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mother talk, but that child's writing performance can certainly be reinforced by positive verbal feedback. If, for the sake of argument, we wish to improve the deaf child's writing skills, is there some kind of process that would mimic the normal situation? Or should we seek more radical alternatives?

Analysing the problem in more detail, it would seem that what we need is a system for supplying stimuli which are meaningful to the child and which provide motivation to understand the situation and also monitoring the response and taking appropriate action depending on the performance level. At the same time, it must be borne in mind that the child is likely to be of normal intelligence and so any systems designed for a remedial situation are probably inappropriate.

There are wider questions to be asked. How do we want the child to communicate with the world? Should speech skills be emphasised at the expense of written communication? If the child's parents are deaf, it is likely that the child is a fluent signer. Do we discourage this? Or is it more appropriate to stimulate general information-seeking skills which generate, in turn, the motivation to develop additional more conventional modes of communication?

If we adopt this latter approach, we are probably less encumbered by entrenched ideas. Certainly, there are some promising candidates to be investigated. Consider Logo.

This language was developed by Seymour Papert in response to a deep conviction of his that mathematics teaching was on the wrong track. A child is not fundamentally cartesian, that is, he or she encounters difficulty in visualising events occurring in an absolute world of X-Y co-ordinates. He or she is self-centred to the extent that world events are perceived as happening to him or her rather than out there.

Mathematics is essentially a way of viewing the world rather than a set of formulae for describing it; therefore, devise a system which takes advantage of the child's self-centred view. A notional turtle (which the child immediately identifies with) defines shapes and structures under the child's control. Procedures can be built up, modified and structured hierarchically.

The essentially visual world of the deaf child maps easily onto this system. Many deaf children, particularly of deaf parents, are fluent signers and so subtle and complex visual discrimination is their stock in trade.

Logo is more than just Turtle graphics: it is a very high level programming language, capable of manipulating text as well as symbols. It also lends itself naturally to those operations which need to be invoked for the handling of complex problems: iteration, hierarchical (top-down) structuring and recursion (the term used for when a procedure invokes itself).

There is every evidence that children grasp and use these concepts in a way which staggers their teachers. It should not be so staggering: after all, the acquisition of language is one of the most complex activities we can imagine, and yet a child can do it.

It is quite reasonable to suppose that, having acquired a facility for handling Turtle graphics, a deaf child would be adequately motivated to handle the language side. The progression from visual images to linguistic images represented visually (i.e., words) would be natural and might possibly go unnoticed.

Although true speech would be a barrier (at least while we are waiting for intelligent speech synthesisers), the child's communication ability would be enhanced to the extent that, one way or another, he or she would be able to communicate with the world.

Anyone who has seen the play *Children of a Lesser God* will be in no doubt that the inability to communicate with fellow humans is one of the most distressing situations, transcending more debilitating disabilities in its misery power.

Another high level language, Prolog, has been developed to enable computer programs to be written directly in a form of predicate logic (of the 'socrates is a man' type) and for the problems so developed to be stored and solved.

It requires a literate person to use it: but imagine we had a version of Prolog which used pictographic symbols instead of words: the deaf child could, given an incentive in the form of a preprogrammed database, rapidly acquire a facility for the language in parallel with his or her hearing peers and learn to use proper words in a progressive way, as described above for the Logo system.

Indeed, the two languages might be used in a complementary way, with Logo being used to develop the pictograms. Moreover, deaf and hearing children might co-operate in the same work space and gain ideas from one anothers' systems. Such a modification is not beyond the capabilities of a competent systems programmer who has access to the source code for the particular implementation of the language. E

EXTERMINATE VDUs!

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No, this article is not an appeal by a computer liberation movement for you to burn your DERs, but to bring to your notice the ever growing number of enthusiasts who, like myself, are blind. This has all been made possible by the phenomenal increase in devices which give home micros a synthesised speech output with programs varying from pinball games to scientific calculators.

It was just such a calculator that I badly needed some 18 months ago. Believe it or not, there was no such thing at that time and my only ready-made option was to wrestle with braille four-figure mathematical tables that dwarfed books like *The Complete Works of Shakespeare* or to tackle the problem in a different direction. I decided to see if I could make the legendary microchip work for me.

I bought a VIC-20 with its excellent keyboard and reliable, if over-priced, compatible tape recorder. It was a combination that allowed me to smile when my wife read me angry letters about loading and saving problems on other micros in the computer press.

I chose the low-priced Vox Box from Mutek as the speech synthesiser — a neat little device which delivered a clear phoneme when a number was poked out to it via the VIC's user port. Each phoneme was, so to speak, a building block and whole words could be constructed from strings of phoneme numbers.

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It was now a simple matter to examine the contents of the screen starting at the top left hand corner and ending at the bottom right hand corner by peeking into each location on the screen memory map. The array element whose number was identified in each location was then poked out to the Vox Box which announced the character in English. When this program was run, it would read (or strictly speaking) spell out to the listener the content on the screen.

The applications for such a program are legion. I started by using the VIC as a scientific calculator and then running the program so that I could take down the answer to a calculation in braille. With the addition of a printer and a little more jiggery-pokery, I produced a talking typewriter. I then progressed to start writing games; for now each line of programming could be checked using the reading routine and the reading routine could be used to give the output for, say, a hangman game.

Although my crude method did the job it was designed to do, it was rather slow, so you can imagine my delight when I found out that Dr Tom Vincent and his staff of the Open University, Manchester, had designed a powerful software package which would make the BBC micro and a Votrax speech synthesiser do just about anything.

