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Report evaluation results

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ABSTRACT

Future offices will have workstations possessing many facilities, such as electronic mail and telephone support, on top of normal word processing. Such equipment appears to be suitable for voice i/o as an addition to conventional i/o media. Technically, voice i/o will present few problems; however, not enough is known yet about the ergonomic aspects of applying voice for these aims. In trying to fill this knowledge gap, we started to study the ergonomics of written or spoken HELP-messages for elucidating a subset of word processor commands, viz. those which present the operator with problems because of their difficulty and/or rarity. An inquiry was held among 200 users of a particular brand of word processor to find out which commands belong to the subset described. For the word processor concerned these are, in order of importance, the commands for the instructions for: (1) reorganizing a file, (2) transposing columns, (3) replacing one or more words with something else in the whole text, (4) changing margins, (5) inserting a variable text in a standard page, (6) inserting a decimal tabulator position.

Apart from this assessment of the individual word processor instructions, general user and usage characteristics were obtained in the inquiry and are reported here.

INTRODUCTION

In the office, workstations having such facilities as word processing, electronic mail and telephone support have already appeared or will do so in the near future. Such equipment seems to have the right degree of complexity to be suitable for considering voice i/o as an addition to the conventional media: keyboard and visual display.
Technically speaking, this addition presents hardly any problems on the output side, and, at least to a certain extent, will soon be solved on the input side. However, there is not enough insight, neither about the way in which voice i/o should be used, nor about its relative strengths and weaknesses in a variety of applications. To fill this knowledge gap is the main aim of our efforts in the HUFIT project.

The training package for workstations as described, in particular for the word processor application, is attractive as a research object on the virtues of speech versus text for training because in this package there seem to be many possibilities for short and long explanatory or illuminating voice messages regarding all possible word processing commands. After the completion of his formal training, the operator of a word processor as a rule still has to consult a manual whenever uncommon functions, outside his normal routine, are needed (Mack, Lewis and Carroll, 1983). A written or spoken HELP-function for this aim may be useful and therefore deserves to be investigated.

In order to find out which functions might be 'uncommon' as described above for real users, an inquiry was made to explore, for a particular word processor, which control commands in every day office practice were easy to remember, hard to remember, often used and seldom used. Especially the commands in the category 'hard to remember' and 'often used' would seem to be eligible for an explanation through a written or spoken HELP-function. To obtain the information sought, a questionnaire was designed and sent out to 200 users of one word processor brand. About 50% of the questionnaires were completed and returned.

In the following the answers from those 50% are reported and analysed, in so far as is necessary for the selection of a subset of commands which were difficult for the user population. An English translation of the questionnaire itself as well as of a numbered list of descriptions of all 69

word processing instructions of the word processor concerned are given as appendices of this deliverable.

METHOD

There are four methods to obtain information on real word processor use: registration, observation, interviewing and inquiring. Only the last two are feasible when a comparatively large number of users is needed. Of these two remaining methods, interviewing is costly and time-consuming, and the quality of the obtained information is not necessarily better than that obtained with questionnaires - so the latter method was chosen.

A particular type of word processor was selected because it was comparatively easy for us to obtain addresses of departments and firms where it was used, and because a study from the literature (Naiman, 1984) showed this type to possess all regular, normal text processing capabilities. A comparative inquiry on several or many word processors might be useful in its own right, but would have required much more effort, possibly without commensurate results for the present purpose.

The first part of the inquiry consisted of general questions to get information about the characteristics of the subjects; the second part contained the questions about the instructions (see Appendix 1). There were two questions about each instruction. The first of these was about the frequency of using a particular instruction. There were four possible answers:

- never: the instruction has never been used;
- sometimes: the instruction is used less than once a week;
- often: the instruction is used at least once a week;
- always: the instruction is used at least once a day.

The second question about each instruction was about knowing or not knowing a particular instruction by heart. By heart meant: without asking another person or using some kind of manual.

Two hundred inquiries in the Dutch language were sent to users of the chosen word processor; these users were selected at random from a list containing all addresses in The Netherlands where it was used. It turned out that about half the number of all these word processors is used within the Philips organization; the other half is used by other companies and public authorities. Roughly, that distribution was reflected in the sample of completed questionnaires.

