STANDARDS FOR EDITING AND PUBLISHING SCIENTIFIC JOURNALS

Report of a Seminar

2nd & 3rd September 1983, Colombo, Sri Lanka

The Natural Resources Energy and Science Authority of Sri Lanka (NARESA)

The Committee on Science and Technology in Developing Countries (COSTED)

Asian Science Communicators' Organization (ASCO)

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Held at NARESA, Colombo

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Edited by Nimala Amarasuriya

Natural Resources, Energy & Science Authority (NARESA),

Colombo, Sri Lanka

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FOREWORD

The Natural Resources, Energy and Science Authority (NARESA) organized the Seminar on Standards for Editing and Publishing Scientific Journals to enable scientists involved in these areas to meet and discuss the problems faced in science editing. It is necessary to follow closely the requirements of international journals so as to maintain and conform to international standards.

The publishers were able to demonstrate to the editors the progress in their field. The recent advances in printing technology have been remarkable and it is obligatory for editors to know how to present the copy to the printer. With widespread use of computers and word processors, new methods are constantly being introduced and a working knowledge is necessary for all scientists who wish to publish their work.

Dr. R.P. Jayewardene,
Director-General,
NATURAL RESOURCES, ENERGY & SCIENCE AUTHORITY OF SRI LANKA

INTRODUCTION

Scientific journals were first published in Sri Lanka in the 19th century, although scientific research had been carried out since the latter half of the 17th century. The first scientific journal to be produced in this country was the 'Medical Miscellany' published in 1853. This was followed by the 'Tropical Agriculturist' in 1881. The Research Institutes (Tea, Rubber & Coconut) played an important part in the development of scientific journalism in Sri Lanka by publishing journals dealing with research conducted in the plantation sector.

The number of scientific journals published locally has increased considerably during the last 50 years. The University of Ceylon began publishing the Ceylon Journal of Science in 1942. Most of the Medical Associations publish journals in their specialized fields. The Sri Lanka Association for the Advancement of Science has published its Proceedings, though in abstract form, from 1945 onwards. The Natural Resources, Energy & Science Authority of Sri Lanka (formerly the National Science Council) has published biannually a primary research journal covering all fields of Science and Technology, since 1973.

Inspite of the increase in the number of local periodicals, most Sri Lankan scientists prefer to publish their research results in internationally known foreign journals. Not more than 25% of the total output of research done by Sri Lankans is published in local journals. Among the many reasons for this is the fact that few of the articles published in local journals are cited by other scientists in international journals. Other factors that discourage authors of good papers are the limited circulation, irregularity, poor physical quality and the absence of standard editing procedures. Under these conditions, many scientific periodicals have ceased publication after a brief lifespan. For example, in the 3 year period between 1976 - 1979, eight journals have ceased to exist.

At present, one of the chief impediments to scientific research in Sri Lanka is the lack of publishing outlets for research carried out locally. Information on ongoing research rarely circulates within the country and much research data lies buried, unnoticed. Raising the standards of local journals and the general standard of editing has thus become an urgent necessity for improving the effectiveness and efficacy of the dissemination and communication of scientific research carried out in this country.

One of the main constraints in publishing scientific periodicals in Sri Lanka is the dearth of professionally trained editorial personnel. This is often evident in the lack of conformity to internationally accepted standards and norms in many of the local journals. No training programmes have been held to date in the field of scientific editing in Sri Lanka.

The present training course was intended to update editors of Scientific & Technical journals on current practices and internationally accepted standards in science editing and to discuss broadly, the practical aspects of the various operations involved in the process of handling a manuscript from the time of its receipt in the editorial office to its publication. The scope of this seminar was extended to areas of general interest to editors such as typesetting and printing techniques as well as reprography. We envisaged that the compilation and publication of the seminar proceeding could serve as a handbook for others working in this field. The seminar also aimed to provide a forum for local editors to discuss problems encountered by them and possible recommendations to improve the present situation. The current problems and possible recommendations for the future, that emerged during the course of these discussions, are outlined in the Epilogue of this Report.

Efforts were made to give the training course as extensive a coverage as possible by selecting only one participant from each of the current Science and Technology journals published in Sri Lanka.

The organization of this course was made possible through financial assistance from the Committee on Science and Technology in Developing Countries (COSTED) and the Asian Science Communicators' Organization (ASCO) to cover lecturers' and participants' expenses. We are very grateful to them for their generous gesture. Our sincere thanks are due to all the resource personnel who so willingly cooperated in this programme and to the NARESA staff who assisted in the Seminar.

Nandadasa Kodagoda

Nimala Amarasuriya

(Seminar Coordinators)

THE SEMINAR AND ITS OBJECTIVES

N. KODAGODA
Professor of Forensic Medicine, Faculty of Medicine, University of Colombo, Colombo

Chairman Sir, and Colleagues,

It would indeed be a rare privilege for any scientist, let alone an applied scientist as I, to meet a conglomerate of foremost scientific personalities, as those assembled here this morning. It is with humility that I take this opportunity to welcome every one of you.

The use of unexplained and unknown acronyms in scientific writing is considered an unpardonable sin. It bothers me therefore, whether we have committed such in this printed programme. Let me pay penance, before it is too late.

COSTED stands for the Committee on Science and Technology in Developing Countries. The committee is of ICSU, the International Council of Scientific Unions. ASCO is an acronym for the Asian Science Communicators' Organisation. Deriving financial support from UNESCO, COSTED promotes any activities that are conducive to the advancement of scientific standards and technology in the developing world. ASCO catalyses science communication at all levels. In so doing, both these organisations concentrate on aspects of science and technology that are relevant to the needs of the developing world; and, they draw on human resource and expertise from within a developing country, rather than from the developed world.

Growth of scientific information in the past few decades has been stupendous. We have been acutely conscious of the truism that via the traditional channels of information transfer, the scientist of the present day can never remain abreast of current scientific knowledge and discovery; not, even if it be in his narrow field of interest. In the early '70s, about 7000 papers and reports left the printer every day. If we are to believe the dictum that the volume of accumulated scientific information doubles every 8-10 years, today there should be no less than 15,000 papers published every 24 hours.

While such colossal amounts of print materials are out of the reach, and beyond the grasp of any human, the stark fact of its importance emerges salient. Without it, science and technology would remain distastefully stagnant. Effective and speedy dissemination of this mass of information is fundamental to progress.

It is in this process that the role of the science writer, editor, referee and publisher has become increasingly vital. While they must not be an impediment to the flow of information from generator to user, they must also remain discriminating and prudent. Equally, it is necessary for us to keep pace with world standards in writing and publishing, and to adapt appropriately, the technological advances in areas such as printing and reprography.

It is in the pursuit of these objectives that this seminar came to be organised.

The usual practice of COSTED is to seek collaboration of national organisations. It is in consonance with this strategy that we found in NARESA, the most appropriate partner. When the suggestion for partnership was made to the Director-General, Dr. R.P. Jayewardene, it was with astonishing promptness that he said, "Yes, I do". I am highly appreciative of the trust he had in us; and, I am grateful to him for the support and guidance he has willingly given us in making all these arrangements.

Every institution to which we wrote responded so promptly. Our resource persons were gracious enough to give us of their time, knowledge and experience. We are grateful to them all.

There is one person, without whose unstinted efforts, this seminar would not have been possible. I refer to our Co-ordinator, Mrs. Nimala Amarasuriya, to whom a sincere thank you is due. It must please her to see her work bear fruit; but I know, she will heave her sigh of relief only tomorrow, when all ends well.

That though, will not be the end. We hope that this is the forerunner of a series of events to come, the first of which is the publication of the proceedings of this meeting. It's success will depend on the efforts of everyone present here; managerial, resource, as well as participant personnel. It is in anticipation of that co-operation that I say a big thank you to everyone.

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PRESENTATION OF MATERIAL IN SCIENTIFIC PAPERS

V. BASNAYAKE,
Professor of Physiology, Faculty of Medicine, University of Peradeniya, Peradeniya

The 'scientific paper' is a special kind of scientific writing. It is a description by a scientific worker or a group of workers of a piece of their original, or at least new, work, with the purpose of getting their findings incorporated into the body of science. The present paper, which seeks to describe the scientific paper in the Lankan context, is itself not one because it reports no new work and it does not seek to add to the corpus of science. A scientific article which seeks to describe the current position in regard to a selected scientific topic is also not a scientific paper, sensu strictu, because it reports no new work. There are therefore many scientific journals which contain no scientific papers. The Sri Lanka Science Index currently scans 50 local science and technology periodicals in English, from the Association of Franco-Ceylonese technologists News Bulletin to Water resources, and 16 Sinhala periodicals, from Arthika Wimasum to Sri Lanka Padanam Ayathana Pravrthi. Twenty-one of the 50 English periodicals, and none of the Sinhalese periodicals, contain scientific papers. Practically all our science student journals contain no scientific papers. The scientific paper has a number of synonyms: 'original' (thus the British Medical Journal has a section entitled 'Papers and originals'), 'original contribution', 'research paper' (this is what the Journal of the National Science Council of Sri Lanka calls it, but we may note in passing that a book on 'How to write a research paper'? may deal with the writing of dissertations by diploma students from library research and not from scientific research). The term 'scientific paper' has not yet entered the dictionary. The Oxford English Dictionary does not have it. Its Supplement published in 1902 has 'scientific 'notation' and 'scientific revolution' but not 'scientific paper'. Nor is the phrase to be found in dictionaries of science and technology,[10,11] or of biology, chemistry, geology, mathematics or physics. This means that the phrase 'scientific paper' has no official status or definite meaning.

Scientific papers in Sri Lanka are written in English because the chance of being read by the scientific world is greater with an international language than with Sinhala or Tamil. Some journals, such as the Sri Lanka Veterinary Journal and the Journal of the National Science Council of Sri Lanka provide translations of the summaries or abstracts of the papers into Sinhala, and Sinhala and Tamil respectively. There is a possibility that authors may ask for the right, or be encouraged to, write in Sinhala or Tamil. In such a case the best that can be done would be to provide a summary in English. Ayurveda Pradeepika, an Ayurvedic medical science quarterly published by the Department of Ayurveda, had three editors for the three languages English, Sinhala and Tamil, and summaries of all papers were published in all three languages. Its scientific papers in fact appeared only in English. Papers written in Sinhala and Tamil never rose, so far as I know, above the level of the traditional essay. The English editor of the journal wrote:

> "The practice of keeping records and analysing results seems to be very rarely observed by the Ayurvedic Practitioners in general. So that when he is requested to write an article he finds it difficult in preparing one.. There are some who do not want to write or divulge their knowledge.. A queation haa been raiaed at one of the editorial board meetings whether it was not possible to pay such specialists for their article, the payment being according to the value of the article. In our minds this might lead to abuse."[2]

There are typical conventions that are used in the presentation of material in scientific papers. These conventions have been evolved over the years by a process of artificial selection so as to make things easier and more precise for everybody concerned - for writer, editor, printer, reader, and indexer- The conventions are explicitly stated, briefly or at length, in some journals, under headings such as 'Instructions to authors' or, more cautiously, as 'Guidelines to Authors', as a mild warning to errant authors and as a sign of limited tolerance towards the unconventional author, the editor often adds a sentence such as the following:

> "Failure to comply with instructions may delay publication. "[7]
>
> "Manuscripts submitted for editorial consideration can be processed expeditiously if they conform from the outset to the style of the Journal. Authors are therefore advised to follow closely the form described in these instructions."[19]
>
> "The usual plan, a short summary, introduction, material and methods, results, discussion, and references should be followed wherever possible."[9]

Scientific literature differe from literary literature in purpose, form and style.[16] The purpose of science is to describe and explain phenomena, human and non-human, in a publicly testable manner, while the purpose of literary literature is to describe the private world of human beings so as to draw attention to human values. Scientific literature is baaed on data, usually aonsisting of measurements, and the method of collecting the data is explicitly described so that others may repeat the work if they wish. Literary literature, on the other hand, is qualitative and vague, and no one is expected to go and check on the characters and events of the story, but the literary work is meant to affect the reader's perception of human values. Scientific literature has evolved a format and style which seek to ensure that the writer confines himself strictly to describing, in a restrained, objective, impersonal way, the work he has done, and the written piece is often provided with a summary so as to place the work in sharp focus. Literary literature has no set format and usually no summary; its style is warm and personal. The heart of the matter is that scientific literature deals with the public world whose delineation needs measurements and its purpose is to uncover natural laws, that is, natural patterns and relationships and to propose testable hypotheses which seek to explain these natural phenomena; while literary literature deals with the private world of mankind whose delineation depends mainly on feelings and its purpose is to clarify human values.

Nevertheless both scientific literature and literary literature use language as their medium of expression and communication. The first desideratum about any piece of writing, whether literary or scientific, is of course that the writer must have something worth saying. A second desideratum is that the writing should be clear and simple. Literary writers make further suggestions in this second category of desiderata. Tolstoy's criteria of good writing and indeed of any good art were lucidity, individuality and sincerity.[29] These are excellent criteria for scientific papers too, with the word 'individuality' denoting newness and originality, and 'sincerity' denoting honesty and also the custom that a paper which is submitted for publication in one journal should not be, or have been, published elsewhere. Somerset Maugham wrote:

> "On taking thought it seemed to me that I must aim at lucidity, simplicity and euphony. I have put these three qualities in the order of importance I assigned to them. There are two sorts of obscurity that you find in writers. One i due to negligence and the other to wilfulness. People often write obscurely because they have never taken the trouble to learn to write clearly. This sort of obscurity you find too often in modern philosophers, in men of science, and even in literary critics.. (wilful obscurity is) the habit of setting down one's impressions in all their original vagueness. Fools can always be found to discover a hidden sense in them. There is another form of wilful obscurity that masquerades as aristocratic exclusiveness. The author wraps his meaning in mystery so that the vulgar shall not participate in it."[22]

Need one add that the manuscript should be neat? The Journal of the Rubber Research Institute instructs the author that the script should be "free of corrections and/or alterations".[20]

While the first and second desiderata mentioned above apply to any kind of writing, the third desideratum to be described now, applies peculiarly to the scientific paper. It consists in fitting the writing, as far as possible into a mould whose component sections typically are:- Title of paper, author's name and address, abstract, introduction, methods, results, discussion (with conclusions), acknowledgements, and references. The 'title', or name of the paper, tells the reader in a single phrase what the work was about. The 'author's name and address' answer the questions, Who did the work and where was it done? The 'abstract' is a resume of the paper. Along with the title, it assumes particular importance because the first line of scientific journals today consists of the indexing and abstracting services of the world. If we ever hope to enter our journals into world scientific abstracting journals, we must perfect our abstracts. The 'introduction' in the paper answers the question, Why? Why was the work done? Whencesoever did it come? The section on 'methods' answers the question, How? How was the work done? What materials were used and in what way? The 'results' section answers the question, What? What were the actual data? The 'discussion' section answers the question, Whither? Whither do the results lead? What conclusions can be drawn from the results with due attention to what was known already from previous work on the subject? What lines of inquiry are opened up for the future? The 'acknowledgements' give credit for help received. The 'references' give the names of the authors, books and papers that have been cited in the text. These various sections have become more or less indispensable in scientific papers. The order of presentation is clear, logical and simple. A different mould may be more appropriate for technological papers. Mathematical papers are in a class by themselves; they are not called 'scientific papers'. Technological papers often go straight into a description of the technological process, such as the building of a machine or a dam, that has been accomplished, without having to describe results or to discuss its strength and weaknesses and where it fits into the past or future. Natural history papers are often long descriptions of patient observations of organisms and their behaviour. Even in the scientific paper proper, we see variants in the order of the main sections and even in the naming of the main sections. Spolia Zeylanica has a notice to contributors according to which the suggested sections are:- Title, Author's name and qualifications, Number of illustrations, Table of contents, Introduction, Acknowledgments of assistance, The subject matter, Summary, Conclusions, References.[27]

The first desideratum of writing being that of having something new to say, the heart of a scientific paper is its 'results' section along with the 'methods' section. These are the most central and most impersonal and objective parts of the paper. The 'introduction' and 'discussion' sections are more deeply coloured by the author's personal opinions, strengths and limitations. The author sitting down to write his paper would be well advised to begin at the middle, that is, to prepare his 'results' section first. The editor, and the careful reader, of a paper too may be well advised to study the 'results' before reading the introduction or discussion or even the abstract. The 'results' consist of facts and figures, the most superior form of these being numbers. Measurements are made in numbers. They are then boiled down into a derived, concentrated set of statistical numbers such as averages, scatters, and significances. These summarised sets of numbers are usually displayed in tables. Numbers reign supreme. Graphs and diagrams supplement them where appropriate but they do not supplant them. When numbers and words fail to convey an adequate description of some new object or scheme, an illustration may be appropriate. Illustrations are expensive to print, and an editor may warn that they are acceptable" only when the descriptions provided in the text are inadequate".[20]

The 'introduction', sometimes called 'prefactory*, describes the background to the author's work. He points out the gap in knowledge which his work is intended to fill. The description is short and cool. To keep it short, the author cites only the most relevant and unavoidable references. A review of the literature is out of place. At the same time, he must cite something, so that the reader may be assured that the author is above the level of a romantic amateur. If there is no literature which the author can cite, he must say so. In order to keep the introduction cool, the author avoids personal details, unless they shed some particular light on the subject or unless they add a touch of colourful warmth without the slightest tinge of vainglory or bitterness. Writing in the cool often takes the form of impersonalness, the word 'I' being avoided by the use of the passive voice.

The 'methods' section strikes a middle path between describing details which are available in books or papers and remaining silent on details which the reader wishes to know. The reader's wish to know arises from the fact that he judges the 'results' from the 'methods': poor methods must yield poor results. It also arises from the fact that the reader may wish to repeat the author's work, or to extend it. He must know what to do and he must be saved the trouble of having to write for details or to visit the author's laboratory. The 'methods* section is sometimes called 'experimental' but this usage ignores the fact that there are acceptable methods which are non-experimental, such as the survey method. The Journal of the National Science Council of Sri Lanka uses the term 'experimental' but publishes survey papers too. The 'methods' section is often also called 'materials and methods'. This is reminiscent of the practice in school practical manuals where the materials are specified in a list so that the laboratory assistant could easily assemble them together while the pupils could then use them in carrying out the 'method' in the practical class.

The 'discussion' seeks to show the place of the author's work in the body of science. To discuss a subject is to deal with and around it, to examine it and sift and debate. The author can have his say and this is the only place in the scientific paper where he can do so. The debating must be impersonal and confined to the niche in the body of science into which the author hopes his work will enter. One of many possible discussion schemes which the author may adopt is as follows:- first, he shows where his results confirm previous results, where they refute, and where they are so new that others will have to confirm or refute them. Secondly, he discusses the interpretation of the results. What hypotheses do they suggest? Do they support a hypothesis he had in mind? Do they confirm or refute previous hypotheses, or do they suggest a new hypothesis? Throughout the discussion he cites the literature. Thirdly, he draws his conclusions from his results and ideas in relation to those of others. Fourthly, he may indicate possible extensions of the work. These sometimes, especially in technological papers, take the form of recommendations. The Journal of the Rubber Research Institute of Sri Lanka pithily describes the 'discussion' as being 'the writer's interpretation of the reasons for the observations made' and the 'conclusions' as 'the writer's interpretation of the meaning of the results'.[20]

A 'summary' must follow the 'discussion' if the paper has no 'abstract'. The 'summary' says everything that has gone before into the paper in the shortest possible form. The 'introduction' and 'methods' are summarised in one or two sentences. The results' are summarised in one to four sentences. The 'discussion' is summarised by condensing its conclusions into one sentence, and, if appropriate, the possible significance of the work is summarised in another sentence. The ideal summary therefore has about six sentences and no tables or drawings or references. In any case it should not exceed about 200 words. The Journal of the Rubber Research Institute of Sri Lanka is somewhat more accommodating: the length of the 'summary' is allowed to be up to three per cent of the length of the paper. They describe the summary as being 'a clear and factual synopsis of the paper, complete in itself without reference to the paper, in that it should not be a collection of sentences from the paper'.[20]

This is the usage which we referred to earlier as being necessary if we wish to enter our material into the world abstracting journals, The summary or abstract must of course be in English. The placing of the abstract at the top of the paper also makes it easier for the reader who uses it to judge whether to read the rest of the paper.

The term 'abstract' is used variously. In one usage it is synonymous with 'summary'. Thus the Ceylon Geographer states that the abstract should give 'a concise summary of the content, including both major and minor points' in less that 100 words.[5] In a second usage it is still synonymous with a good summary but it is placed at the head of the paper, between the author's name and the introduction. The Sri Lanka Veterinary Journal places the 'summary' at the head of the paper and calls it 'summary'. In a third usage, where the abstract appears in a book of the abstracts of proceedings without the scientific paper of which it is a part, the abstract is meant to indicate what the full paper promises to contain. Such an abstract may be bigger than one that is printed along with the paper. It contains references and it may even contain a highly condensed table. The communications given at the annual session of the Sri Lanka Association for the Advancement of Science (SLAAS) and the Kandy Society of Medicine (KSM) are published as abstracts.[23,24] The SLAAS asks for abstracts of papers to be read and calls them 'summaries' in their publication.

Let me paraphrase the points I made about a good summary because they apply exactly to the 'abstract' too. The abstract consists typically of the following parts:-

One part of one sentence summarising the 'introduction'.
One half-sentence to two and a half sentences summarising the 'methods'.
About four sentences or less summarising the 'results'.
One sentence summarizing the conclusions.
All the sentences form a single paragraph. No table or illustration is allowed. The total number of words should be about 150, or about 25 words per sentence in a six-sentence abstract.

The type of abstract described above us called 'informative'. It has a certain quality of wholeness, so that the reader who cannot read the whole paper still gets a pretty rounded idea of the work. Another type, called 'indicative', merely gives an indication of what was done without any statement of conclusions or any detail of method and results. The 'indicative' type of abstract may be pardonable for a long paper. A third type of abstract has been called the 'useless' abstract: this is an abstract which is too short and too vague to be of any use as an abstract.[31]

The 'acknowledgements' section gives thanks where they are due, and with due restraint. Donors of research grants and apparatus must be mentioned, individuals who went out of their way to give material help in advising and in checking deserve mention. Acknowledgements are of course not the same as flattery.

The 'references' are cited systematically. Editors often specify the system which they favour. This is most often the Harvard system where the citation in the body of the text gives the cited individual's name and the year of publication. Another system is to cite with superscript numbers, without name and date, in the body of the text. This plays down the name cult but induces anxiety in the author in that, if he finds it desirable to add another citation to his text, his whole set of numbers may have to be re-done. The reference list itself is set out in a definite way. A typical pattern for citation of a paper is:- Author's name, date, title of paper, name of journal, volume number, page numbers. There are numerous variants of this pattern. The title of the paper may be insisted upon, as the Tea Quarterly does, or it may be omitted and the reader must then find it by fetching the referred-to journal from the library. The journal name is sometimes written in full, but more often it is abbreviated in a standard way, just as doctors write their prescriptions in a standard abbreviated way, and there is a learned mystique about these things, which is relished by the initiated.

The 'title' of the paper must strike a balance between excessive shortness and ambiguity on the one hand and excessive length on the other. It usually consists of a single phrase, not a sentence. The single phrase mentions the subject or topic. It may in a few cases also mention the method or the conclusions or both. The words in the title are official ones rather than purely popular ones. Occasional exceptions occur and may even be delightful. One of the earliest local scientific papers[26], published in the first issue of the Journal of the Ceylon Branch of the Royal Asiatic Society in 1845, was entitled 'On the ravages of the Cooroominea, or cocoanut beetle'.[6]

The author's name is placed just beneath the title of the paper. Great ancient works of art and technology have gone unsigned. Government technical reports still go unsigned. But the scientific paper is a signed paper. The Ceylon Government itself instituted the Ceylon Journal of Science in 1924 and published it until 1942 when it was handed over to the University of Ceylon. All the papers in the Ceylon Journal of Science were signed by the authors. Several reasons may be given for the practice of signing scientific papers. The Ceylon Journal of Science was founded 'in order to provide facilities for the publication of papers dealing with scientific researches which are being carried out in Ceylon by Government officers and others'.[8] The motivation to write a paper and therefore to work is enhanced by signing the paper. We may suppose that scientists, like others, love to see their name in print. More seriously, responsibility for the work can be fixed upon the author when he is named. Personal credit can be given to the author; the paper he writes and gets published in a scientific journal adds to his curriculum vitae and his chances of rising in the job market, and of winning prizes at national and international level. This credit system relies on its experience that, in the long run, errant individuals will be found out. Multiple authorship is common. It may or may not add to the quality of the work. The order in which the names are placed in a multiple-authorship paper is left to the authors themselves. They have a choice between a plain alphabetical order, which may make X,Y and Z envious of A,B and C, and a merit order, which lists the chief contributor first and the smallest contributor last in some more or less democratic way. Hanging on is not encouraged, The Ceylon Medical Journal specifies that "authorship should be limited to direct participants; technical assistance can be acknowledged as a footnote".[9]

A 'postscript' is occasionally added when some important new material has turned up between the writing of the paper and its publication. The postscript is usually placed at the end of the paper before the 'acknowledgements' section or the 'references' section.

Journals differ in their practice of providing instructions to contributors. Some journals provides none. I have found none in such issues as I have seen of some local scientific journals such as Agricultural Engineering. It may be that this type of journal caters to the needs of a specialised professional body whose members know all about scientific papers and prefer to publish abroad when occasion arises. The editors then have to beg for papers and far be it from them to try to instruct their writers. Examples of specialised society journals are:-

Agricultural Engineering, the journal of the Agricultural Engineering Society of Sri Lanka, which consisted of some 30 members when vol.1, no.1 appeared in July 1977.

