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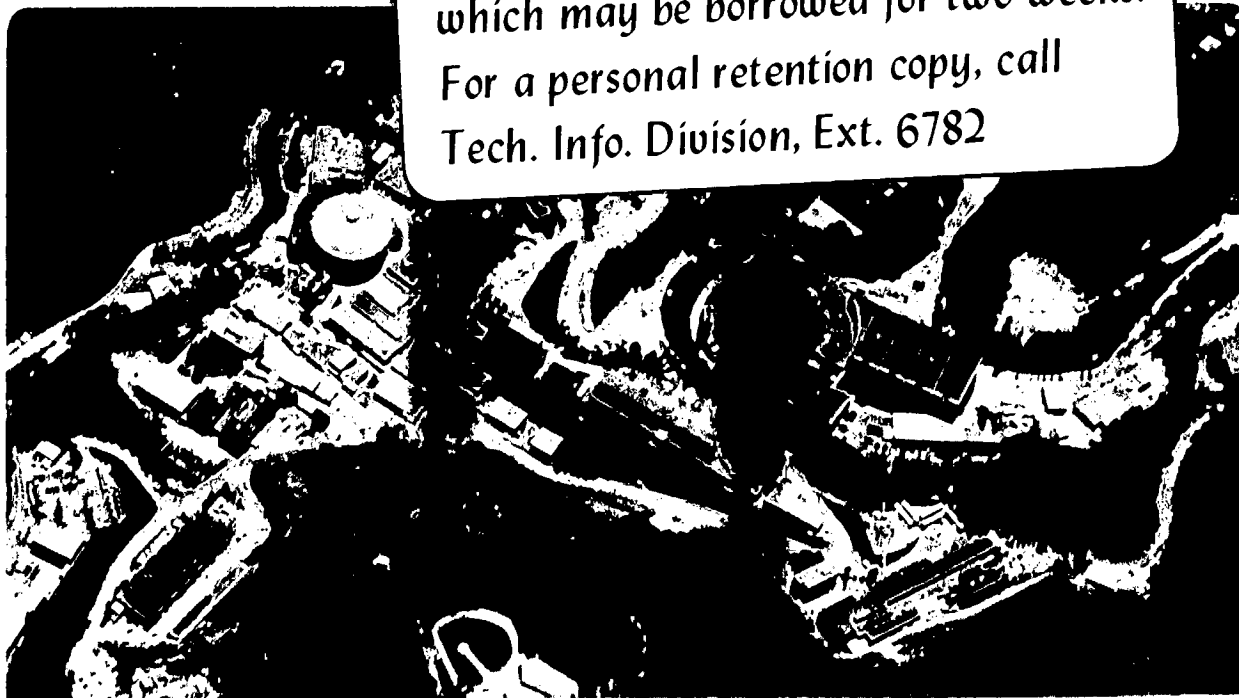Washington, DC, March 15-17, 1982; and to be published
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TYPOGRAPHIC DESIGN FOR INTERFACES OF INFORMATION SYSTEMS

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**Typographic Design for Interfaces
of Information Systems**

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Principles of information-oriented graphic design have been utilized in redesigning the interface for a large information management system. These principles are explained and examples of typical screen formats are shown to indicate the nature of improvements.

1. Introduction

Computer-based information systems communicate with human users by means of visual symbols. For most information systems the visible language or coding system employed is the set of alphanumeric characters found on the standard keyboard. Given the crucial role of these characters in the overall effectiveness of an interface, i.e., how well the interface communicates intentions, states, structures, and processes, it is surprising that the graphic design of interfaces for information systems has received relatively little attention. This article focuses on the typography of interface design and will show how careful selection of the appropriate symbols, words, or word groupings, their placement, and their visual attributes can effect improvement in the legibility of an interface. In addition, these changes can affect a user's impression of the 'friendliness' of the system by presenting the viewer with a sequence of orderly, appealing frames which exhibit the proper information at the appropriate time in a consistent manner.

Normally, information specialists and computer scientists must rely upon their own limited expertise in establishing typographic standards and visual hierachies for the frames of information which the system must exhibit. However, there exists a discipline of graphic design, specifically information-oriented graphic design, whose professionals are concerned with the generic task of designing frames of information for other communication media. Such graphic designers are normally involved in making legible, readable textbooks, charts, maps, or diagrams [1]. There also exists a body of literature that can be applied to the typographic communication problems currently facing the builders, users, and managers of information systems. The graphic designer of an interface may eventually be a traditional graphic designer, an information specialist, a computer scientist, or a group of any of these persons.

