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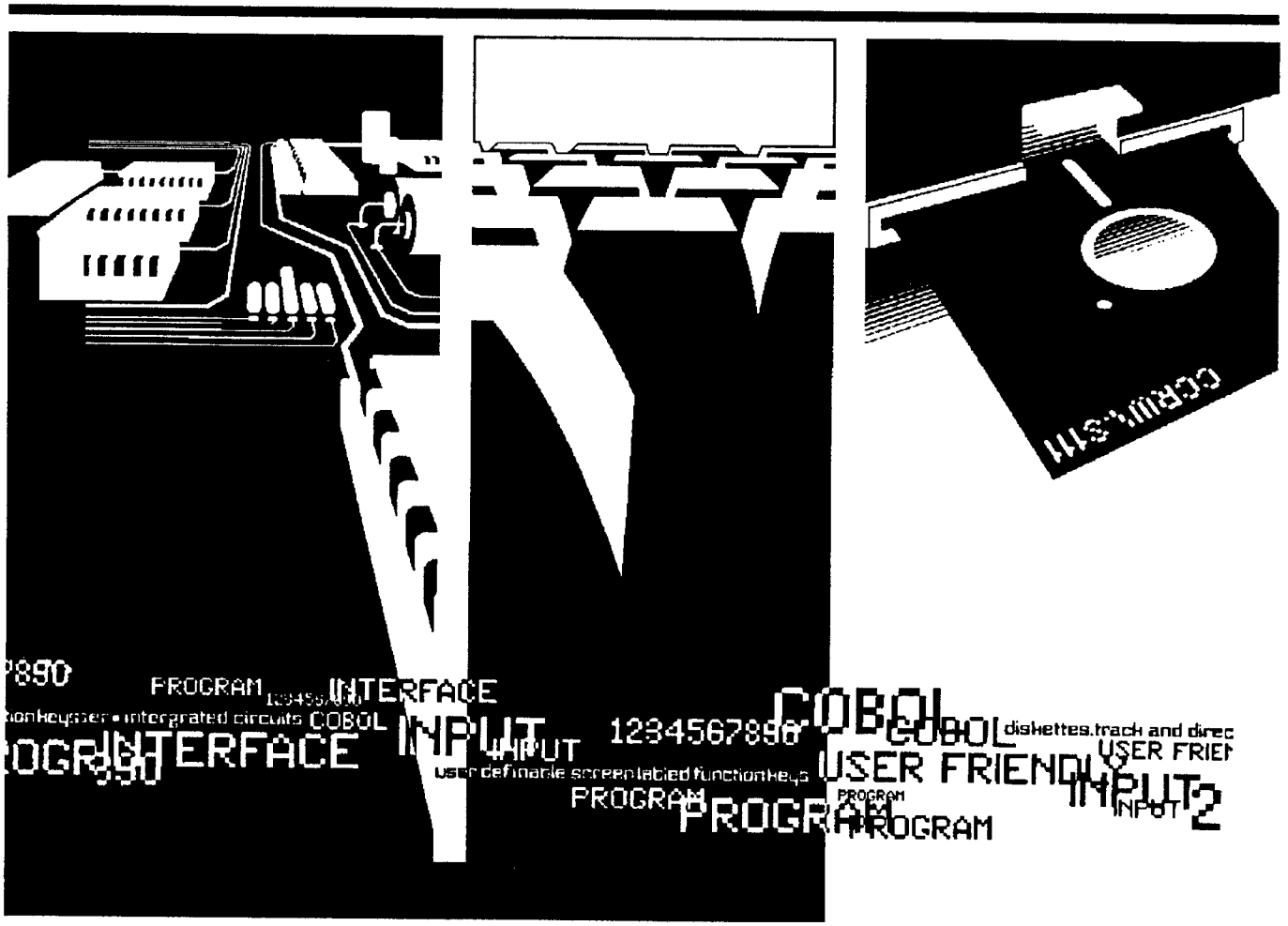

