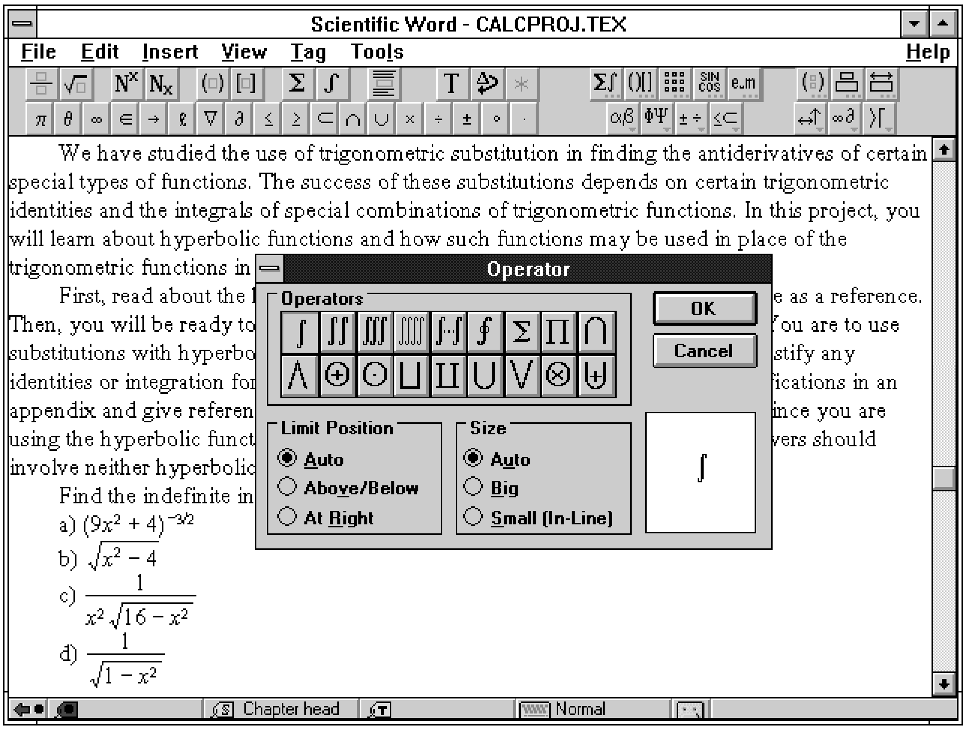

The Operator dialog

To create a mathematical display, you click the display icon and type the mathematics. Or, you can select the mathematics and click the display icon. A display can be set up so that it is automatically numbered. Displays can be given symbol names so that they can be cross-referenced in the body of the document. When the document is printed, the cross-reference is replaced by the automatically generated equation number.

Complex expressions are easy to create. The process is made even easier by the ability to apply radicals, brackets, fractions, and displays to selections. For example, if you have already typed a large expression and you want to apply brackets to all or part of it, you select that part, then click on the brackets icon.

You enter a matrix by specifying the number of rows and columns. Typing the entries is the same as entering any other mathematics in SCIENTIFIC WORD. You can select rows or columns and delete them. You can left, center, or right align columns, and you can align the entire matrix vertically at its center, at the top row, or at the bottom row. It is a simple matter to insert additional rows or columns in an existing matrix.

The document you are now reading was created with SCIENTIFIC WORD. The following sample expressions were created using the operations discussed above.

$$\left(\begin{array}{ccccccc} 1 & 0 & \cdots & 0 & 0 & \cdots & 0 \\ 0 & 1 & & & & & \\ \vdots & & \ddots & \vdots & \vdots & & \vdots \\ 0 & & \cdots & 1 & 0 & \cdots & 0 \\ \frac{\partial F_1}{\partial x_1} & & \cdots & \frac{\partial F_1}{\partial x_n} & \frac{\partial F_1}{\partial y_1} & \cdots & \frac{\partial F_1}{\partial y_m} \\ \vdots & & & \vdots & \vdots & & \vdots \\ \frac{\partial F_m}{\partial x_1} & & \cdots & \frac{\partial F_m}{\partial x_n} & \frac{\partial F_m}{\partial y_1} & \cdots & \frac{\partial F_m}{\partial y_m} \end{array}\right)$$

