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offer expires March 15,1975

Who did this issue ? ? ? ? ?

Table of Contents

Going to buy a Minicomputer *for* ☆ *yourself!*
☆ *your school!*
☆ *your friend?*

Before you do it, *GET*

JANUARY 1975 VOLUME 7, NUMBER 1

Popular Electronics

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

and read about

If you want to buy your very own ALTAIR 8800, or at least find out more about it, write:
MITS,INC., P.O.Box 8636, Albuquerque ,NM 87108 . . . or call(505) 265—7553

THE HOME COMPUTER IS HERE!

For many years, we've been reading and hearing about how computers will one day be a household item. Therefore, we're especially proud to present in this issue the first *commercial type* of minicomputer project ever published that's priced within reach of many households—the *Altair 8800*, with an under-$400 complete kit cost, including cabinet.

To give you some insight to our editorial goal for this momentous project, we were determined *not* to present a digital computer demonstrator with blinking LED's that would simply be fun to build and watch, but suffer from limited usefulness. High chip costs would have made this a most expensive toy. What we wanted for our readers was a state-of-the-art minicomputer whose capabilities would match those of currently available units at a mere fraction of the cost.
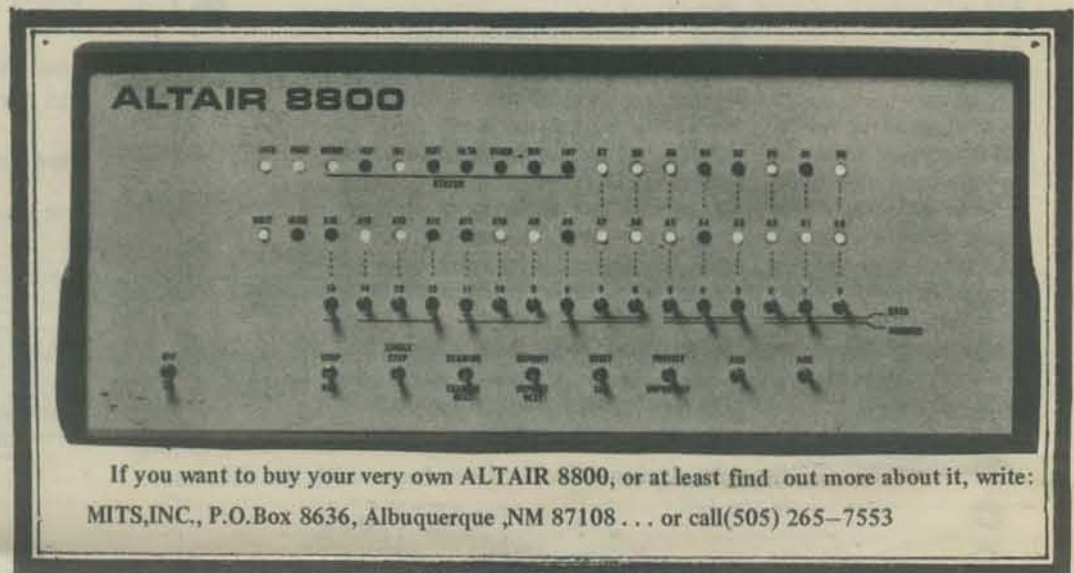
After turning down three computer project proposals that did not meet these requirements, the breakthrough was made possible with the availability of the Intel 8080 n-channel CPU (central processor unit)—the highest-performance, single-chip processor available at this time. As a result, *Altair 8800* offers up to 65,000 words of memory, 256 inputs and outputs simultaneously, buss line expansion, subroutines that are enormously deep, and fast cycle time, among other desirable characteristics. Peripheral equipment such as a "smart" CRT terminal is expected to be available, too, to make up a within-pocket-book-reach sophisticated minicomputer system.

Unlike a calculator—and we're presenting an under-$90 scientific calculator in this issue, too—computers can make logical *decisions* for an accounting system, navigation computer, time-shared computer, sophisticated intrusion system, and thousands of other applications. The "power" of *Altair 8800* is such that it can handle many programs simultaneously.

What we're presenting to you, the POPULAR ELECTRONICS reader, therefore, is a minicomputer that will grow with your needs, rather than one that will be obsoleted as you move more deeply into computerized applications. With minicomputers exhibiting an annual growth rate of some 50%, according to the E.I.A., and with predictions that six out of ten computers sold by 1975 will be mini's, you can be sure that there will be manifold uses we cannot even think of at this time.

There'll be more coverage on the subject in future issues. Meanwhile, the home computer age is here—finally.

Art Salsberg

★★★★ ALTAIR 8800 ★★★★
PROCESSOR DESCRIPTION

Processor: 8 bit parallel
Max. memory: 65,000 words (all directly addressable)
Instruction cycle time: 2 microseconds
Inputs and outputs: 256 (all directly addressable)
Number of basic machine instructions:
  78 (181 with variants)
Add/subtract time: 2 microseconds
Number of subroutine levels: 65,000
Interrupt structure: 8 hardwire vectored levels plus software levels
Number of auxiliary registers: 8 plus stack pointer, program counter and accumulator
Memory type: semiconductor (dynamic or static RAM, ROM, PROM)
Memory access time: 850 ns static RAM;
  420 or 150 ns dynamic RAM

The **HEART** of the ALTAIR 8800 is the INTEL 8080 *MICROPROCESSOR*, a complete CPU (Central Processing Unit) on a "chip." We couldn't find a picture of the INTEL 8080 in time for this issue, but here is a picture of the INTEL 8008, little sister to the 8080.

Next issue, we will start a series about the INTEL 8080 microprocessors so that people won't accuse us of becoming old-fashioned. Behold! P.C.C. leaps to the future!

WE WILL PUT OUR CHIPS ON THE CHIP. IF YOU ARE ASSEMBLING A HOME COMPUTER, SCHOOL COMPUTER, FRIENDLY NEIGHBORHOOD COMPUTER, COMMUNITY MEMORY COMPUTER ... GAME-PLAYING FUN LOVING COMPUTER ... USING AN INTEL 8008 OR INTEL 8080, PLEASE WRITE A LETTER TO THE PCC DRAGON !

2

and now a few words from.. COMPUTER DECISIONS

Three hundred buck mini kit!

How would you like to have a $20,000 minicomputer system for only $3,000? Sound like an impossible dream? Well it's not, not if you're handy with a soldering iron that is. This impossible dream will start to come true next month when a popular hobby magazine, a kit manufacturer from Albuquerque, New Mexico, and a microprocessor chip from Intel Corp. team up on an electronic hobbyist's project that is bound to throw the minicomputer business into a tizzy.

The heart of the system, the minicomputer itself, is scheduled to appear as a cover feature in the January issue of *Popular Electronics*. Dubbed the Altair PE 8800, the minicomputer uses a microprocessor to produce a machine that they claim is comparable to (and in many respects better than) the Nova II mini from Data General, from a hardware viewpoint.

The PE 8800 minicomputer, designed by and available from MITS, Inc. of Albuquerque, is only the first of a series of projects that will result in a complete minicomputer system. The other system components, which will appear as construction projects in *Popular Electronics* in the coming months, include a cathode ray tube terminal and a floppy disk memory system.