Research in Word Processing Newsletter

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The Internal Structure of Files Created by Word Processors

Eric Johnson

When I created version 3.0 of *StrongWriter*, a grammar and style checker, I wanted to make it as easy to use as possible. (See my article describing *StrongWriter* in the January, 1989, *RWPN*, pages 10-13.) However, as I said in that article, the way word processors save text can produce a difficulty for writers wanting to use a grammar and style checker. In addition to the text itself, the files produced by almost all modern MS-DOS word processors include strings of special characters to hold formatting information. A grammar and style checker needs only the text; the special characters get in the way. All word processors have a way of saving only the text (sometimes a pure text file is produced with an "ASCII save" command or by "printing" to disk); however, saving a text in such a way is often a lot of monkey-motion. Therefore, I wrote routines for *StrongWriter* that would convert or translate the format of the file produced by four popular word processors to pure text format that a checker needs.

In writing these translation routines for *StrongWriter*, I learned some things about the internal structure of several kinds of MS-DOS word processing files; that is the subject of this article.

I asked the manufacturers of three MS-DOS word processors for information about the format of the files their products produced. Their differing responses are interesting. The manufacturer of one word processor (which I will not name, and I would not recommend even to my cat) replied that "those formats are proprietary information and are not documented for external release to customers." Microsoft mailed me a seventeen-page detailed explanation of its *Word* formats after asking me to sign a statement in which I agreed not to reveal their proprietary formats to others. The explanation was complete and accurate, but unnecessarily cryptic and confusing. It was free. WordPerfect asked me to sign nothing, but they charged me forty dollars for the *WordPerfect 5.0 Developer's Toolkit*. It was money well spent. The *Toolkit* contains one hundred and fifty-two pages of clearly-written explanations of everything anyone would want to know about the highly complex files produced by *WordPerfect* (it also includes disks containing sample programs and test

files). The Introduction to the *Toolkit* says that "the information contained in this document is not confidential."

FILE FORMATS

A file produced by a modern word processor and saved in the usual way has at least two sections: a header and the text itself. Usually the text portion is sprinkled with special embedded codes (to indicate margins, when to turn on and off underlining, bold, and so on). At least one word processor avoids embedding codes in the text portion by adding a third section which contains the same information as embedded codes would.

Before continuing, we should remember that the ASCII character set used by microcomputers contains two hundred and fifty-six characters, and that they are of three kinds. First, those numbered from 32 through 127 represent the letters, numbers, and punctuation we are accustomed to seeing printed and on the screen. Second, those numbered from 0 to 31 are control codes; they do things or mark things; for example, number 10 is called a "line feed" because when it is sent to a printer it moves the paper up one line; number 13 is called a "carriage return" because it causes a printer to print what follows at the left margin (10 and 13 are usually used together); when number 12 is sent to a printer it produces a "form feed." Number 26 is often used to mark the end of a file. If the characters 0 through 31 are sent to the screen they usually appear as arrows, faces, and odd symbols. Third, characters 128 through 255 are called the "IBM extended character set" or "upper ASCII" characters. When these characters are sent to a printer, they may produce foreign language letters, italic letters, or graphic characters. What is printed will depend on the type of the printer and how it is set up.

Now, if we send a file produced by a modern word processor (say *WordPerfect 5.0*) directly to a computer screen (using the TYPE command in DOS or using a utility program) we would notice several things. First, what appears would seem to be a confusion of almost all of the 256 ASCII characters. Within this mess we could probably more or less identify a header section (made up of odd-looking symbols and blank areas with a few familiar letters and words mixed in) and more or less identify the text itself (mostly recognizable words, but with a sprinkling of the odd-looking symbols and blank areas). It would be difficult to read the text because it would stretch across the full eighty columns of the screen and lines would not necessarily break at the ends of words.