$$iB_r\left[\tilde{a}_{kl}^n\right] \equiv \frac{1}{2}(h_{n-1}+h_n)\int_0^R 2\pi r\,dr\left[\rho_k^{n*}(r)\right]\frac{d}{dr}\left[\Psi_l^n(r)\right],$$

$$\left[D_{r,kl}^n\right]^{-1} \equiv \int_0^R 2\pi r\,dr\int_{z_n-\frac{1}{2}h_n-1}^{z_n+\frac{1}{2}h_n}\left[\rho_k^{n*}(r)\right]\left[D^{-1}(r,z)\right]\left[\rho_l^n(r)\right],$$

$$\psi = -\frac{\kappa\varpi\varpi'}{4\pi}\int_0^{2\pi}\frac{\cos(\theta-\theta')d\theta}{\sqrt{\{(x-x')^2+\varpi^2+\varpi'^2-2\varpi\varpi'\cos(\theta-\theta')\}}}$$

$$1/f(x) = \frac{1}{c_0}\left[\frac{1}{1+\left(\sum_1^\infty+\sum_{-\infty}^{-1}\right)\frac{c_n}{c_0}e^{inx}}\right]$$

$$\prod_{j\geq 0}\left(\sum_{k\geq 0}a_{jk}z^k\right) = \sum_{n\geq 0}z^n\left(\sum_{\substack{k_0,k_1,\ldots\geq 0\\ k_0+k_1+\cdots=n}}a_{0k_0}a_{1k_1}\cdots\right)$$

$$\overbrace{\underbrace{\left\{\left(\left[\left\|\boxed{\sum}\right\|\right]\right)\right\}}}$$

$$\hat{a}\hat{A}\check{a}\check{A}\tilde{a}\tilde{A}\acute{a}\acute{A}\grave{a}\grave{A}\dot{a}\dot{A}\ddot{a}\ddot{A}\breve{a}\breve{A}\bar{a}\bar{A}\vec{a}\vec{A}$$

$$\tau \stackrel{\rm def}{=} \frac{\dot{\mathbf{R}} \cdot (\ddot{\mathbf{R}} \times \dddot{\mathbf{R}})}{\left\| \dot{\mathbf{R}} \times \ddot{\mathbf{R}} \right\|^2}$$

$$\min_{u \in U} \max_{v \in V} \Phi(u, v) \geq \max_{v \in V} \min_{u \in U} \Phi(u, v)$$

$$\hat{\beta} = \frac{\sum\limits_{i=1}^{m} x_i y_i - n\bar{x}\bar{y}}{\sum\limits_{i=1}^{n} x_i^2 - n\bar{x}^2} = \frac{\sum\limits_{i=1}^{m} x_i y_i - \frac{1}{n}\left(\sum\limits_{i=1}^{m} x_i\right)\left(\sum\limits_{i=1}^{m} y_i\right)}{\sum\limits_{i=1}^{m} x_i^2 - \frac{1}{n}\left(\sum\limits_{i=1}^{m} x_i\right)}$$

6 Fragments

You can select a portion of a document (called a fragment) and save it for later recall. This macro-like feature is useful for creating a library of frequently-used formulas and phrases. To recall a fragment, you place the cursor where you want to insert the fragment, then click on the fragment icon at the bottom of the screen. This pops up a list of fragments to choose from.

7 Document Structuring

SCIENTIFIC WORD provides a direct interface to the document structuring features of LATEX. To create a section heading, you type the text of the heading, select it, then click on Section in the list of sectioning tags which pop up from the bottom of the screen.

Items in lists, theorem statements, and bibliography entries are all created in the same way—by applying the appropriate tag to a selection. Cross-references and citations are entered as special fields.

The components of the document front matter, including the title, abstract, and list of authors, are entered into a separate section of the document. A table of contents is generated automatically by checking an entry in the dialog box which configures the document front matter.