According to Ed Roberts, president of MITS, the PE 8800 minicomputer is a parallel 8-bit data word, 16-bit address computer with a cycle time of 2 microseconds. The central processing unit of the mini consists of a single LSI chip—Intel's 8080.

The 8080, and hence the MITS mini, has a 78-instruction repertoire, including some instructions for double precision. This, according to Roberts, is almost twice the number of instructions found in comparable processors. While the basic cycle time of 2 microseconds is slower than the 1 microsecond of the Nova II, Roberts points out that it is still possible for the PE 8800 to outperform the Nova. Explaining further, he notes that if a particular problem requires decimal arithmetic and a lot of I/O capability, then the MITS mini has the advantage because the 8080 contains a decimal converter that makes it easy to perform arithmetic on BCD numbers. In addition, Roberts reports, the 8080 has a very powerful I/O structure.

If on the other hand the problem to be solved is a cpu-related problem that requires speed, the Nova may be significantly faster. It's difficult to compare the two systems, he notes, because there isn't any software system—like *Fortran*—that's sophisticated enough to run any benchmarks that are common between the two processors.

Another feature of the PE 8800 computer is that the processor can directly address up to 65k words of memory. This is in contrast to most minis which require an indirect address through a base page.

The basic kit comes with 256 words of memory. But the drivers and other components necessary to expand the unit's memory up to 65k words are included so it is only necessary to plug in additional memory cards. The memory can be expanded in blocks of 256, 1k or 4k words. This allows the user to tailor the memory to his application at minimum cost. The cost of the additional memory boards is about $200 for each additional 4k words.

The memory access time for the basic unit is 850 nanoseconds, with static RAM memory chips. If dynamic RAM memory is used instead, the access time can be cut to as little as 150 nanoseconds.

Other features of the PE 8800 include 256 directly addressable inputs and outputs, a real time clock and 8 hardwire vectored levels of interrupt with additional software levels.

The mini, notes Roberts, is available in three configurations; a bare-bones model with no case, switches or power supply for $295, a complete kit of parts for $395 and a fully assembled unit for $495.

Another project that is currently being developed by the Albuquerque kit manufacturer is a disk operating system for the computer. This system will run from a floppy disk. The controller portion of the disk system will cost about the same to build as the computer, Roberts estimates, but the disk drive will be significantly more. The reason, he explains, is that MITS would simply be buying drives from a manufacturer in OEM quantities and selling them to individuals. The projected cost for the drive is between $600 and $700.

Two other peripherals, both of them terminals, have already been designed by MITS. One is a crt and the other is a gas discharge display terminal. Plans for the crt unit are not yet available but will be appearing in *Popular Electronics* in the next few months. But the gas discharge display terminal is ready now. Known as the Comter 256, it is available for $395 (less cabinet and power supply) and $495 complete. The unit features a built-in acoustic coupler, a 32 character Burroughs display and an internal memory capability of four 256-character pages. The terminal also has a tape recorder input/output jack to enable the taping of frequency shift keyed tones during telephone connection to a computer. This feature gives virtually unlimited memory capability.

The entire computer system will be completed by the summer, says Roberts and a stand-alone unit that will consist of a processor, terminal and several disk drives will be available for about $3,000. That would be comparable to a system that now lists for 15 to 20 thousand dollars.

—JHG

THE 8080 IS HERE

It is getting to the point that every week when a new Electronic News, Computerworld, or Electronic Design magazine is received a new case of "future shock" leaves us reeling for some time. The January 1975 issue of Popular Electronics is no exception. In that issue another computer kit was announced using not the common, cheap (we thought) 8008 or 8008-1 chip but the new, super-performance 8080.

The company is MITS and the computer is dubbed the ALTAIR 8800. The price for a basic kit (less case, switches, power supply) of $298 left us here at TCH very skeptical as to the inclusion of the 8080 chip. The singles list price of $360 for the 8080 and the ambiguous language of the Popular Electronics article led us to a long and very informative conversation with H. Edward Roberts, president of MITS.

Yes, Virginia, there really is an 8080 in the basic, $298 kit. Not only that but the system is properly organized around a comprehensive, single bus, somewhat like DEC's UNIBUS but synchronous. 256 words of RAM are also included in the basic kit to get the buyer started. The lack of a power supply in the basic kit is a minor problem since MITS's philosophy is local regulators on each board. Other versions of the ALTAIR 8800 currently offered are a complete system kit with cabinet, console, and power supply for $397 and an assembled, checked out, 90 day warranted system for $498. First deliveries are slated for mid-January, 1975.

Large memory users have not been forgotten by MITS. Although the memory board supplied with the system uses 1K static RAM's and has a maximum capacity of 1024 words, larger boards with 4096 words each will be available. These will use the new 4K dynamic RAM chips which until now have been enthusiastically ignored even though the price per bit in 25 quantity from industrial distributors is actually less than surplus 1101's. The 4K RAM's being used are the TI style with 22 lead packages, the most common type. Price for the 4K board will be about $230.

Besides the computer, MITS has on their drawing boards or in the lab a complete line of peripheral gear for their systems. There will be four different types of general I/O interface boards, one 8 bit parallel and the other three serial using UART's. An audio recorder modem usable with one of the serial interfaces will be available. A 16 line by 64 character alphanumeric CRT display is planned using a high-quality monitor, which is required for such a long line. Both hard and floppy disk controllers are planned using, you guessed it, an 8080 chip for the control intelligence. These disk controllers will use the inherent direct memory access capability of the ALTAIR bus. Other more esoteric devices mentioned in our conversation include a 32 by 32 element image sensor, PROM programmer interface, and 8 bit analog-to-digital and digital-to-analog converters.

MITS has not forgotten software either. Naturally an assembler has been written. This one is unusual however in that it is a one-pass assembler. It will be free to customers who purchase more than 8K of memory with their ALTAIR 8800. Of course I/O handlers are being written for each peripheral device. In addition an operating system is being written. High-level languages are being considered with BASIC at the top of the list. Software will probably be for sale to anybody.

The natural question is how can MITS offer so much for so little and stay in business. The answer is both surprising and indicative of near future trends. It is well known that Intel and others can be induced into giving deep discounts on complex IC's when quantities get into the range of 10K to 100K, particularly with the current slump in the economy. Deep discounts here mean a factor of five or so. Mr. Roberts said flatly in response to our question that his company believes the potential computer hobbyist market is larger than the amateur radio market. The latter has over 300,000 license holding members, supports several high quality publications and manufacturers, has several active nation-wide and worldwide organizations, and even has a yearbook. The prospect of a "computernik" on every block is truly mind-boggling. In the words of Mr. Roberts, the whole concept is truly "super!"

The Computer Hobbyist

With this issue, THE COMPUTER HOBBYIST begins regular publication. It will be published once a month in Raleigh, North Carolina. Plans are to send out a new issue during the first week of each month. We appologize for not being on time this time, but after all it is only our second printing.

Since THE COMPUTER HOBBYIST has decided to publish regularly, we have secured a post office box for newsletter mail. Our new address is:

The Computer Hobbyist
Box 295
Cary, North Carolina 27511

$6 per year; 12 issues.

they asked you me to tell you that ... unfortunately...
the 8008 system does not belong to THE COMPUTER HOBBYIST.