RESULTS

General user and usage characteristics

About 50% of the questionnaires were completed and returned. Table 1 shows the age-, gender- and education distributions of these users: they are predominantly female (88%), young (67% below 30 years) and have a relatively high level of education (58% has HAVO, about equivalent to high school, or more). Table 2 shows, for the same user group, the distributions of the amount of time spent on the word processor and of the experience with it; also, the experience with other brands of word processor. This user group had considerable experience: 85% has used the system for more than one year; the average time it is used was reported to be around 90 hours/month, i.e. about 50% of the overall working time.

Assessment of the individual word processor instructions

In the second part of the inquiry all 69 instructions of the word processor were regarded. For every instruction two questions were answered by the users. Table 3 shows the results for the instruction: ' to change a margin for the whole text'. For each of the other 68 instructions these figures were also calculated. Appendix 2 contains a numbered list of descriptions of all 69 instructions.

Table 1: The age structure, the gender distribution and education distribution figures for the users of the chosen word processor.

sex:

male	12%
female	88%

Total number of usable answers on the gender question is 95.

age structure:

15 - 20	10%
21 - 25	37%
26 - 30	20%
31 - 35	8%
36 - 40	11%
41 - 45	4%
46 - 50	5%
51 - 55	3%
56 - 60	2%

Total number of usable answers on the age structure question is 100.

education:

LTS/LEAO/LHNO	5%
MAVO/Mulo/MMS	20%
MAVO/Mulo/MMS + vocational training	17%
HAVO	8%
HAVO + vocational training	35%
VWO+HBS	3%
VWO/HBS + vocational training (=HBO)	8%
MO	2%
WO	2%

Total number of usable answers on the education question is 96. The letter combinations refer to Dutch school types. Roughly, all schools below the dashed line are equivalent to high school or more. 58% Of the respondents had such educational training.

Table 2: The experience of the word processor users measured in (1) working hours on the word processor in one month, (2) the number of years of experience on the chosen word processor and (3) the number of other word processors they have worked with.

		0-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-	
years of expe- rien- ce	0-1	0%	1%	2%	2%	4%	3%	2%	0%	1%	15%
	1-3	2%	7%	2%	9%	11%	5%	3%	2%	1%	42%
	3-..	2%	3%	2%	5%	13%	8%	4%	6%	0%	43%
		4%	11%	6%	16%	28%	16%	9%	8%	2%	100%

Number of other word processors:		
	0	45%
	1	36%
	2	15%
	2-..	4%

Total number of usable answers on the experience question is 97.

Table 3: The results of two questions answered by 100 persons for the instruction: 'to change a margin for the whole text'. The two questions were: (1) how often the persons used the instruction and (2) if the persons knew this instruction by heart.

How often used?

		never	sometimes	often	always	
By heart?	yes	1%	37%	24%	7%	69%
	no	16%	13%	2%	0%	31%
		17%	50%	26%	7%	100%

To arrange the 69 instructions in order of difficulty and frequency of use, four aspects may be considered important. These aspects are:

- For all subjects sometimes using a particular instruction: the ratio (R1) between the number of subjects knowing it by heart and the number of subjects not knowing it by heart;
- The ratio (R2) between the number of subjects who sometimes use a particular instruction and the total number of subjects;
- For all subjects often using a particular instruction: the ratio (R3) between the number of subjects knowing it by heart and the number of subjects not knowing it by heart;
- The ratio (R4) between the number of subjects who often use a particular instruction and the total number of subjects.

As an example, the four ratio's for the instruction 'to change a margin for the whole text', i.e. that represented in Table 3, are calculated below.

- R1: $\dfrac{\text{yes/sometimes frequency} \quad 37}{\text{no/sometimes frequency} \quad 13} = \underline{}$

- R2: $\dfrac{\text{sometimes frequency} \quad\quad\quad\quad\quad\quad 50}{\text{never + sometimes + often + always frequency} \quad 100} = \underline{}$

- R3: $\dfrac{\text{yes/often frequency} \quad 24}{\text{no/often frequency} \quad 2} = \underline{}$

- R4: $\dfrac{\text{often frequency} \quad\quad\quad\quad\quad\quad\quad 26}{\text{never + sometimes + often + always frequency} \quad 100} = \underline{}$

These four ratio's can be weighed and then combined in such a way as to yield a level of difficulty and importance for each instruction, expressed in points. The more important a ratio is judged to be, the more points it will contribute. When the command for an instruction is not known by heart by many users, and is often used by them, it will get a high ranking on the scale expressing its difficulty and importance. For our immediate purpose: selection of the commands needed for those 'uncommon' word processing functions that were the most difficult and frequently used for the whole sample of users, only the top of the scale is important.