8 TEX, LATEX and Scientific Word

As those of you familiar with TEX already know, TEX is the mathematical typesetting system created by Donald Knuth and supported by the American Mathematical Society. It is the acknowledged leader in high-quality scientific typesetting. LATEX is a TEX macro package created by Leslie Lamport. LATEX enhances TEX with document structuring features such as lists, automatic table of contents generation, cross-references, automatic theorem numbering, bibliographies, and tables. The Windows implementation of TEX and LATEX supplied with SCIENTIFIC WORD is called TurboTEX, a product of Kinch Computer Company.

By using TEX for printing, SCIENTIFIC WORD takes advantage of the many automatic typesetting features available within TEX, such as kerning, hyphenation, and automatic sizing, placement, and positioning of mathematics.

Some features of TEX and LATEX are not directly accessible in the first release of SCIENTIFIC WORD but will be added in future releases. These features include tables, footnotes, and marginal notes. To handle these cases in the first release, SCIENTIFIC WORD provides a TEX field for direct entry of LATEX commands. Using TEX fields requires a knowledge of TEX and LATEX. A selection of pre-defined TEX fields for the most common items is supplied in the form of recorded fragments.

Future releases will include a direct interface for entering tables, footnotes and marginal notes so that the user will not be required to use TEX fields to take advantage of these features.

9 Logical Design

The heart of the SCIENTIFIC WORD approach is the separation between content and appearance. The purpose of writing is to convey ideas, so the creative process of forming ideas and putting them into words should be the writer's primary concern. The mechanical process of displaying the document on the printed page in the most readable and organized format is a function of typesetting, not writing, and should not be the writer's primary concern.

SCIENTIFIC WORD's separation of the creative process of writing from the mechanical process of layout is known as *logical design*[1]. Logical design results in greatly increased productivity because the writer is freed from formatting concerns and can focus on creating content. Logical design also leads to better, more consistent typeset results because choices of fonts, spacing, emphasis, and countless other aspects of the document's appearance are made automatically. Before SCIENTIFIC WORD, this approach was only available in batch systems like TEX, LATEX, and production typesetting systems which use markup languages. The unique feature of SCIENTIFIC WORD is that it provides a graphical interface to logical design.

An alternative approach to word processing, called *visual design,* is to make the screen look as close to the printed page as possible. This approach has also been called WYSIWYG for What You See Is What You Get. It is the approach taken by T^3, Ami Pro, Word for Windows and WordPerfect for Windows.

Why is it important that you understand the difference between logical design and visual design? Because a logical system requires a very different interface from a visual system. If you are familiar with a WYSIWYG

[1]This concept of "logical design" vs "visual design" is used by Leslie Lamport in his book, the LATEX User's Guide and Reference Manual.

system, you may at first be surprised by some of the differences:

- WYSIWYG systems divide documents into pages according to their anticipated typeset appearance. To see an entire line, you often have to scroll horizontally because the screen dimensions and page dimensions do not match. In a logical design, working with pages is unnecessary, since the division of a document into pages has no connection with the document's logical structure. Thus, SCIENTIFIC WORD breaks lines to fit the window. If you resize the window, SCIENTIFIC WORD reshapes the text to fit. You never need to scroll horizontally.
- In WYSIWYG systems, you are constantly giving commands which affect the appearance of text—you select text and then select a font, point size, or typeface. You apply alignment commands like center, left justify, and right justify. To center an equation, you select it and choose the center alignment. In SCIENTIFIC WORD, all of these commands are replaced by commands which define the logical structure instead of the appearance. There is no command to center—it is replaced by commands to create a title, to create a section head, and to create a displayed equation. The format of the title, the alignment of section heads, and the alignment of equations, are all determined separately by the print style, which can be changed in an instant. SCIENTIFIC WORD comes with a range of pre-defined styles. If none of these fits your needs, TCI will endeavour to create one for you. LATEX style experts can create their own and add them to the list of predefined styles available within SCIENTIFIC WORD.
- In systems that focus on appearance instead of content, pressing the *spacebar* inserts a space that shows on the screen and is duplicated in print. Pressing the *spacebar* a second time inserts a second space. In a logical system like SCIENTIFIC WORD, a space is the separation between words. Pressing the *spacebar* a second time has no meaning, so it has no effect.