Within the Computer Science and Mathematics Department of Lawrence Berkeley Laboratory, the author (who has a professional background in graphic design) has begun to apply the principles of good information-oriented typographic design to the redesign of the interface for a large experiemental geographic information management system called Seedis [2]. The interface for Seedis has gone through several stages since its genesis as a series of stand-alone batch programs in 1972, particularly as it expanded its functional capabilities. The current version of Seedis operates in an interactive VAX/VMS environement with a textual (i.e., essentially alphanumeric) interface. Seedis permits a relatively computer-naive person to examine data dictionaries, extract data from databases, to aggregate or disaggregate data between different levels of detail, and to display the selected data as a labeled table, dot matrix chart, pie chart, line chart, bar chart, or area/symbol choropleth map. A major interface redesign effort is currently underway. It is the intention of this paper to highlight those aspects that are relevant to the typographic design of the human-computer interface.

2. Typographic Design and Graphic Design

The design task concerns determining a relatively high degree of fit among the different requirements of the following:

the sender (the machine or user)
the medium (the display device)
the receiver (the user or machine)
the message (the information content)

By means of the position, color, size, grouping, and temporal sequence of symbols the graphic designer must convey the usual components of an information system's interface: continuous prose (e.g., help messages), interrupted prose (error messages, system status reports, etc.), and tables/lists (menus, data dictionaries, etc.).

Typographic design begins with a concern for the design of individual symbols. Seedis has attempted to remain device independent for both its interface and its display devices. In this context there is almost no control over symbol design. It is assumed that the standard medium for interaction is a display showing 24 lines of 80 alphanumeric characters each. This is a basic capability of almost all terminal types and allows Seedis to be easily portable. However, it also means that the use of reverse video, italic, or levels of brightness can not be assumed. These means of visual emphasis are not used, but other approaches are available. For example, there is a strong reliance on a horizontal line of hyphens to highlight certain titles or to separate divisions of the frame.

Even within these limitations of Seedis, attention to graphic design principles can improve the interface. Consider the use of all upper case words, a typographic approach which many interfaces utilize. The fixed width of the letters are often created by a 7x9 or similar dot matrix. In such conditions lower case letters with occasional capitals are more legible. Research shows [3, 35] that not being able to perceive word shapes (as is true for words set in upper case characters only) may slow reading speed by as much as 13%. Because terminals often have little space between lines in comparison to normal textbook typography, lower case letters are particularly important in providing visual space between lines of type and thereby improve legibility. In the redesign of Seedis, lowercase typography for machine messages and for the echoes of user input are standard. When all capital settings are used, they are intended to highlight a restricted set of primary content elements, e.g., the main title of a frame or the module in which a prompt occurs.

3. The Grid

As for the design of a book page, the graphic designer of an

interface must consider the visual field, the terminal screen, as an entity whose proportion, size, and distance from the viewer are important to the design of information. Information is presented in conceptual frames or screenfulls. To assist the overall organization of elements within the frame and consistency from frame to frame, a reference grid of a few horizontal and vertical lines was determined to locate certain standard positions for elements such as titles, prompts, etc. One of the most important features of the grid is to establish certain basic divisions of the frame. The Seedis grid establishes a major column of text of approximately 60 characters in width (at character positions 21 to 80) and a special position for all user input located at character position 1. In this manner the user's input and the machine's responses are visually distinct. Primary tab settings of 10 characters each and a secondary set every 5 characters divide the entire visual field. Selection of upper or lower case alphanumeric characters and a grid influence other aspects of the typographic design, viz., character spacing, word spacing, line length, justification, line spacing, and the overall spatial structure of the frame.

4. Words, Lines, and Paragraphs

Because character width is constant and letterform design is quite simple on most terminals, word spaces are relatively large and lines of text tend to fall apart into a loose collection of symbols. Wherever possible the typographic design approach for Seedis attempts to keep words that belong together close to each other for word, line, and paragraph groupings. For example, only one word space is sufficient after a period in continuous prose to separate the end of one sentence and the beginning of the next. The graphic design approach also seeks to emphasize clear spatial groupings over the entire visual field in order to make distinctions of content. At the same time these spatial groupings are limited in their variation so that there is an overall visual consistency or rhythm within and between frames.

