

DESIGN CRITERIA FOR THE ELECTRONIC JOURNAL

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An electronic journal (EJ) must meet the needs and satisfy the expectations of the readers if it is to succeed. Some reasonable criteria for an EJ are derived from consideration of the qualities of a paper journal (PJ). None of the requirements can be shown to be impossible to achieve or to be very much beyond today's state of the art.

I. INTRODUCTION

Although a variety of techniques has been used from the earliest days of telegraph to transmit alphanumeric information, the application to the handling of large volumes of scientific and technical communication has arisen as a possibility only in relatively recent times. Certainly in the early days it would have been possible to transmit complete manuscripts from one scientist to another in the form of Morse Code. Few readers would have had the skill, or if the skill, the patience to make the translation. Similarly, the teletype permits large documents to be sent from one place to another swiftly but usually only under time pressure which makes it reasonable to absorb the cost. For most ordinary scientific and technical communication-communication between a producing scientist and a using scientist- the costs in time and money associated with such transmission have made it unfeasible.

When in the early 1960's it became possible to imagine the storage of large volumes of text in digital form, it also became possible to conceive of a digital computer and a system of data handling lines as a complete substitution for the more traditional way of disseminating scientific and technical information. Early experiments done under the direction of J.C.R. Licklider at Bolt, Beranek and Newman in 1961 and 1962 showed that a number of the functions which deal with whole texts could be performed entirely on a computer without the necessity of reduction to hard copy. (1) Unfortunately the available memory was relatively small and the amount of text that could be stored was limited to a few demonstration manuscripts.

The rapid increase in size and speed and decrease in cost of memories and large storage systems, and the proliferation of computers in the scientific and technical community suggest a publication system can now be set up which is entirely in digital form and is never reduced to hard copy except at the will or whim of the reader.

A paper journal (PJ) has three basic components:

an editorial processing center; a search and retrieval system; and a dissemination system. The last is usually a printer-binder which delivers to a post-office. The first two of these parts have already been extensively computerized. The third constitutes what has been called the Electric Journal (EJ). A successful EJ must have acceptance by its readers for it to be successful; acceptance, in turn, requires that the EJ be not less good than the PJ it may replace. The design criteria of a good EJ must use the PJ as a point of departure.

2. CHARACTERISTICS OF THE PJ

An issue of a PJ (Human Factors for example) is about 175 by 250 mm and 10 mm thick. This is a comfortable size which can be held in one hand and, since it weighs about 300 grams, can be so held for a long time without great discomfort.

The print is black on white and provides a high level of contrast. This facilitates reading in less than optimal lighting and minimizes the fatigue induced by strain.

The local memory is excellent. No power is required either to maintain the material nor, much of the time, to read it.

There are two pages facing in a PJ. These make it easier to compare tables and graphs (although this feature is not often taken advantage of). The fact that two pages are simultaneously available makes it easy (at least half the time) to refer back without having to change anything except the line of regard.

The local store of an issue of a PJ is impressively large. Human Factors typically contains in an issue 100 pages of 45 lines of 70 characters each. This is a total per issue of 315,000 characters. If there are 26 alphabetic symbols, in two sizes and two fonts, we have 104 different characters. We must add the 10 numeric symbols, and a generous allowance for mathematical and special symbols and punctuation marks and obtain slightly less than 256 different characters or

8 bits per character. The memory equivalent of an issue is therefore about 315,000 8 bit words.

A PJ has a table of contents which is usually on the face of the cover and is therefore easily located and referred to. The table also facilitates browsing and serendipitous discovery.

An issue of Human Factors is rugged. It can be dropped from any height; it can serve as a rest for a hot coffee pot and keep the table from being scorched. It can have coffee spilled on it with no penalty except for the telltale stain.

One can bend down the corner of a page or many pages and find them easily again with the finger tips.

One cannot change the scale of a graph nor extract a table corresponding to the points on a plot of data. Nor can one direct the PJ to plot the data in a table, or to produce a composite plot of two or more tables.

One cannot direct the issue to search itself for instances of a word or phrase.

The PJ is inert. What is done is done by the reader on scratch pads of one sort or another. Yet this inert device is a remarkably handy way of doing things and has survived with few changes for some hundreds of years.

3. CHARACTERISTICS OF THE EJ

An EJ must be able to do all or nearly all that a PJ can do, and to add some functions that the PJ cannot do.