THE POWER OF AN 8008

This issue of TCH was generated on an 8008 driven system. All text was entered, edited, justified, and printed under the control of a stand-alone 8008. The system has 8K of 1103 memory and a floppy disk. The program is divided into 12 overlays and consists of over 10,000 8008 assembly language statements. The CRT display used for editing and formatting is probably the biggest ever with 69 lines of 102 characters capacity. The actual printing was done with offset masters which were photographically reduced from the printout from a Diablo Hytype I printer. Isn't it wonderful, the things you can do with a microprocessor.

yet another BASIC BOMB OUT!

-OR-

How We've Learned To Live With The INPUT Statement

Sometimes in the old days, often in the middle of a game, and usually to somebody new to computers, our terminals would say:

ERROR xx IN LINE xxx

READY

(By which the computer meant: "You typed the wrong thing when I asked for INPUT so I've kicked you out of the program. Out of the goodness of my heart, I've described what you did wrong (i.e. ERROR xx) and where the error happened (i.e. IN LINE xxx). To understand it, all you have to do is look at page xx in the reference manual, then look at the program listing (wherever that is or type LIST), and with your thorough knowledge of BASIC (oh, you say you don't speak the language — well, ask somebody then), you can figure out where you went wrong. Naturally, the READY means you're in BASIC so if you type some "random" number (like the input you tried to type in the first place), you might wipe out a line in the program and then . . . To pick up again where you left off, type GOTO xxx — by the way, I zero all variables so you can't really start where you left off so you may as well start over. Be more careful next time!!")

Games encourage non-standard responses — like, I THOUGHT YOU WERE 'IT' when the terminal is asking, WHERE DO YOU THINK THE HURKLE IS HIDING?. People were being heavily discouraged from exploring and seeing *what would happen if*.

Suppose the terminals would print something like, I'M CONFUSED — I NEED 2 COORDINATES FROM 0 TO 9. Then the *computer* is the dummy — *it* doesn't understand *me*. "Watch me get the computer all confused." Quite different than feeling upset because the program has to be reloaded (on our 10 cps reader — no mass storage, alas) because a few random lines were erased. Blahh!

THE HACKER RIDES AGAIN...

STRIKING YET ANOTHER BLOW FOR THE CAUSE OF THE KLUDGE!

"EEYACH! ETC.!"

"MUMBLE! FOOBAZ!"

"SO WHAT ?!"

4

Our current solution happened in three stages.

1. A subroutine for all input. *Pass* the number and types (numeric or string) of inputs wanted to the subroutine. Input the entire user response into a character string and parse it. One special input was always recognized — STOP (the user could type STOP anytime to stop the game). We never bothered to tell our game players about Control C (remember, we never wanted a game player to give commands directly to BASIC). *Return* the inputs and a condition code to the calling routine; 1 = STOP , 2 = couldn't find all the inputs you wanted , 3 = o.k. The '2' would cause a "helpful" message to be sent to the player and the input would again be requested.

The parsing of the inputted string was complicated because there was no direct way to convert from string to ascii (*ascii* is the numeric representation of a character) and numeric operations (like subtraction) could not be performed with strings. If we could compute

$$T = C\$ - "0" ,$$

we'd almost be done; T would equal the digit in C\$ (from 0 to 9) (you still need to check if T is from 0 to 9 to see if C\$ actually is a digit). For numeric input, we used a FOR–NEXT loop variable as a pointer into an internal character string. If a match were found with the input character, the value of the FOR–loop variable was the ascii representation. (?!?).

The problem (and the reason that step 1 was not our final solution) was that *it took a lot of time* to parse the input. People got really impatient, especially with multiple terminals running.

2. We eliminated the parsing subroutine. We tried all programs having line numbers greater than 1000 (hopefully, it would be harder to accidently erase a line since most inputs to the games were less than 1000). The player was supposed to ignore an ERROR when (and generally *when*, rather than *if*, for first-timers) it occurred and blindly type RUN.

It was faster than before but it didn't solve much — "What does ERROR xx IN LINE xxx mean"? And a player couldn't continue where the game aborted because of the zero-all-variables insanity of our BASIC. So, . . .

3. One night, after everyone was asleep and all was quiet, it happened. Did you know that if you compute

$$T = C\$$$
$$\text{and } X = INT(LOG(ABS(T))) + SGN(T)$$

that X will be unique for each possible ascii character (on DEC EDU20, at least)? This gives you a *unique* index into an array where the ascii value of each character can be stored.

So, we redid phase 1 with a streamlined, razzle-frazzle lookup that would gladden the heart of the most hardened hacker. And — our method of parsing INPUT isn't perceptibly slower to the user, even with multiple terminals, than good (or is it bad) ol' INPUT.

THE END (We hope.)

ART

Imagine

*** You move through a narrow space *** blue... lavender... minimal visual stimuli *** Air pressure of different intensities and temperatures brush you *** Warm and cool air ducts respond to your presence and open and shut invisible spaces for you *** You may ignore the wind pressures and move according to your inner choice or you may yield to the air currents *** Vulnerable... Maleable...

*

You become the media molded by the space and your relation- ship to it *

PAM SCARVIE
Palo Alto Community Cultural Center
PERFORMANCE – ENVIRONMENTS
January 26 – 3:30
... 1313 Newell Road...
February 9 – 3:30
... Palo Alto...
February 23 – 3:50
... 415 329-2366...

****

Conceptual art emphasizes the elimination of the art object. Built in permanence no longer makes sense. We move. We change. Experiencing the process of any change or movement is more valuable than any object which results from the process. "... The detachment of art's energy from the craft of tedious object production has further implications. This reclamation of process refocuses art as an energy driving to change perception..."(Robert Morris) Focusing on idea implies that artists identify their concepts and intents. Artists began to ask questions of them-selves which made some of the elements of their creative process clearer and more accessible to them. Taking the focus off the object allowed artists to re-examine process in terms of cultural values.

Conceptual art began to gain momentum as a new form as early as 1965 and seemed to evolve as one aspect of the post-minimalism development. Conceptual art receives its heritage from Marcel DuChamp who, with the execution of "Nude De-scending the Staircase," changed his emphasis from painting to idea. He became interested in making new inventions (Ready-Mades) as opposed to traditional painting. These Ready-Mades were also intended as a jibe at the elite art establishment. Conceptual art is also linked to Abstract Expressionism spectifically by Jackson Pollock's "action painting:" which emphasized process of work instead of product. In the 1950's Alan Kaprow held spontaneous events called "Happenings." These experiences existed for a short moment in time and then became intangible except as straight verbal and photographic documentation. Another important influence was John Cage's philosophy of conceptual music.

Encompassed within the larger title " Conceptual Art" within the last ten years have been the following:

Earth Works in which the earth may have been drawn upon , dug out and re-shaped or transplanted , in residue, to a museum or gallery. An example of this is Michael Heizer's " No. 2/3 Displaced-Replaced Mass" 1969 in which a 30 ton granite mass remained within a cement depression. This was completed in Silver Springs, Nevada.

Process Art in which artists completed an action, leaving behind visable traces or clues about their activity such that the viewer could re-ex-perience the process in his own mind. An example of this work was " First Ascent, University Art Museum,Berkeley,"1972, in which Don and Jeanne East climbed the exterior of the Museum spent the night and descended, leaving behind pitons and boot tracks which remain as a clue to their process.