All the hardware is completely standard (apart from a lump of bluetac on the 9 and h keys to help you position your fingers on the keyboard) and the machine code program is popped into the top of memory leaving the user well over 20K to program with in MODE 7.

It is also possible to use a modified Perkins brailler as an input device giving the blind user an additional advantage of having a braille hard copy. With the addition of a dot matrix printer and a word processor program, a hard copy for sighted readers can be produced — ideal for writing essays, etc. Such essays can be stored on disc using a filing program.

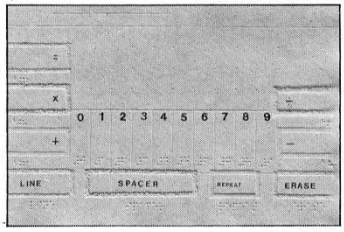
Once the Votrax interpreter has been loaded, every time a key is depressed the character it represents is announced, so an error may be corrected immediately by using the delete key — which, incidentally, announces the letter it has deleted. On hitting return, the entire line is spoken.

I must say that the excellent quality of the pronunciation quite surprised me, even with rather obscure English words. It certainly announced my address in North Wales much more clearly than the average summer-time tourist! A clever touch is that letters like CLS and ASC are pronounced CLEAR SCREEN and ASCII value. Editing is also possible using the cursor keys — a great time saver.

I was fortunate enough to be asked if I would evaluate the Votrax Interpreter package and immediately started to think in terms of devising a few games suitable for blind players and because when a program is run every PRINT statement is spoken, an Adventure game seemed the best program to start with. It was a most interesting project to work on and it was my first long program and could be played by either blind or sighted players. I had to incorporate a LOOK command so that blind players could remind themselves from time to time whereabouts they were.

Designing a reaction game for blind players was quite a challenge. I started with the relatively simple fruit machine which had a nudge facility. I brought in as many of the BBC sonics as I could to make the game more exciting and although I say it myself, it was quite a thrill to hear the word plum being spoken three times one after another! I produced a number of other reaction games, but I think Pinball Wizard is my favourite. It uses both sound pitch and spoken word clues as to the ball's position on the pinball table and I found a child-like delight in getting bonus scores when the buzzer was going.

I am at present working on a number of tactical board games which a blind person could play against the computer, with the help of one of the many tactile games boards produced by the Royal National Institute for the Blind. I feel that I am beginning to get somewhere with Ludo and maybe even Backgammon, but someone else will have to come up with a Chess program for the blind! E



Above: the Computing and the Blind project at the Open University has made tremendous progress; people like David can use this workstation to produce normal and braille hard copy. The system includes BBC micro, Perkins Brailler and an embossed overlay which (right) is used with a concept keyboard to provide, in this case, talking arithmetic for young visually handicapped pupils.

THE MICRO AND SPECIAL NEEDS

Members of the Rotherham Special Education Computer Users Group describe software development projects including a creative story program by Gill Duffy, a reading development and resources program by Gill Armstrong and a route finding program by Margaret Matthews.

The curricular framework within which all schools operate should determine the contribution of the micro rather than the reverse. Programs should relate directly to methods of teaching for which it is the best tool available, and not be involved in repetitive basic skills practice alone, which is often better done in more traditional ways.

Development of computer-based aids for those with physical and sensor handicaps is well advanced. The aim of the Rotherham group is to produce context-free programs which will be of use to both teacher and pupil across a broad spectrum of ability.

Three programs have been developed in the past year. The first is designed to stimulate interest in imaginative writing by using the micro's facility to motivate a small group of children to discuss the story's progress and by their interaction decide its conclusion. The same interaction is not achieved by the use of a book.

The second program gives a teacher an instantly available reference system for the reading materials in the school, thus saving time in cataloguing and filing, with all the updating that this implies.

The third program uses a simple map to teach route-finding skills and has in-built possibilities for a network of subroutines for teaching social skills.

The initial purpose of the creative story program is to provide pupils of any reading ability with a readily available facility for rehearsal, consolidation and stimulation. The format allows a maximum of five lines of text per screen and a total maximum of three screens (15 lines) before a two option choice is offered.

Teachers will be able to create their own stories which the micro will formulate automatically on the basic pattern of the program and give an approximate reading age for the story based on the Havering index. These stories can be geared to the readability and social level of the individual or group and linked to their specific interests, thus creating a climate in which their confidence can be increased and the motivation to improve reading skills is stimulated.

Because of the in-built flexibility of the program, the stories can be incorporated into on-going classroom activities, topic work or areas covered by specialist subject teachers. The children can decide which way the story will go and there is a facility for them to type in their own imaginative ending.

Finally, if the hardware is available, a printout will provide a satisfying end for the individual or group, especially for those who have difficulty with writing skills. Expansion of the program to include visual clues from slides, photographs, videos, etc., will allow further stimulation for those with special needs.

In trials, the program has been seen to promote skills in decision making, group interaction, language, imagination, free writing and thinking. The micro is the ideal tool for this exercise because of the immediate motivation for children to use it. The flexibility of the program could not be achieved in conventional print, as the information retrieval would be cumbersome and complicated, requiring teacher involvement at every step.

The pupil centred control of the program means that those involved are allowed to proceed on the basis of their own decisions, with minimum teacher influence.

There are at present about 10 stories available already. It is planned to retain a library of all the stories, each graded and coded for reading and interest levels.

Teachers who were interested in writing

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Educational Computing. December 1983. Page 37.

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