI. Discussion

Trials and operational data requirements for an eventual cost-benefit analysis; the importance of criteria for defining the population; visual acuity as a measure of functional performance; conclusions on size of the severely visually impaired population; discussion of relative effectiveness of aids; development of threshold values; the overriding importance of functional needs as the determining factor in choice of prosthetics; eye-condition specifics; development of a matrix relating objective values, functional needs and indicated prosthetics; the cost factor.

VII. Future work

Broadening the statistical and cultural basis for the study; plans for further study of CCTV in an operational environment, particularly in relation to de-

sign questions; future development, and a modular concept for CCTV systems, the "blindness system" and cost-benefit analysis.