Art Language- a natural development since Conceptual Art differs from other contemporary art in that it makes its premise known. An artist states his ideational intent. This is a shift from art in which appearance is the major concern. Conceptual Art depends upon the written word to explain its concept. An example of this work is "Information Room 1970," by Joseph Kosuth in which there are two long tables stacked with newspapers and books. An except from his statement of philosophy - "Art's only claim is for Art. Art is the definition of Art."

Cinema and Video are used either as documentation for a piece or abstractly to express a pre-determined concept. "Movie for the Blind," by Les Levine contains no im ges. At Documenta 5, in Kassel, Germany, a film, looped end to end, was pro-jected out an open window into space.

Dance in which video, film and music are often used as well - noteably "Walk She Said," by Yvonne Rainier which incorporated cinema and reading.

Performance - Terry Fox - "... Fox's art lives on a spiritual plane; the work itself, the parts we see, act as a medium in an almost occult sense. Fox makes art as a means of pursuing new levels of consciousness. Each new piece he presents or performs for us (and for him) still another potential means of expanding consciousness. His seeking after spirituality manifests itself in art - art acts the role of "medium," of spiritualist...." Brenda Richardson

Environments I will use my own work as an example. They were created to let viewers experience the artist's mood or sensibility in a total way- usually in quiet, simple places so that the viewer could respond and experience himself. Interactive environments have been made in which strobes pulse or panels move or change color as a person approaches. It is my intent to make available some spaces and environments in which people can get in touch with their own creative processes. Given an environment in an artist's sensibility, one could allow the aesthetic decisions of the space to be determined by the people experiencing it. Each person would have his unique perceptions and associations. This extends interactive environments by linking a person's perceptual emphasis to his creative decision-making process. The important part of the interaction will happen within the person's mind. The interaction will be between the person's perception of his environment and the creative process of his mind which will enable him to change the space in such a way as to explore his perception.

Within the verbal limitations of intent and premise stating, Conceptual Art often sounds super serious and logical. In fact, the information which results in a piece comes in on every level and sometimes reasoning blocks it. I offer you a quote from artist Scott Geiger: "... An artist should be unconscious as much of the time as possible, otherwise ideas might creep into his work, and they are harder to get rid of then roaches, once they take root... artist as feedback... direct connection between universal conscious and sub-conscious..."

References:IDEA ART, A Critical Anthology edited by Gregory Battcock, E.P. Dutton&Co.,Inc., New York, 1973

CONCEPTUAL ART , Ursula Meyer, E.P. Dutton & Co., Inc.,New York, 1972

MARATHON '74

DAILY EVENTS

9:00 – 5:00 p.m. Computer Area
THE HEURISTICS LABORATORY. Dr. Jack Lochhead. The heuristics laboratory contains a variety of manipulative materials designed to make you think and grow along lines defined by Piaget. These include games, puzzles, video tapes, experimental devices, computer terminals and robots. It will be open throughout Marathon Week .

11:00 – 12 noon Computer Area 6158 5
THINKING ABOUT THINKING. Jack Lochhead and Jof Clement. A session in which we will try to solve some puzzles and puzzle about our attempts to solve them.

12:00 – 2:00 p.m. Computer Area 6015 10
PYGMALION'S COMPUTER. Professor H.A. Peelle. Computer-assisted instruction: Panic or Panacea? The state of the art; historical sketch; misuses of computer; controversial issues; new directions.

2:00 – 3:00 p.m. Computer Area 6156 5
SYMMETRY PATTERNS AND PIAGET. Jof Clement. Piaget's concept of the structured and active nature of knowledge will be introduced using some perceptual experiments and pattern construction activities.

1:00 – 2:00 p.m. Computer Area 6160 5
CRAWLING, WORM CRAWLING, TURTLES AND THOUGHT: CONSCIOUSNESS RAISING A LA PIAGET AND PAPERT. Jack Lochhead. An introduction to techniques for making students aware of their own learning processes.

12:00 – 2:00 p.m. Computer Area 6018 10
COMPUTER PROGRAMS FOR TEACHING CHILDREN THINKING. Professor H.A. Peelle and graduate seminar students. Description of a new approach to teaching children using computer programming languages as a conceptual framework. Examples demonstrated and feedback invited.

2:00 – 3:00 p.m. Computer Area 6157 5
WHY ARE WORD PROBLEMS SO HARD? Jof Clement and Jaak Lochhead. An investigation of some of the skills needed to solve word problems. Special emphasis will be placed on semi-quantitative thinking – solving problems that involve NO numerical calculations.

3:00 – 5:00 p.m. Computer Area 6016(5) 10
COMPUTER GAMES. Professor H.A. Peelle. "Hands-on" an interactive computer playing educational games.

THE HEURISTICS LABORATORY IS AN OPEN CLASSROOM FOR BOTH ADULTS AND CHILDREN; IT IS DEDICATED TO TEACHING THINKING.

Below we give some samplings from our faire.

BE WARNED, READING THESE PAGES WILL TELL YOU NOTHING UNLESS YOU TRY SOME OF THE ACTIVITIES YOURSELF.

TOTAL TURTLE TURMOIL

Turtle is a cybernetic toy that crawls along the floor under computer control.

TURTLE TALK is the language used at UMass. to control turtles. It behaves like a subset of LOGO but it is written in FORTRAN.

Enquiries on FORTRAN TURTLE TALK should be sent to David Stemple, Computer Center, University of Mass., Amherst, Ma. 01002. Enquiries on Turtle and LOGO should be sent to General Turtle Inc., 545 Technology Square, Cambridge, Ma. 02139.

Don't have a computer?

Use TURTLE WALK. This is a classroom game in which TURTLE TALK is used to guide a blind folded student through a maze of chairs, tables, etc. . .

INCHWORM loves TURTLE WALK

"The most powerful of all ideas is the idea of powerful ideas." Seymour Papert

TURTLE TALK

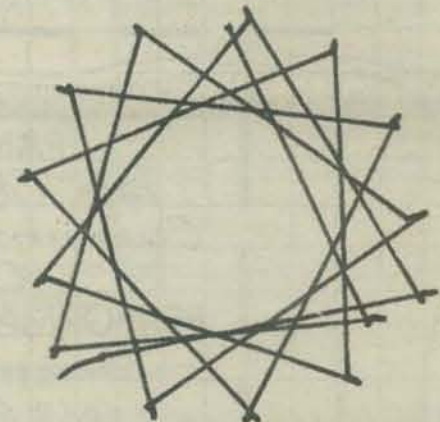|	
FORWARD #	TO
BACK #	END
LEFT #	MAKE
RIGHT #	STOP
PENUP	IF
PENDOWN	PROCS
TOOT	LIST
LAMPON	SAVE
LAMPOFF	

Write a program to make a:

"The principal goal of education is to create men who are capable of doing new things. Not simply of repeating what other generations have done."