Engineer, the journal of the Institution of Engineers, Sri Lanka, begun in 1973. The editor wrote: "Past experience has shown that it requires personal inducement to get one to put down one's thoughts and experiences on paper. Therefore, we request the senior engineers in charge of various departments, both in the public and private sectors, to encourage the younger engineers in their charge to write up for publication any interesting work they have been engaged on, for the benefit of the others. We also appeal to those eminent men who have hitherto been publishing their work in reputed foreign journals only, to publish some of their work in our local journals, too. It is hoped that as momentum is gathered, it will keep rolling on without much prodding".[13]

Jalavrudhi, journal of the Irrigation Department, primarily for engineers in the Irrigation Department and related organisations. The editor woos potential contributors:- "Have you come across a peculiar problem in design, or construction which you have solved successfully, or not found a solution? Have you devised a design method which you think other engineers will benefit by knowing? The Editor is interested in you".[17]

(The Ceylon Journal of Sciehce did not beg. It chose to wait until enough papers turned up to fill an issue.

Publication was therefore irregular but this was accepted as being inevitable).
Journal of the National Agricultural Society of Ceylon.
Journal of the Sri Lanka Meteorological Society.
Tappos, published by the Technologists' Association of Pulp and Paper of Sri Lanka.

Another reason for dispensing with a statement of guidelines is the variety of disciplines which may be entertained by a journal. "The Ancient Ceylon being a journal to which papers are contributed by various writers within and outside the Department of Archaeology, it is not possible to adhere to a uniform method of editing, presentation of notes, variation of types, method of reference, etc. Consequently each paper in this issue appears as prepared by the author".[1] The first issue of the Journal of the Ceylon Branch of the Royal Asiatic Society contained a fine piece of encouragement to enthusiasts:- "And if there is any one who would willingly come forward as the friend of the Society, but is unacquainted with the technicalities of science and the set words of art, I say, let him lay these aside, as David did the armour of Saul, and let him send his communications in the way he is most familar with".[18] The Tropical Agriculturist, which gives no directions to authors, used to state that it "enjoys a world-wide circulation. It is the premier Journal on Tropical Agriculture and reaches all classes of agriculturists".[30]

Freedom of speech is highly valued but it has its limitations. A journal that is run from a government department may feel obliged to point out that statements which go contrary to government policy may need to be screened. Thus the Sri Lanka Forester, which is the journal of the Forest Department, warned that "criticisms of Government policy or other Government Departments will not be published without the prior approval of the Secretary, Ministry of Agriculture & Lands".[28] The Sri Lanka Forester is also unique in that each issue carries a quotation from the Buddha:- "The forest is a peculiar organism of unlimited kindness and benevolence that makes no demands for its sustenance and extends generously the products of its life activity: it affords protection to all beings, offering shade even to the axeman who destroys it".

Some journals publish a detailed set of instructions to contributors. A journal that is sure of its clients may afford to lay down detailed rules, and it may provide for contingencies by putting in a saving clause that non-conformist authors who have otherwise some merit may still be accommodated without forcing the editor to engage himself in prolonged negotiations and correspondence or to re-write the paper himself. The Journal of the National Science Council of Sri Lanka gives four pages of 'instructions to contributors' in each of its half-yearly issues. It says: "The following pattern is suggested for Research Papers: (a) Introduction (b) Experimental (c) Results (d) Discussion (e) Conclusions (f) Acknowledgements (g) References. In many cases, two of sections (b) (c) and (d) can be combined". The Journal even numbers the sections in the papers which it prints: 1. Introduction; 2. Experimental; 3. Results; 4. Discussion; 5. Conclusions. The sections on Acknowledgements and References are not numbered. The Journal does not mean to apply such a mould to all research papers. Thus it publishes mathematical papers whose sections typically are: Introduction, Statement of Theorem, Proofs. Acknowledgements and References are not numbered. The Journal of Rubber Research Institute of Sri Lanka gives two-and-a-half pages of guidelines for authors.

What can he done to overcome the disadvantages of editorial over-prescription of format and style for scientific papers on the one hand and under-prescription on the other? The disadvantages of over-prescription are those of the Procrustean bed, of Hyperion to a Satyr, and of a Voice in the Wilderness. The disadvantages of under-prescription are that novitiates may feel lost while the veterans may give headaches to the editor. One Lankan editor wailed: "The editor's task is not an easy one. His work is often exasperating and only occasionally exhilarating".[2] Perhaps a solution is to produce a guide booklet which would describe standards as well as acceptable variants. There are many works of international standard which deal with scientific and technical writing.[4,12,15,21,25] The UNISIST document Guidelines for editors of scientific and technical journals[31] is excellent; it is compact and yet full of examples. The proceedings of the present seminar will have material that is specially relevant to Sri Lanka. Perhaps we could add to it an annotated list of Lankan scientific and technical journals. This section may need frequent revision because the journal scene is kaleidoscopic: many journals die young. The dead or hibernating list includes the Bulletin of the Ceylon Institute of Scientific & Industrial Research, Ceylon Journal of science, section E (meteorology), F (chemistry, physics and mathematics), G (anthropology, archaeology, ethnology), H (engineering), K (geography, geology and mineralogy),[8a] Gazette of the Peradeniya medical school, Journal of the Ceylon Institute of Architects, Orchidologia zeylanica, State engineer, and a whole lot of Sinhala and Tamil journals. Even Gupta gaveshana, a journal on astrology, sorcery and talismanic rituals has perished.[14]

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INTERNATIONAL STANDARDS, QUANTITIES AND UNITS, SYMBOLS, TERMINOLOGY AND NOMENCLATURE FOR USE IN TECHNICAL WRITING

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1 Introduction

Scientific papers, reports, and journals form one of the major sources of scientific and technical information and many centres exist for their widespread dissemination. The growth in volume and use of published technical information has necessitated the adoption of standard practices that will aid in their interpretation and understanding and will facilitate their processing through information systems.

The purpose of this paper is to provide information to those concerned with scientific and technical writing (authors and editors), on international standards and other relevant aspects which have gained acceptance at international level, covering quantities, units, symbols, terminology and nomenclature.

The International Organization for Standardization (ISO) which is the recognized international agency for the development of international standards, has published several international standards in this field. Special mention is made of the following international standards.

ISO 31 - Quantities, units and symbols (Parts 0 to 13)

ISO 1000 - SI units and recommendation for the use of their multiples and certain other units.

ISO 5966 - Documentation - Presentation of Scientific reports.

The Bureau of Ceylon Standards has published the following standards based on ISO 31 and ISO 1000.

SLS 83 : 1975 - Rules for the use of SI units.

CS 84 : 1969 - Basic quantities and units of SI. (Parts 0 to 7).

2 Quantities and Units

2.1 Physical quantity, unit and numerical values

Physical quantities are used for the quantitative description of physical phenomena. Quantities may be grouped together into categories of quantities which are mutually comparable. Lengths, diameters, distances, heights, wavelengths, would constitute one category. If a particular quantity out of such category is chosen as a reference quantity called the Unit, then any other quantity from this category can be expressed in terms of this unit, as a product of this unit and a number.

Example:
The wavelength of one of the sodium lines is $= 5.896 \times 10^{-7}$m
where,
 is the symbol for the physical quantity:wavelength,
m is the symbol for the unit length:metre,
5.896×10^{-7} is the numerical value of the wavelength expressed in metres.

We can write this as
Physical quantity = numerical value x unit.

2.2 Equations between quantities

Two or more physical quantities cannot be added or subtracted unless they belong to the same category of mutually comparable quantities.

Physical quantities are multiplied or divided by one another according to the rules of algebra.

Physical quantities are related to one another through equations that express laws of nature and/or define new quantities.

Example:
A simple equation between quantities is

$$v = l/t \quad \text{----------------(1)}$$

in which letter symbols denote the totality of physical quantities (i.e. numerical value x unit). This is independent of the choice of units.

Where,
l is the distance travelled by a particle in uniform motion in a time interval t
and
v is the velocity of the particle
if $l = 6$ m
$t = 2$ s
then

$$v = \frac{l}{t} = \frac{6\ \text{m}}{2\ \text{s}} = 3\ \text{m/s}$$

However, if we choose kilometre per hour, metres and seconds as units for velocity, length and time, we derive the following equation between numerical values.

$(v)_{km/h} = 3.6(l)_{m}/(t)_{s}$ --------------(2)

The number 3.6 results from the particular units chosen.
(1) is an equation between physical quantities independent of the choice of units. (2) is an equation between numerical values which is no longer independent of the choice of units. In equations between numerical values, the units used should always be indicated. Equation (1) is preferred and (2) is not recommended for use.

2.3 Unit systems

Units for physical quantities may be chosen arbitrarily, but making an independent choice of a unit for each quantity would lead to the appearance of additional numerical factors in the equation between numerical values.

In practice it is more convenient to choose a system of units in such a way that equations between numerical values have exactly the same form (including the numerical factors), as the corresponding equations between the quantities. A unit system defined in this way is called coherent with respect to the system of quantities and equations in question.

The International System of Units, SI (from the French System International d'Unites) is such a system.

2.4 SI Units

This system includes three classes of units :

- Base units
- Supplementary units
- Derived units

which together form the coherent system of SI units.

BASE UNITS

Quantity	*Name of base unit*	*Unit symbol*
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

SUPPLEMENTARY UNITS

Quantity	*Name of supplementary unit*	*Unit symbol*
plane angle	radian	rad
solid angle	steradian	sr

DERIVED UNITS

Units for other physical quantities may be expressed in terms of the base units.

Examples :

Quantity	*Symbol for SI unit expressed in terms of the 7 base units (and the supplementary units in some cases)*
velocity	m/s
angular velocity	s^{-1} or rad/s
force	$kg \cdot m/s^2$
energy	$kg \cdot m^2/s^2$
entropy	$kg \cdot m^2/(s^2 \cdot K)$
electric potential	$kg \cdot m^2/(s^3 \cdot A)$
permittivity	$A^2 \cdot s^4/(kg \cdot m^3)$
magnetic flux	$kg \cdot m^2/(s^2 \cdot A)$
illuminance	$cd \cdot sr/m^2$
molar entropy	$kg \cdot m^2/(s^2 \cdot K \cdot mol)$
Faraday constant	A.s/mol
relative density	1

For some derived units, special names and symbols have been adopted. A list of such units is given in Annex 1.

SI PREFIXES

In order to avoid large or small numerical values, decimal multiples and submultiples of the SI units are added to the coherent system within the framework of the International System of Units.

Factor	*Prefix*	*Symbol*
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10	deca	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	µ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

2.5 Recommendations for writing SI units.

2.5.1 Unit symbols should be written after the complete numerical value, leaving a space between the numerical value and the unit symbol.

2.5.2 The symbol of a prefix is considered to be combined with the single unit symbol to which it is directly attached, forming with it a new symbol. Symbol for prefixes should be written without space between the symbol for the prefix and the symbol for the unit.

2.5.3 Prefixes should not be used in combination.

2.5.4 Unit symbols should remain unaltered in the plural.

2.5.5 Unit symbols should be written without a final full stop except for normal punctuation (at the end of a sentence).

2.5.6 Unit symbols should generally be written in lower case letters except that the first letter is written in upper case when the name of the unit is derived from a proper name. Ampere - A, Kelvin - K

2.5.7 Symbols for units are used only in conjunction with numbers. Otherwise the name of the unit should be spelled out. Eg. 10 cm^2, a few square centimetres.

2.5.8 When a compound unit is formed by multiplication of two or more units this may be written as

N.m N m

NOTE - The last form may also be written without space provided that special care is taken when the symbol for one of the units is the same as the symbol for a prefix.

Example : mN mean millinewton and not metre newton.

2.5.9 When a compound unit is formed by division, the division may be written in one of the following ways:

$\frac{m}{s}$ m/s ms^{-1} $m.s^{-1}$

2.5.10 The internationally recognized symbol for the litre is l. It is often difficult and sometimes impossible to distinguish between the letter l and numeral 1. In contexts where this can lead to confusion or misunderstanding it is advisable to spell out litre in full rather than use its symbol. The letter symbol L has also been tentatively accepted for the unit litre.

For further details on SI units, International Standard ISO 1000 should be consulted.

3. SYMBOLS

3.1 Symbols for physical quantities

Recommended symbols for physical quantities are contained in International Standard ISO 31, which has been issued in several parts dealing with quantities and units in various fields of science and technology. A complete list of parts of ISO 31 is given in Annex 2.

These normally consists of single letters of the Latin or Greek alphabet, sometimes with subscripts or other modifying signs, which are used to represent the quantities concerned, especially in equations showing relations between them.

Examples :

electric current at time t...........I_t
heat capacity at constant pressure...C_p
pressure at different locations......p_1, p_2, p_3
heat capacity at constant pressure...$C_{p,B}$
of substance B

Letters used for this purpose whether Latin or Greek, capital or lower case are to be printed in Italic (sloping) type

A selected list of internationally recommended (ISO 31) symbols for physical quantities, extracted from British Standard BS 1991: Part 1 is given in Annex 3.

3.2 Unit symbols

Standardized symbols for SI units are indicated under section 2.4. SI units with their multiples and submultiples are recommended for use. There are certain units outside the SI which are used in science and technology. Symbols for these units have gained wide acceptance throughout international science and unnecessary deviation from them should be avoided. A selected list of unit symbols extracted from BS 1991:Part 1 is given in Annex 4.

3.3 Symbols denoting mathematical operators and constants

Standardized symbols for mathematical operators and constants have been covered in ISO 31 Parts 11 and 12. A selected list of these symbols extracted from BS 1991:Part 1 is given in Annex 5.

3.4 Decimal marker

In the matter of decimal marker it has not yet proved possible to achieve effective international standardization. European and many other countries use the comma as the decimal marker. ISO also uses comma as the decimal marker. UK, USA and other English-speaking countries use the point as the decimal marker. To improve the possibility of eventual international harmonization it is recommended that when the point is used in English text it should be placed on the base line.

It is recommended that to facilitate the reading of numbers consisting of more than four digits on either side of the decimal marker, these numbers may be separated into groups of three counting from the decimal sign towards the left and the right. The groups should be separated by a small space but never by a comma or a point. This will lead to confusion.

Example :

The number 8.532,674 would be read as
$8\ 532\ 674 \times 10^{-6}$ in English speaking countries
$8\ 532\ 674 \times 10^{-3}$ in other countries.

This number should be written as
8.532 674

3.5 Symbols for Chemical Elements

Symbols for chemical elements have been standardized by the International Union of Pure and Applied Chemistry (IUPAC). This list is contained in ISO 31 Part 8 1980.

The following recommendations have been made with regard to these symbols:
Symbols for chemical elements should be written in roman (upright) type. The symbol is not followed by a full stop.

Examples :

H He C Ca

The attached subscripts or superscripts specifying a nuclide or molecule should have the following meanings and positions:

The nucleon number (mass number) of a nuclide is shown as a left superscript, for example

^{14}N

The number of atoms of a nuclide in a molecule is shown in the right subscript position, for example

$^{14}N_2$

The proton number may be indicated in the left subscript position, for example

$_{64}Gd$

If necessary a state of ionization or an excited state may be indicated in the right superscript position.

Examples :

State of ionization : Na^+, PO_4^{3-}

Electronic excited state : He^*, NO^*

Nuclear excited state : $^{110}Ag^*$ or $^{110}Ag^m$

4 TERMINOLOGY AND NOMENCLATURE

Standardized terminology and rules for nomenclature in different fields and disciplines have been established by recognized international bodies responsible for various disciplines of science and technology. There are several International Standards on terminology and nomenclature covering specific fields of science and technology. These have been prepared by various technical committees of the ISO. A list of these cannot be given in this paper. For details the catalogue of International Standards should be consulted. Terminology and nomenclature used in scientific papers and journals should be those which have gained acceptance in the particular field of science or technology and such terms and symbols will be readily understood by the expected readership. Specific references cannot be given in this paper for the purpose. Every editor must be familiar with the terminology and rules of nomenclature pertaining to his particular field of science.

5 USE OF ABBREVIATIONS

Abbreviations are used in text to avoid the tedious repetition of expression in full. Each abbreviation is normally followed by a point to indicate that it stands for a word, but in contexts in which the abbreviation is so familiar as to make such an indication superfluous, the points may be omitted. When an abbreviated term is first used in text it is advisable for clarity to give the name of the term first followed by its abbreviation in parenthesis.

6 REFERENCES

1. ISO 31 Quantities, Units and Symbols (Part 0 to Part 13)
2. ISO 1000 SI units and recommendations for the use of their multiples and sub-multiples.
3. ISO 5966 Documentation - Presentation of Scientific reports
4. ISO 1991 Letter, symbols, signs and abbreviations (Part 1 to Part 6)

ANNEX 1
DERIVED SI UNITS

Quantity	Special name of derived SI unit	Symbol	Expressed in terms of base or supplementary SI units or in terms of other derived SI units
frequency	hertz	Hz	1 Hz = 1 s^{-1}
force	newton	N	1 N = 1 kg·m/s^2
pressure, stress	pascal	Pa	1 Pa = 1 N/m^2
energy, work, quantity of heat	joule	J	1 J = 1 N·m
power	watt	W	1 W = 1 J/s
electric charge, quantity of electricity	coulomb	C	1 C = 1 A·s
electric potential, potential difference, tension, electromotive force	volt	V	1 V = 1 J/C
electric capacitance	farad	F	1 F = 1 C/V
electric resistance	ohm	Ω	1 Ω = 1 V/A
electric conductance	siemens	S	1 S = 1 $Ω^{-1}$
flux of magnetic induction, magnetic flux	weber	Wb	1 Wb = 1 V·s
magnetic flux density, magnetic induction	tesla	T	1 T = 1 Wb/m^2
inductance	henry	H	1 H = 1 Wb/A
Celsius temperature	degree Celsius	°C	1 °C = 1 K
luminous flux	lumen	lm	1 lm = 1 cd·sr
illuminance	lux	lx	1 lx = 1 lm/m^2

Derived SI units with special names accepted for the sake of safeguarding human health

Quantity	Special name of derived SI unit	Symbol	Expressed in terms of base units or derived SI units
activity (of a radionuclide)	becquerel	Bq	1 Bq = 1 s^{-1}
absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	1 Gy = 1 J/kg
dose equivalent	sievert	Sv	1 Sv = 1 J/kg

ANNEX 2

LIST OF INTERNATIONAL AND NATIONAL STANDARDS ON QUANTITIES,UNITS AND SYMBOLS

International Standards

ISO 31 : Quantities Units and Symbols.

- Part 0 : General principles concerning quantities, units and symbols.
- Part 1 : Quantities and units of space and time.
- Part 2 : Quantities and units of periodic and related phenomena.
- Part 3 : Quantities and units of mechanics.
- Part 4 : Quantities and units of heat.
- Part 5 : Quantities and units of electricity and magnetism.
- Part 6 : Quantities and units of light and related electro-magnetic radiations.
- Part 7 : Quantities and units of acoustics.
- Part 8 : Quantities and units of physical chemistry and molecular physics.
- Part 9 : Quantities and units of atomic and nuclear physics.
- Part 10: Quantities and units of nuclear reactions and ionizing radiations.
- Part 11: Mathematical signs and symbols for use in the physical sciences and technology
- Part 12: Dimensionless parameters.
- Part 13: Quantities and units of solid state physics.

ISO 1000 : SI units and recommendations for the use of their multiples and certain other units.

Sri Lanka Standards

SLS 83:1975 Rules for the use of units of the international system of units, and selection of the decimal multiples and sub-multiples of the S.I. units (1st revision).

SLS 84:1969 Basic quantities and units of S.I. (Part 1 to Part 7)

British Standards

BS 1991 : Letter Symbols, Signs and Abbreviations.

- Part 1 : General
- Part 2 : Chemical engineering, nuclear science and applied chemistry
- Part 3 : Fluid mechanics
- Part 4 : Structures, materials and soil mechanics
- Part 5 : Applied thermodynamics.
- Part 6 : Electrical science and engineering.

ANNEX 3

RECOMMENDED SYMBOLS FOR PHYSICAL QUANTITIES

Symbols for physical quantities are normally single-letter symbols of the Latin or Greek alphabet, capitals and lower case, and are to be printed in italic (sloping) type without a full point. In order to obtain additional flexibility, capital letters may be used as variants for lower case letters, and vice versa, if no ambiguity arises. Vector properties that quantities may have are not indicated in the symbols shown here. (For recommendations on the use of special founts, e.g. bold face and sans serif type, see section one, (ii).)
Where two or more symbols, separated by commas, are given for a quantity, these are alternatives for which no preference is expressed; where two such symbols are separated by a dotted line, those to the left are preferred

Quantity	Symbol
1. General constants*	
gravitational constant	G
speed of electromagnetic waves in a vacuum	$c \dots c_0$
elementary charge (of proton)	e
rest mass of electron	m
Planck constant	h
	$\hbar \quad h/(2\pi)$
Boltzmann constant	k
Bohr magneton	μ_B
Stefan-Boltzmann constant	σ
Rydberg constant	R
Avogadro constant	L, N_A
Faraday constant	F
molar gas constant	R
2. Mensuration	
length	l
distance along path	s, l
height	h
breadth	b
radius	r
diameter	d
area, area of surface	$A \dots S$
volume	V
angle, plane	α, β, γ, θ, ϕ, ψ etc.
angle, solid	Ω, ω
rectangular coordinates	x, y, z
spherical coordinates	r, θ, ϕ
cylindrical coordinates	r, ϕ, z
generalized coordinate	q

Quantity	Symbol
3. Kinematics	
time	t
period (time of one cycle)	T
time constant (of an exponentially varying quantity)	τ
frequency	ν, f
rotational frequency (number of rotations in unit time)	n
angular frequency	ω
wavelength	λ
attenuation length (of an exponentially decaying quantity)	l
wavenumber ($1/\lambda$)	σ
circular wavenumber ($2\pi\sigma$)	k
velocity	u, v, w
angular velocity	ω
acceleration	a
angular acceleration	α
local acceleration of free fall	g
damping coefficient	δ
logarithmic decrement	Λ
attenuation coefficient	α
phase coefficient	β
propagation coefficient ($\alpha + j\beta$)	γ
4. Mechanics	
mass	m
density	ρ
density, relative	d
momentum	p
force	F
weight	W
moment	M
pressure	p
work	W
energy (see also subsection 5, 'Electricity and magnetism')	E

* All the general constants in subsection 1 may be represented alternatively by the specified symbols printed in bold italics.

Quantity	Symbol
energy, kinetic	T
energy, potential	V
Lagrangian function	L
Hamiltonian function	H
power	P
efficiency	η
moment of inertia (second moment of mass)	I, J
radius of gyration	k
stress, normal	σ . . . f
stress, shear	τ . . . q
strain, linear	ε . . e
strain, shear	γ
strain, volume	θ
Young modulus	E
shear modulus; rigidity	G
bulk modulus	K
compressibility	κ
Poisson ratio	ν, μ
bending moment	M
torque	T
coefficient of friction	μ . . . f
viscosity (dynamic viscosity)	η . . . μ
kinematic viscosity	ν
surface tension	γ, σ
Mach number	(Ma) . . . M, M_a
Reynolds number	(Re) . . . R, R_e

NOTE. There are difficulties in the selection of a uniform symbolic notation for the wide range of dimensionless parameters in use. Of the systematic notations employed, that in which the symbol consists of two letters written in the form (Gr) for Grashof number, (Nu) for Nusselt number, etc., has been adopted in the hope that the use of a systematic notation will eventually be encouraged. This type of symbol is written here in parentheses to avoid confusion and to show that the symbol is to be treated as an entity. The parentheses may be omitted if the symbol does not appear as a factor in a product.

It is appreciated that the symbols M for Mach number and R for Reynolds number are widely established in fluid mechanics. These symbols are also included, though subject to the preference stated above for the double letter symbolism.

5. Electricity and magnetism

The symbols for the fundamental electromagnetic quantities marked * in this schedule may be printed alternatively in the bold type used for vectors, even when the directional character of these quantities is not to be emphasized. By this means the pressure on the use of the same letters required for other quantities may be relieved. (See section one.)

Quantity	Symbol
electric charge	Q
volume charge density	ρ
surface charge density	σ
electric field strength*	E
potential, potential difference, voltage	V . . . U
electromotive force	E
electric flux, flux of displacement	Ψ
electric flux density, displacement*	D
capacitance	C
permittivity	ε
permittivity, relative	ε_r
electric constant (permittivity of free space)	ε_0
electric susceptibility	κ_e, κ
electric polarization*	P, D_i
molecular electric dipole moment	p, μ
electric current	I
current density	J
magnetic field strength*	H
magnetomotive force	F, F_m
magnetic flux density, magnetic induction*	B
magnetic flux	Φ
magnetic vector potential*	A
self inductance	L
mutual inductance	M, L_{mn}
permeability	μ
permeability, relative	μ_r
magnetic constant (permeability of free space)	μ_0
magnetic susceptibility	κ_m, κ
magnetic mass susceptibility (κ_m/ρ)	χ
electromagnetic moment (magnetic moment)	m
magnetization ($B/\mu_0 - H$)*	M
magnetic polarization ($B - \mu_0 H$)*	J
Poynting vector*	S
resistance	R
conductance	G
resistivity	ρ
conductivity	γ, σ
reluctance	R, R_m
permeance	Λ
reactance	X
impedance ($R + jX$)	Z
susceptance	B
admittance ($G + jB$)	Y
energy (see also subsection 4, 'Mechanics')	W
power, active power	P
reactive power	Q
apparent power	S
phase displacement	ϕ
power factor (sinusoidal quantities only)	$\cos \phi$
dielectric loss angle	δ
number of turns in a winding	N

* See note at the head of Schedule B.