SCIENTIFIC WORD's emphasis on logical structure doesn't ignore the fact that documents must still be printed in a readable, organized, and visually pleasing format. SCIENTIFIC WORD provides a variety of article, report, and books styles that you can apply to your document to produce a high-quality, typeset appearance in print. Because you must be able to see how a document will look without actually printing it, SCIENTIFIC WORD provides an on-screen preview feature.

10 Scientific Word File Formats

SCIENTIFIC WORD stores documents as ASCII files in LATEX format. Wherever possible, SCIENTIFIC WORD writes standard LATEX commands. In cases where this is not possible, SCIENTIFIC WORD uses special macros supplied with the system. These include macros for mathematical constructs not directly supported in LATEX, and macros for importing graphics.

Most existing LATEX documents can be read into SCIENTIFIC WORD.

SCIENTIFIC WORD imports documents created by T^3's T3toTeX converter.

11 Scientific Word's Mathematics

The mathematical objects in SCIENTIFIC WORD are designed to provide the simplest and most natural editing possible. When we read plain text, we deal with whole words at a time. However, the best and most natural text editors deal with individual characters at the lowest level—the cursor moves between the letters of a word and you make changes at the lowest level by inserting or deleting individual characters. Although there are hundreds of thousands of words in the English language, there are only 26 characters and a few punctuation symbols which are the "atoms" of plain text editing. In the same way, SCIENTIFIC WORD provides a small set of mathematical "characters" as the atoms for the two-dimensional structure of familiar mathematical notation. This notation is used to represent thousands of mathematical objects and concepts.

For example, the SCIENTIFIC WORD formula $\int_a^b \frac{2}{\sqrt{3-5x^2}}\,dx + 1$ is a five-element list: an integral operator, a fraction, the word dx, the binary operator $+$, and the word 1. The integral operator is a template containing the two one-element lists a and b. The fraction is a template containing the one-element list 2 and a one-element list containing a radical. The radical is a template containing a four-element list: the word 3, the binary operator $-$, the word $5x$, and a superscript. The superscript contains the one-element list 2. The atoms are the operator, fraction, radical, and superscript. The cursor moves naturally through this structure, and you can edit it without constraint.

This approach avoids the awkwardness of systems which insist, for example, that operators have a distinct argument component ($\frac{2}{\sqrt{3-5x^2}}$ in our example), forcing the user to be aware of invisible boundaries. To get around this, the argument region is surrounded by a dotted box on screen, cluttering the screen and making the mathematics unreadable.

Another feature of SCIENTIFIC WORD's objects is that the empty input boxes of templates like operators are suppressed as much as possible, again with the goal of making the mathematics look as natural as possible at all times to enhance readability.

12 Summary

Scientific Word is a Windows based software package that makes it possible that even the non-knowledgeable TEX-person can write TEX documents! The knowledgeable TEX-person can add to the internal storage format his knowledge, either by making small changes or by adding macros or complete style sheets to the many provided. The price of the package is H.Fl. 2000,–.[2] Further information[3] can be obtained from Technical Marketing Consulting, Gagelweg 3, 4651 VL Steenbergen, phone 01670-64422 and fax 01670-66555.

A Note added in proof by Kees van der Laan

TEX à la WYSIWYG does appeal. Like similar systems it suffers from the following general drawbacks.