The weighing factors chosen should be regarded as preliminary: we want to verify them in a separate procedure, to be reported later. The presently chosen values lead to a scale from 0 points (for eighteen different instructions) to 18 points (for one single instruction). The instructions at the top of the scale are:

1. to reorganize a file (18 points; nr. 41 in App.2);

2. to transpose text columns (12 points; nr. 35 in App.2);

3. to replace a word or text portion with something else throughout the whole text concerned in one operation (9 points; nr. 40);

4. to change a margin for the whole text (9 points; nr. 20);

5. to insert some variable text into a standard page at a coded place (9 points; nr. 38);

6. to insert a decimal tabulator position (9 points; nr. 12).

These six instructions can therefore be regarded as the first candidates for written or spoken HELP-information.

CONCLUSIONS

1. The questionnaire-technique can provide valuable and detailed indications about a variety of parameters regarding users and usage of complex data-processing equipment, such as word processors, in real-life situations, such as the daily work in an office.

2. The questionnaire-technique is fairly cheap and not too time-consuming in preparation and analysis. When properly introduced, its efficiency in terms of percentage returned questionnaires is satisfactory.

3. The questionnaire-technique may be recommended in general as a way to rapidly collect data which may serve as a guideline for setting up human factors research and development projects. However, in this process the limitations of the technique should not be lost from view. Especially questions such as: how representative are the data for the whole user population concerned, and: how truthful are the answers, merit attention.

4. It is possible to devise questions and algorithms which allow to discriminate between a considerable number of machine commands in terms of their degree of difficulty for the users of the machine.

5. The machine commands with the highest degree of difficulty lend themselves for being described and/or explained, in written or spoken form, by the machine itself on request of the user.

REFERENCES

Mack, L.R., Lewis, C.H. and Caroll, J.M. (1983) Learning to use word-processors: Problems and prospects. ACM Transactions on office information systems, 1 (3), 254-271.

Naiman, A. (1984) Evaluating word-processing programs. Byte, 2, 243-246.

Appendix 1 : The inquiry

QUESTIONNAIRE

A number of instructions are used to operate the word processor. By an instruction is meant a series of actions which lead to a pre-determined goal (e.g. moving the left-hand margin). This survey includes questions as to how often you use the various instructions, how often you refer to literature for guidance (e.g. handbook/manual) and a few general questions about the use of the word processor.

The questions which relate to the instructions begin on page 4, after a short introduction. First there are some general questions not directly connected with specific instructions. Would you be so kind as to answer these first? Please fill in the correct answer or blacken the circle next to the correct answer.

General questions

- age: .... years
- sex: Male   0

             Female   0

- education: Secondary   0

             Secondary + vocational 0

             Higher   0

             Higher + vocational   0

             Teacher training   0

             University   0

             other i.e. ....

Appendix 1 : Continuation

- For how many hours a month on average do you make use of the word processor?

    Number of hours per month = ...

- How long have you been using the system now?

    ..... years and ..... months

- What do you use the word processor for?

    (Several answers are possible)

    - Writing letters (one to two pages);   0

    - writing reports and memos (several pages);   0

    - writing formulae;   0

    - drawing up graphs and/or tables;   0

    - and also for ....

      ....

- Do you use a Dutch or an English version of the word processor?

    (Several answers are possible)

    - Dutch version   0

    - English version   0

- How did you learn to use the system?

    - primarily through the help of a person or several persons;   0

    - primarily by means of a handbook/manual;   0

    - by a combination of help from a person or persons and use of handbook/manual, neither predominating;   0

    - by other means, i.e. ....

      ....

- Did you learn to use the system on a course?

    - yes   0

    - no   0

- How many hours did you devote to studying the word processor before you began to use it?

  number of hours = ...

- Do you ever use references with text names? (References are used to further subdivide a text name)

  yes . 0

  no   0

- Do you sometimes not know whether an instruction should begin with the "command" key or with the "mode" key, in other words do you sometimes confuse these two keys?

  yes   0

  no   0

- Do you sometimes have problems in ending instructions?

  yes   0

  no   0

- Does it ever happen that you forget to record newly typed pages or to update corrected pages?

  yes   0

  no   0

- Have you also worked with other word processors?

  yes   0

  no   0

- If so, how many other word processors have you worked with, and which?

  number of other word processors = ...

  types of word processors = ...