6. Light and other electromagnetic radiation

NOTE. The same symbol is often used for a pair of corresponding luminous and radiant quantities. Subscripts v for luminous and e for radiant may be used when it is necessary to distinguish these quantities.

Quantity	Symbol
Light	
quantity of light, luminous energy	Q
luminous flux	Φ
luminous intensity	I
luminance	L
luminous emittance, exitance	M
illuminance (illumination)	E
absorption factor	α
reflection factor	ρ
transmission factor	τ
linear absorption coefficient	a
refractive index	n
Radiation (other than light)	
radiant energy	Q
radiant power (radiant flux)	Φ
radiant intensity	I
radiance	L
radiant emittance	M
irradiance	E

7. Thermodynamics

Quantity	Symbol
temperature, thermodynamic	T
temperature, common	θ, t
quantity of heat	$Q \ldots q$
work	$W \ldots w$
internal energy	$U \ldots E$
specific internal energy	$u \ldots e$
entropy	S
specific entropy	s
Helmholtz function, (free energy)	$A \ldots F$
specific Helmholtz function	$a \ldots f$
enthalpy	H
specific enthalpy	h
Gibbs function	G
specific Gibbs function	g
heat capacity	C
specific heat capacity	c
specific heat capacity at constant pressure	c_p
specific heat capacity at constant volume	c_V
ratio c_p/c_V	γ
coefficient of thermal expansion, linear	α, λ
coefficient of thermal expansion, cubic	α, β, γ
thermal conductivity	λ, k
thermal transmittance*	U
Joule-Thomson coefficient	μ

8. Physical chemistry

Quantity	Symbol
atomic number, proton number	Z
relative atomic mass ('atomic weight')	A_r
relative molecular mass ('molecular weight')	M_r
number of molecules	N
amount of substance	n
stoichiometric number	ν
degree of dissociation	α
mole fraction	x
molecular concentration of component X	C_X
concentration†	c
concentration of substance X	c_X, [X]
molality‡	m
surface concentration	Γ
equilibrium constant	K
rate constant (of reaction)	k
activation energy (of reaction)	E
mean free path	l, λ
diffusion coefficient	D
osmotic pressure	Π
chemical potential	μ
absolute activity	λ
relative activity	a
activity coefficient (mole fraction basis)	f
activity coefficient (molality basis)	γ
osmotic coefficient	ϕ
charge number of ion	z
electrolytic conductivity	κ
molar conductance	Λ
transport number	t
electromotive force of voltaic cell	E
electrolytic polarization, overpotential	η
electrokinetic potential	ζ

* Heat flow rate divided by area and overall temperature difference.

† Amount of solute divided by volume of solution.

‡ Amount of solute divided by mass of solvent.

ANNEX 4

LIST OF SELECTED UNIT SYMBOLS

The following list has been selected to meet the broad requirements of users of this standard. Not all these units are recommended for continued use. Many are obsolescent and a few nearly obsolete; the purpose here is to show their correct letter symbols.

SI units, which with their multiples and submultiples are specially recommended for use, are indicated by plus signs (+) at the left-hand side of the table. For information on SI units and their use BS 3763 and PD 5686 should be consulted.

The list is not extended to include compound or prefixed unit symbols, except for a few particular examples. Reference should be made to BS 350 : Part 1 for definitive or quantitative information on most of the units listed and for examples of widely used unit symbols for compound units. Symbols for units should be printed in roman (upright) type and should remain unaltered in the plural. They should be written without a full point. Almost without exception the unit symbols shown here are internationally standardized, and deviations are not recommended.

Symbols for the prefixes to provide decimal multiples and submultiples of SI and other metric units are listed at the end of this Schedule.

Unit	Symbol
+metre	m
+micrometre*	µm
ångström	Å
inch (see section one, page 2)	in
foot	ft
yard	yd
mile†	mile
astronomical unit	AU‡
parsec	pc
+square metre (similarly for square centimetre, etc.)	m²
are	a
hectare	ha
square inch (similarly for square foot, etc.)	in²
square mile	mile²
cubic metre (similarly for cubic centimetre, etc.)	m³
litre (see section one, page 2)	l
cubic inch (similarly for cubic foot, etc.)	in³
gallon	gal
+second (of time)	s
minute (of time)	min
hour	h
day	d
year	a
degree, minute, second (of angle)	° ′ ″
+radian	rad

* The alternative name 'micron' is no longer approved by CGPM.

† This refers to the statute mile (1760 yd). For the international nautical mile (1852 m) there is no CGPM-approved unit symbol, but ISO indicate 'n mile' as an abbreviation.

‡ Not internationally standardized. Sometimes UA is used.

Unit	Symbol
+steradian	sr
+radian per second	rad/s
+hertz	Hz
revolution per minute (similarly per second, etc.)	r/min*
gal (1 cm/s², used for acceleration of free fall)	Gal
+kilogram	kg
+gram	g
+megagram	Mg
tonne†	t
unified atomic mass unit	u
pound	lb
grain	gr
ounce (avoirdupois)	oz
hundredweight	cwt
ton	ton
+newton	N
dyne	dyn
kilogram-force‡ (similarly for gram-force, etc.)	kgf
poundal	pdl
pound-force (similarly for ounce-force, etc.)	lbf
+pascal (1 N/m²)	Pa
bar (10^5 Pa)	bar§
atmosphere, technical‖	at
millimetre of mercury (conventional)	mmHg
torr¶	Torr
+pascal second	Pa s
poise	P
+metre squared per second	m²/s
stokes	St
+joule	J
erg	erg

Unit	Symbol
kilowatt hour	kW h
electronvolt	eV
foot pound-force	ft lbf
calorie	cal
British thermal unit	Btu
+watt	W
horsepower*	hp
volt ampere	V A
reactive volt ampere (var)	var
Temperature units†	
+kelvin	K
degree Celsius‡	°C
degree Fahrenheit	°F
degree Rankine	°R
+coulomb	C
+ampere	A
+volt	V
+ohm	Ω
+siemens	S
+farad	F
+henry	H
+weber	Wb
+tesla	T
+candela	cd
+lumen	lm
+lux	lx
+mole	mol
+becquerel§	Bq
curie	Ci
+gray‖	Gy
rad¶	rad, rd**
röntgen	R
decibel††	dB
neper††	Np
hydrogen ion exponent††	pH

* Formerly shown as rev/min in British Standards. The symbol r is now being indicated by IEC for 'revolution'.

† Best called 'metric tonne' in speech, to avoid confusion with 'ton'.
1 t = 1 Mg.

‡ In Germany, the kilogram-force is named the kilopond (with symbol kp).

§ The internationally recognized unit symbol for the bar is the same as the unit name, and consequently mbar is the symbol for millibar. However, in meteorology, mb is commonly used for millibar.

‖ The *standard* atmosphere (symbol atm) should not be regarded or used as a unit, but as a reference pressure.
1 atm = 101 325 Pa (= 760 mmHg to within 1 part in 7×10^6)
1 at = 1 kgf/cm² = 98 066.5 Pa

¶ 1 Torr = 1 mmHg to within 1 part in 7×10^6

* This refers to the horsepower traditionally used in this country and now obsolescent. It does not refer to the 'metric horsepower', another obsolescent unit used on the continent of Europe; for the metric horsepower the symbol 'CV' is sometimes used in France, and 'PS' in Germany.

† The symbols for these units are now applicable to both *temperature* and *temperature difference or interval*, hence the quantity concerned needs to be separately stated if it is not clear from the context. The use of 'deg', i.e. degK, degC, degF, degR, specially to signify temperature difference or interval, is no longer recommended.

‡ Widely but incorrectly described as 'Centigrade'.

§ For activity of radionuclide, nuclear transformations per unit time
1 Bq = 1 s^{-1} 1 Ci = 3.7×10^{10} Bq

‖ For absorbed dose of ionizing radiation
1 Gy = 1 J/kg

¶ For absorbed dose of ionizing radiation
1 rad = 10^{-2} J/kg = 10^{-2} Gy

** The symbol rd may be used whenever confusion with the symbol for the radian (angular measure) appears possible.

†† Listed here for convenience, though not classifiable as units in the accepted sense.

ANNEX 5

RECOMMENDED SYMBOLS FOR MATHEMATICAL OPERATORS AND CONSTANTS

In this schedule, symbols for general constants and functional operators are printed in upright type, and for variables in sloping type. Where two or more symbols, separated by commas, are given for a quantity, these are alternatives between which no preference is expressed. Where symbols are separated by a dotted line, those to the left are preferred.

Term	Symbol
brackets (Printers describe [ ] as brackets, { } as braces and ( ) as parentheses)	[{ ( ) }]
plus	$+$
minus	$-$
plus or minus	$\pm$
a multiplied by *b**	ab, $a\ b$, $a \cdot b$, $a \times b$
a divided by *b**	$\frac{a}{b}$, a/b, ab^{-1}† ... $a \div b$
is equal to	$=$
is equal by definition to	$\stackrel{\text{def}}{=}$
is not equal to	$\neq$
is identical with	$\equiv$
corresponds to	$\triangleq$
is approximately equal to	$\approx$
is asymptotically equal to‡	$\simeq$
is proportional to, varies directly as	$\propto$
is greater than	$>$
is less than	$<$
is equal to or greater than	$\geqslant$
is equal to or less than	$\leqslant$
is much greater than	$\gg$
is much less than	$\ll$
parallel to	$\parallel$
perpendicular to	$\perp$
limit of *y*	$\lim_{x} y$
approaches *a*	$\to a$
infinity	∞
sum of	Σ
product of	Π
square root of *x*	$\sqrt{x}$, $x^{\frac{1}{2}}$, $x^{1/2}$
cube root of *x*	$x^{\frac{1}{3}}$, $x^{1/3}$
base of natural logarithms	e
logarithm of *x* to base *a*	$\log_a x$
natural logarithm of *x*	$\ln x$, $\log_e x$
common logarithm of *x*	$\lg x$, $\log_{10} x$
binary logarithm of *x*	$\mathrm{lb}\ x$, $\log_2 x$
antilogarithm	antilog
exponential function of *x*	$\exp x$, e^x
factorial *n*	$n!$
binomial coefficient, $\frac{n!}{p!\,(n-p)!}$	$\binom{n}{p}$
ratio of circumference to diameter of circle	π
trigonometric (circular) functions of *y*	$\sin y$, $\cos y$, $\tan y$, $\mathrm{cosec}\ y$, $\sec y$, $\cot y$
inverse trigonometric functions of *y*	$\arcsin y$, $\arccos y$, $\arctan y$, $\mathrm{arccosec}\ y$, $\mathrm{arcsec}\ y$, $\mathrm{arccot}\ y$
hyperbolic functions of *y*	$\sinh y$, $\cosh y$, $\tanh y$, $\mathrm{cosech}\ y$, $\mathrm{sech}\ y$, $\coth y$
inverse hyperbolic functions of *y*	$\mathrm{arsinh}\ y$, $\mathrm{arcosh}\ y$, $\mathrm{artanh}\ y$, $\mathrm{arcosech}\ y$, $\mathrm{arsech}\ y$, $\mathrm{arcoth}\ y$
function of *x*	$f(x)$, $\mathrm{f}(x)$, etc.
increment or finite difference operator	Δ, δ
differential coefficient of *y* with respect to *x*	$\frac{\mathrm{d}y}{\mathrm{d}x}$, $\mathrm{d}y/\mathrm{d}x$, $\mathrm{D}y$
differential coefficient, *n*th	$\frac{\mathrm{d}^n y}{\mathrm{d}x^n}$, $\mathrm{d}^n y/\mathrm{d}x^n$, $\mathrm{D}^n y$
differential coefficient, partial	$\frac{\partial y}{\partial x}$, $\partial y/\partial x$, $\mathrm{D}_x y$
integral of *y* with respect to *x*,	
indefinite	$\int y\,\mathrm{d}x$
from $x = a$ to $x = b$	$\int_a^b y\,\mathrm{d}x$
around a closed contour	$\oint y\,\mathrm{d}x$
complex operator satisfying the equation $i^2 + 1 = 0$	i, j
real part of complex number *z*	Re *z*
imaginary part of *z*	Im *z*
modulus of *z*	$\lvert z \rvert$
argument of *z*	arg *z*

* Here, *a* and *b* represent physical or algebraic quantities. For the multiplication of plain numbers, i.e. 123.4 and 567.8, the form 123.4 × 567.8 should be used. For the division of plain numbers the forms

$\frac{123.4}{567.8}$, 123.4/567.8, 123.4 ÷ 567.8, 123.4 × $(567.8)^{-1}$ and 123.4$(567.8)^{-1}$ are all valid.

Multiplication and division of unit symbols are treated on page 2.

† Or any of the other forms shown above for multiplying *a* and b^{-1}.

‡ The symbol ~ is frequently used in the UK to mean 'is asymptotically equal to', whereas in continental European and many other countries it has the meaning 'is proportional to', a meaning recommended by ISO.

Term	Symbol
complex conjugate of z	z^* (The asterisk is part of the symbol)
vector	$\boldsymbol{A}$ or $\boldsymbol{a}$, $\boldsymbol{B}$ or $\boldsymbol{b}$
unit vector, typical examples of	$\boldsymbol{e}_x$, $\boldsymbol{e}_y$, $\boldsymbol{e}_z$
magnitude of vector	$\lvert\boldsymbol{A}\rvert$ or A, $\lvert\boldsymbol{B}\rvert$ or B
scalar product	$\boldsymbol{A}\cdot\boldsymbol{B}$
vector product	$\boldsymbol{A}\wedge\boldsymbol{B}$, $\boldsymbol{A}\times\boldsymbol{B}$
differential vector operator, nabla	∇, $\frac{\partial}{\partial \boldsymbol{r}}$
gradient of ϕ	$\nabla\phi$, grad ϕ
divergence of A	$\nabla\cdot\boldsymbol{A}$, div $\boldsymbol{A}$
curl of A	$\nabla\wedge\boldsymbol{A}$, $\nabla\times\boldsymbol{A}$, curl $\boldsymbol{A}$, rot $\boldsymbol{A}$
Laplacian of ϕ	$\nabla^2\phi$
second order tensors	$\boldsymbol{S}$ or $\boldsymbol{s}$, $\boldsymbol{T}$ or $\boldsymbol{t}$
dyadic product of vectors	$\boldsymbol{A}\,\boldsymbol{B}$
contracted product of vector with tensor	$\boldsymbol{A}\cdot\boldsymbol{S}$
contracted product of two tensors	$\boldsymbol{S}\cdot\boldsymbol{T}$
doubly contracted (scalar) product of two tensors	$\boldsymbol{S}:\boldsymbol{T}$
average of several values of x	$\bar{x}$, $\langle x \rangle$
standard deviation (for a population)	σ
standard deviation (for a sample)	s
number in a sample	n
correlation coefficient (for a population)	ρ
correlation coefficient (for a sample)	r
range	w
probability	p

HOW TO WRITE A SCIENTIFIC PAPER FOR PUBLICATION

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Introduction

A Scientific paper in fact is a report which describes original research carried out on any particular subject. It is written to be published in a Journal and therefore must be presented in a special manner. The broad concepts of how to write for publication have been developed over the years. In addition to these basic requirements, which are similar for all scientific Journals, each of them usually has its own "house style" which it favours, eg. in the presentation of the abstract, summary and references. Therefore, it is necessary to keep to the format required.

It is generally accepted that a scientific paper should satisfy three essential requirements: it should contain sufficient information for a reader to (a) assess observations, (b) repeat the methods used, and (c) evaluate the thinking process that has gone into the study and the discussion resulting from it. DeBakey (1976) has put this very succinctly: "the contents of an article should be now, true, important and comprehensible".

The art of presenting a scientific paper is now well developed, and each paper should have in proper sequence the following sections: Title, Abstract or Summary, Introduction, Materials and Methods, Results, Discussion, Acknowledgements (if any) and References. This order of presentation is now so well developed that it is accepted by a great majority of Journals publishing scientific papers, and all new Journals generally adopt the same sequence as it is quite logical, and can be adopted for any discipline in science, whether it be biology, chemistry, economics or medicine.

Day (1979) states that this method of reporting becomes simple and logical when you answer four questions in order: (a) What was the problem? Your answer is the Introduction (b) How did you study the problem? Your answer is the Materials and Methods (c) What were your findings? Your answer is the Results (d) How do you interpret your results? Your answer is the Discussion. Then follows the Acknowledgements, which is a matter of courtesy and the Literature Cited.

The paper must be written in good, clear and easily understood language. This is most important, as good scientific work is often rejected by journals, as the reports on the subject are not written clearly so that they can be easily understood, even by the layman.

The Title

It is important to accept that you write to be read; therefore, from the beginning you must try to woo your reader. Remember that a great number of people will read the title of your paper; but only a few will read the full paper, and that only if the reader's interest is aroused by the title. So it is essential to write a good title, which can be defined as "the fewest possible words that describe the contents of the paper".

The title should give sufficient detail for a person scanning the contents page to know whether the paper will be of interest to him, eg. if the paper deals with a fungus, it should give the name of the organism, what aspect is being studied, and if it is a pathogen, what crop was affected. However, the title should never be too long and should not have redundant words such as "Studies on ..." or "Investigations on ..." obviously the report is on a study. Abbreviations, chemical formulae, proprietory names of drugs and coined words should not be used in titles. Finally the series title eg. "Studies on head injuries - 1 ..." is definitely taboo in current journals.

The abstract should not exceed 300 words, and should be a good summary of the paper presented, so that the busy reader can decide whether he should read the whole paper. Ray (1979) has described the ideal abstract as one that: "(a) states the principal objectives and scope of the investigation, (b) describes the methodology employed, (c) summarizes the results, and (d) states the principle conclusions".

The abstract as far as possible should be one paragraph, contain no information that is not in the text and should not have any literature references.

Writing the Introduction

The title and the abstract of a paper are best prepared after the full paper is written; but you should have a provisional title in mind, while writing.

The introduction is the first part of your paper and introduces the subject to the reader by stating the problem that you have set out to study. Then you should describe the available information on the subject, by reviewing the relevant literature, which should be brief and to the point. This is followed by an equally brief reference to the methods used, bearing in mind that a detailed description of the methods is to follow immediately after the introduction. There must then be a clear statement, usually in one sentence, to explain why you did the work described. Finally, you give the principal results of the investigation as concisely as possible.

You can see that everything you have referred to in the introduction and the sequence of presentation is logical, and this is important in reporting. You start by defining the problem; then you state what is already known about it in the literature survey; next, you say how you carried out the study, and finally your results and observations on them. The essence of good scientific writing is simplicity and a natural sequence of events, described in that way.

Description of Materials and Methods

Materials

This section must give a full description of the materials you used and the methods you adopted in the study. The most important requirement you must keep in mind when writing this section is that it should provide enough detail for any competent worker to repeat your study.

The materials used should be described in detail, eg. if you carried out a study on coconut sap, where, at what time of the day, and how you collected the material - how you carried it to the laboratory: in a refrigerated can or thermos flask or in a test tube, after treatment with a preservative - what you did with the sap when you brought it to the laboratory - did you leave it on a lab table or in a refrigerator? If any chemicals were used, their grade and quality must be given. These details are essential for someone who wishes to repeat your studies; as each treatment will alter the conditions of the experiment.

Methods

The methods are best described in chronological order, as they were carried out in the laboratory. If you used a new method, describe it fully; but if you used a modified method, already described by someone else, give the reference to the earlier work and describe only the modification fully. Remember the important requirement, to give enough detail to enable someone else to repeat your study.

Presentation of Results

Handling data

This is essentially a matter of presenting data, that you have obtained, in the best possible manner, so as to be meaningful to the reader and enables you to present your own point of view to best effect.

You should avoid the common error of starting the results section, by describing the methods you may have left out by error, from the previous section. The results section must present only the data you recorded; but never any interpretation of those results, which will follow.

One of the most important factors to remember here is that, your paper should present only some of the data that you recorded, not an endless succession of the results of hundreds of experiments that you repeated. Therefore, the data should be representative of the whole and never the whole. Thus selection and preparation of the selected data, for presentation to best effect, becomes all important.

Handling numbers

A large series of numbers can be handled in several ways: in Tables, Graphs or Histograms. In the great majority of cases, one of these methods should be selected and the presentation of the same data in both a table and a graph should be avoided, unless a series of numbers have to be presented to make a very important point, the table to show exact values and the graph to show trends. Generally, unrelated numbers are best presented in tables, and it is important to ensure that each table does not contain such a large number of figures that it becomes difficult for the most interested reader to follow. Therefore, only sufficient data to make the point that you wish to make, without tiring out the reader should be presented.

If the data show pronounced trends, which can be made into an interesting picture, clearly showing the trends, then such data are best presented in a graph. A reader can very easily grasp the significance of trends and relationships between lines presented in a graph: the visual effect always has a greater and more immediate impact on the reader. However, the cost of preparation and printing of graphs is much higher than for tables. Therefore, the decision to present data as a graph should be carefully considered.

Histograms too have a high visual impact and can be used to show similarities and differences between figures that do not show clear trend lines. However, like graphs, histograms are costly to produce, and should be used only when they are essential to make an important point.

The results should be presented as such, short and sweet, without any fanfare. If statistics are used to qualify the results, they must be meaningful, and not used merely to make the results look more profound. The simpler the results and their message, the clearer their impact: always strive for clarity and avoid making any interpretation of the results in this section.

Writing the Discussion

A lot of people can carry out high quality research work, especially if they are guided and supervised by a competent scientist. However, it takes a good research worker to interpret the significance of the results recorded. Therefore, the writer always considers the Discussion as the most important part of a research paper, and the hardest to write. Many papers are rejected by the editors of journals because of faulty discussions, even though the data presented in the paper may be both valid and interesting. The true meaning of the data in a paper may be completely misinterpreted in the discussion, and this will again result in rejection of the paper.

This section is so important that I should like to quote from Day (1979) the essential components of a good discussion, which he states should:

"1. Try to present the principles, relationships and generalization shown by the results. In a good Discussion, you discuss; but not recapitulate the results.

2. Point out any exceptions or any lack of correlation and define unsettled points.

3. Show how your results and interpretations agree (or contrast) with previously published work.

4. Discuss the theoretical implications of your

work, as well as any possible practical applications.

5. State your conclusions as clearly as possible.

6. Summarize your evidence for each conclusion."

Briefly stated, the purpose of the discussion is to inform the reader how you interpret the results, and what you think of their significance. To do this successfully, the writer must be widely read on the subject on which he has worked, and have a nimble mind that recognizes the relationship of different pieces of information. The discussions should end with a summary giving the significance of the full study.

Acknowledgements

The main text of the paper is now over, all that remains is to acknowledge the help or assistance you received from your colleagues, assistants or supervisors and thank those that provided financial aid for the work. Finally, if you worked part or full time in someone else's laboratory, this is the place to record your appreciation for the facilities provided. It is important to remember that the acknowledgements are a simple matter of courtesy, and the more sincerely you express your thanks the better it will read.

Literature Cited

It is necessary and correct to list only published references, which have a significant bearing on your work. References to unpublished data, personal communications and other material need not be listed in this section.

There are several methods of writing the list of references; all Journals have their own style and it is essential to adhere to the requirements given. The most favoured style of listing references is the Harvard system, where the name of the author is given first, followed by his initials, then the year of publications, in brackets; next comes the full title of the paper, the name of the Journal in which the paper is published, its volume number and the number of the first and last page on which the paper is published. Many journals use the abbreviations provided by the World List of Abbreviations for Journals, but a few have recently started publishing the full title of the Journal.

The preference of various Journals for a particular style of presenting the literature cited, makes it essential for the writer to refer to a recent issue of the Journal he wishes to write for, not only for the "house style" for references; but for general information on the style of presenting the full paper. All Journals almost invariably publish a note on: "Instructions for Contributors" at least once a year in their Journal, giving clear, detailed advice on how they require their papers to be prepared for publication.

Useful Points

1. It is always advisable to start writing the paper quite early. This will not only enable you to write when the material is still fresh in you mind, but allow you time to repeat experiments where the data are not up to the required standard for writing up.

2. Write in very simple English, so that everybody will understand what you wish to say. Therefore write "find out" instead of "ascertain"; "do" instead of "perform"; and make everything else equally simple.

3. Write in the past tense, after all you are reporting work that has been completed.

4. Do not strive hard and write in the passive voice, it is not a crime to say: "we did this and we found that". More and more journals are encouraging the method of direct reporting, instead of the old style of: "it was found that". The same goes for writing in the abstract.

5. Put your manuscript aside for 2-3 weeks after writing it, then read it again. You will be amazed at the corrections you have to make.

6. It is very useful to request a colleague to read your manuscript, and discuss his suggestions with him. If this is done it is important to remember that nothing your colleague says or suggests should ever be misinterpreted as destructive criticism.

7. Check and re-check that the verbs agree with the subjects in your writing. Disagreement in this is a common error and it can easily happen.

8. Write the Abstract and Title after writing the full text; but do have a tentative title in mind while writing the paper.

References

1. Day, R.A. (1979) How to write and publish a scientific paper. ISI Press, Philadelphia, USA.

2. DeBakey, L (1976) The Scientific Journal. Editorial policies and practices. Guidelines for editors, reviewers and authors. The C.V. Mosby Co., St. Louis.