- **Cost-effectiveness**
  It is doubtful whether the keyboarding is the most expensive part of (La)TEX-ing, see experience AMS. Syntactical correction and fine-tuning—that is adaptation of the results to the traditional high-quality proofs—is hard.
- **Incompleteness**
  What about graphics? What about tables? What about programmable items? What about general constructs, for example figures, which are reused, slightly modified? And what about real difficult things like commutative diagrams?
- **Entering vs. correction**
  What about correcting/adapting an already existing document?
- **Context dependence**
  From the example on the first page the integral sign is too small and does not 'know of' the size of the integrand. The systems I have seen lack context awareness.
- **Interfacing with other tools**
  What about inclusion of encapsulated PostScript? What about Metafont prepared graphics à la 'When Metafont and TEX work together?'
- **High-Quality?**
  For high-quality typesetting math explicit kernings and awareness of formula classes are needed . The classical example is ':' as operator or as separator.
  Furthermore, the general advice to keep the typesetting as simple as possible is neglected. Confer the example of $1/f(x)$, and the representation of $\hat{\beta}$.
- **Formats**
  What about the role of formats c.q. sty-fyles?
- **Portability**
  Can resulting documents easily be exchanged via e-mail?

Remember that this kind of software needs a powerful machine, while elementary processing —$plain+know-how$— can be done on a very modest equipped machine, and is portable.

B Note added by MAPS editor

Up to now, I have the following experience with this product:

- The paper in this issue of the MAPS was originally generated by SCIENTIFIC WORD. Both LATEX files, style files and encapsulated PostScript files were send by author to the editor using diskettes. After a minor correction within the SCIENTIFIC WORD style file, the pictures were included in the MAPS without any problem.
- The main function of SCIENTIFIC WORD is in my opinion the easy generation of mathematics LATEX code, especially for the novice and occasional user. Besides that, the software could be a first introduction for the use of LATEX, or can be used by the non-LATEX interested (or WordPerfect minded) user community.
- This kind of tools could force the user not to start directly with TEX. As most of my colleagues knows, your MAPS editor strongly discourage the use of *plain* TEX, both by novice and experienced users. The only function of plain TEX should be the construction of building blocks (objects/macros) in order to use these in a logical (con)text environment (LATEX).

In additions to this, A. Al Dhahir forwarded me the following information:

- SCIENTIFIC WORD is based on LATEX, with corresponding restrictions.
- It is not really WYSIWYG. On the screen you see PostScript ATM fonts (also for mathematics). In the printing or preview mode, CM fonts are used.
  SCIENTIFIC WORD has an interface with TurboTEX for windows, and works as a layer between Windows and LATEX of TurboTEX.
- Tables were not used, but they can be expected in a next release.

C Note added by author

- **Cost-effective for the average user**
  SCIENTIFIC WORD is intended to make it easy for the user to input text and formula's. The resulting document can be fine-tuned within SCIENTIFIC WORD to a large degree. But for the final publication the publisher with its elaborate practical experience can and will fine-tune the document created by SCIENTIFIC WORD anyway.
- **Incompleteness**
  Graphics are supported and tables will be fully supported in the next release. General constructs can be stored as keyboard macro's and be recalled.
- Entering and correction
  A TEX document under SCIENTIFIC WORD is much easier to correct than a document without a WYSIWYG interface. In many instances an existing TEX document can be read into SCIENTIFIC WORD for correction.
- **Context dependence**
  SCIENTIFIC WORD has full context awareness. Size of subscript and superscript is dependent on the contents like for in-line or display formula's. Due to the limited screen resolution that may not always be visible on the screen but it is there on the print out.
- **Interfacing with other tools**
  SCIENTIFIC WORD does import Encapsulated PostScript files not Metafont files.
- **High Quality**
  High quality can be accomplished but the average user can and will leave this to the final publisher, see under Cost-effective.
- **Formats**
  SCIENTIFIC WORD is delivered with many style files. With TEX knowledge they can be changed.
- **Portability**
  There is freely available a special utility to 'pack' a SCIENTIFIC WORD file into a format suited for e-mail. Obviously it can do the reverse too.

[2] Special for NTG members there will be a 25% discount if they order the software before the end of this year. More details about this offer can be found elsewhere in this MAPS.

[3] In the next issue of the MAPS, an evaluation of Scientific Word by one of the NTG members, will be published