Information is needed from the manufacturer of the word processor in order to determine (1) what is where in the header, (2) where the header ends and the text begins, and (3) whether embedded codes are used in the text, and, if so, what they mean. The following overview of a word processing file is based mainly on information contained in the *WordPerfect 5.0 Developer's Toolkit.*

THE HEADER

A header is a block of essential information at the start of a file. Almost always, the first few characters of a word processor file are the signature or identification of the word processor. For example, all files produced by *WordPerfect* have the same first four characters: ASCII number 255 followed by the ASCII numbers for the letters "WPC." It is necessary to give this signature at the very start so that a program (like my *StrongWriter*) that converts files will know at once what it is dealing with.

Somewhere in the header the location of the text itself must be indicated. *WordPerfect* files do this in the four characters immediately following the signature. They tell the position of the start of the text indirectly by giving the number of characters in the header which precede the text. Since *WordPerfect* files have nothing following the text, only its starting location is needed, but if there were a section of formatting codes at the end of the text (which at least one word processor produces), the length of the text would also have to be given. Thus, if the first four characters of a file give the signature for *WordPerfect*, and if the next four characters contain the number 500, we could confidently expect the text portion would start at character 501 and continue to the end of the file.

The headers of *WordPerfect* files can contain additional kinds of information: the type of printer that should be used, the kind of monitor, huge amounts of graphics data, and all kinds of miscellaneous information. These kinds of information are contained in "data packets" each of which is indexed in the header.

Reading numbers in a file (such as the number telling the length of the header) is not as straightforward as reading numbers given in a book because in a file they are stored in multiples of 256 — and in multiples of multiples of 256. It is almost impossible to recognize them simply by examining the file: it will appear to be a jumble of almost all of the 256 ASCII codes in various combinations, but there is a system to it. For example, the number 300 will be stored as 256 plus 44. It will be stored as two characters: 1 (times 256) and 44. Thus the numbers 1 and 44 (in the correct positions) mean 300. However, if we looked directly at the file, we would see a smiling face (the screen representation of ASCII 1) and a comma (ASCII 44)! So how can we know that ASCII 44 is part of a number and not a comma? We cannot know unless we have a guide (like the *Toolkit*) that tells us that there is a number in that position.

THE TEXT SECTION

Again, remember what appears if you send a file (saved by a word processor in the normal way) directly to the screen using the TYPE command of DOS or using a utility program. The content of the text portion of the file may be recognizable, but it certainly does not look like it did on the screen when you entered it with your word processor. To start with, the lines of words stretch across all eighty columns, and the lines do not necessarily break at the ends of words. The lines look like this because only at the ends of paragraphs are there line-feed characters and carriage-return characters (ASCII numbers 10 and 13). If these characters were put at the places lines break, they would interfere with word wrap when the file is edited. Therefore, they are inserted at the end of each line only when the lines are sent to the printer; they never become a permanent part of the file.

The text portion of your file will probably also contain a series of goofy-looking characters you do not remember putting there. These characters may be single characters scattered throughout the text; there may also be strange characters in clusters or strings of considerable length.

These characters found within the text portion of the file are the control codes that turn underlining and bold on and off and perform similar functions. (The alternative to inserting these codes within the text is to put them in a separate section following the text, and in that case there must also be an indexing system to insure that the codes affect the proper parts of the text.)

Files created by *WordPerfect* contain single-character codes and multi-character codes. They perform a range of complex functions.

Single-character codes are never the ASCII values from 32 to 126 since those numbers represent the letters, numbers, and punctuation that make up the text itself (and if the codes got confused with the text, they would not work). Single-character codes are ASCII 1 through 31 and 128 through 191 (127 is not used). Many of these single-character codes signal that some action is to be taken when the document is printed. For example, ASCII character 129 turns right justification on for what follows it, and character 130 turns it off. Character 134 signals that the page is to be centered from top to bottom. (Not having used *WordPerfect* much, I did not realize that it had the power to center vertically until I noticed that it had a code to perform the action.)