NA-35-45

PRESENTATION OF ILLUSTRATIONS IN SCIENTIFIC PAPERS

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Introduction

Illustrations are unavoidable in scientific papers. They make the communication easier and more effective from the standpoint of the author. Although many authors are aware of the effect of an illustration on the reader and the intricacies of how it is made to appear on the printed page, it is the editor's responsibility to ensure that each illustration conforms to a number of important criteria.

Whilst the purpose and arrangement of an illustration may be patently clear to the author, a reader may find it otherwise. Hence the editor must primarily safeguard the reader's interests. In doing so he may find it necessary to give guidance to authors through general instructions and specific comments.

It is my intention to increase your general awareness of various aspects of the illustration of scientific papers. In this presentation, greater emphasis will be placed on the communication of information to the reader. The material is arranged in conformity with the sequence of steps or stages through which an illustration passes. These stages may be broadly identified as: identification of need and conception; selection of type and content; organizing of information and design; execution; reproduction; acceptance and use by reader.

The Criteria

Relevance to the paper is the first criterion. In the context of a scientific paper, an illustration is an abstraction and has no standing of its own. If it is not an integral part of the message you want to convey, it is best to leave an illustration out, because too much information could be as bad as too little of it.

An illustration should be appropriate. There are instances when a free-hand drawn line diagram is more appropriate than a photograph for conveying a specific idea.

Both the space in a journal and the method of reproduction can be expensive, or even prohibitive. Hence cost-effectiveness may even override considerations of appropriateness.

The convenience of the reader is a criterion that will determine the arrangement of a given illustration as well as its setting within the text.

Consistency refers to the use of conventions, symbols, lettering, nomenclature and abbreviations, and style.

Clarity of an illustration is an important consideration because it is an integral part of a scientific communication. Some methods of reproduction can lead to a loss of clarity, and the editor has to be mindful of this when assessing the suitability of an illustration.

Appearance has to do with both the internal arrangement of details within an illustration and its visual relationship to the rest of the contents of the page on which it is placed. Neatness, good choice of lettering and layout, and the care and competence applied during all aspects of the reprographic process affect the appearance.

Quality of an illustration is something that is difficult to define, but is easily recognizable and is something the reader will naturally respond to.

Types of illustrations

Illustrations can be classified broadly under three categories, namely: line illustrations of diagrams; shaded and tinted illustrations; and photographs. This classification is based on the method of preparation of the illustration, and also has a bearing on the effectiveness of communication and cost of printing. The kinds of illustration that belong to each category are as follows:

Line illustrations:

- graphs
- charts and nomograms
- diagrams
- views
- drawings
- sketches

Shaded and tinted illustrations:

- pictorial views
- sectional views
- charts

Photographs:
Monochrome (usually black-and-white)
Colour

The classification given above is a very broad one. The names are sometimes used interchangeably; but for the purpose of our discussion we shall use them in a manner given in the next section.

Graphs

Graphs are the most common illustrations used in scientific literature. Either raw data or processed data may be presented through graphs. The plotting of points is first done conveniently on a graph paper. When preparing a graph for inclusion in a paper, it is not necessary to have the grid of fine lines usually found on the graph paper; this grid may even impede effective communication. Only the main grid lines are necessary; sometimes the grid lines are omitted altogether (see Fig.1)

Good graph plotting depends on several matters: the choice of variables; system of plotting; scales used; title; axis labels; and style and technique of plotting.

The choice of variables is dictated usually by the needs of the user. Variables can be classified under dimensional variables (such as height, speed) and non-dimensional variables (such as efficiency, Mach number). The use of dimensional variables enable the reader to make direct use of a graph; whereas the use of non-dimensional variables permit wider generalization of the results.

The general rule about plotting of graphs is that the vertical axis corresponds to the dependent variable and the horizontal axis corresponds to the independent variable. However, it is not always simple to decide which of a given pair of variables is the independent variable. Sometimes the needs of the user may compel us to plot the independent variable of an experiment along the vertical axis.

If either or both axes are used to represent more than one variable, the axis representing the smaller number of variables is placed horizontally.

Logarithmic plotting is useful when dealing with variables having wide ranges of magnitude. If the relative change in magnitude of one variable is far more rapid than that of the other, it may be useful to plot the former on a logarithmic scale and the latter on a linear scale. Log-linear graph paper is available.

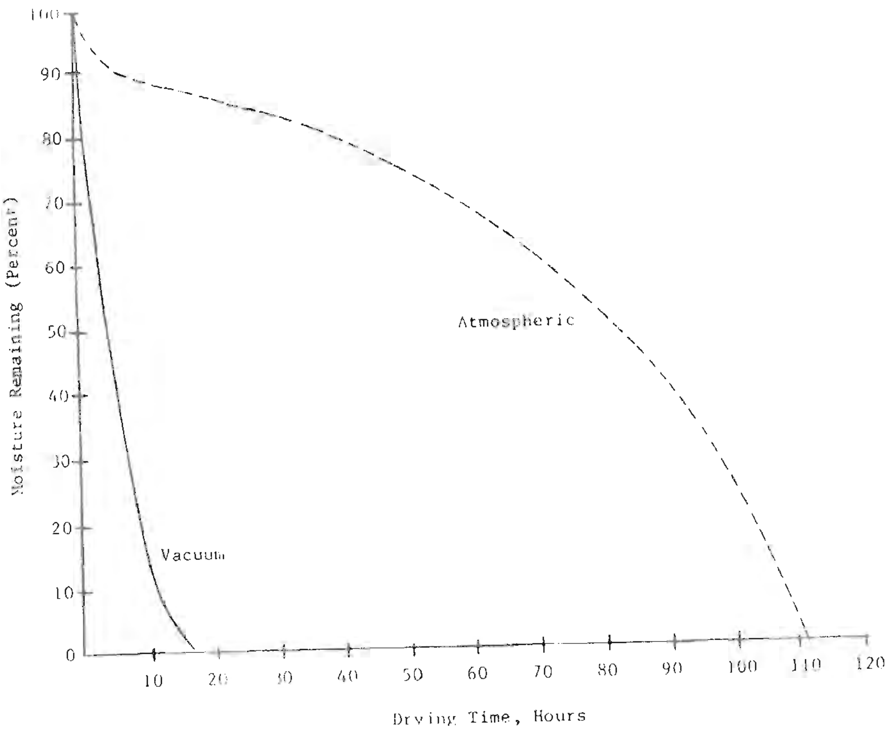


Figure 1

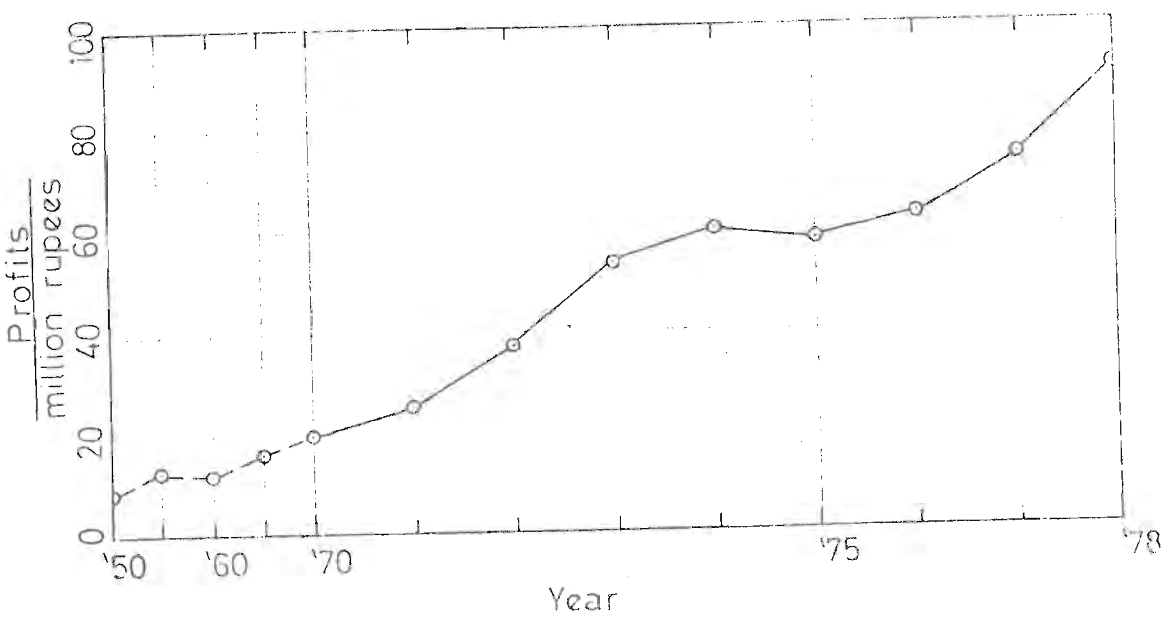


Figure 2

Logarithmic plotting is not the only way to deal with pairs of variables having ranges of small and large magnitudes. Linear plotting different scales over different ranges is a useful method. This is particularly useful if you need to show on the same graph the behaviour of the dependent variable over two different ranges of the independent variable (see Fig.2).

Sometimes it is not necessary or desirable to plot the graph for the entire range of values of one or both of the variables. Irrelevant portions of a graph may be omitted where such omission is necessary and this may be indicated as in Fig.3.

As nontechnical readers generally find it difficult to interpret logarithmic graphs, their use should be kept to a minimum in papers meant for such readers. Another danger in logarithmic plotting is that it can conceal the 'scatter' in experimental data and give a less precise interpretation of the results.

The choice of scales of a graph should reflect the accuracy of plotted quantities and should permit easy reading of values off it. Especially if raw data has been plotted, the precision with which values can be read off, should match the precision with which the readings were possible in the experimental set-up. When the readings are fairly precise a large scale should be used and when the experimental accuracy is poor a smaller scale should be used.

The fine grid in most graph papers divides each main grid space into ten equal parts. Thus, choosing scales of 1, 2, 5, 10, 20, 50, etc, (and 0.5, 0.2, 0.1, 0.05, 0.02, etc) for the variables permits convenient reading of graphs. If two variables related by a graph are of the same dimension and are expected to have similar magnitudes throughout, the same scale should be used for both axes. If the graph is a straight line or a gentle curve then the scales should be chosen such that the slope of the line or the major part of the curve should lie between 30° and 60°. This permits maximum accuracy in calculating the gradients and gives the graph a good appearance.

Every graph should have a title which is sufficiently descriptive of the graph. If there is more than one illustration including graphs, every illustration should be given a serial number for easy reference. The reference number and title should be placed at the foot of the graph. The same remark applies to the number and title of any other type of illustration. The title should not be placed within the frame or box of the illustration, except where there is some difficulty in placing it within the frame.

Each axis of a graph should be labelled clearly and prominently. This label should contain the name of the variable and its unit. A very clear and unambiguous style of labelling is, for example,

$\frac{\text{AIR FLOW RATE, } V_a}{m^3/h \times 10^2}$

or

AIR FLOW RATE $(V_a)/(m^3h^{-1}x10^2)$

An author might prefer his own style of labelling the axes of graphs; however, it is essential that he uses it consistently throughout the paper.

Numerical values supplied along the axes should be integer multiples of the scale used. There is no need to insert numerical values at all points of intersection of the axes with scale lines. Inserting numerical values at locations other than the intersection of an axis with scale line should be avoided, unless the graph is drawn without scale lines.

There is sufficient latitude within the rules of technical drawing and illustration for each author to evolve his own style. The idea of style will become clear to you if you compare the sets of illustrations of any issue of a journal. Style concerns the way points are marked, lines are drawn and various details are inserted.

Points should be marked prominently and the lines should be at least as thick as the frame lines. Each set of points should be marked with simple symbols of uniform size. The size of these symbols may be chosen so as to give an idea of the precision of the values that have been plotted.

The manner of drawing a graphical relationship, i.e. as a smooth curve, a straight line, or several short lines linking pairs of points, is determined by the context. However, certain guide lines may be stated.

A straight line is used only when it is certain that the variables are expected to have a linear relationship. A straight line also serves as a convenient but restricted form of correlation, where the results justify such linearization. The straight line representing a set of points need not pass through even a single point in the case of experimental and statistical data. A line of best fit is generally prefered.

Curves are used when it is not possible to use a simple linear correlation. In some cases the form of the curve is prescribed by theory, and hence can be drawn accurately. In practice, the curve of best fit is often found by inspection. It is important that the curves are drawn smoothly and are of uniform thickness.

There are often situations where the author is not certain about the nature of the correlation and the points on the graph fail to indicate it. The use of a continuous straight line or a curve should be avoided under such circumstances. Often the

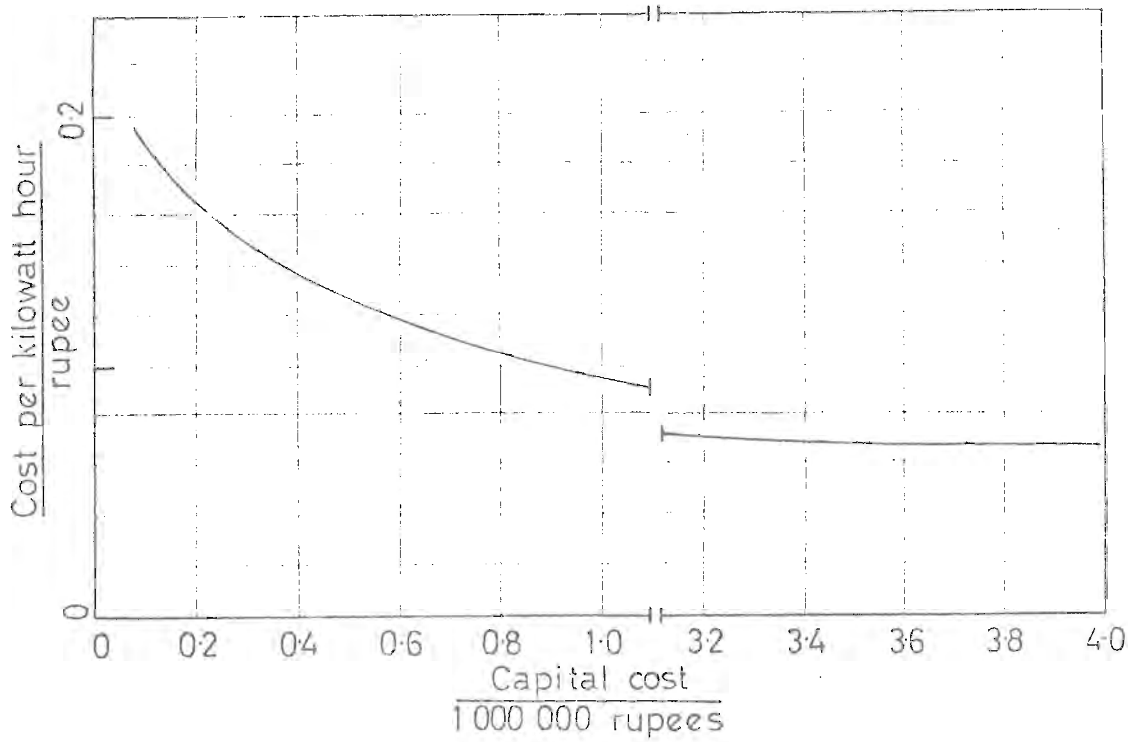


Figure 3

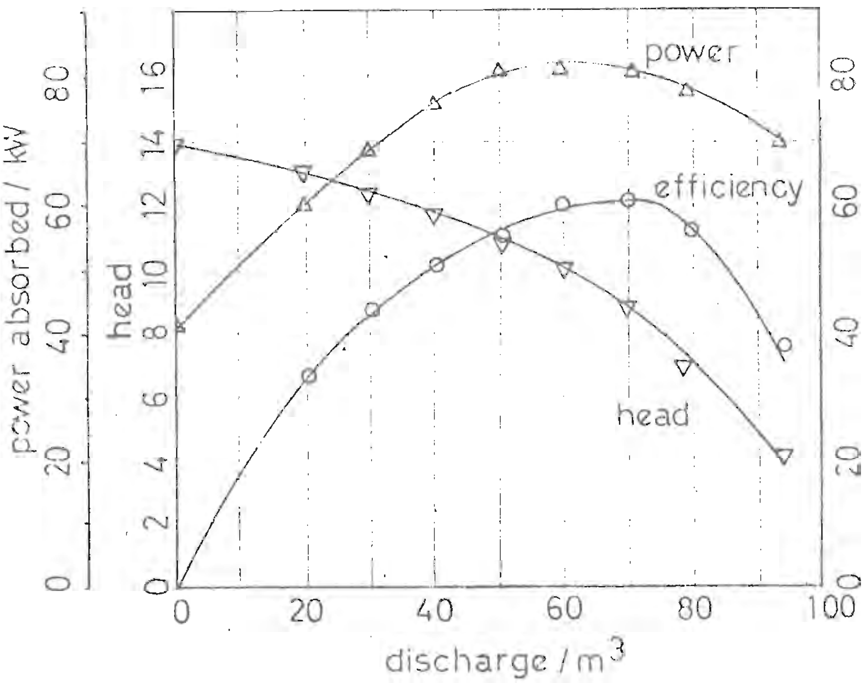


Figure 4

points are left unconnected. Sometimes succesive points are connected by short straight line segments to indicate that the connected points belong to one set.

Extrapolation of lines is not a good practice. If a graph is extrapolated under special circumstances, the extrapolated region should be indicated by the use of a broken line.

Often, it is necessary to plot more than one curve within the same frame. The curves may involve the same dependent variable or different variables. The advantage of such plotting is that it is not only economical but also useful in the comparison of related sets of results. Multiple plotting is also used for the representation of functions of two or more variables. If the dependent variable is not the same for all the curves, the scale of each dependent variable should be clearly shown along the axis. The different curves and the respective data points should be identified and distinguished from each other. This can be done by the use of different types of lines and distinct symbols for the points. The curves and points may be identified by direct labelling or by the use of a legend (see Fig. 4)

An excess of curves can lead to confusion. This remark also applies to grid lines. Clarity is the main consideration in deciding on the number of curves that may be plotted within the same frame. If a large number of curves relating the same pair of variables need to be presented together, they may be grouped together (as shown in Fig. 5).

Although the line graph plotted in rectilinear coordinates is most popular in scientific work, there are other forms of graphs which find wide application in specific fields of study.

Scattergrams, or target diagrams, is the name given to graphs where the points show a wide scatter, like holes on a target after shooting practice. A scattergram is used to illustrate the randomness of the data and, generally, no lines are plotted through the points. However, there are instances when an expected trend is shown by a broken line (see Fig. 6).

Polar diagrams are graphs drawn in polar coordinates. A polar diagram is precise and useful in representing the variation of a property with direction (see Fig. 7).

A histogram is used in the presentation of statistical information (see Fig. 8).

Charts

The term 'chart' refers to a wide range of illustrations; bar charts and pictograms are among the more vivid forms; flow

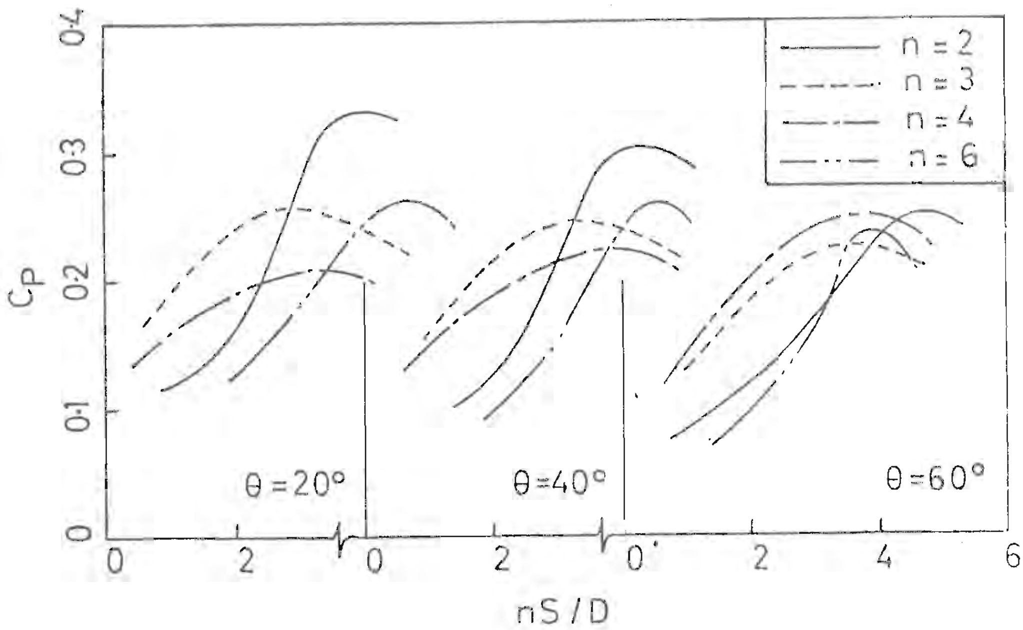


Figure 5

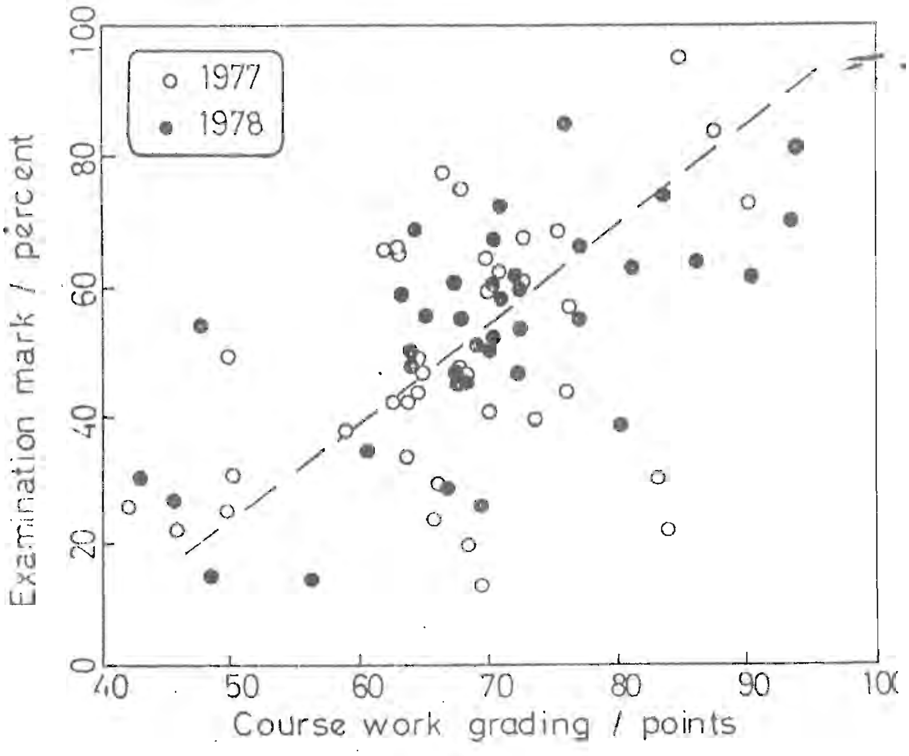


Figure 6

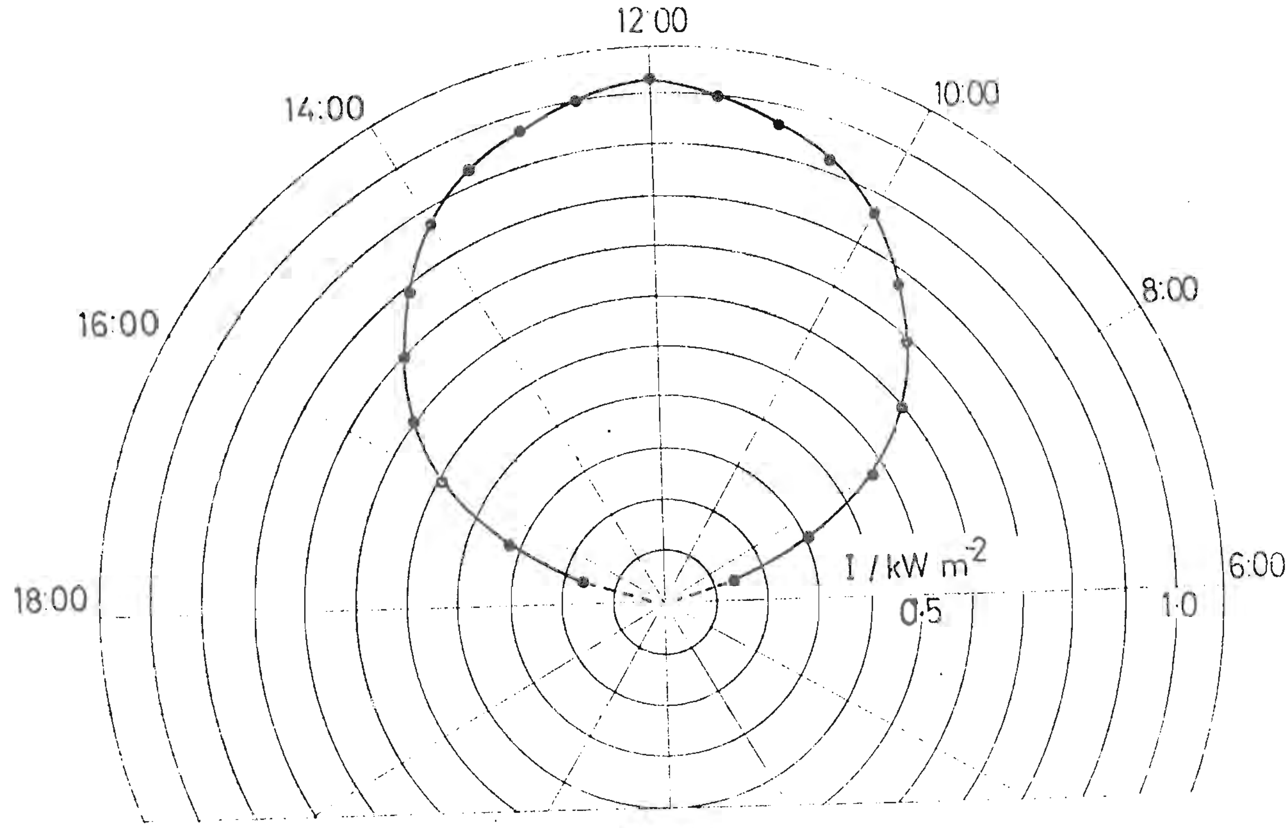


Figure 7

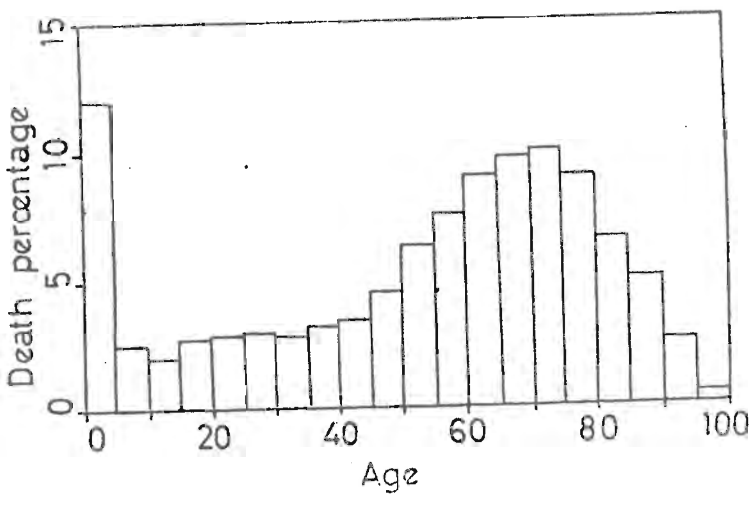


Figure 8

charts and organizational charts have an explanatory function; alignment charts are used in conutational work.