Appendix 1 : Continuation

- Can you easily find the information you need from the

handbook/manual?

     yes   0

     no   0

- Do you think that some information is missing from the

handbook/manual?

     yes   0

     no   0

- If so, what is the missing information? ....

....

....

....

....

....

....

Appendix 1 : Continuation

Instruction questions

The instructions which can be used on the word processor can

be generally divided into three main groups: ·

     A: instructions which are used during or before the inputting

       of text;

     B: instructions which are used to change existing text;

     C: other general instructions.

The possible instructions are listed below under these three

headings. After each instruction in the list you can see a group of

four circles, and then another group of two. Above the first four

columns of circles are the headings "never", "sometimes", "often"

and "always". These headings refer to the average number of times

that you use the instructions, and they have the following

significance:

    never   : the instruction is never used;

    sometimes : the instruction is used less than once a week;

    often   : the instruction is used at least once a week;

    always   : the instruction is used at least once a day.

For each instruction choose one of these four possibilities and

blacken the corresponding circle.

The last two columns of circles relate to the use of the

instructions from memory or otherwise. If you currently need to

consult a handbook/manual, another person or your own notes before

you can type in the instruction, then blacken the "no" circle.

Appendix 1 : Continuation

A: instructions which are used during or before the inputting of text

(Column headings)	how often used?				from memory?	
	never	some-times	often	always	yes	no

- setting position of margins
- inserting a tab
- setting bell zone
- indenting several lines of text from the left with one instruction
- indenting several lines of text from the right with one instruction
- setting a second pair of margins beside the first pair so that columns of text can be typed next to each other
- typing letters directly as capitals
- underlining text directly while typing
- dividing a word by syllables while typing so that, if the whole word comes to stand on one line because of text revision, the hyphen vanishes
- inserting an obligatory space, a space which will always be typed
- the typing of indices and exponents (quarter line higher/lower than line number)
- setting a decimal tab (horizontal or vertical) so that decimal numbers arranged in columns can easily be typed

Appendix 1 : Continuation

- drawing horizontal and/or vertical lines
- changing the page design:
  - width
  - number of lines per page on the screen
  - number of lines per page on the paper
  - offset (number of blank lines from top edge of
    paper)
  - line spacing
  - letter pitch

Appendix 1 : Continuation

B: Instructions which are used to change existing text

- changing position of margin so that whole text
  is immediately reformatted
- indenting several lines of text from the left
  with one instruction
- indenting several lines of text from the right
  with one instruction
- underlining previously typed text
- dividing words between syllables
- printing in bold
- filling out (justification) of part of the text
  (e.g. one paragraph from a page) so that there
  is a straight right margin
- deleting text by marking the portion of text to
  be deleted
- inserting text
- clearing indented blanks, i.e. the blank spaces
  (e.g. created by using the autotab key) are
  replaced by written spaces (e.g. created by
  using the tab key)
- moving text on the page so that the text does
  not disappear from the screen
- buffering text, so that the text disappears from
  the screen and is later replaced in a defined
  position
- centring text
- releasing a centred text, i.e. moving the text
  back to the left margin
- overwriting all characters in the marked section
  of text with spaces
- interchanging columns of text
- clearing a column of text
- clearing the margins from a column of text

Appendix 1 : Continuation

C: Other general instructions

- deleting/clearing in the format line
- clearing text on the screen
- clearing text on the screen plus the symbols in
  the format line
- displaying the index on the screen
- storing or updating a page on the (floppy) disc
- recalling a page from the (floppy) disc to the
  screen
- recalling a subsequent/previous page from the
  same text name
- recalling some blocks from a page on the disc,
  by means of block numbers
- filing "deleted pages" ("*") and later
  recalling
- providing all pages of a certain text name with
  a header and/or footer (header/footer page)
- printing pages of text directly from the
  (floppy) disc
- printing pages of text directly from the screen
- immediate printing on the printer while typing
  in onto the screen
- stopping printing in the middle of a page, e.g.
  in order to change the print wheel
- terminating (final ending) of printing in the
  middle of a page
- cancelling flashing system messages or error
  messages on the screen
- filling out (justifying) the whole text so that
  there is a straight right margin
- removing codes (codes appear in front of the
  left margin, e.g. when the line spacing of a
  portion of text is changed)

Appendix 1 : Continuation

- making visible on the screen what are written
  and what are blank spaces
- duplicating the total content of (floppy) discs
- duplicating a single text name (document) only
- removing a text name (document) on the disc
- changing a text name
- moving a page within a text name (document)
- typing in, storing and using terms which occur
  regularly (library)
- moving a page to another text name (document)

Have you any further comments, e.g. relating to one of the above
points, or about some other aspect of the use of a word
processor?