Multi-character codes begin and end with the same ASCII number. They begin (and end) with an ASCII number above 191, and this number is used as an identification code. They may be of fixed length or variable length. Fixed-length multi-character codes begin with a number above 191, but less than 208. Like the single-character codes, the fixed-length codes can also start and end an action, but in addition they can specify the action. For example, ASCII number 195 followed by number 5 starts printing what follows in superscript, and number 195 followed by 12 starts bold print.

WordPerfect uses seventy variable-length multi-character codes. Variable-length codes begin and end with an identification code which is an ASCII number of 208 or above. They are used to set or change margins, to set spacing, to draw lines and boxes, to change fonts, to identify footnotes and hold their text, and many other tasks—some of which are very sophisticated (such as changing print colors to any one of 256 values). Since these codes can be of any length, they must contain a number which gives their overall length. The length is given at the start of the code string, and again given at the end of the string. There may also be a sub-function code, and if so, it is given both at the start and the end of the string.

Following is an example of a rather short variable-length multi-character code which is used at the end of a page. The codes are given below in a vertical string; next to each is a brief explanation of its function.

212 opening identification code for the function

004 opening sub-function identification code

006 length: number of characters following this code

061 number of lines on the page

011 the page number

000 number of footnotes on this page

006 closing appearance of the length given above

004 closing sub-function identification code

212 closing identification code for the function

In this example, the first two characters identify it as an end-of-page function. The third character states the remaining length of the string (6). These first three characters are repeated (in reverse order) at the end of the string. The next three characters (that are not repeated) are the actual data characters (there would usually be far more than three). In this example, the data characters tell the word processor that there are 61 lines on this page, that it is page number 11, and that there are no footnotes on the page. Other information could be given in additional data characters if it were needed (such as the number of lines in each column if there were multiple columns). This example is accurate, although it is slightly simplified (large numbers require two characters to express, and some information can be indicated in several bit flags contained in a single character).

To those who are interested in learning more about the internal structure of word processing files, I highly recommend the *WordPerfect 5.0 Developer's Toolkit*. It can be ordered for $40.00 from PC Development, Attn: Developer's Toolkit, WordPerfect Corporation, 1555 N. Technology Way, Orem, UT 84057. It is not easy reading, and, like most computer references, it can be incoherent at times, and, of course, the Toolkit expresses ASCII numbers in hexadecimal.

Eric Johnson is a Professor of English and Head of the Division of Liberal Arts at Dakota State College, Madison, South Dakota 57042. He is the Director of the International Conference on Symbolic and Logical Computing; his articles on computing, writing, and literary study have been published in *RWPN* and in other journals.

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> "*WordStar 5.0*'s many new features include the choice of the original interface or new pull-down menus, automatic text alignment, advanced page preview (single, multiple thumbnail, or zoom), windows for split-screen editing, footnotes and endnotes (up to 16K for each annotation or comment), newspaper-style columns, faster search-and-replace functions, index and table-of-contents generation, spelling and thesaurus assistance, and support for PostScript- and HP-compatible laser printers." (p. 69)

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> "Indeed, the acquisition of a computer-aided publishing system can lead to a deterioration in document presentation. Documents produced on word processors almost always follow a simple format if only because a complex one is difficult to produce. The arrival of computer-aided publishing software can herald the employment of a bewildering range of fonts, every conceivable variety of typographic ornamentation and a proliferation of layout designs within the same document. The basic function of communication may be confused and overwhelmed by a neophyte's desire to experiment with software features." (p. 25)