Bar charts (Fig.9) are useful in comparing magnitudes of quantities. It is possible to have more than one independent variable represented by a bar chart.

Pie charts (Fig.10) are basically circular and are used to illustrate the composition of a quantity which can be analysed into a number of constituents. They are easily understandable to the laymen, but tend to take up more space than an equivalent tabulation.

Pictograms (Fig.11) are diagrams in which stylized figures are used to represent quantities. They are more commonly used in popular writing and seldom in scientific papers. They are, perhaps, the most vivid and the least precise of charts.

Cartograms are pictograms involving maps. The use of symbols, colour and shading make it possible to represent a wide variety of information on a single map.

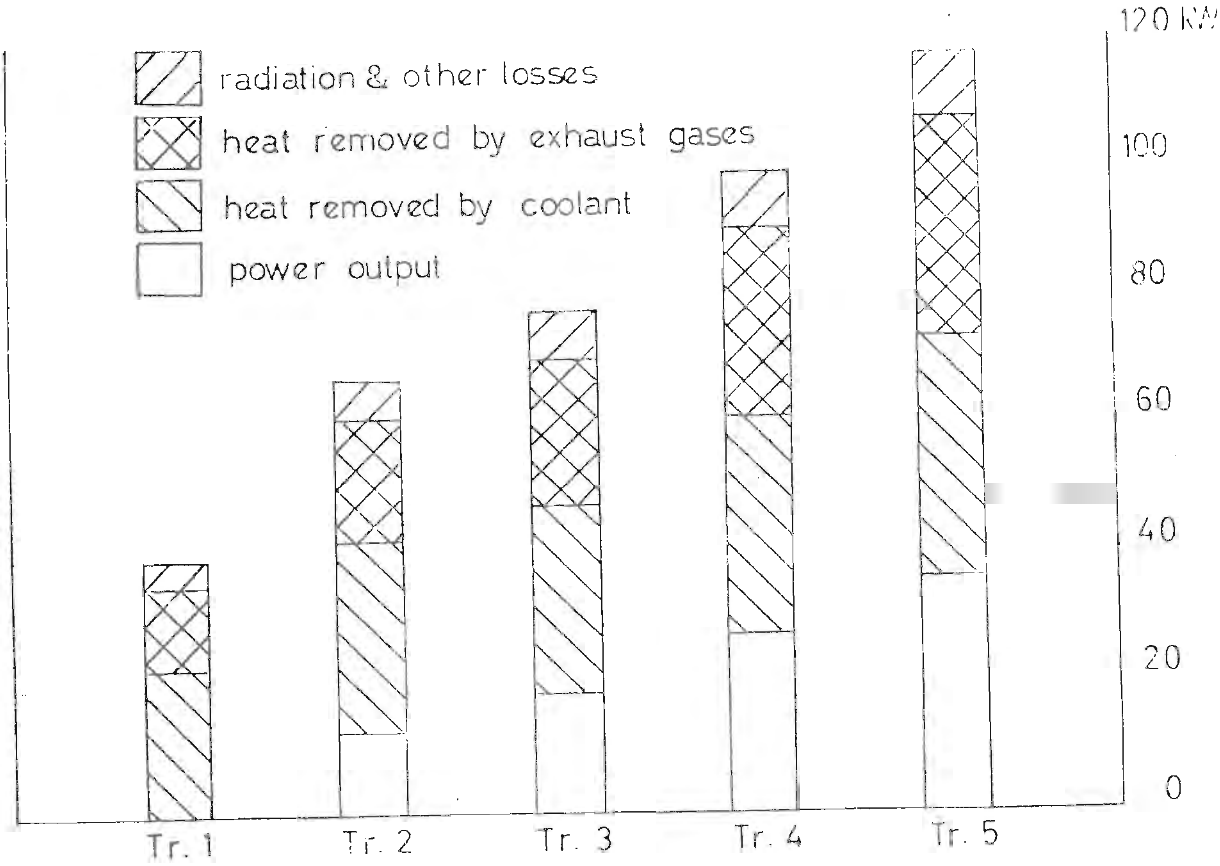
Alignment charts, also known as correlation charts or nomograms are graphical calculating slides prepared on the basis of formulae (see Fig.12). They permit rapid evaluation of quantities, and a carefully constructed chart can give results to the same degree of precision as a slide-rule.

Flow charts or flow diagrams are very useful in illustrating the arrangement of steps and interconnections in a complex process or procedure. Computer programmes, and complex natural and industrial processes are amenable to this representation. Either a standard or a consistent set of symbols, boxes and interconnections should be used. Marking the directions of flow with arrowheads facilitates understanding (see Figs.13 and 14).

Organization charts resemble flow charts in many respects. They are used for describing hierarchical structures in an organization and the interrelationships between various sub-units.

Layout diagrams are used for showing the physical arrangement of an experimental set-up, industrial plant and other complex system. Figure 15 shows the layout of equipment for an undergraduate experiment on a steam power plant.

Electrical circuit diagrams and wiring diagrams are drawn using standard symbols and conventions. An accepted standard system must be adhered to, and stated clearly close to the title of the diagram.



HEAT BALANCE CHART

Figure 9

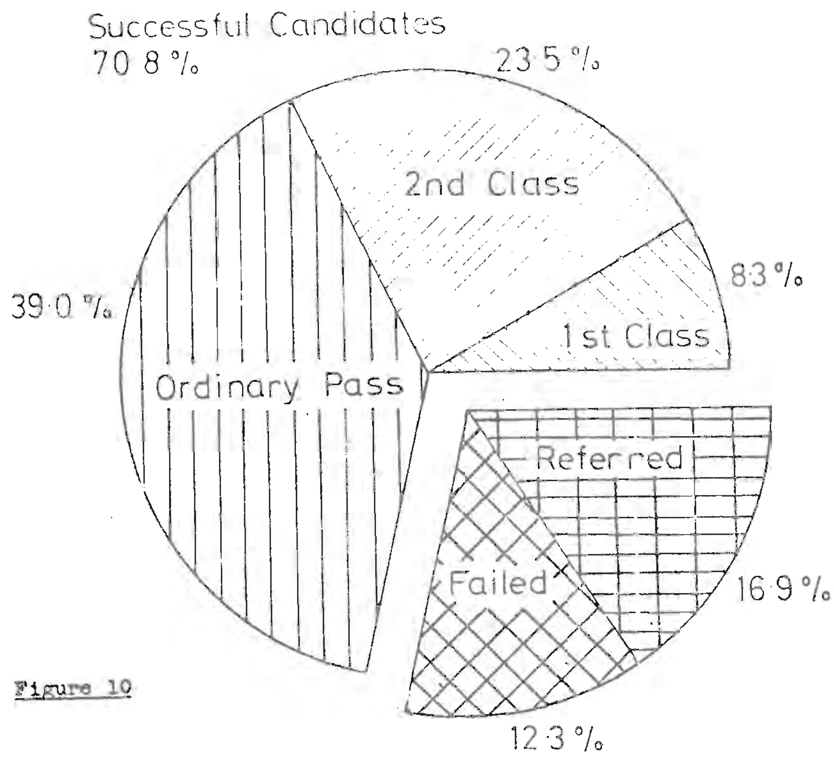


Figure 10

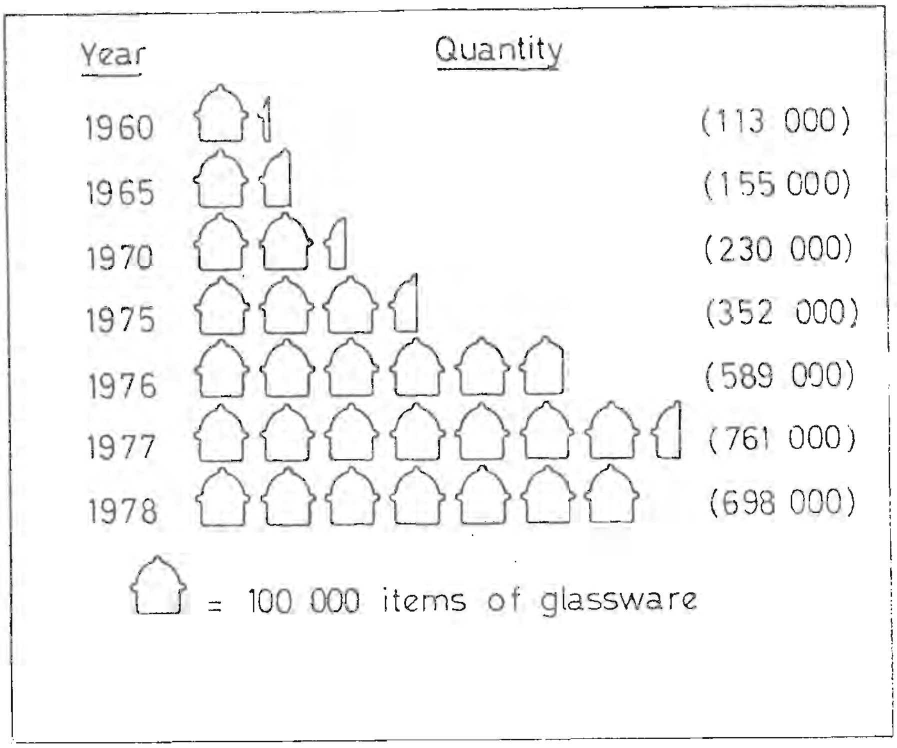


Figure 11

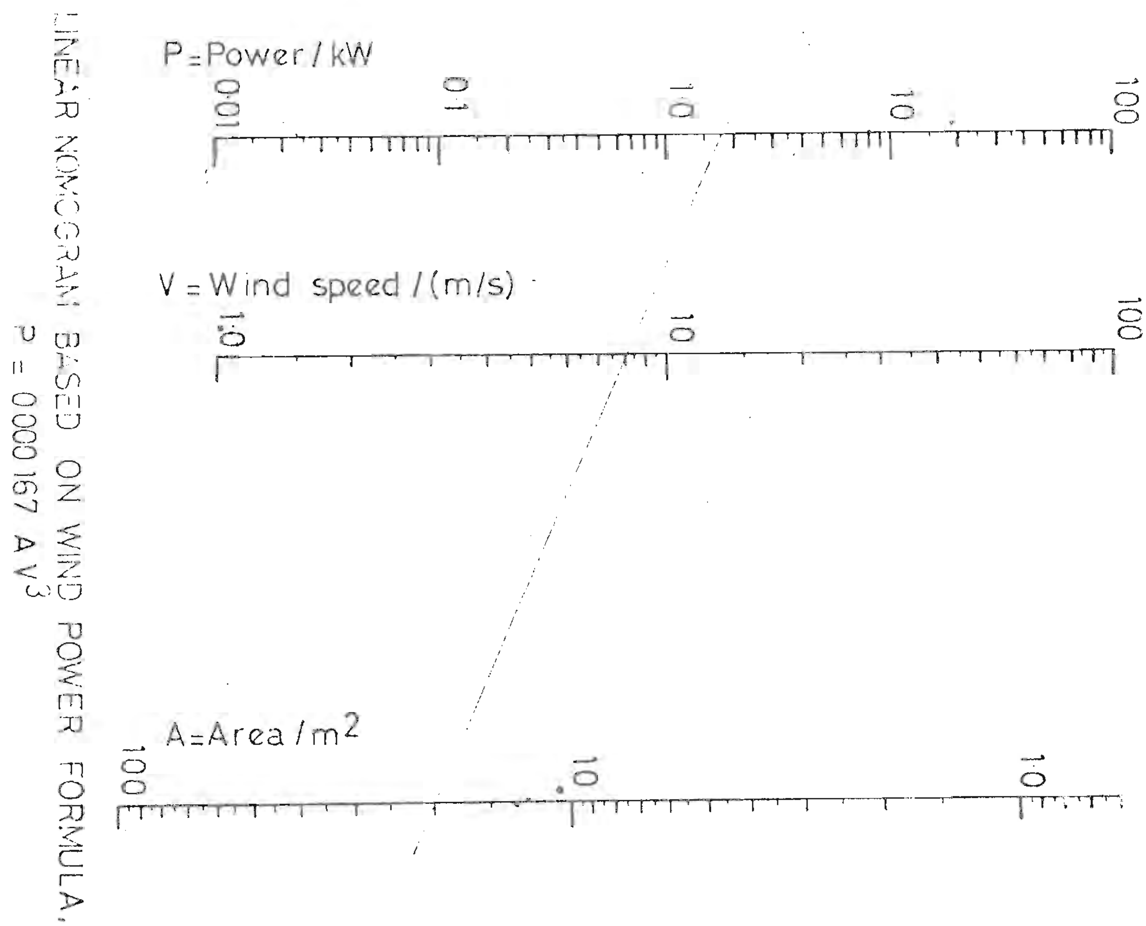
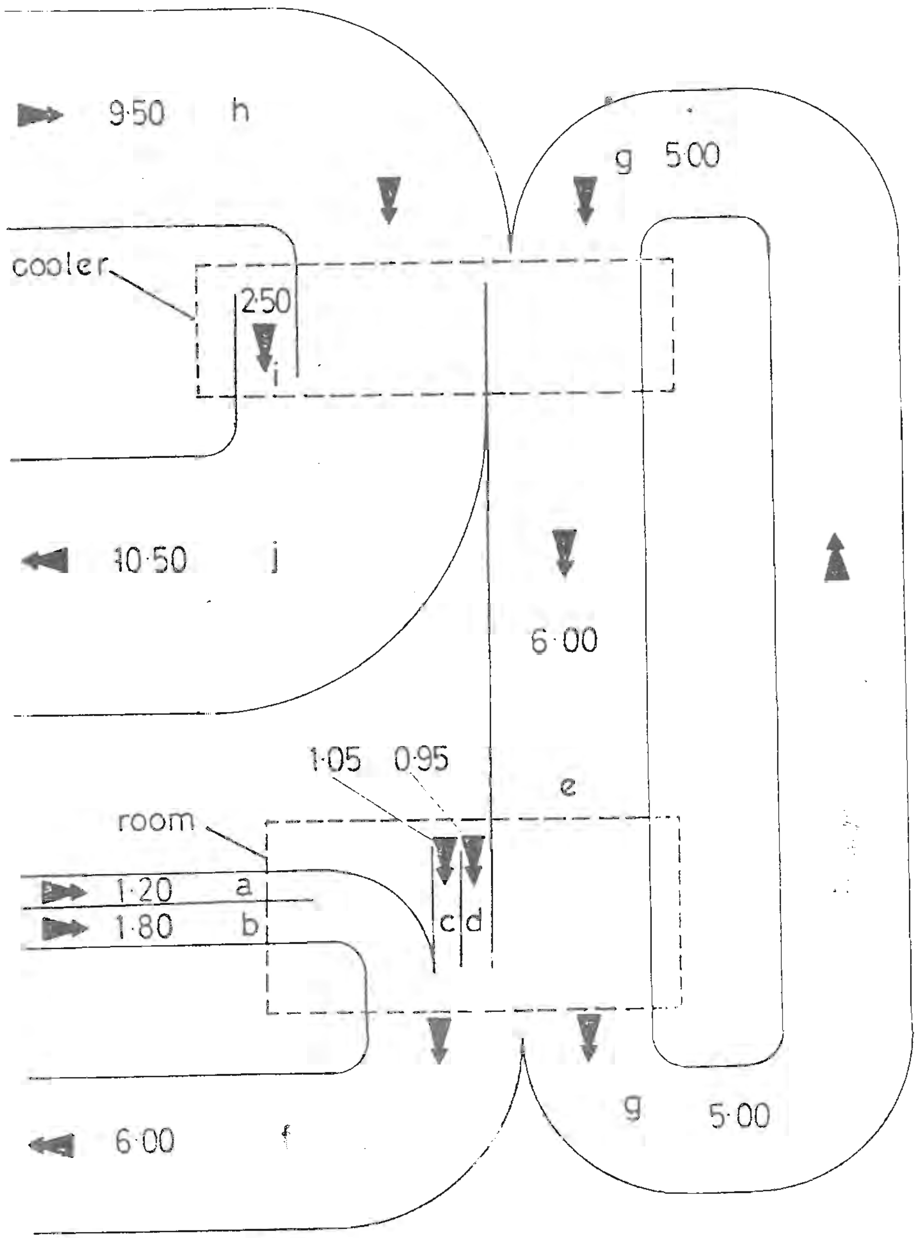


Figure 12



HEAT FLOW DIAGRAM FOR AIR-CONDITIONED ROOM

Figure 14

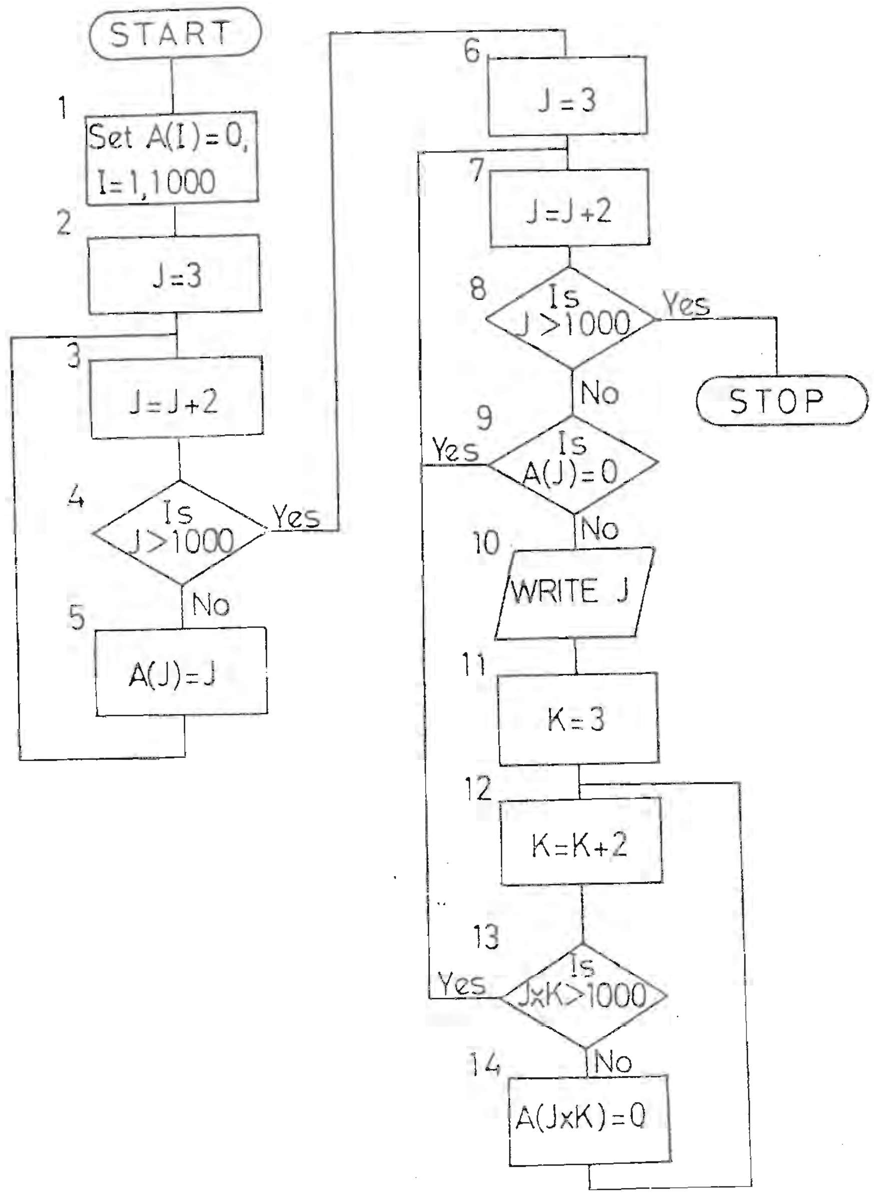


Figure 13

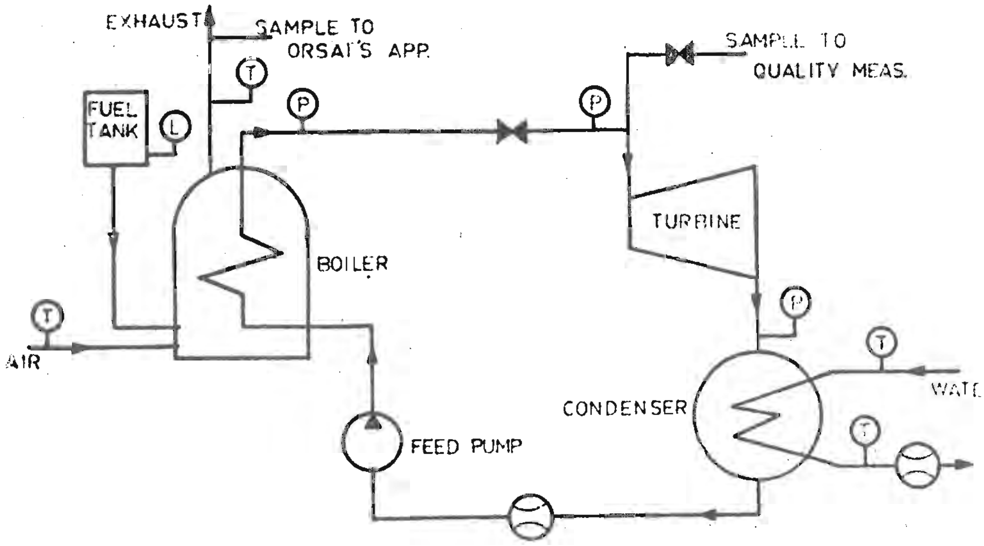
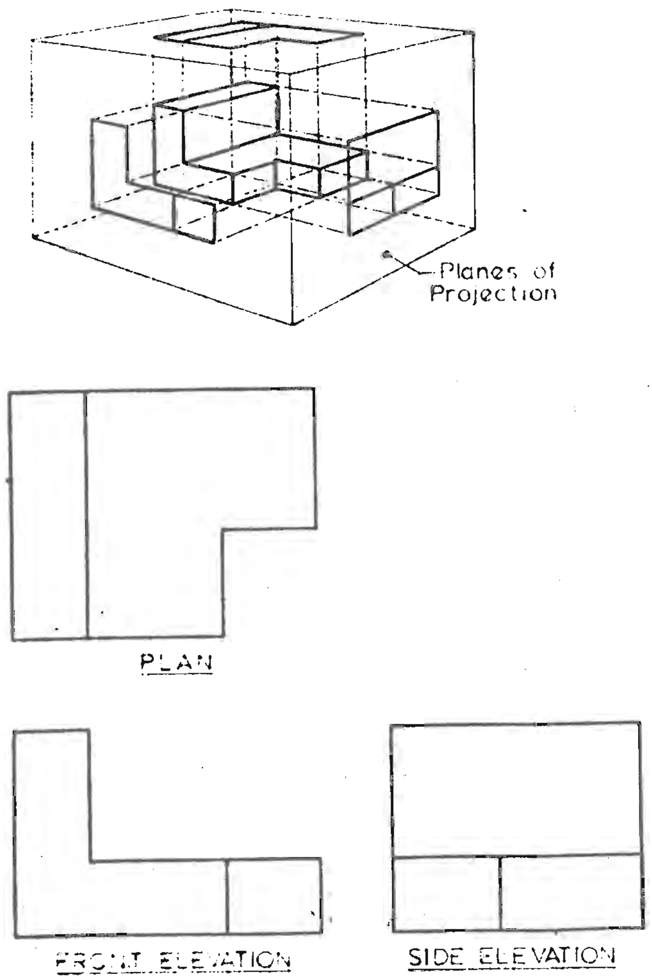


Figure 15



ORTHOGRAPHIC PROJECTION

Figure 16

Views of objects and structures are often constructed with lines. Most man-made objects are bounded by regular surface such as planes, cylinders and other surfaces of revolution. Hence they can be represnted by views constructed using drafting instruments. Stylized and abstract views of natural objects can also be drawn with drafting instruments and aids; realistic line drawings have to be drawn free-hand. Figures 16, 17, and 18 contain views of objects made according to conventional methods.