A typical oversight in most textual displays is using text lines of too great a width. Normally there should be approximately 40-60 characters per text line (about 10-12 words) [3, 29]. The Seedis interface is designed with this principle in mind. Research has shown [3, 33] that unjustified (unequal length) text lines are just as legible as justified text. In the case of fixed width characters, justification usually means that large gaps of empty space appear between words in order to achieve equal width text lins. These large spaces interrupt eye movement and impede reading. Consequently, the Seedis typographic design calls for unjustified paragraphs. This design feature has the added effect of making character position 21 visually the most important in the frame. An implied vertical line of the beginnings of text lines appears at this position. This becomes the location for many key words, text line beginnings, etc. The user quickly develops the habit of scanning this location for most beginnings of messages.

In fixed character width, fixed interline spacing situations, the space between groups of lines has limited variation. Whenever possible Seedis avoids any spacing larger that a single line skip. This is used between paragraphs, line clusters, and individual sets of menu prompts and user responses. In this way a maximum number of text lines per frame can be utilized. Note that the horizontal line made of hyphens replaces a skipped text line and does not add another line to the already limited number of lines in a frame.

5. Tables and Lists

A major design principle is to limit the amount of variation wherever possible. This applies especially to tabular settings for tables and lists. The most important words or word groupings are placed at or near (i.e., before or after) the tab setting at the 21st character position. All tables and lists require headings to describe the contents in general and to identify the parts if there are many. These titles should not scroll off the screen but should be regenerated as needed so that each frame includes sufficient titles to be comprehendable. All horizontal positioning of tables and lists is governed by the desire to keep codes, page numbers or other symbol groups close to the items to which they refer and to allow easy scanning down and across items.

6. Examples

The principles outlined above are embodied in the current redesigned formats of the Seedis interface. A comparison between old and new versions will clarify how earlier designs for frames were faulty and inconsistent. Improvements in the newer versions should be obvious. The examples appear in the accompanying Figures.

7. Conclusions

Most of the changes in the Seedis interface have been relatively easy to implement within the software. These redesign features are more than a 'cosmetic' facelift to the system. By carefully considering not only what to show, but also when, how, and why to show it, a better understanding of the functionality of the system emerges in the minds of the builders and ultimately in the minds of the users of the information system.

Many of the changes in design constitute working conventions rather than as yet carefully proven standards. However, many of the changes corresponded to recommendations of an independent critique of the system [4, 54-55]. It is also already clear to many of the users and implementors of the system that changes brought about by consideration of typographic design principles have made clear improvements that programmers as well as users have readily perceived. These design principles as well as specifications for the new interface of Seedis are being documented more completely in a graphic design manual [5] for Seedis being prepared separately by the author. This manual will assist future builders of Seedis modules to maintain a consistent, high quality interface to the system.

Acknowledgment

References

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4. Bleser, Terry, Peggy Chan, and Mei Chu, "A Critique of the SEEDIS User Interface," Report GWU-IIST-81-04, Department of Electrical Engineering and Computer Science, The George Washington University, Washington, D.C., March 1981.

5. Marcus, Aaron, "A Graphic Design Manual for Seedis", in preparation.

Figure 1a: Undesigned Seedis Welcome Message

Comments: Note the scattered appearance of text groups, the inconsistency in the use of all caps and lower case, and the order of the text, in which the user is told about getting out even before being welcomed.

Figure 1b: Designed Seedis Welcome Message

Comments: Note the order of text elements, the use of rules, lower case, and specific tab settings. The full screen width is equivalent to 80 typewritten characters in width. Information on global commands is introduced in the very first information to the user. Note also the standard form of the menu-prompt which identifies the module (all capital letters) in which the user is currently working and the appropriate commands at this point.

```
    seedis
    If you exit abnormally from SEEDIS, continue by typing
        @restore
        seedis
            Welcome to SEEDIS    VMS version 1.0
            Type   ?  for expanded menus
            Type   $  before VMS commands
    (HELP,REVIEW,SUBJECT,AREA,AGG,DISAGG,
        PROFILE,DATA,DISPLAY,BUGS,NETSTAT,SHOW,QUIT): subject
    Please select both data and a geographic area.
    FORTRAN STOP
    WELCOME TO THE SYSTEM.
    YOU CAN ENTER

            EXPLAIN :TO SCAN KEYWORDS.
            SEARCH :TO LOCATE FILES CONTAINING KEYWORDS.
            QUIT :TO TERMINATE.

    ENTER COMMAND OR ?COMMAND FOR MORE DETAIL.
```

```
                    ------------------------------------------------------------
                    WELCOME TO SEEDIS, VERSION 2.0
                    ------------------------------------------------------------
                    At any point in Seedis, you can type the following global
                    commands to get these services:

    Input           Description
    -----------------  ------------------------------------------------------------
    ?               list and describe commands in this menu
    help            describe the purpose of this menu's commands
    show            list and explain items to be selected
    review          list current sessin status and history
    cancel          delete current selections (depends upon context)
    quit            return to previous menu
    *<comment>      enter a comment in Seedis log

    shortly.        Please stand by. Your menu prompt will appear

                    SEEDIS: area, data, display, profile

    :
```

Figure 2a: Undesigned Command Menu Descriptions Frame

Comments: Note the illegibility of all capitals in comparison to upper and lower case and the interrupted list of command definitions.