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> "Hypertext aficionados propose a number of different dates for the genesis of hypertext. Some attribute the first use of the word to Ted Nelson, the acknowledged father of hypertext, in 1965. Others belive the root concept was first proposed in a prescient *Atlantic Monthly* article in July of 1945 by Vannevar Bush, Franklin Delano Roosevelt's science advisor. However, the watershed event in the information revolution that made hypertext inevitable can be dated back to the 16th century. Erasmus, the Dutch scholar believed to be the last person to have mastered essentially all of the Western world's knowledge, died in 1536. After that time, the comforting thought that knowledge was somehow inherently scaled to human capabilities--that it was possible to know it all--disappeared." (p.38)

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"Beginning and reluctant writers frequently have great thoughts but are stymied by the mechanics of getting their words onto paper. The sheer emptiness of an entire sheet is too forbidding. But computers can help. Many simple programs offer image and word integration. With limited instruction, children create beautiful messages. The following are some programs that encourage reluctant writers to create. Children as young as six or seven are likely to enjoy participation, while those at the secondary level will continue to profit from simple structured formats and picture perfect products." (p. 19)

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"The most distinct difference between the *Type Director* and the *Bitstream Fontware* Installation Kit is that Hewlett Packard's new product isn't product-specific. In Bitstream's case, you must purchase an installation kit specifically for *Microsoft Windows, Lotus Manuscript,* or other programs. Not so with *Type Director.* At this time, the package will work with *Microsoft Windows* (which includes *Aldus Pagemaker,* differentiated in the installation process), *Microsoft Word,* and *Xerox Ventura Publisher.*"

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"Menu commands now have keyboard equivalents. Multiple documents can be opened, with the only limiting factor being disk space. New printing options include output in reverse page order, user-defined order, and odd or even pages only. A Smart Quotes algorithm substitutes typographically correct single and double quotation marks in printed output instead of the standard keyboard quotation marks. *WriteNow 2.0* will also provide a character, word or paragraph count in either a selected area of the document or in the whole document." (p.3)

New Features Added in *Indexx 7.10*

The indexing software reviewed in the February issue (*RWPN* , Vol. 7, No. 2) by Prof. Charles Ess of Drury College has been updated by its creator, Prof. Norman Swartz of Simon Fraser University, who reminds colleagues that "wildcard searches of the database are possible for both major entries as well as minor ones," a feature actually possible in Version 6.02. Additions to *Indexx* 7.10 include the following:

1. In addition to case-sensitive and case-insensitive sorting, *Indexx* now allows both word-by-word and letter-by-letter sorting.

Letter-by-letter:	Word-by-word:
game	game
gamekeeper	game plan
game plan	game theory
gamete	gamekeeper
game theory	gamete

2. Wildcard searches are possible for both major and minor entries.

3. Formatting options now permit variable indenting.

4. The setup procedure has been simplified for color monitors.

For more information, please contact Prof. Swartz at 1053 Ridley Drive, Burnaby, British Columbia, Canada V5A 2N7.

International Text Processing Conference in Boston

October 4-6, 1989, has been set aside for PROTEXT V, the Fifth International Conference on Computer-Aided Text Processing, to be held in Boston, Massachusetts, and sponsored by the Institute for Numerical Computation and Analysis. Seeing text and word processing in the larger sense, the conference will emphasize practical applications rather than theoretical schema. Conference proceedings will be published. Contact PROTEXT Conference, INCA, PO Box 2, Dun Laoghaire, Ireland.

Summer Workshop on Parsing Technologies

An International Workshop on Parsing Technologies will be held August 28-31, 1989, at Carnegie Mellon University in Pittsburgh, Pennsylvania. Sponsored by the National Science Foundation and the Center for Machine Translation at Carnegie Mellon, the workshop will include attention to the following algorithms: formal parsing, linguistic parsing, parallel parsing, unification, and spoken sentence. Calls for papers (2-page abstracts) were accepted until April 30th, with final versions to be readied by June 30th. Contact Masaru Tomita, Parsing Workshop Chairman, Center for Machine Translation, Carnegie Mellon University, Pittsburgh, PA 15213-3890, USA, or call (412) 268-6591.