....

....

....

....

....

....

<u>Many thanks for your cooperation!</u>

Appendix 2:   Instruction descriptions

Instruction number	Instruction description
1	-· setting position of margins
2	- inserting a tab
3	- setting bell zone
4	- indenting several lines of text from the left with one instruction
5	- indenting several lines of text from the right with one instruction
6	- setting a second pair of margins beside the first pair so that columns of text can be typed next to each other
7	- typing letters directly as capitals
8	- underlining text directly while typing
9	- dividing a word by syllables while typing so that, if the whole word comes to stand on one line because of text revision, the hyphen vanishes
10	- inserting an obligatory space, a space which will always be typed
11	- the typing of indices and exponents (quarter line higher/lower than line number)
12	- setting a decimal tab (horizontal or vertical) so that decimal numbers arranged in columns can easily be typed
13	- drawing horizontal and/or vertical lines
	Changing the page design:
14	- width
15	- number of lines per page on the screen
16	- number of lines per page on the paper
17	- offset (number of blank lines from top edge of paper)
18	- line spacing

-22-

Appendix 2: Continuation

Instruction number	Instruction description
19	- letter pitch
20	- changing position of margin so that whole text is immediately reformatted
21	- indenting several lines of text from the left with one instruction
22	- indenting several lines of text from the right with one instruction
23	- underlining previously typed text
24	- dividing words by syllables
25	- printing in bold
26	- filling out (justification) of part of the text (e.g. one paragraph from a page) so that there is a straight right margin
27	- deleting text by marking the portion of text to be deleted
28	- inserting text
29	- clearing indented blanks, i.e. the blank spaces (e.g. created by using the autotab key) are replaced by written spaces (e.g. created by using the tab key)
30	- moving text on the page so that the text does not disappear from the screen
31	- buffering text, so that the text disappears from the screen and is later replaced in a defined position
32	- centering text
33	- releasing a centred text, i.e. moving the text back to the left margin
34	- overwriting all characters in the marked section of text with spaces
35	- interchanging columns of text
36	- clearing a column of text

Appendix 2: Continuation

Instruction number	Instruction description
37	- clearing the margins from a column of text
38	- inserting variable text at coded locations in the standard page
39	- replacing a word or portion of text individually each time it occurs (manually)
40	- replacing a word or portion of text throughout the text name at once (automatically)
41	- reorganising a document, repaginating
42	- changing the line spacing for a portion of the text
43	- changing the letter pitch for a portion of the text
44	- deleting/clearing in the format line
45	- clearing text on the screen
46	- clearing text on the screen + the symbols in the format line
47	- displaying the index on the screen
48	- storing or updating a page on the (floppy) disc
49	- recalling a page from the (floppy) disc to the screen
50	- recalling a subsequent/previous page from the same text name
51	- recalling some blocks from a page on the disc, by means of block numbers
52	- filing "deleted pages" "*" and later recalling
53	- providing all pages of a certain text name with a header and/or footer (header/footer page)
54	- printing pages of text directly from the (floppy) disc
55	- printing pages of text directly from the screen
56	- immediate printing on the printer while typing in onto the screen
57	- stopping printing in the middle of a page, e.g. in order to change the print wheel
58	- terminating (final ending) of printing in the middle of a page.

Appendix 2 : Continuation

Instruction number	Instruction description
59	- cancelling flashing system messages or error messages on the screen
60	- filling out (justifying) the whole text so that there is a straight right margin
61	- removing codes (codes appear in front of the left margin, e.g. when the line spacing of a portion of text is changed)
62	- making visible on the screen what are written and what are blank spaces
63	- duplicating the total content of (floppy) discs
64	- duplicating a single text name (document) only
65	- removing a text name (document) on the disc
66	- changing a text name
67	- moving a page within a text name (document)
68	- typing in, storing and using terms which occur regulary (library)
69	- moving a page to another text name (document).