Jean Piaget

```
TO SQUARE A B
FORWARD A
LEFT 90
IF B = 1 STOP
SQUARE A B–1
END
```
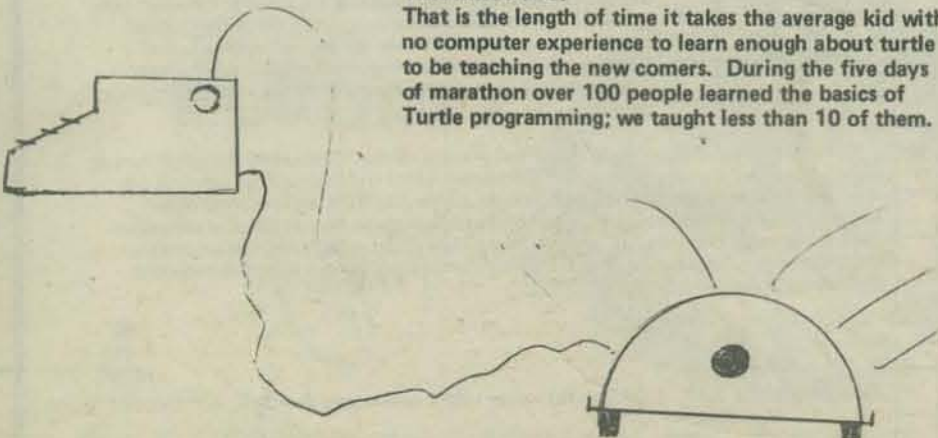
What value should you use for B to get four sides?

What is TURTLE TURNAROUND?
TEN MINUTES.
That is the length of time it takes the average kid with no computer experience to learn enough about turtle to be teaching the new comers. During the five days of marathon over 100 people learned the basics of Turtle programming; we taught less than 10 of them.

ALPHABETSOUP

HELLO. WHAT'S YOUR NAME?

CHARLIE BROWN

WELL, CHARLIE, I'M JUST SITTING HERE . . .
. . . EATING MY ALPHABET SOUP . . .

       GULP!!

I DON'T BELIEVE I ATE THE WHOLE THING!
CAN YOU TELL ME WHICH LETTER THAT WAS?

O.K. CHARLIE, GUESS A LETTER.

A
NOPE. THAT'S NOT IT. BUT I CAN TELL YOU THAT
IT IS NOT A VOWEL.

O.K. CHARLIE, GUESS A LETTER.

B
NOPE. THAT'S NOT IT. BUT I CAN TELL YOU THAT
IT HAS NO 'EYES' (CLOSED LOOPS).

O.K. CHARLIE, GUESS A LETTER.

F
NOPE. THAT'S NOT IT. BUT I CAN TELL YOU THAT
IT DOESN'T HAVE ANY 'LEGS'.

O.K. CHARLIE, GUESS A LETTER.

O
NOPE. THAT'S NOT IT. BUT I CAN TELL YOU THAT
IT HAS NO 'EYES' (CLOSED LOOPS).

O.K. CHARLIE, GUESS A LETTER.

C
NOPE. THAT'S NOT IT. BUT I CAN TELL YOU THAT
IT IS NOT A CURVED LETTER.

O.K. CHARLIE, GUESS A LETTER.

Z
NOPE. THAT'S NOT IT. BUT I CAN TELL YOU THAT
CAMPBELL'S SOUP IS M-M-M- M-M-M GOOD!

O.K. CHARLIE, GUESS A LETTER.

L
CONGRATULATIONS
L WAS IT . . . . GULP!!

TRY ALPHABETSOUP AGAIN LATER.

COMPUTER GAMES OF LANGUAGE 'N LOGIC!!

HANG

HOW MANY LETTERS DO YOU WANT
IN YOUR MYSTERY WORD?
5
HERE IS YOUR WORD

_ R _ _ _

GUESS A LETTER OR THE WHOLE WORD
E

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 . . . . .
 .       O
 .
 .
 .
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 . . . . .
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_ R _ _ _

GUESS A LETTER OR THE WHOLE WORD
A

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 . . . . .
 .       O
 .       l
 .
 .
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 . . . . .
```

_ R _ _ _

GUESS A LETTER OR THE WHOLE WORD
I

_ R _ I _

GUESS A LETTER OR THE WHOLE WORD
S