A degree of realism can be introduced to line drawings of objects by the use of perspective projection. Perspective projection is based on the principle that paralled edges or lines on an object appear to converge as they recede from the observer (see Fig.19). The point of convergence of set of parallel lines is called the 'vanishing point'. When constructing the views, the vanishing points help to align the lines that represent edges. A free-hand drawing made from a natural object will have the effects of perspective effortlessly incorporated while being drawn.

The user of the scientific paper has to 'read' the drawings just as much as he reads the text. Therefore it is very necessary to adhere to conventional and standard practices when making a drawing.

Internal details of composite objects and assemblies are communicated through sectional views, cut-away views and phantom views. Geometrical accuracy and the consistent use of appropriate types of line are very important to avoid confusion. Figures 20, 21 and 22 are examples of these three types of view.

An exploded view is a useful construction for showing the constituent parts of an assembled object (See Fig.23).

Poor labelling of an illustration causes much frustration to the reader. Very often illustrations labelled with numbers or letters do not have a key close at hand; sometimes the key is embedded in the text many pages away; occasionally the key is omitted altogether. It is best if the key is placed within the frame of the illustration. If this is not possible, it could be typeset and placed immediately below; but at all costs the key should not be separated from the diagram. If the labels are not many, and if each comprises not more than one or two words, they may be neatly printed directly on the diagram. Whatever the kind of labelling used, labels should be arranged in an orderly manner within the frame of the drawing and connected clearly to the corresponding details with leader lines (see Fig. 20).

Labels should be arranged so that they can all be read from the lower side of the page. To give added prominence, single character labels may be enclosed in circles; however, this is

AN ISOMETRIC VIEW

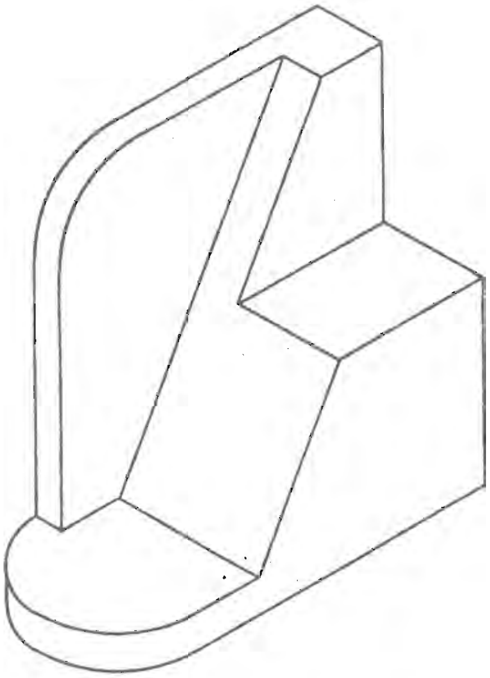
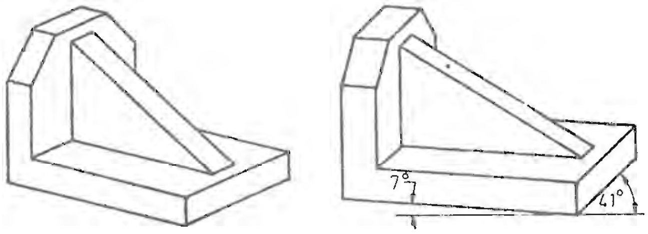


Figure 17

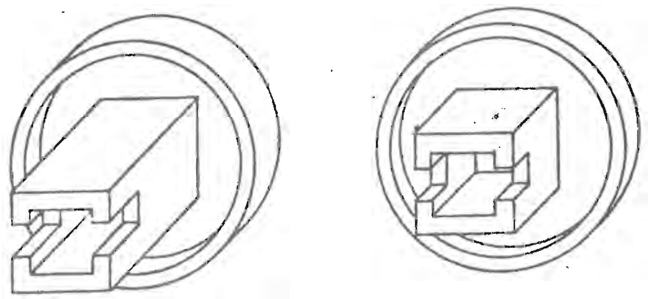
AXONOMETRIC VIEWS



TRIMETRIC

DIMETRIC

OBLIQUE VIEWS

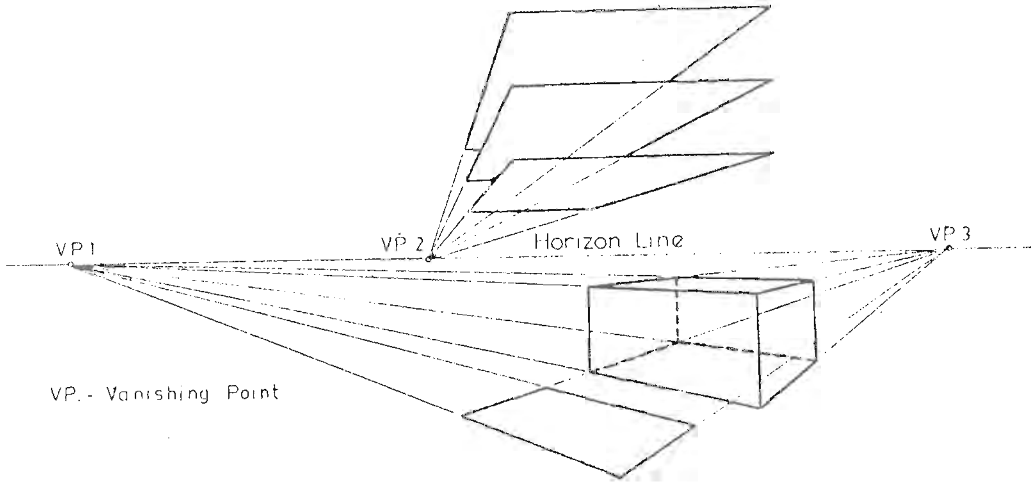


CAVALIAR

CABINET

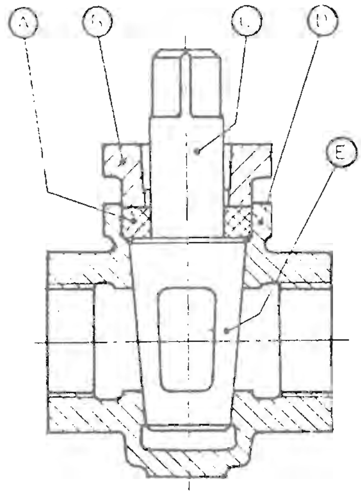
Note: In Cabinet projection dimensions set-out parallel to the slanting-axis are reduced by half, with no reduction of dimensions parallel to the other two axes. In Cavaliar projection the reduction factor in each of the three principal directions is unity

Figure 18



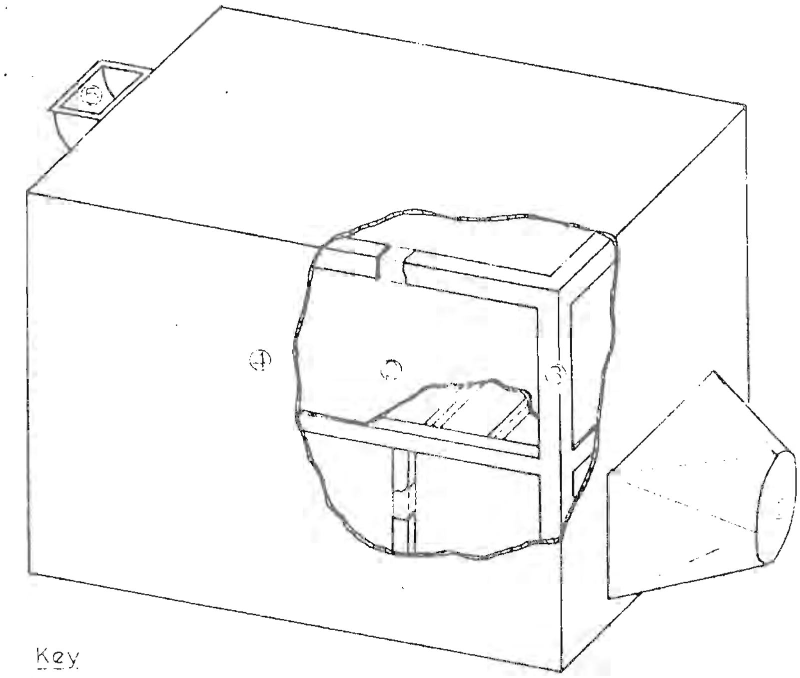
PRINCIPLE OF PERSPECTIVE DRAWING

Figure 19



A SECTIONAL VIEW

Figure 20

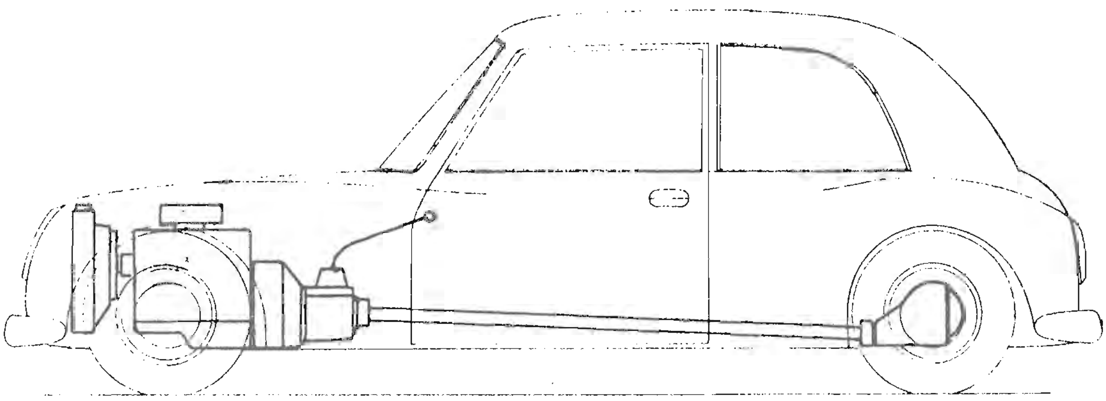


Key

1 AIR INLET
2 SHELF
3 FRAME
4 CLADDING
5 VENT

A CUT-AWAY VIEW

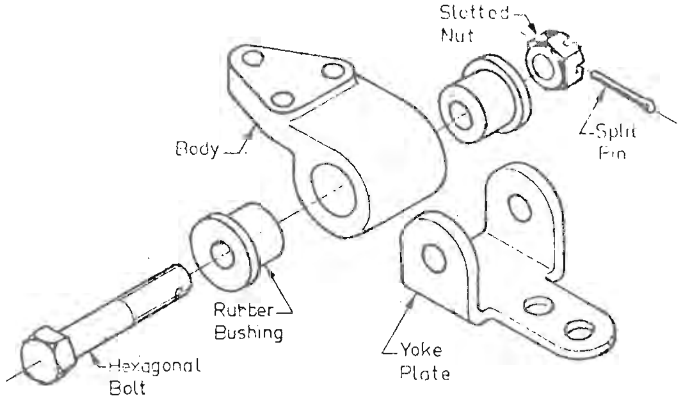
Figure 21



Positioning of engine and transmission

A PHANTOM VIEW

Figure 22



AN EXPLODED VIEW

Figure 23

unsatisfactory if there are many lables. Some illustrations, particularly those having blocks or sufficiently large areas covered by each item, could have the labels placed inside the respective areas. In such an event, any cross-hatching or shading should be interrupted locally to provide a clear background for the label.

Illustrations which are produced with drafting aids and reproduced with modern methods show up defects clearly. Wavy and smudged lines, sloppy corners, disjointed tangents, blotches of ink and dirt, and inconsistent lettering are some of the factors that destroy the quality of an illustration. The quality of an illustration should be in keeping with the time and effort that have gone into the collection and processing of the information in it.

Shaded and tinted illustrations

The application of tints and shading can improve the clarity of pictorial views and sectional views. The use of a colour or of a mechanical tint helps to give emphasis to important details of an illustration. Bar charts, pie-charts and cartograms which contain many items of information could be made more effective by the use of tints. Judicious choice of the pattern of mechanical tints that are used in combination in views could add a touch of realism and enhance the aesthetic appeal.

The use of shading in views of objects could create the effect of solidity and convey better idea of shape. However, when the need is to highlight function, spatial relationships and structure, a highly detailed and shaded drawing may be inferior to a somewhat simplified and abstract line drawing.

The blockmaking operation would be more expensive when gray and coloured tints are used. The use of an additional colour would require an extra block and a second printing operation, both of which add to the cost.

Photographs

The method of science does not directly require the use of photographs for recording and conveying information. In some instances special cameras, accessories and dark-room techniques are used for making visible and measurable records of details which are not observable or detectable by the human eye. The scientist's interest is usually in the quantifiable and measurable information that is made accessible through such records. Hence the infrequent use of photographs in scientific papers. A line illustration could serve the same purpose better.

Photographs supplied to the blockmaker or the platemaker should be made on glossy paper. The picture should be sharp, but not necessarily of high contrast. The printed illustration that corresponds to the photograph is made of a distribution of uniformly spaced dots. This formation of dots can be observed under a magnifying glass. Fine details in a photograph, of dimensions comparable to the spacing between dots, will not reproduce well on the printed page.

Photographs intended for printing should be handled with care. The surface of the photograph should not be indented and creased. Greasy fingerprints should not be left on the surface. It is best to avoid writing on the back; this can result in undulations and projections on the surface, which give stray reflections of light that will be picked up by the process camera. The best way of labelling a print would be to type the details on a piece of paper which can then be pasted to the back along an edge and folded over to the front so that the label is visible.

A photograph of a printed half-tone illustration produced from a photograph is not suitable for blockmaking.

Production of illustrations

The design and execution of an illustration requires a specific set of skills and techniques. In order to facilitate communication with authors and to appreciate the difficulties of the producer of illustrations, it is useful for the editor to be familiar with the practice of illustrating. With the increasing availability of computers with graphic facilities, another dimension has been introduced to the field of technical illustration.

Although the use of computer graphics will relieve human drudgery at the drawing-board, and give a higher degree of accuracy and a uniformity of appearance, the creativity and decision-making will still be in the hands of the author. With the use of computers to convert the results of mathematical calculations and data processing into illustrations suitable for publication, scientists could be released for more productive activities.

Reprographic Processes

The editor who is concerned with maintaining a high standard of illustrations, should become familiar with the processes of block-making, plate-making and printing. He should know the potentials and limitations of the various techniques, materials and equipments used in the printing trade.

In conclusion: the reader's point of view

It goes without saying that the editor's primary responsibility is to safeguard the reader's interests. He must be sensitive to the reader's needs, and must ensure that the content and the presentation of the paper fulfills them. If the criteria set out at the beginning of this presentation are applied consistently to the illustrations in a paper, a satisfactory outcome may be expected.

In addition to gaining the scientific knowledge contained in the paper, one also practises the reading of a paper together with its illustrations. If we recall the principle "the medium is the message', we may become bold enough to say that the enhancement of the reading skills, and the aesthetic experience of encountering a well prepared and printed paper with fine illustrations are the primary gains of the reader.

NA-35-67

ROLES AND RESPONSIBILITIES OF AUTHORS, REFEREES AND EDITORS

Prof. R.S. Ramakrishna,
Department of Chemistry, University of Colombo, Colombo.

Any discussion on the roles and responsibilities of authors, referees and editors should consider that the content of scientific journals would normally include:-

Full papers which are comprehensive accounts of studies which have reached a stage of completion. It should be relevant to the reader who wishes to repeat the author's work or evaluate its findings.

Notes are in general a concise account of the research results not warranting a full paper, but with data essential for repetition and critical evaluation.

Communications represent preliminary reports of first research results of importance for dissemination and rapid publication. They are, in several, expected to be followed by a full paper.

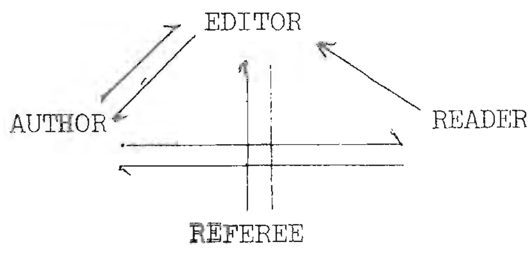
The journals at times include Reviews which are comprehensive and evaluate advances in a limited subject area. These should as well be interpretative.

The essential objectives of any scientific journal are:

i. to provide an effective and speedy dissemination of scientific information,
ii. to ensure a healthy Author-Editor-Referee relationship,
iii. to contain clarify and improve readability of contributions,
iv. to maintain standardisation of presentation regards units, symbols, etc.,
v. to serve as a guide to repeatability and extension.

This paper would largely discuss the roles of authors, referees and editors in meeting the general objectives of a scientific journal. The position and needs of the reader should be carefully considered in this discussion.

The relationship between these groups could be pictured as follows:



The two - way interactions would provide a pivotal role for the editor. The editor is generally required to provide guidelines for authors and readers. He is responsible for the choice of referees and should edit referees' reports to improve communication between the author and reader. He should possess competence for a trial decision. In this effort, the needs of the author and reader should be borne in mind.

The MANUSCRIPT of a paper should conform to the following:
The Abstract of a paper should be concise. It should indicate newly observed facts, conclusions of experiments and give essential parts of any new theory, treatment, apparatus, technique, etc. The paper often has an introductory section. This is intended as a write-up including relevant reported work, background literature and general objectives of the paper. The experimental section is important, in that it should contain all essential conditions of experiment, preparation of any standards, procedures and details of apparatus used. This section should be sufficiently detailed as to enable repetition of the experiments described. Results and Discussion form the concluding section. It would normally present data and the conclusions derived from the results. Suggestions for further work, constraints, etc., should also be included.

The AUTHOR in general wants to convey a complete account of his work and his thoughts. He may choose to do this in his own way and with his own words, regardless of whether or not this corresponds with the needs of the reader. The reader on the other hand, requires information he needs in a form which is concise and yet complete, and in a form which is easy to comprehend and rapid to scan. The Editor has an important role to play in improving communication between the author and reader, in preventing inferior material from entering the stream.

What then are the responsibilities of the Author? The content of a Full paper in general requires a title. The title often forms the sole basis for the reader to decide whether to read a paper in full or not. It should therefore give a clear indication of the contents of the paper. It is useful if the authors are required to indicate 'key words' to assist the reader to decide on reading the paper. It should have sufficient number of key words vital to the reported study. These should meet the needs of indexing as well. The title should be carefully chosen as not to be unnecessarily lengthy and loaded with irrelevant words; eg: "Studies on Cobalt estimation" is more effectively reworded as "Spectrophotometric determination of Cobalt in laterites with 2,2'-bipyridyl". The latter, is informative regards nature of method used, samples studied and reagent used. This certainly assists the reader who requires to obtain information on the type of work carried out as relevant to his interests.

Once the paper is received, the EDITOR would carry out a preliminary evaluation. He would see that the subject covered is within the defined scope of the Journal. He would reject it outright, if the paper is substandard and is only one of routine investigation. Otherwise, he would proceed to a physical checking of the manuscript to see if it conforms to the guidelines set regards abstract, tables, figures, titles, references, etc. Is the typing careless? If any of these factors are wanting, he would either reject the paper or refer it back to the author for corrections.

Should the paper pass the preliminary evaluation of the editor, it would have to be sent to a referee. The choice of referee is important. He should necessarily be a specialist in the narrow field of investigation covered in the paper, be engaged in research in the field in recent years and made contributions of good quality. He should above all, have the ability to impart the requisite level of authority to his assessments. It is often useful for the editor to maintain a 'roster' of referees and evaluate them periodically. The referees' anonymity should always be maintained.

The obligations of the REFEREE should include the following:

i. assist the editor in maintaining the quality of papers,
ii. aid authors by constructive criticisms,
iii. respond within a limited period of time to the request of editors,
iv. guide the editor to transmit to the author comments to improve the paper or to enable him to understand the reasons for the rejection,
v. the referee should in all cases act as the advisor to the editor and not as final arbiter.

The common faults of referees are delays in responding within a limited period, or more seriously, to hold back comments in order to publish paper of similar contents. If the referee finds himself not competent to judge all parts of a manuscript, he should promptly return the paper. Bias in favour or disfavour for reasons unrelated to the contents of paper are at times identified. The editor should keep a watchful eye for such deficiencies.

The REFEREE plays an important role in assisting the editor in maintaining the quality of the Journal. He should ask the following questions of a paper submitted to him for refereeing:

i. Is the paper of sufficient scientific interest and originality?
ii. Is the abstract sufficiently informative, concise and clear?
iii. Do the data support the conclusions?
iv. Do any parts of the paper call for elaboration, clarification or condensation?

v. Are there errors in computation, equation, formulae, derivations, tables, graphs or nomenclature?
vi. Is the paper well written and the presentation clear and concise?
vii. Have you any further suggestions for improvement?
viii. Are there any parts of the paper requiring another referee? If so, suggest name.
ix. Is the number of references excessive?

The answers to these questions often assists the referee to decide on acceptance, rejection or the need for clarification. These comments should be transmitted to the author through the editor which should aid in improving the paper or understand the reasons for rejection.

The growth of scientific information is such that the rate of generation of technical information is greater than the rate of dissemination. In the early 1970s, there were 2 million scientific papers per year, which is roughly 6000 - 7000 papers per day. The scientific paper has a doubling period of 8 years and is even smaller for specialised areas of science. Today's science is tomorrow's technology. Dissemination of scientific information assumes an important role. In this effort, the responsibilities of the author, referees and editor are of vital importance in serving the reader - the consumer of scientific information. Editing is both an "Art" as well as a "Craft" and requires competence, understanding, experience and the support of the referee, author as well as the reader.

Effective and speedy dissemination of scientific information is useful for the progress of science and technology. Delays cause duplication of research effort. Haste causes more harm if the editor is unduly hasty in pushing communications without proper evaluation and screening. The editor should avoid unnecessary delays and not be an impediment to the speedy flow of information. Above all, the Editor must be firm in dealing with communications of doubtful value.

This paper does not discuss the editor - publisher relationship which is also important.

MANUSCRIPT EDITING: PREPARATION OF MANUSCRIPTS FOR THE PRINTER

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Editing of manuscripts is primarily concerned with ensuring that the material submitted for publication is of some value and interest, and to see that the material is presented in a form which is grammatically correct, arranged in a logical sequence, concise and relevant to the subject, devoid of unnecessary material and repetition, and perhaps above all, worth the time spent by the reader. It is well to remember that excellent research poorly reported may appear to be of less worth than less significant research that has been well reported. Research workers are busy and want information quickly. It has been said that the ideal article is written so that the words are for children and the meaning for adults. Hence articles must be written in a way which expresses what is meant to be conveyed and not merely to impress the reader. We nay take as an example Benjamin Franklin's well known dictum "early to bed, early to rise, makes a man healthy, wealthy and wise". Would this have been remembered if he had chosen to express it as 'early to retire, early to arise, makes a man salubrious, opulent and sagacious'?. Similarly, the technical paper must sell itself to the reader, and it is the editor's responsibility to assist the author in achieving this objective. In order to ensure that these requirements are met it is advisable that editing be carried out in a stepwise manner.

1. Read improve and mark for the printer the body of the text without paying more than cursory attention to the rest of the manuscript. This will enable the editor to obtain a grasp of what the author wishes to convey and to determine whether it is worth publishing at all. If it is not worth publishing he will reject it. There are at least four reasons for rejecting papers. These are
   (1) the subject matter is outside the avowed field of the journal,
   (2) an extreme lack of scientific merit or novelty,
   (3) the editorial conclusion, supported by adequate referee reports, that although the paper contains good material, its publication would not be in the best interest of the journal,
   (4) inadequate experimental evidence to support the conclusions reached.
   Some of these reasons for rejecting papers are subjective

and could be a real source of worry to the editor, especially if they involve prominent and reputed scientists.

2. Ascertain whether the title of the paper indicates concisely the content of the paper.

3. Read, improve and mark for the printer the abstract of the paper so that it is intelligible even without reference to details described in the paper.

4. Read and improve the introduction so that it explains clearly the purpose of the paper, and briefly recounts previous relevant work with the necessary references thereto.

5. Ensure that the materials and methods section is given in sufficient detail to permit the work to be repeated if necessary, and that techniques, or modifications to previously described techniques, are given in full detail.

6. Read and improve the tables and figures including their captions and ensure that they contain only relevant data as described in the text - unnecessary data should not be included. Also make sure that they do not contain unnecessary blank space, and that clarity is assured. In the ideal situation a reader should be able to have a very good idea of what the author wishes to convey by a study of the tables and figures only.

7. The discussion section of the paper should be relevant to the aim of the paper and be based on the results obtained. It should avoid excessive speculation.

8. Read and check the references and also check that they are really necessary, that they have been quoted appropriately in the text, and that they are in the standard form required.

9. Check the abbreviations used and ensure that they are unambiguous, fully explained, and in keeping with accepted conventions.