Figure 2b: Designed Command Menu Descriptions Frame

Comments: The command menu description frame appears when the user types a question mark at any decision point, i.e., if there is some confusion about the proper response to the immediately preceding prompt. Note the continuation of the standard tab settings at position 1 and 21. Note also the consistent use of standardized verbs to describe the input commands. Global commands are separated from local commands appropriate to the particular decision point. The list is labeled to aid identification of its component parts.

```
?
    TYPE ONE OF THE FOLLOWING COMMANDS...
    ?              FOR THIS LIST OF COMMANDS
    HELP           FOR HOW TO GET HELP
    MORE           TO SEE NEXT SCREENFULL
    TABLE          FOR THE TABLE OF CONTENTS
    <N>            FOR PAGE <N>
    * <COMMENT>  TO ENTER A COMMENT IN THE LOG
    DATA <SEQUENCE LETTERS>        SELECT DATA CODES
    CANCEL <SEQUENCE LETTERS>      CANCEL DATA CODES
    FOR X <C>    SUBSTITUTE C FOR X IN DATA CODES -
                 ALSO XX XXX XXXX Y YY YYY YYYY
    REVIEW         LIST DATA SELECTIONS MADE SO FAR
    SAVE           SAVE DATA SELECTIONS AND RETURN
    QUIT           CANCEL DATA SELECTIONS AND RETURN
    READY
```

```
                       DATA: <line letter(s)>, table, <page number>, CR
    : ?

    Input               Description
    -------------------  -----------------------------------------------------------------
    <line letter(s)>    select one or more data elements by line letter
    table               display table of contents for this database code
    <page number>       display a particular page
    CR                  (carriage return) display the next page

    ?                   list avalable commands in this menu
    help                describe data element selection
    show                display table of contents for this database
    review              list current data element selections and history
    cancel              delete current data element selections for this database
    quit                return to database selection menu

                        DATA: <line letter(s)>, table, <page number>, CR

    :
```

Figure 3a: Undesigned Help Messages Frame

Comments: Note the long lines of text, the clutter in the last para-
graph caused by clumps of all capital words, the gaps in word
spacing caused by justification, and the mixture of small indenta-
tions with centered headlines.

Figure 3b: Designed Help Messages Frame

Comments: Help messages are a standard one page description.
Note the use of standard tab settings, unjustified text, the use of
all capital headline together with hyphen line, removal of all capi-
tal keywords (replaced by exdented words, i.e., positional
emphasis), and the use of second person in English language
style. Further frames of information are available on the four key
words listed.

```
READY
  MONITOR.SEEDIS.HELP.

                        INTRODUCTION TO SEEDIS

  The three major processes in SEEDIS are:

  AREA: define a geographic study area (composed of states,
        counties, or census tracts)

  DATA: select data appropriate to the geographic study area
        chosen.  For  example, for a study area consisting of a group
        of states, only state level data, and not  county  or  tract
        level data, are appropriate.

  DISPLAY: manipulate and display the data in table, chart, graph,
        and/or map form.

  Normally AREA,  DATA,  and  DISPLAY  are  performed in the order
  given. However, once the geographic study area is defined (AREA),
  one  may  alternate  between  DISPLAY  and  the    selection    and
  extraction of additional items in DATA.
  TYPE MORE TO SEE NEXT SCREENFULL
  TYPE ? FOR A LIST OF COMMANDS
```

```
                         SEEDIS: area, data, display, profile
  : help
                         USING SEEDIS
                         ------------------------------------------------------
                         LBL's Seedis is an experimental information system that
                         includes integrated program modules for retrieving, analy-
                         zing, and displaying selected portions of geographically
                         linked databases. Program modules in Seedis include:

             area        select geographic area (level and scope of analysis)
             data        select, extract, enter, or transform data
             display     manipulate and display data in tables, maps, and charts
             profile     produce standard socio-economic reports for selected areas

                         Normally Area, Data, and Display are used in the order
                         given. However, once the geographic study area is defined
                         in Area, you may alternate between Display and
                         the selection, extraction, or entering of additional items
                         in Data.

                         SEEDIS: area, data, display, profile

  :
```