```
 . . . . .
 .       O
 .       l
 .       O
 .
 .
 . . . . .
```

Faithful Frank cranks the sausage machine while you
man the controls. The faster he turns the crank, the
shorter each sausage will be. When you move the Lever
lower, the Meter moves to the right. The machine
makes each sausage longer whenever the Meter moves
to the left. Fred has been cranking hard for 11 hours
now and in spite of your encouragement, he's slowing
down. You must keep Tasty Sausages the same
length.

Should you move the lever:

a) lower b) higher c) don't know

RULES, DO WE NEED THEM?

Imagine a game of checkers with 25 kibitzers yelling
on each side. But the game isn't checkers; it is
FOCUS and nobody, but Jof knows the rules. This
was the scene at Jof Clement's workshop *Piaget,
Game and Learning*. Each side was permitted to
attempt one move during their turn. They were
not told if the move was legal until after it had been
made. Neither the rules nor the goals were stated or
demonstrated explicitly; but after 40 minutes of
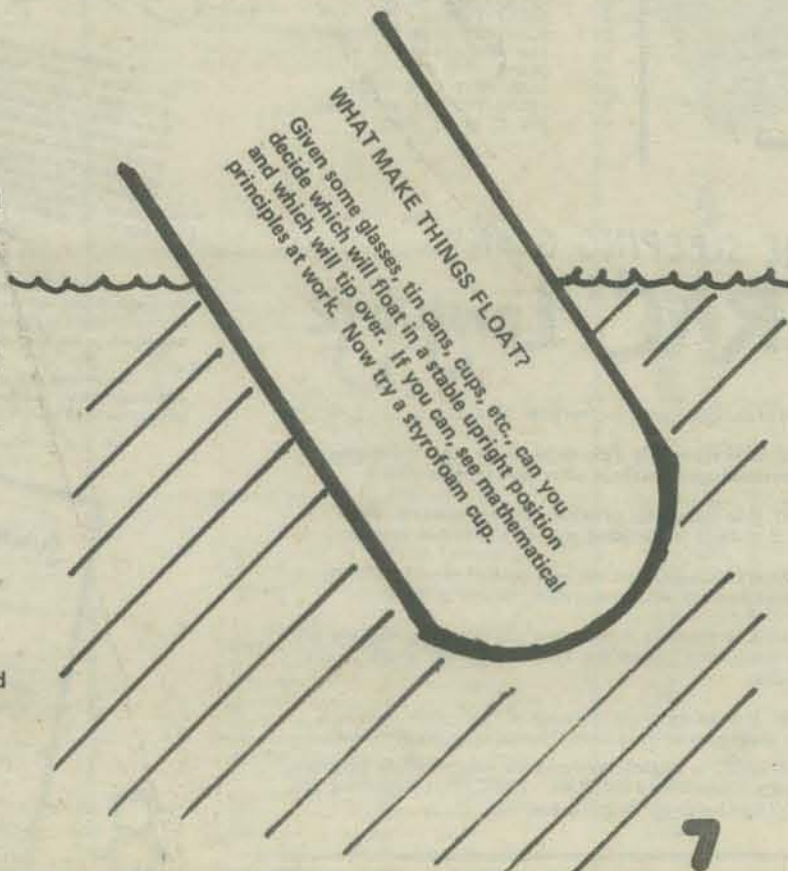heated discussion and play everyone knew the rules.

Try your own version of FOCUS the next time you
are at a dull party.

WHAT MAKES WORD PROBLEMS SO HARD?

It isn't just math. Consider:

If 2 pipes can fill a tank with water in 9 minutes and
one can fill it in 15 minutes, how long would it
take using just the other pipe?

Don't use algebra.

WHAT MAKE THINGS FLOAT?
Given some glasses, tin cans, cups, etc., can you
decide which will float in a stable upright position
and which will tip over. If you can, see mathematical
principles at work. Now try a styrofoam cup.

SEMI QUANTITATIVE PROBLEM SOLVING

Before a student can reliably solve numerical word
problems she has to learn to handle qualitative
relations of the form "more A means more B" and
"more A means less B." Below is a taped trialog
between a teacher, Paul age 7 and John age 8.

Teacher (reading) "Putting less sugar in lemonade
makes it taste more sour. Does that make sense?"

Paul: "nnn no."

John: "Oh yeh."

Paul: "It doesn't."

John: "Yes it does."

Paul: Oh, yes it does."

. . . "Not it doesn't."

Teacher: "I don't like sour drinks so should I add
more than the regular amount of sugar or less?"

John: "More."

Paul: "Less."

*HOW DO YOU CRAWL?
CAN YOU DESCRIBE THE SEQUENCE THAT
YOUR ARMS AND LEGS FOLLOW WHEN YOU
CRAWL?*

Computer people all know that learning to program
teaches you to think straight and say what you mean.
How can you show 50 nonprogrammers that experience
in one hour without using a computer?

Borrowing an idea from Piaget *Crawling, Worm Crawling,
Turtles and Thought* began with the above question on
crawling. Then we adjourned for 5 minutes of crawling
puzzlement and debate. Try it yourself.

COMPUTER LIB

You can and must understand computers NOW.

© 1974 Theodor H. Nelson.

Any nitwit can understand computers, and many do. Unfortunately, due to ridiculous historical circumstances, computers have been made a mystery to most of the world.

This book is a measure of desperation, so serious and abysmal is the public sense of confusion and ignorance. Anything with buttons or lights can be palmed off on the layman as a computer. There are so many different things, and their differences are so important, yet to the lay public they are lumped together as "computer stuff," indistinct and beyond understanding or criticism. It's as if people couldn't tell apart camera from exposure meter or tripod, or car from truck or tollbooth. This book is therefore devoted to the premise that

(And nowhere have I seen a simple book explaining to the layman the fabulous wonderland of computer graphics which awaits us all, a matter which means a great deal to me personally, as well as a lot to all of us in general. That's discussed on the flip side.)

Computers are simply a necessary and enjoyable part of life, like food and books. Computers are not everything, they are just an aspect of everything, and not to know this is computer illiteracy, a silly and dangerous ignorance.

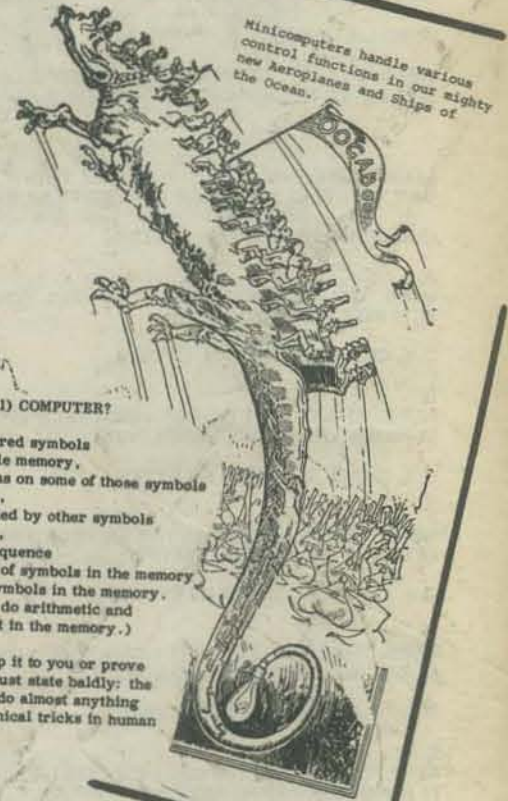## HERE THEY COME — the MICROPROCESSORS!
COMPUTERS INSIDE COMPUTERS

"Big fleas have little fleas that bite 'em;
And so forth, ad infinitum." — Proverb

Microprocessors are what's happening.

Computers cost several thousand bucks on up. Microprocessors cost several hundred on up, and that price range is falling fast.

Some microprocessors are already on integrated circuits, postage stamp-sized electronic tangles that are simply printed and baked, rather then wired up; this means there is effectively no bottom limit to the price of microprocessors. What this means that in a few years there will be a microprocessor in your refrigerator, your typewriter, your lawnmower, your car, and possibly your wallet. (If you don't believe this, look what happened to pocket calculators in the last couple of years. The chip those are built around costs five bucks. But next come the programmable chips, the microprocessors.)

Remember the song that had a pointer data structure?

(in alphabetical order)

ANKLE BONE
BACK BONE
FOOT BONE
HEAD BONE
HIP BONE
KNEE BONE
NECK BONE
SHIN BONE
SHOULDER BONE
THIGH BONE

Minicomputers handle various control functions in our mighty new Aeroplanes and Ships of the Ocean.

WHAT, THEN, IS A (Digital) COMPUTER?

A device holding stored symbols
in a changeable memory,
performing operations on some of those symbols
in the memory,
in a sequence specified by other symbols
in the memory,
able to change the sequence
based on tests of symbols in the memory
and able to change symbols in the memory.
(For example, do arithmetic and
store the result in the memory.)

Rather than try to slip it to you or prove it in some fancy way, let's just state baldly: the power of such a machine to do almost anything surpasses all previous technical tricks in human history.

STARK & CLEVER APL

Some people call it a "scientific" language. Some people call it a "mathematical" language. Some people are most struck by its use for interactive systems, so to speak. But most of us just think of it as THE LANGUAGE WITH ALL THE FUNNY SYMBOLS, and here they are:

```
ⁱⁿᵘⁿᵃᶜ⁺ωᵗᵉ⌈∧⌉⊃⌷;f⊤∇⍺
⌽⍙∋⌿⊥⊃⍵∇⍴⌈↓∨∆ (⍺⊤⍳⋯○⍳⌷∟
123⍙4567⌉9.BⲄⳐⲨⳁ⍅ⲒⲦOⲈⲆ⋆
PⲢⅤⲤⲀⲌ⋆ⲘⲨⲌⲎOⱲXⳐ,S⌿GXⲎ
```

Enthusiasts see it as a language of inconceivable power with extraordinary uses. Cynics remark that it has all kinds of extraordinary powers for inconceivable uses — that is, a weird elegance, much of which has no use at all, and some of which gets in the way.

This is probably wrong. APL is a terrific and beautiful triumph of the mind, and a very useful programming language. It is not for everybody, but neither is language. It is not for children, mathematicians, and companies who want to build interactive systems but feel they should stick with IBM.

YOUR FIRST COMPUTER LANGUAGE: DARTMOUTH'S BASIC

Many ordinary people find computers intuitively obvious and understandable. Perhaps only the complications elude them. Perhaps these intuitively helpful definitions may help your intuition as well.

1. Think of the computer as a WIND-UP CROSSWORD PUZZLE.

2. A COMPUTER IS A DEVICE FOR TWIDDLING INFORMATION. (So, what kinds of information are there? And what are the twiddling options? These matters are what the computer field consists of.)

3. A computer is a completely general device, whose method of operation may be changed, for handling symbols in any specific way.

WHERE IT'S AT IN THIS BOOK

THIS IS THE BEST FINGER-LICKING BOOK OF COMPUTER YUMMIES THAT YOU CAN FIND ✠ANYWHERE ✠ START HERE AND GO EVERYWHERE!

Somehow the idea is abroad that computer activities are uncreative, as compared, say, with rotating clay against your fingers until it becomes a pot. This is categorically false. Computers involve imagination and creation at the highest level. Computers are an involvement you can really get into, regardless of your trip or your karma. They are toys, they are tools, they are glorious abstractions. So it you like mental creation, toy trains, or abstractions, computers are for you. If you are interested in democracy and its future, you'd better understand computers. And if you are concerned about power and the way it is being used, and aren't we all right now, the same thing goes.

CYBERCRUD

A number of people have gotten mad at me for coining the term "cybercrud," which I define as "putting things over on people using computers." But as long as it goes on we'll need the word. At every corner of our society, people are issuing pronouncements and making other people do things and saying it's because of the computer. The function of cybercrud is thus to confuse, intimidate or pressure. We have all got to get wise to this if it is going to be curtailed.

SUPERCHIP!

THE SLEEPING GIANT TRAC* Language

It is included here for several reasons.

1) It is extremely easy to learn, at least for beginners. Experienced programmers often have trouble with it.

2) It is extremely powerful for non-numeric tasks. In fact, it is ideal for building your own personal language.

3) It offers perhaps the best control of mass storage, and your own style of input-output, of any language.

4) It is superbly documented and explained with the new "The Beginner's Manual for TRAC Language," which is now available.

5) It is likely to catch on one of these days. (Some large corporations have been investigating it extensively.)

If BASIC is a fairly conventional programming language, strongly resembling FORTRAN, TRAC (Text Reckoning and Compiling) Language is fairly unusual.

This side of the book, Computer Lib proper (whose title is nevertheless the simplest way to refer to both halves), is an attempt to explain simply and concisely why computers are marvelous and wonderful, and what some main things are in the field.

The second half of the book, Dream Machines, is specially about fantasy and imagination, and new techniques for it. That half is related to this half, but can be read first; I wanted to separate them as distinctly as possible.

SUMMARY OF THIS BOOK

Man has created the myth of "the computer" in his own image, or one of them: cold, immaculate, sterile, "scientific," oppressive.

Some people flee this image. Others, drawn toward it, have joined the cold-sterile-oppressive cult, and propagate it like a faith. Many are still about this mischief, making people do things rigidly and saying it is the computer's fault.

Still others see computers for what they really are: versatile gizmos which may be turned to any purpose, in any style. And so a wealth of new styles and human purposes are being proposed and tried, each proponent propounding his own dream in his own very personal way.

This book presents a panoply of things and dreams. Perhaps some will appeal to the reader...
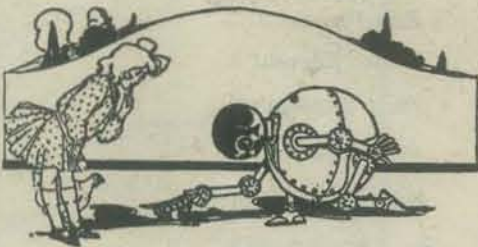
CONTENTS
OF
Dream Machines.

{FLASH!}

BODY ELECTRONICS

"I sing the body electric..." — Walt Whitman

There are various people who want to attach electronics to people's bodies and brains.

There are basically two starting points for this ambition. One is authoritarian, the other is altruistic. I am not sure both schools are not equally dangerous; however.

COMPUTER-ASSISTED INSTRUCTION

Like Artificial Intelligence and Information Retrieval, Computer-assisted instruction sounds like something exact and impressive but is in fact a scattering of things, techniques tied together only nominally by a general idea.

The real name for it should be automated Dialogue Teaching. That would immediately allow you to ask: should computer teaching use dialogues? But they don't want you to ask that.

In the classic formulation of the early sixties, there were going to be three levels of CAI: drill-and-practice systems, much like teaching machines, that simply helped students practice various skills; a middle level (often itself called, confusingly "computer-assisted instruction") in which students studying on Socratic systems would be perfectly led; and a third level, the Socratic system, which would so eloquently and thoughtfully instructed and corrected by a perfect being in the machine. "No doubt," you now know how to do that yet," the people keep saying. YES, indeed.

(My personal view on this subject, expressed in an article follow-up) is that Computer-assisted instruction in many ways extends the worst features of education as we now know it into the new realms of presentation by computer.)

DREAM MACHINES

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Come Dream along with me;
The Best is Yet To Be.

(This is the flip side of Computer Lib.

(Feel free to begin here. The other side is just if you want to know more about computers, which are changeable devices for twiddling symbols. Otherwise skip it.)

(But if you change your mind it might be fun to browse.)

In a sense, the other side has been a come-on for this side. But it's an honest come-on, I figure the more you know, the readier you'll be for what I'm saying here. Not necessarily to agree or be "sold," but to think about it in the non-simple terms that are going to be necessary.

The material here has been chosen largely for its exhilarating and inspirational character. No matter what your background or technical knowledge, you'll be able to understand some of this, and not be able to understand most of the rest. That's partly from the hasty preparation of this book, and partly from the variety of interests I'm trying to comprise here. I want to present various dreams and their resulting dream machines, all legitimate.

If the computer is a projective system, or Rorschach inkblot-- as alleged on the other side-- the real projective as it systems-- the ones projectors in them; are all the more so. The people try to do with movies, TV and the glamorous uses on screen-- are strange whereby it makes and foldovers of the rest of the mind and heart. That's the peculiar origami of the self.

Very well. This book-- you see this side, Dream Machines-- is meant to let you see the choice of dreams. Noting that every company and university seems to insist that its system is the wave of the future, I think it is more important than ever to have the alternatives spread out clearly.

But the "experts" are not going to be much help; they are part of the problem. On both sides, the academic and the industrial, they are being painfully pontifical and dogmatic. In their jargons (see Haberli in Toyland), little clarity is added by this. Few things are funnier than the pretensions of those who profess to dignity, sobriety, and profound process to identify-- especially when they, too, are pouring out their own personal views under the guise of what's technically going to bit the fan, dreams of what's going to bit the fan. Most people don't dream of technically. Most people are likely to bit the fan...