10. Read over the entire manuscript and check that everything is orderly and methodical.

It should be always remembered that any editorial alterations should result in significant improvement in clarity and brevity. The editor should guard against re-writing the entire paper merely because his own style of writing differs from that of the author. Extensive alteration is particularly dangerous because it may give the paper a slant which was not the intention of the author, or indeed even change the points which the author wished to emphasize. If a manuscript is altered extensively by the editor, it is advisable to show the new version to the author for his approval of the alterations before sending the paper to the printer. Expensive and time-consuming corrections of the typeset text can thus be avoided. What is meant by typeset text is the way in which the printer arranges the words of the manuscript. Slight alterations in the typeset text are more difficult than altering typewritten statement and there are varying degrees of difficulty encountered. It is for instance relatively easy to change individual letters, more difficult to change words especially if they are of different length, even more difficult to alter sentences, and impossible to change large chunks of the text. In fact some publishers charge authors if extensive alterations in typeset are required.

The first reproduction of the typeset version of the manuscript is known as the galley proof. The galley proof should be proofread by the printer to correct the majority of printing errors, and copies then sent simultaneously to the editor and the author. The copy of the galley proof to the author will also include the edited version of the manuscript and an order form for reprints. The printer usually also informs the author that only printing errors and errors introduced by the editor will be corrected at no cost to him, and that he will be charged for corrections caused by alterations which he introduces into his paper at this stage.

Having made any necessary corrections in the galley proof, the author will return to the editor the corrected galley, the edited version of the manuscript, and the order form for re-prints.

The editor will then transfer corrections made by the author from the author's galley into the editor's galley. When doing so he will omit alterations which are not absolutely necessary, and also make any improvement:; which he himself considers to he necessary. Thereafter the editor will check the entire galley carefully to detect any errors which may have been overlooked. It is well to remember that particular attention should be paid to equations, tables, captions, numbering of tables and figures, titles and references, because it is in these areas that printing errors are most frequent.

Corrections should be indicated in the text and explained in the margin of the galley. Here the editor should consult the printer for the specific meanings of the different symbols used by the particular printer, (eg. italic, small caps, bold face, etc.).

On receiving the corrected galley proof the next task of the printer is to prepare the page proof, i.e. a reproduction of the journal page as it will appear after printing.

The editor now checks the page proof to aee that all corrections have been properly made and that all parts of the text have been included. Also that tables and figures appear in the proper places relative to the text and that each figure is accompanied by the appropriate legend. He must bear in mind that readers often photocopy a single page from an article and later discover that they have forgotten to note the source. The editor should therefore see that the journal's name in full, or, in abbreviated farm, the volume number, and year appears as a headline or footline on every page of the journal. The editor also checks that the gages are numbered consecutively and then returns it to the printer with his permission to include it in the journal.

Having edited the manuscript, it is also the responsibility of the editor to see that the articles are correctly placed in the contents section of the Journal and that the journal is identified on the text pages. All issues of the journal must have the same format - otherwise it will be impossible for librarians to have the different issues bound together.
The information required on the cover of a journal are -

the complete and unabbreviated title of the journal
the volume number
the issue number (in bold face type)
the date (month and' year) of publication
the name of the publisher or the publishing organization
the bibliographic strip

The bibliographic strip consists of the following -

the abbreviated title of the journal
the volume number
the issue number
the year of publication
the number of the first text page of the issue
the number of the last text page of the issue
the journal's CODEN
the journal' s ISSN (International Standard Serial Number)

CODEN and ISSN are unique and equivalent representations of a journal's title and are mainly used by computerized services. CODEN consists of six letters and/or numbers. ISSN consists of eight numbers in two groups of four digits each. The former is assigned by the International Coden Service in the U.S.A, and the latter by the International Serials Data System. Centre in France.

The journal should also include information about itself such as -

the name and address of the editor(s)
the members of the editorial board
the frequency of publication of the journal
the annual subscription rate
the price of a single issue
the holder of the copyright

Finally every issue of the journal should have the table of contents giving the names of authors, full title of the paper, number of first page and number of last page.

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REPROGRAPHY

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The word "Reprography" is a comprehensive term first used in 1954 as a generic term for all types of reproduction of documents. Accordingly, "Reprography" includes all processes and techniques associated with photocopying, microcopying, electrocopying, thermocopying, etc. Earlier all these processes and techniques were known as "copying" or "duplicating".

According to the above definition of the word "Reprography", copying and duplicating processes include methods using a camera and without a camera. The camera process would include micro-copying forms, such as microfilm, microfiche, superfiche, cartridges, jackets, com, micro-cards and prints, aperture-cards, cassettes and micro-opaques. A camera is used even in the photostat process. The other copying processes not using a camera would be electrostatic processes (quick copies), stencil duplicators, addressographs, etc.

Photography still remains an essential element in reprography. Although it is a wet, slow and expensive process, no other copying process so far devised could equal its quality and versatility.

Out of the reprographic processes, "Micrography" could be regarded as the greatest reprographic process in the modern world. Micrographics combine the science, the art, and the technology by which information can be quickly reduced to the medium of microform, stored conveniently and then easily retrieved for reference and use. Accordingly, "Microreprography" is a photocopy of any object, though for our purposes usually a page of text, which has been copied on an unusually small scale, or as we more commonly say, at ratios of reduction such as to make reading difficult or impossible with the unaided eye. The microforms cover all forms of microimages, - may be transparent or opaque and they may be in the form of film rolls of various widths and lengths, in the form of strips, or in the form of sheets or cards of various sizes.

Although microfilming was introduced to Sri Lanka in 1967, it has a long history , beginning in 1839 when John Benjamin Dancer, a British scientist invented the technique of microfilming. He reduced 50 centimetres of the original to 03 centimetres of the microphotograph. A French photographer, Rene Patrice Dagron used the microphotographic technique for sending news of the outside world to the citizens of Paris besieged during the Franco-Prussian war of 1870. The news despatches were photographically copied on tiny films and were conveyed by carrier-pigeons under the nose of the Prussian army to Paris, where they were read by projecting the image through a big gas-lighted "magic lantern". Each film measured 3 x 5 cm and contained 16 pages in four, or three vertical columns. Eighteen of these strips, weighing one gram, were inserted in a feather quill and tied to the leg of the pigeon. Thus about 1,15000 microfilmed messages were flown to Paris by pigeon post. It should be noted that microphotography was commercially made use of by an American, George Macarthy in the 1920's. Microfilming became very popular during the Second World War in 1942, when Eastman Kodax Company popularised and developed microfilming in the West.

Microfilm

The greatest reprographic demand in manuscript depositories is for the microfilm. Although microfilm was used widely as a means of reproducing original documents for preservation and security since the Second World War, its importance and use was not realized in this country till recent times. It has only spread to one or two documentation centres or libraries, but mainly for the production of microfiche. However, Librarians, Documentalists, and Information Scientists and Researchers have realised its importance for storage and retrieval of knowledge.

Microfilm may be defined as a transparent flexible material for the photographic reproduction of documents in reduced size or as a series of photographic reproductions on this medium that may be viewed optically and that may be used for making additional microfilm copies or enlarged to make eye-legible prints. There are three main types of microfilms in use today. (1) The Silver-halide emulsion type, (2) Diazo or ozalid type and (3) the Kalvar type. The silver-halide emulsion films consist of a thin strip or roll of cellulose acetate, known as the base, containing a coating of the light sensitive emulsion on one side. Usually, the emulsion side of microfilm has little or no gloss, while the non-emulsion side is very glossy. The only permanent record films, i.e. those that have permanance are silver-halide emulsion type. There are four classes of emulsion type microfilms according to use:

(1) The master or camera or original negative. This negative should be used only for making additional film copies. The only time it should be used in a microfilm reader is during the inspection process.

(2) The master positive or security copy. This copy is specially prepared for use in producing a duplicate in case the master negative is damaged or destroyed.

(3) The positive or reference copy. This copy, usually a second generation copy, also has the same tonal values as the original text photographer.
(4) The duplicate negative copy. This copy usually a third generation copy, has the same tonal values as the master or camera negative. In 1966, Eastman Kodax Company produced a negative microfilm from an original negative directly, without going through the intermediate stage of preparing a positive. This development makes it sensible to preserve the original negative as a "master" security copy and use the direct negative for production of positive prints for scholars.

The Ozalid or Diazo type of film consists of a thin strip of cellulose acetate that has a light sensitive diazo dye either incorporated with the film base or coated on the base. With this type of microfilm a negative image could be produced with a negative image.

The Kalvar film consists of a thin strip of polyester film that contains a diazonium emulsion. With Kalvar film a negative image will also produce a negative image.

One must not forget that Ozalid and Kalvar films are not so suitable for use in a microfilm camera, but only for preparing film duplicates. Neither one has been approved for archival permanance. Both these types are generally more suitable for the production of film copies from high contrast materials, such as newspapers or line drawings than they are for the reproduction of archival documents.

The emulsion type of microfilms with silver-halide base are the ones suited for reproduction of archival materials. This type of film negatives are fine grade with resolving power, good sensitivity and contrast. For filming archival records, non-perforated (without sprocket-holes) microfilms should be used as the use of perforated film results in the loss of 25% or more of the useful area of the film. This is so because the image on the film must be kept in the area between the perforations or holes.

The normal size of microfilm used for copying archival materials, newspapers and books is 35 mm on reels with a capacity of not more than 110 feet (33.53 metres). The mm measurement is the width of the film, & the standard roll length is 100 feet (30.48 metres). But rolls are often made shorter or a little longer. The 16 mm films could be used for the production of card indexes and some letter size materials with good contrast between the writing and the paper base. Seventy mm and 105 mm microfilms are used for the reproduction of large engineering or architectural drawings that cannot be microfilmed satisfactorily on 35 mm film.

The reduction ratio of a 35 mm microfilm is 12x-24x; a 16 mm is 25x-30x of the original document. Most of the documents and books are microfilmed at medium reduction, i.e. usually between 16x-30x. Newspapers are usually filmed at 17x or 19x on 35 mm film, thus permitting legible images to be projected via medium magnification. Sixteen mm reels are primarily used for record material such as correspondence, checks and similar information. Microfilms of 105 mm may be used for large maps and plans. The roll microfilms are available not only in reel form but also in cartridge and cassette, Jacket and Aperture - card forms. Microfilm cartridges are convenient packaging for rolls of microfilm.

Microfilms on reels, which require threading, cartridges can be self threading. They are well protected and not subjected to fingerprints and other possible sources of damage. The microfilm in cassettes gives added convenience to the handling of continuous rolls of microfilm. Each cassette contains two film spools i.e. the feed and the take-up. There is no need to rewind a cassette film when it is removed from the reader. Any frame may be held in viewing position for further reference at a later time. Microfilms could be produced and cut into strips and inserted in acetate Jackets. A Jacket is a plastic carrier with single or multiple sleeves or channels designed to accept strips of 16 mm or 35 mm film. Jackets both protect the microfilm and also facilitate the organization of material. Images may be copied or read directly from the jacket without removing film. They can be visibly titled for a quick, easy file reference. Jackets are useful for storing microimages of case files, such as hospital records (case files of patients) or current personnel records which are active and cumulative. It is also possible to take individual microfilm images and with the aid of special machinery mount them on aperture-cards or punch cards, which permit rapid retrieval of the information on them.

Aperture-cards are available in many sizes, 3^{3}/4" x 7^{3}/8" tab size is most commonly used. They may contain a single image or up to eight page-size images on one 35 mm frame. A table of contents, an abstract, and engineering drawings are available on aperture cards. The Com recorder converts the data stored on Computer tape directly to microfilm.

Documents or books may be recorded and reproduced on reel film in four organized formats and styles, depending on the nature of the material and how it is to be used. Some users require a microfilm system that can reproduce documents within a wide range of sizes from large engineering drawings to a small file card. Some like bank and law firms, need a system that can reproduce both front and back of a document (a cancelled check of a notary deed) side by side. Simplex - comic, Simplex - cine, Duo and Duplex are the formats that documents could be arranged on the microfilm.

If the arrangement of the original documents on the film is in a sequential order and the text is arranged on image running parallel to the length of the microfilm, it is called the Simplex Comic arrangement. This arrangement is like in a comic strip. Most documents up to $8^1/2$" x 11" (21.2 cm x 27.5 cm) are filmed in simplex-comic format. Simplex-cine format, is microfilm containing images in a sequential order, but the text runs across the width of the film. The standard archival microfilming is done by combining the two formats described above. Normally, oversized documents and books are filmed using the Simplex-Cine arrangement. In both Simplex comic and Simplex-Cine arrangements it sometimes is the practice to film more than one page per frame. The facing pages of a book or document, might be photographed together.

The two other commonly used formats, each of which use one half of the film width, are Duo and Duplex formats. Duo format is, microfilm containing pages filmed in sequence on one half of the film's width with the film being reversed at the end of the roll to contain subsequent pages. Duplex format features the front and back of documents filmed side by side. This format is ideal for filming Bank cheques where signature and endorsement appear in both sides filmed simultaneously thereby accommodating more frames on the film. The reductions used for both Duplex formats usually range between 32 X & 45x.

The majority of microfilms used to-day for filming of archival documents are black and while, although the use of colour films is increasing. The colour film has one major advantage over black and white film i.e. when colour is essential to the understanding of the subject matter, for instance, in reproducing an art book, chart or diagram, or colour illustrations.

Microfiche is another popular microform which literally means small (micro) card(fiche). It is a transparent sheet of microfilm containing micro images in a grid pattern. It usually contains identification information which can be read without magnification. They are available in a variety of sizes. i.e. 3" x 5", 4" x 6", 5" x 8", etc. The most common size is the 4" x 6" fiche. The maximum number of images that can be contained on a fiche depends upon the amount of photographic reduction. Most fiche are filmed at 18 X to 24X, but some are 48X. In a microfiche of 3"X5", 60-98 frames or images could be accommodated. 78 pages of a journal would be grouped on a microfiche of 10.5X14.7 cm.

An improved form of microfiche has been developed as ultrafiche containing images reduced more than 90x, thus permitting thousands of images per fiche. 11" X $8^1/2$" ultrafiche could accommodate 3200 images. Accordingly, ultrafiche offers the advantage of storing more information in less space than a standard microfiche. A superfiche is also developed at a reduction rate of 75x, including about 1000 pages on one fiche. While planetary camera is used for filming roll microform, a camera called a "step and repeat" is used for microfiche.

Micro-opaque is another microfilm similar to microfiche. They are images on opaque stock i.e. images, may be stored on both sides of the film. They are available in 5" X 3" and 6" X 9" sizes. The duplication of micro-opaques is rather expensive.

Microcard is similar to microfiche but reduced on an opaque card. It is produced by a photographic process. A microprint, another microform is similar to a microcard, except that it is produced by a printing process.

Advantages and Disadvantages of Microforms

Advantages

Today microforms have become very popular in reproducing books and documents as their advantages are much more than the disadvantages. Each microform has its strengths and weaknesses for the reproduction of original material. The economy, efficiency and the speedy retrieval of information are the advantages of microforms to the Librarians, Archivists, Documentalists and Information Scientists. Even the user or the scholar is benefitted by the advantages of these microforms. The most versatile, and best suited microform for the reproduction of archival or library materials has been, and is, at the present state of technological development the roll microfilm. The file integrity or the ability to retrieve and reproduce a document without the chance of its being lost or misfiled after use is assured in a microfilm. Secondly, the file security or the use of microfilm to duplicate irreplaceble records as assurance against loss or destruction of the originals is also secured. It is said that 95% of space will be saved by storing microforms, than by storing the originals. Storage space is an important factor to an expanding library, specially in a metropolitan where space is extremely important and expensive. As microforms could be stored in compact storage, they are considered as a great space-saving device. Books and documents are produced in various sizes and as a result a librarian should order various types of racks to store them. In the case of microforms, as they are produced in standard formats, racks could be ordered or manufactured to one uniform size. This would save space and will be economical too.

The retrieval of information is considered less time-consuming in the case of microforms than obtaining information from originals. As these microforms are machine-readable records where information is obtained through a push button or other mechanical device, it invites readers to handle it, rather than handling fragile, brittle or faded original documents. Librarians and archivists would certainly produce their books or documents to the readers in microform, than allowing the readers to handle valuable originals through fear of loss or damage to them. The risk of loaning rare and valuable books to a reader could be overcome by giving a microform copy. Even this would prevent a library from engaging in recalling costs. A librarian could afford losing or damaging a positive copy of a microfilm loaned to a reader, if the negative is deposited in the library. Every librarian has experienced the rising costs of original books. This has hampered the purchase of new books to the library, in order to improve its collection. Today, microforms have come to the aid of the librarian by supplying the new books at 1/3 of the price of an original book. An example could be cited as 13 volumes of the Oxford Dictionary could be purchased in microform at 1/3 of the price of the original.

The use of the microfiche is the reproduction of printed, typed or other high contrast materials such as periodical literature, pamphlets, and scientific research reports. Microfiche has gained popularity owing to the advantage of less cost than that required for conventional printing. Microfiche is being used increasingly for the reproduction of catalogues and various types of directories both in industry and government. When sections of catalogues, for example, that have been reproduced on microfiche are revised, the revisions are also placed on microfiche at a lower cost, thus avoiding the purchase of a revised printed catalogue which would cost more. The eye-legible titles that are prepared for a microfiche, enables the user to file them in card catalogue drawers. Microforms are more easily mailed at a lower cost than original books. It is clearly demonstrated that newspapers, the most difficult of all printed materials to preserve, store and handle have been reproduced satisfactorily in microform to solve the above problems faced by the librarians and archivists.

Disadvantages

The significant advantages of microforms should not be looked upon as a panacea for solving all problems of records and books. The microfilming of records has been so oversold and sold in so many wrong places that the salesmen have often become their own worst enemies. Its capabilities have often been honestly and dishonestly misrepresented. Sometimes very important cost factors have been glossed over, treated as of no consequence, or ignored completely. It is estimated that we could provide the space required for a longer period of the original document, far less than the cost of microfilming and maintaining it. In this context, costs in respect of microfilm software, hardware, periodic inspection, servicing and air-conditioning should not be ignored. Accordingly, although microforms offer the largest saving in space, their costs are alarming.

Microfilms and fiche are normally very durable and would last for 500 years. At the same time, the film producers will furnish a set of specifications for film storage that will scare you. You should know that excess of moisture will ruin the film by sweating or mould, whereas a very cold or dry atmosphere will cause the film to become brittle. If the film is kept in a safe or vault of variable temperature, a slight distortion would occur and ruin the film completely. It should be remembered that permanence and durability of microforms depend on the maintenance of high technical standards during the process of production. The nature of the microform material, i.e. acetate film, is a more delicate medium than paper records. Minimum archival storage conditions for microforms are filtered air-conditioning systems which will maintain a temperature, between 65° and 70° F. (18.3°C and 21.1°C) and relative humidity of about 40%. Therefore, the cost of maintaining and servicing records in microform may be more expensive than storing and servicing the originals.

It is argued by librarians and archivists that retrieval of information from microforms is much more speedy, easy and efficient than in the case of original records. Let us consider the physical operation for a moment. If you want a file or book in the original form, a record clerk or library assistant would walk to the file drawer or the rack, take the original and hand it to the reader. In a matter of minutes you see it. However, if you want to see a microfilm, you go to the index, find the number of the roll you want, go to the storage cabinet, find the film or films and proceed to the reader with it, you open the carton, take out the can, open the can, take out the film thread the film on the reader and start-looking. With 600 -3,000 or more frames on a roll or fiche, you will have to find the necessary frame or frames. This operation is more time-consuming than going through an original record or book. If you happen to experience a power cut or a failure, you will be frustrated. This would be the case if the bulb of the reader fuses while viewing the film. Even viewing a microfilm in a dark room is a strain on your eyes.

In a microfilm, not more than one or two pages can be scanned simultaneously. This may be inconvenient when a reader wants to compare facts appearing in another page which is at the end of the film. Therefore, it is not possible to compare two images even on the same roll.

It is often said that the intrinsic value of an original document is lost in the film copy. The determination of the age and genuineness of the original document is not possible in the microfilm. Even the colour writing and illustrations are not shown in the microfilm and this would be a disadvantage to a research worker in need of colour illustrations.

The necessity of using a viewing device in the microform, would prevent a reader from browsing or reading in a train, bus, queue or in bed. Every Librarian and Archivist think that legality of microfilm is pretty well established, as actually to date no major case has been challenged. The day someone challenges the legal validity of the microform in court of law, film as primary evidence will be rejected.

The Photostat is another process of reprography, using photography. It is a large camera with a prismatic mirror attached to the lens. It takes in a roll of silver-halide paper, onto which the copy is directly made. It can copy documents up to 40" X 30" but the largest print it can produce is 24" X 18" because 18" is the width of the roll of sensitized paper, 350' long.

There are few advantages of the photostat process. As the photograph is taken on to paper instead of the film, copies of the same size as the original could be reproduced. However, the ability to vary the size of the prints is advantageous in producing negative, eye-legible copies for research purposes. Moreover, high quality reproductions are assured as wet chemicals are used in processing. The positive copy is more legible and the tones are reversed in obtaining positive copies. The photostat process is ideal to obtain copies of newspapers in its original size and format. Photostat process could be used with advantage to reproduce faded, brittle and oversized archival documents. The use of ultra-violet-rays in this process is an advantage to reproduce original material with a poor contrast. The copying of palm-leaf manuscripts could be done satisfactority by using the photostat process.

However, the modern revolution in reprography began in 1950 with the invention of Xerox, Thermofix and other electrostatic processes of document reproduction. As a result, reprography, which required trained and skilled personnel was taken out of them and placed in well lighted offices where clerical personnel without any knowledge of photographic process were making reproduction of documents.

These quick copies produced copies of documents at a cheaper rate with reasonable speed of copying thereby making the whole community aware of the advantages of reprography.

The Archivists, Librarians, Documentalists and Information Scientists have realized the importance of these copies for reproduction of documents, mainly for dissemination of information to readers.

The electrostatic process could be used to reproduce single sheets of small volumes which contain valuable information to research workers at a cheap rate. A page or part of a book, an article in a journal, a printed document could be reproduced efficiently.

However, large bound volumes or files and faded documents cannot be copied satisfactorily in quick copiers. The maximum copying area is also limited to 11" X 17". Accordingly, newspapers, engineering drawings, architectural drawings, large maps and plans wll not be accommodated in this type of copiers. To describe the uses of reprography to a library, archives and other centres engaged in storing and dissemination of knowledge, would encourage the personnel in these institutions to plan for the future to set up reprography centres in their respective institutions.

Broadly, there are seven major common uses of reprography: (i) Security, (ii) Preservation, (iii) Disposal, (iv) Acquisition (v) Reference (vi) Administration, and (vii) Publication.

(i) Security

The reprography of documents for security is done to provide insurance against the loss of valuable information in the documents in the event that the documents themselves should be destroyed by flood, fire, theft, insects, war or other calamity. As experience has shown, fire, theft and insects (specially rats, white ants and silverfish) are the most common enemies of documents in Sri Lanka. The loss and damage caused by these hazards are irreplaceable. Fire risks of documents are more common in business organizations than in Archives and Libraries, as a large number of people are employed using inflammable and other chemicals for production purposes. One must not forget the fire outbreaks which are suspected sabotage activities caused by employees holding different political ideologies and belonging to various trade union organisations. The damage caused by insects and loss by theft are common occurences in archives and libraries. Accordingly, valuable and irreplaceable documents of an organization should be microfilmed or xeroxed to prevent any hazards mentioned here. It is essential that the security copies of documents should be stored, in a place located in a different building from the one in which the original documents are kept.

(ii) Preservation

Reprography of documents for preservation is done for two reasons; (a) to protect records against possible deterioration from use, i.e. against wear and tear, and (b) to preserve the informational content of documents against deterioration and eventual loss. The use of "preservation reprography" of documents is ideal for archives and libraries in Sri Lanka. It is essential for organisations holding old manuscripts in their possession. Archives and libraries especially could make good use of this technique of document reproduction. At present only the National Archives is engaged in this type of preservation filming. An organisation which possesses documents produced on poor materials, such as highly acid woodpulp, containing a pH value less than 5.5 or non-permanent quick copies, or documents that are faded, brittle, charred or watersoaked should be transferred into microfilm. Moreover, even an individual who possesses rare and invaluable records or books should adopt preservation filming to preserve and safeguard his collection. The archives and libraries should be compelled to rely on preservation filming owing to the constant use of their records and books which are accessible to scholars and the general public. The wear and tear and the loss of original documents in archives and libraries could be arrested only by preservation filming. The high cost of repairing original records could be cut down to a fraction of cost by avoiding repairs on originals and filming them to be used by the readers. Accordingly, essential repairs can then be reserved for documents that have value or that do not lend themselves easily to microfilming, such as documents (a) that contain very fine writing, (b) that are oversize, (c) that are in colour or (d) that have poor contrast between the reading matter and the paper.

(iii) Disposal or space-saving

Although, disposal or space-saving filming of records is popular in the advanced countries, Sri Lanka has not yet ventured on this type of document reprography. According to the statistics placed before the 8th International Congress on Archives held in October 1976, only eleven countries are using disposal filming. I am sure that there is no organisation or institution in this country engaged in or which has adopted disposal filming. This is a method used to save considerable amount of space (5% of the space required to store the originals), and to dispose of the originals. For example, the Lakmini Pahana Newspapers for the period 1862-1900 were transferred into four reels of microfilm, i.e. (400 feet of film). However, the filming of permanently valuable records for disposal purposes alone is rather risky and expensive. This type of disposal filming will attract any organisation in this country as in most instance, they complain of the lack of space to store the originals. Nevertheless, the disposal filming should be undertaken with extreme care, as some of the legal problems involved in disposal filming are not yet internationally solved. The legislation will have to be amended and the problems of acceptance of the reproduced copy as equivalent to the originals must be settled before any project is undertaken for disposal filming. One must not forget that disposal filming may be undertaken only for records which have little permanent value or when legal limitations are not specified for the permanent preservation of any series or type of records. Before engaging in any disposal filming project, the following factors should be considered (a) the effect on reference cost, (b) the expense of additional microfilm readers. (c) the generally higher cost of obtaining eye-legible enlargements (on paper) from the originals in a depository and establishment of a microfilming unit, its maintenance and cost of raw materials, such as reels and chemicals.