Conference on Corporate Communications

Fairleigh Dickenson University in Madison, New Jersey, will be the site of The Second Conference on Corporate Communications on May 24-25, 1989. The theme will be "The Challenge of Change: Managing Communications and Building Corporate Image in the 1990s" and will include an emphasis on desktop publishing. Contact Fairleigh Dickenson University, The Conference on Corporate Communications, c/o Department of English/ Communications, Madison, NJ 07940, or call (201) 593-8666.

Consulting in Technical Communications Seminar

June 24, 1989, is the date set for a one-day seminar on training and consulting in technical communication at Plymouth State College, in Plymouth, New Hampshire. Contact Dr. Richard Chisholm, Seminar Director, Plymouth State College, Plymouth, NH 03264, or call (603) 536-5000, extension 2301.

May Magazine Publishing Congress in New York

"Desktop Publishing for the Pros" is the theme of the Magazine Publishing Conference and Folio Show, to be held May 22-26, 1989, in New York City. Exhibits and over 200 seminars are scheduled, many with relevance to literary and academic publishing on Macs and PCs. Contact the Hanson Publishing Group, 911 Hope Street, Six River Bend Center, Box 4949, Stamford, CT 06907-0949, or call (203) 358-9900.

Society for Technical Communication Conference in May

STC's 36th International Technical Communication Conference will come together May 14-17, 1989, in Chicago, Illinois, and will include workshops, 90-minute panels, 90-minute discussions, and 20-minute papers. Conference proceedings will be available. Contact the Society for Technical Communications, 815 15th Street, N.W., Washington, DC 20005, or call (202) 737-0035.

RWPN Back Issues

Volume 7, #3 [March '89] – *Microsoft Word 5.0* – An Update; Bibliography Update; News & Notes

Volume 7, #2 [February '89] – Academic Utilities: *Indexx 6.02* ; Bibliography Update; News & Notes

Volume 7, #1 [January '89] – Hard Disk Utilities: Backup Programs; *StrongWriter* : A Better Grammar and Style Checker; Bibliography Update; News & Notes

Volume 6, #9 [December '88] – Project Jefferson: A Hypertext Application for Teaching Students Research Skills; Bibliography Update; News & Notes

Volume 6, #8 [November '88] – Hard Disk Utilities: File Recovery Programs; Bibliography Update; News & Notes

Volume 6, #7 [October '88] – How the Other Half Wordprocesses; Bibliography Update; Hard Disk Utilities, DOS Shells, and Disk Optimizers

Volume 6, #6 [September '88] – Improving Your Writing With Style Analysis Programs; Bibliography Update; News & Notes

Volume 6, #5 [May '88] – Writing in a World of Word Processing, Hypertext, CD-ROM, and Computerized Typesetting: A Bibliographic Report on the Rise of Computer-Oriented Document Engineering (CODE)

Volume 6, #4 [April '88] – *Norton Textra*: Word Processing for Composition Classes; Bibliography Update; Beyond Word Processing – Text Management Programs

Volume 6, #3 [March '88] – *Microsoft Word 4.0*: Battling *WordPerfect* for #1; Bibliography Update; Prewriting and Revising with *Writer's Helper*

Volume 6, #2 [February '88] – The Professional Writer's Workstation: Software for Managing Information; Bibliography Update; News & Notes

Volume 6, #1 [January '88] – Ten Computerized College Writing Programs: Toward a Benchmark; The Professional Writer's Workstation: Content Analysis Comes to the Micros; The Future of Desktop Publishing in Technical Communications

Volume 5, #9 [December '87] – Electronic Manuscripts in the Midwest, Or, When Chicago Talks, People Listen; Word Processing in College Writing Labs: What the Experience at Ten American Universities is Telling Us; Bibliography Update; News & Notes

Volume 5, #8 [November '87] – An Approach to Multilingual Texts; *RamFont* and Transliterated Greek: A Look Back at the Hercules Graphics Card Plus; News & Notes

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