Within the last 6 months as of this writing new (if somewhat expensive) personal computers which have modems built in have become available in a very small package. The GRID, weighing at 4.5 kgs., and the GAVILAN at 4.0 kgs., are examples of such devices. They occupy about .1 sq. meter of surface and are about 10 cm. thick. Both have modems and communication software. The GRID with 256KB RAM will store 125 single space pages of text.

The page size displayed is smaller than that of a PJ. The GRID shows 25 lines of 80 characters. The GAVILAN screen is wider and shorter. This latter screen is probably too small to serve as a substitute for a conventional journal page.

The weights are too large for convenient use anywhere except on a supporting surface. Thus much of the convenient portability of the PJ is absent. The GRID can store up to three complete issues of Human Factors (with the 512KRAM as an option. It also has 384KB non-volatile memory which would be mandatory for use as a local EJ. Whether this is available for permanent storage of text material is not clear from the descriptions.

A table of contents is easy enough to provide in an EJ; and to arrange to call it up with a single button push is trivial.

The ruggedness of the PJ is not matchable in a presently available terminal unless some of the military requirements have engendered such a one in recent times. One can imagine that it would be possible to make a well encapsulated package which would withstand the casual use given to a copy of a PJ. The cost would probably be very large and prohibitive for users in the scientific community except for those on very rich grants indeed. In no case is it likely that even a well engineered EJ could be used to stand a hot coffee pot on. This is not a serious drawback whereas the ability to withstand having hot coffee spilled on it would be very important.

Keeping one's place in an EJ might be rather difficult to emulate. The bending down of a page is more than just a marking. It presents spatial information which enables the reader to recall what was there which was to be remembered.

The facing pages on the PJ are the result of the fact that all the pages simultaneously exist in human legible form and can be bound in that format. The EJ has no convenient way to replicate the appearance of the PJ except by use of a very wide screen. In this case the resolution requirements become a problem. The smallest detail in an issue of Human Factors is the fullstop at about .2 mm diameter. The page contains, therefore the equivalent of about 875 x 1250 pixels or approximately 10^6 in all. Such screens are not presently available in the convenient size of a PJ although there is no fundamental obstacle to their construction.

We are left with the impression that weight and fragility are the major difficulties to be overcome by the designers of local EJ formats. Cost must be reduced, but if the last 20 years of experience in the computer industry continues, one has but to wait a while for all of the obstacles to vanish.

An EJ can do much that the PJ cannot do. If some of these capabilities are offered, readers may find it convenient to tolerate many of the present shortcomings of the hypothetical EJ-

Software, either local or central or preferably both, must be provided to change the scales on data plots; to present plots and graphs in various forms of data presented in the form of tables in the published "paper"; to combine the data from one paper with those from another and present the result in a new plot. In short the EJ should be able to do everything that was demonstrated in 1962 and much more as well.

A reader should be able to store a great quantity of text for portable use and to avoid typing up communication lines, or be able to work

on line with the power of a central computer to perform statistical analyses of published data and to fit other models or whatever comes to the mind of the reader.

The local formats must be capable of high speed acquisition of text from the central store in order to avoid interference with other communications needs.

They must also be capable of performing various word-processing functions and of transmitting textual material back to the central computer. Thus the reader will be able to be an author as well and to submit material directly to the editorial center as a new "paper" or as a comment on an old one.

4. CONCLUSIONS

The natural evolution of computers and computer-associated devices will bring about the necessary development of suitable devices for the local format of an acceptable, perhaps a highly desirable, EJ. It is merely a matter of time.

The EJ must be able to give what the PJ gives, or very nearly so. In compensation for what is lost, it must offer possibilities which are inconceivable with a PJ. (unless someone is able to "print" on paper a computer, its memory and in human readable form; and endow it with variable type.)

Most presently available personal computers and terminal devices are patently unsuitable for use as the local format of an EJ. It would be unfortunate if the advent of the EJ were further delayed by reader rejection of the experimental systems of today, and a consequent slowing of the effort to achieve the necessary formats to obtain reader acceptance.

5. REFERENCES

1. Library of the 21st. Century Project; under the auspices of the Council for Library Resources ; Bolt, Beranek & Newman, Cambridge, MA 1962

Note: The information about the GRID and the GAVILAN computers was obtained from advertisements, March, 1984 Things may have changed since then!