(iv) Acquisition

This method of document reproduction is defined as the filming of documents in other depositories or institutions or in private possession to supplement and strengthen one's own holdings. Acquisition filming is more suitable and essential for archives and libraries. It is an ideal method for colonial countries to obtain the copies of rare and valuable originals taken away by their masters at the time or before gaining independence and for documents created at the far end by the masters as a result of their administration of colonies. Moreover, copies could be obtained from the original documents containing material on Sri Lanka lying in archives and libraries of other foreign countries. This is the easiest and a low cost way of obtaining records which have left our shores, where the present owners are unwilling to part from them. A library or a documentation centre which is newly established could adopt this method to acquire the rare and valuable books and magazines held by other libraries and institutions here and abroad, in order to build up the collection. The acquisition of copies of originals in the format of photocopy or xerox (quick copies) would serve a library, building up its collection of books and magazines, than obtaining them on microfilms. It is because the users of libraries are more inclined to browse or read the material in the book form. A library could cut down it's cost for purchasing microfilm readers if acquisition of documents are obtained on the format of photostat or quick copies. Acquisition of copies of theses and dissertations submitted to foreign universities on Sri Lanka by Sri Lankans, which are unpublished would be a valuable acquisition, if obtained on microfilm or Xerox format, to any institution interested in depositing such material. Even an individual could improve his own private collection of documents by obtaining photocopies of originals which are difficult or expensive to purchase.

(v) References

In filming documents for reference, the purpose is to provide the researcher with exact copies of documents at a cost far less than the cost of transcribing, typing or photostating the originals. It could be used as a substitute for note-making and the scholar or requesting institutions could make a copy without making use of the original document over and over again. If a microfilm is made filming valuable records, a master negative should not be preserved in the institution where the original document is preserved. Accordingly, any number of positive copies could be made for scholars and others who request the same document. The retained negative copy may also be used for security, preservation or disposal purposes.

(vi) Administrative or facilitative uses

Administrative filming is used in an institution to facilitate its services to the users of the material of a particular institution. A book or a document which is badly deteriorated beyond repair should be filmed before any restoration work is undertaken on the document. This would enable a reader or a scholar to evaluate the original form of the book and the format of it before the repairs have been effected to the original. Moreover, if the letters in a book or record are fading or faded, to facilitate reading it should be reprographed immediately. If a library or an archive wishes to exhibit their documents to the public, it is much safer to exhibit the copies of originals reproduced in various forms so as to safeguard the originals from theft or damage.

The efficiency of documentation and information centres and archives or libraries lies in its finding aids which enable these institutions to render a good reference service to the users. Accordingly, indexes, lists, calenders or other finding aids to books and records could be easily supplied to researchers if they are on film.

(vii) Publications

Copies of series of records, rare books or periodicals can be published in their entirety on microfilm at far less cost, more rapidly and with less editorial labour than is needed for letterpress publications. Appropriate title pages, an introduction, a table of contents, indexes and special lists could be reproduced on film to facilitate the investigator. The method of "microfilm or microfiche publication" is now becoming popular in the western countries, where information is disseminated at a low cost and in a speedy manner. When publishing scientific or technological literature, microform publication techniques could be made use of to publish material now out of print or to obtain literature at a low cost in the preparation of research articles for publication. Moreover, enlarged or reduced copies of illustrations, charts, plans, photographs, etc, could be obtained quickly and at a low cost by making use of microform techniques.

Reprography and Copyright

Restrictions on free copying is not a very old phenomenon. Even the invention of printing by Gutenberg during the 16th century did not make the authors conscious that they were being robbed of their intellectual labours. However, on 9th September 1886, the nations who met in Berne signed a convention for the protection of literary and artistic works. This convention was completed at Paris in 1896, revised at Berlin in 1908, again completed at Berne in 1941, revised at Rome in 1928 and in 1948 at Brussels and at Stockholm in 1967. Under the Berne convention both published and unpublished works are entitled to automatic protection in all countries signatory to the Berne convention without the compliance to any formality whatsoever. Sri Lanka is a signatory to this convention.

The Universal Copyright Convention adopted by the Inter Governmental Copyright Conference held at Geneva in 1952 agreed that it is necessary to affix on all copies of the work a statement showing that the work is copyrighted, using the symbol (c) the date of its copyright and the name of the copyright holder. The copyright period under the Berne convention is life of the author and 50 years from the date of his death. Under the Universal Copyright Convention it is 25 years after the death of the author. Being a crown colony of Britain, Sri Lanka adopted the Imperial copyright Act of 1911 and in 1979 passed a new copyright law titled "Code of Intellectual Property Act No. 52 of 1979" which is in operation at present.

The modern development of Reprography equipment has made photographic reproduction of recorded material an extremely simple, rapid and inexpensive process. It should be noted with caution the threat to existing copyright laws, as Librarians, Documentalists, information Scientists and others engaged in retrieval of Information are engaged in copying of copy-righted material.

"Copyright" is a Paramount right given to the authors and publishers in order to motivate them to continue their respective activities which ultimately contribute to the enrichment of human knowledge. Accordingly, copyright should operate between two limits, (a) that author and publisher are not deprived of their just rewards, and (b) the right granted to the author and publisher does not impose unnecessary restrictions on the use of their work.

The Librarian, Documentalist and Information scientist has never acted with the intention of robbing off the intellectual labours of the author and the investment risks of the publisher. Their main interests are to make reading material available and to disseminate it to the user as quickly as possible. In this enthusiasm of dissemination of knowledge to the users, one may infringe the copyright laws and pay the penalty. Accordingly, any person working in a centre where knowledge is disseminated, should be aware of the pitfalls of reproduction of copyright works.

According to the Copyright Act in operation in this country, clause 13 stipulates that reproduction of a work exclusively for the user's own personal and private use is allowed under the "Fair use" condition without the permission of the author. Accordingly, no infringement of copyright can arise unless a substantial part of the copyright is involved. Even where a substantial part is involved, and copying may be permissable as "fair practice or dealing" provided, it is for the purpose of research and private study and also that it is for the purpose of published criticism and review. Even under the "Fair copying" or "Fair use" clause, it is important to remember that if reproduction of a copyright matter has deprived the copyright holder the benefit of the sale of one or more copies of his book, it is a case of infringement of copyright.

If a court of law had to decide what is "reasonable copying" or "use", they would not normally regard it as unfair if a single copy is made from a copyright work of a single extract not more than 4,000 words, or a series of extracts (of which none exceeds 3,000 words) to a total of 8,000 words, provided that in no case the total amount exceeds 10% of the whole work. However, it should be noted that this is not a final judgement on the "Fair copying" clause.

It is always safe for a librarian or a centre engaged in information retrieval through Reprography techniques to devise an application form when requesting photocopies of copyright material. This form should contain a signed statement that the person who is requesting the copyright material has not obtained the same material from another source, and it is the first application for such copy to be used in his bona fide research or private study. When issuing photocopies of copyright material, the person who is dealing with the issue of photocopies should make a statement stamped on the photocopies issued to the user to the effect that the copies are issued only for research and not for commercial purposes. This would safeguard the librarian if action is brought against a user, who has utilized photocopy material issued by any documentation centre for commercial purposes.

I give below a specimen declaration from a person requesting for a reprographic reproduction:-

I, (Name)...

....

of (Address)..

....

hereby request you to make and supply to me a copy of the above material/article or section of above work which I request for the purpose of bona fide research or private study. I have not previously been supplied with a copy of the said article/the said part of the said work by any other person. I undertake that if a copy is supplied to me in compliance with the request made above, I will not use it except for the purpose of research or private study.

Signature:.......................

Date:.................

A specimen declaration to be stamped on every page of a photocopy issued on request would be "single copy for personal or private use", "Reproduction limited to one copy strictly for personal use".

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THE PROMOTION AND PUBLICITY OF SCIENTIFIC, TECHNICAL AND MEDICAL JOURNALS

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The promotion and publicity of scientific, technical and medical journals falls within the marketing or, as it is termed, the distribution function in publishing. However, it is the content of a publication that largely determines or should, at any rate, determine the distribution or sales strategy, more so in the case of publications such as specialised journals serving a particular readership as do journals of the genre we are considering. Promotion and publicity of publications and especially journals have, therefore, to be considered with due reference to content and readership. And, so that we may get our perspective right and bring the subject into correct focus, it would, I think, be useful for us to see, first, where such journals are placed within the context of publishing in general and what their special characteristics are, and secondly, and more to our purpose, how their promotion and publicity could be formulated to best advantage. But even before that we need to look at the publishing enterprise, and thereafter more particularly, at those aspects of it which have a hand in shaping the methods of promotion and publicity best employed for the class of journals we are concerned with here.

Publishing through the medium of the printed word covers, as we know, a vast field from ephemeral pamphlets, booklets and the like to works of relatively timeless value. It is apparent, therefore, that they could be classified into a number of categories or branches, having their special characteristics. Scientific and other journals of that kind would be placed within the category known as scientific publishing, itself a sub-division of that branch, or it can be even considered an integral part, of what is called scholarly publishing. The function of scholarly publishing may be described as assisting in adding to and spreading man's store of knowledge, interpreting culture, bringing of analysis and criticism to bear on what we know and how we think and generally, making a contribution to the advancement of the frontiers of knowledge. The journals we are concerned with have their own part to play in this on-going enterprise. It may even be claimed for them that, with the phenomenal growth there has been in many branches of knowledge and in science and technology over the last decade or two, and considering the nature of their content, journals of this kind have in a real way been in the vanguard of scientific publishing, low though their profile may be if reckoned in terms of the number of journals or the quantities in which they have been published. That they hold a special place in scholarly and scientific publishing is to be accepted, but they have, as a class, their own characteristics. From the point of view of promotion and publicity the characteristics of which we need to take special note would be that : (a) they would normally contain new material or critical comment (b) they would cover specific areas (c) they aim to reach a specialised and a limited readership (d) they would normally be issued periodically.

The next aspect of publishing to be looked at is the economic aspect, and with special reference to its bearing on distribution and therefore, on promotion and publicity. Within the context of our general economic system, publishing, for the most part, is commercially based and needs thus to remain financially viable if it is to survive and grow. The point which needs to be noted is that scholarly books by and large - and this includes the class of journals we have in mind - though they are admittedly of considerable importance for the growth and diffusion of knowledge, are unhappily often uneconomic to produce, that is, they are by themselves generally not self-supporting financially and unable to provide the degree of profit normally required in any commercial enterprise. Fortunately, however, there have been and are a sufficient number of publishers willing to risk capital and to engage in the publishing of scholarly, including scientific books, not infrequently by making up the losses incurred on scholarly publishing from profits earned from books and magazines which have a more general or popular appeal and which bring in, if not the schekels, an adequate return. But in Sri Lanka, it seems that learned journals do not share in this, being left largely to their own devices for making ends meet. However, the good news is that in the case of these journals, there are some special circumstances which can help in a material way in overcoming some of the difficulties and disadvantages to which scientific and scholarly books and journals are subject. These we will discuss after we have taken note of some facts relating to pricing of books and to distribution costs. The point to bear in mind is that behind the promotion and publicity of journals, indeed as a part of its publishing, one has to reckon with the economic factor.

Books are priced now generally between about three and five times their costs of production, and this would be broadly true of journals, too. If the difference between physical cost and sale price seems unduly high, it is because provision has to be made for (a) costs of distribution, including promotion and publicity, which may absorb as much as 45% to 55% of the sale price, (b) author's royalty, usually for scholarly books between 10% and 15% of the sale price (c) the publishers' services, overhead and financial costs, and (d) some margin of profit to the publisher. This is the picture for books, but in the case of journals there would be some important variations, such as what payments, if any, are to be made to contributors in lieu of author's royalties, whether copies or most of them, are sold on a subscription basis, the distribution arrangements, including promotion and publicity, and these may vary to a significant degree. Why distribution costs take as large a proportion as 45% to 55% of the sale price may need some explanation. The reason is simply that of this 40% or 45% something like 20% or 25% has to be passed on to the Bookshop or retailer and the balance is needed to cover the publisher's or distributor's costs of services, overheads and to include some margin of profit. Similarly, the bookseller has out of the 20% or 25% he receives to meet his own cost of operation, and retain something of it as profit. Costs of promotion and publicity have also to come out of the provision for distribution.

It will be seen, therefore, that under normal book publishing arrangements, a substantial slice of the selling price has to go to meet costs of distribution, including promotion and publicity. A little reflection will also show that estimates as to sales to be expected and decisions, therefore, of what number of copies to print and what price to fix, whether of books or journals, are crucial basic decisions to be made by the publisher, and they need to be carefully planned.

Now what I have said may suggest that the outlook for publishing, including publishing this class of journals, is not promising. But, fortunately for scientific and other such journals, there are some significant and distinctly material advantages which can be exploited to overcome the main financial and distribution problems that scientific books are heir to: specifically in the matters of what number of print and what price to fix, and in helping in restricting distribution costs. These advantages are:-

(1) Easier assessment of sales and of the number of copies to print as compared with books and magazines, as the potential readership is more easily assessed where the subject matter as in the case of journals, covers a specialised area. This is a major advantage not only in the decision as to the number of copies to print, but also in planning promotion and publicity;

(2) Pricing, which may be difficult to decide on where the number of copies which may sell poses uncertainties, is simplified with both production costs and what will come in from sales being more easily ascertainable;

(3) Little or no risk of over-pricing: likely buyers and subscribers - academics, professional persons, libraries, learned institutions - being particularly interested in the content of these journals, could be expected to pay any price within reason. Apart from minimising financial risks, an adequate margin to cover costs of promotion and publicity could thereby be ensured;

(4) Accessability to the majority of potential subscribers or buyers: this is a special advantage in distribution and in publicity and promotion work and makes for more effective and less costly sales as most customers could be reached by direct mail rather than through trade channels and relatively expensive newspaper advertising;

(5) Depending on the content, there could be a worthwhile market abroad for these journals, especially among libraries and learned institutions; foreign sales could also help materially in the area of finance as, in accordance with general practice, the fixing of higher than local prices for foreign sales is acceptable.

It is important to bear in mind, however, that to benefit from the advantages I have enumerated, there are two pre-requisities: firstly, the availability of information or of arrangements for researching the information as to names, addresses, etc., of persons, institutions, etc., constituting the market and from which information the sales figures could be worked out; secondly, the availability of facilities to make use of the information for planning production and distribution, and therefore, promotion and publicity. The more efficiently these are done the more effective would be the promotion and publicity.

Having seen how journals fit into the publishing picture, their characteristics and how certain circumstances could be turned to their advantage, we may now look at how and where methods of promotion and publicity could be managed so as to play their part and with maximum effect.

By the terms "promotion" is meant all methods and techniques which a publisher uses both to make known that a particular publication has been or is to be published and to induce people to buy or, in the case of some journals, to become regular subscribers to it. Promotion is, to some extent at any rate, a creative activity as ideas and imagination are basic to its techniques. Promotion with which goes publicity, could in some cases, particularly new publications, including journals which are more dependent on it, make all the difference between a publication being placed on the map or allowed to languish unknown. Promotion and some publicity are, it must be acknowledged, necessary for journals even though they do not play as essential a role as for books, which are published for mass readership or, in the case of scholarly books, for a relatively larger readership.

The second important point to be noted is that while even for books promotion methods need to vary with each book, to some extent at least, this is much more so in the case of journals where the promotion has invariably to be a tailor-made exercise for each. As we shall see, there are several promotion methods that are available, but what the best combination is has to be worked out for each.

The third point I would make is that promotion has to commence well in advance of publication and be followed through almost till the readership or sales targets are within sight. Of course, the methods and tempo have necessarily to be varied according to how sales are progressing and other such circumstances.

We now come to the practical level and to the kinds of, and, methods of, promotion and publicity from those generally used by publishers of books but which would be appropriate for the journals we are here concerned with:

(1) Advance announcements to academic and/or professional circles, as the case may be; also to editors of newspapers and other appropriate journals or magazines whose readers may be expected to be interested with requests for suitable mention;

(2) Brochures giving details to all who may be expected to subscribe to or purchase copies, incorporating an order form to be sent to the publisher or distributor as the case may be;

(3) A special pre-publication price in the case of a new publication might also be offered as an inducement, particularly where finances are needed to get a new journal going. This could be sent with the advance announcement, but only to those who could be expected to subscribe;

(4) After publication, review copies to selected newspapers and magazines and journals. These had best be sent addressed to the editors by name under cover of letters so as to ensure safe receipt. Some follow-up, by phone or otherwise, would be advisable as editors are busy and may wish to consult as to who might be asked to review the journal;

(5) Presentation copies to a carefully selected number of prominent individuals whose opinions may be expected to carry weight. These copies had best be sent with personal notes from the publisher or editor. A request for observations could be included; if received and found useful for publicity purposes, they can be so used. As to persons to whom these copies would be sent, this will depend on the publication and its contents. Among those to be considered would be: leaders in the academic or professional field, particularly those considered authorities or

specialists; according to their content, educationalists, important figures known for their interest in subjects covered in these journals; editors of newspapers which could be expected to take special notice of the kind of material the journal carries for news or feature purposes.

These methods would, of course, be more appropriate for new journals but some of them could be suitably modified for later issues.

From what I have said, it will, I think, be clear that if promotion and publicity are to be carried through on a systematic basis, a fair amount of regular work would have to be done commencing with the researching and collation of data of subscription/sales prospects, right through till sales or subscriptions targets have nearly been reached. Sales promotion and publicity, as part of distribution, is the publisher's responsibility and these functions the publisher, therefore, performs in the normal course. But in the case of journals of the kind we are concerned with, the publisher is, I believe, more often the editor, or rather the editor is expected to carry out the publisher's functions as well; that is, if he is not fortunate enough to have an associate who undertakes to carry the burden and responsibility of the distribution work, including publicity and promotion. Book publishers could, of course, undertake the publishing of journals, but perhaps because of the limited market and the difficulty in obtaining the type of information as to particular readership, more easily accessible to editors, as well as certain other circumstances, the publication of journals by commercial publishers is the exception and not the rule.

Whoever is to be responsible for the promotion and publicity of scientific and other such journals, if we proceed on the basis of what I have said earlier, a scheme for promotion and publicity set out a chronological basis would run roughly as follows:-

(1) Using data obtained of persons and institutions likely to subscribe for or purchase copies of the journal in question, prepare lists with names and addresses for mailing advance notices, brochures, etc.

(2) Thereafter send advance notices to possible subscribers, libraries, professional persons; also prepare brochures, and have advance advertisements carried in other journals, local and foreign. Have these printed or produced in suitable form;

(3) While the journal is in press, send out notices, brochures, etc. Here, too, local and foreign;

(4) Immediately copies of the journal are printed, send out review, presentation or complimentary copies; have suitable follow-up action with a view to having reviews published as early as possible in other journals, newspapers, etc. This will include foreign journals;

(5) If sales or subscriptions orders have not been as satisfactory as necessary, and, depending on availability of funds in publicity budget, have some supplementary advertising done in the press or other journals;

(6) Radio and television publicity: where appropriate, interest those in radio and T.V. in any aspects of articles carried in a journal, which may have a general appeal or which could fit into any feature programmes in these media: a talk or discussion may be both interesting and helpful publicity-wise.

I have dealt with scientific, technical and medical journals as a group and not as if each was in a separate category calling for individual treatment. This is because their problems in promotion and publicity are of the same kind and the same sort of approach and treatment would be needed. But as I have pointed out earlier, each journal needs to be treated according to its individual content and sought-for readership, and it is for the publisher or whoever carries out his functions to plan the promotion and publicity and to work out the methods and techniques which would be expected, to bring in optimum results.

In conclusion, I would like to say a few words on promotion of scientific publishing in Sri Lanka, but not in the sense we have been considering promotion, namely, in relation to sales and publicity for individual journals. Rather, of promotion in its role as an active agent in helping in, encouraging and developing the regular and systematic publication of scientific, technical and other related material in any form. I think it is probably true that not a few manuscripts, of some value at least, are languishing in the desks of scientists, research workers and professional persons, mainly for the want of means of having them published, a situation which must also tend to discourage would be workers and writers from making their own contributions; and if even in the developed world, there are still not a few difficulties to be overcome in obtaining ready publication for such material, despite there being such vigorous institutions as the University Press in the United States and long established scholarly presses in the United Kingdom and the Continent, the difficulties are obviously so much the greater as to seem insurmountable in Third World countries like Sri Lanka with their limited resources and facilities. It is in these regions, however, that the need is more pressing for adequate publishing facilities for scientific and technical material.

How can this be achieved? I think a break-through in the context of our economic circumstances, can only be worked out on the basis of state support, directly and indirectly and using agencies, local and foreign, assisted or sponsored. The main areas in which support would be needed seem to be in financial backing and in publishing expertise. Whether, for example, the National Book Development Council set up with Unesco backing, can work a special scheme towards this end in association with bodies such as the COSTED and ASCO, I do not know, but perhaps it may be a notion worth considering. After all, in this age of science and technology, unless we in the developing world see whether and how we and our children are going, and how we and they can join in and become part of the global community of the future, we are likely to recede and be lost in what may seem a glorious but what is nevertheless a futureless past. Let us hope we get both our perspectives and priorities right.

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a. PROBLEMS IN EDITING SCIENTIFIC JOURNALS

1. The lack of professionally trained science editors. At present, persons with little or no knowledge of science editing are employed as editors by many scientific institutions, or else, senior scientists, with heavy schedules have to act as part-time editors.
2. There is a lack of awareness of internationally accepted standards as regards nomenclature, symbols, units, etc. Basic information, e.g. name of publisher, date of issue, etc., is often not given in some local journals.
3. The difficulty of attracting sufficient contributions of good quality. Most scientists prefer to publish their papers in internationally accepted foreign journals, whose wider circulation and prestige ensures greater visibility for their research.
4. The problem of finding suitable referees. Because of the small scientific community, it is often difficult to find appropriate referees locally in some specialized areas of Science and Technology. This necessitates sending articles abroad for refereeing, thus incurring expenditure of considerable amounts of foreign exchange as payment to referees and adding to the cost of producing the journal.
5. Many local journals are not specialised but cover wide subject areas. If a journal covers more than 3 subject areas, the possibility of it reaching the correct user target is decreased. As only a limited number of copies are published of most local journals, the chances of their reaching those working in specialised fields is remote. The journals of the Tea Research Institute and the Rubber Research Institute on the other hand cover definite areas and therefore can be directed to a definite user group.
6. Because most local journals, cover wide subject areas they are not included in the major international abstracting and indexing services which generally cover only the specialised journals in a given area of Science and Technology.
7. The language barrier. The medium of education for most of the younger scientists has been the national languages, Sinhala and Tamil. The scientific research journals, on the other hand, are published only in English (sometimes with abstracts in Sinhala and Tamil). This language barrier restricts the younger scientists from contributing freely to the local journals.
8. Specialised presses with facilities for scientific publishing are lacking in Sri Lanka. Only a very few presses currently in operation have the capability of handling technical printing.
9. Lack of information about available publishers and their capabilities as regards type-setting, printing techniques, etc.

10. Financial constraints due to the high cost of printing and production. Most journals have to be sold below cost, and have to be subsidized by government grants, etc. Others depend on advertisements to cover the cost of production.
11. Distribution systems both locally and abroad are poorly organized.
12. Limited market for the Science and Technology journals in Sri Lanka. Most journals have few subscribers or sales and are distributed mostly on exchange for other journals, locally and abroad. Because of the limited sales, it is very difficult to make the publication and production of a scientific journal a financially viable venture.

b. RECOMMENDATIONS

1. To provide training courses for editors to achieve professional standards in editing scientific publications. Training programmes should be organized to inculcate the necessary editing skills in persons having a science background.
2. To maintain a pool of professional science editors at NARESA. Other institutions could then have their publications edited at NARESA.
3. To maintain a pool of science writers at NARESA. They could assist research workers to present the results of their research work following internationally accepted standards and norms.
4. The Bureau of Standards should publicise Sri Lanka Standards on basic information needed for publishing scientific and technical journals.
5. All journals should include detailed 'Instructions to Contributors' regarding internationally accepted nomenclature, units, symbols, etc. Medical Journals should carry instructions to authors regarding the use of photographs for illustrations.
6. The publication of scientific journals both at the research and popular level in the national languages should be encouraged.
7. The distribution of journals abroad should be organized.
8. Financial problems could be partly minimised by merging journals in the same area of Science and Technology.
9. Journals should aim for greater subject specialisation. The Journal of the National Science Council of Sri Lanka could be divided into two sections:- Life Science and Physical Sciences to ensure greater specialisation.
10. Information regarding printers and publishers in Sri Lanka and their capabilities should be made available.
11. A survey should be conducted to assess the current situation regarding the publishing of scientific and technical journals in Sri Lanka.

    The following criteria could be assessed in the course of the survey:-

    a) How many copies of the journal are published
    b) What are the problems, (financial , etc.,) faced in publishing the journal.
12. The proceeding of this Seminar should be published to provide guidelines for science editors in this country.

ANNEX I LIST OF PARTICIPANTS

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