And the computer and electronics people are the last war.

THE GESTALT, DEAR BRUTUS,
IS NOT IN OUR STARS,
BUT IN OURSELVES.

get
DREAM MACHINES
from PCC
Bookstore

★THINKERTOYS★

Our greatest problems involve thinking and the visualization of complexity.

By "Thinkertoy" I mean, first of all, a system to help people think. ('Toy' means it should be easy and fun to use.) This is the same general idea for which Engelbart, for instance, uses the term "augmentation of intellect."

But a Thinkertoy is something quite specific: I define it as a computer display system that helps you envision complex alternatives.

9

If I ever got my school, the one course taught will be
HOW TO LEARN ANYTHING

As far as I can tell, these are the techniques used by bright people who want to learn something other than by taking courses in it. It's the way Ph.D.'s pick up a second field; it's the way journalists and "geniuses" operate; it brings the general understandings of a field that children of eminent people in that field get as a birthright; it's the way anybody can learn anything, if he has the nerve.

1. DECIDE WHAT YOU WANT TO LEARN. But you can't know exactly, because of course you don't know exactly how any field is structured until you know all about it.

2. READ EVERYTHING YOU CAN, especially what you enjoy, since that way you can read more of it and faster.

3. GRAB FOR INSIGHTS. Regardless of points others are trying to make, when you recognize an insight that has meaning for you, make it your own. It may have to do with the shape of molecules, or the personality of a specific emperor, or the quirks of a Great Man in the Field. Its importance is not how central it is, but how clear and interesting and memorable to you. REMEMBER IT. Then go for another.

4. TIE INSIGHTS TOGETHER. Soon you will have your own string of insights in a field, like the string of lights around a Christmas tree.

5. CONCENTRATE ON MAGAZINES, NOT BOOKS. Magazines have far more insights per inch of text, and can be read much faster. But when a book really speaks to you, lavish attention on it.

6. FIND YOUR OWN SPECIAL TOPICS, AND PURSUE THEM.

7. GO TO CONVENTIONS. For some reason, conventions are a splendid concentrated way to learn things; talking to people helps. Don't think you have to be anybody special to go to a convention; just plunk down your money. But you have to have a handle. Calling yourself a Consultant is good; "Student" is perfectly honorable.

8. "FIND YOUR MAN." Somewhere in the world is someone who will answer your questions extraordinarily well. If you find him, dog him. He may be a janitor or a teenage kid; no matter. Follow him with your begging-bowl, if that's what he wants, or take him to expensive restaurants, or whatever.

9. KEEP IMPROVING YOUR QUESTIONS. Probably in your head there are questions that don't seem to line up with what you're hearing. Don't assume that you don't understand; keep adjusting the questions till you can get an answer that relates to what you wanted.

10. YOUR FIELD IS BOUNDED WHERE YOU WANT IT TO BE. Just because others group and stereotype things in conventional ways does not mean they are necessarily right. Intellectual subjects are connected every whichway; your field is what you think it is. (Again, this is one of the things that will give you insights and keep you motivated; but it will get you into trouble if you try to go for degrees.)

* * *

There are limitations. This doesn't give you lab experience, and you will continually have to be making up for gaps. But for alertness and the ability to use his mind, give me the man who's learned this way, rather than been blinkered and clichéd to death within the educational system.

BIBLIOGRAPHY

Wilmar Shiras, Children of the Atom.
   Science-Fiction about what a school could be like where kids really used their minds. I've always been sure it was possible; the R.E.S.I.S.T.O.R.S. (see p. 47) made me surer.

LIGHTNING IN A BOTTLE:
THE CATHODE-RAY TUBE

A cathode-ray tube is actually a bottle filled with a vacuum and some funny electrical equipment. The equipment in the neck of the bottle shoots a beam of electrons toward the bottom of the bottle.

This beam of electrons is called, more or less for historical reasons, a cathode ray. Think of it as a straw that can be wiggled in the bottle.

Actually the bottle is shaped so as to have a large viewing area at the bottom (the screen), and this screen is coated with something that glows when electrons hit it. Such a chemical is called a phosphor.
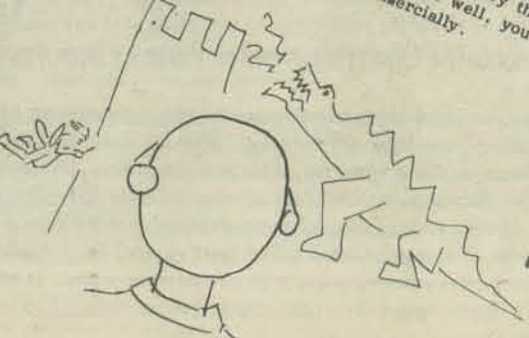
Now, two useful things can be done with this beam.

1) It can be made brighter by increasing the voltage, which increases the number of electrons in the beam.

2) The beam can be moved! That is, it can be made to play around the face of the tube the way you can slosh the stream of a garden hose back and forth on the lawn; or wiggle a straw in a coke bottle. The beam can be moved with either magnetism or static electricity. This is applied in the neck of the bottle-- or even from outside the neck-- by deflection plates, whose electrical pulsations determine the pattern the beam traces on the screen. (Note that the beam can be moved on the screen at great speed.)

IF WE HADN'T STANDARDIZED TV WHEN WE DID, WE'D HAVE A BETTER SYSTEM NOW.

Let it be a beam, standardize on the best system, not necessarily the first.

Probably the most astonishing 3D display is Sutherland's incredible Helmet. This consists of a helmet with two dinky CRTs mounted on it, each being driven in real time by a perspective system (such as the LDS-1) and set up with prisms to the wearer's eyes. Through the prisms the wearer can see the real world in front of him. Reflected in the prisms, however, and thus merging into the view of the real world, is the glowing wire-frame being presented to him-- in perspective, and with its separate views merging into an apparent object in front of him. But he need not stand still: as he moves, the helmet's changing position is monitored by the program, and the display system changes the views accordingly, meaning he can walk around the object. The illusion, and the possibilities, are fantastic: imaginary architecture, explanations and diagrams of things in the room, poetry that changes as you walk through it, ... well, you work on it. Not available commercially.

MODEMS & ACOUSTIC COUPLERS

leonard p levine

Leonard Levine is Director of the Computing Services Division at the University of Wisconsin, Milwaukee.

When a computer is to be connected to a device such as a teletype or a cathode ray tube, the simple way is to connect them directly by wires. The data is sent as voltage or current levels. If the connections are to be more than about 50 feet long, some care must be taken to insure that the levels are transmitted without loss to and from the computer. The direct line may be extended to distances of five miles or so, if the cost of maintaining the wires is not too expensive. Generally, however, when the terminal is to be installed beyond the immediate vicinity of the computer, the best route is to convert the signal levels to audio tones and to operate by way of conventional phone lines. More on that later.

FROM THE KEYBOARD TO THE PRINTER

When a key on a teletype is struck, eight switches are set in a "code" corresponding to that key. Thus the letter "A" sets the eight switches to ON ON OFF OFF OFF OFF OFF ON, and the letter "B" to ON ON OFF OFF OFF OFF ON OFF. In the usual logical notation where ON = 1 and OFF = 0, this corresponds to a "11000001" for an "A" and "11000010" for a "B". To these eight "bits" of information (each of those switch settings is called a bit) are added three more bits of information, one bit to start the receiving mechanism and two more as a stall to allow the mechanical parts to come to a complete halt after the character is transmitted. The 11 bit message is then transmitted one bit at a time. (serially) across the lines. At the printer, the rapidly varying signal moves a small relay armature whose position is sensed mechanically by a set of eight moving blades and the blades cause the print head to move and ultimately strike the paper and ribbon to make the letter "A" when the "11000001" is detected.
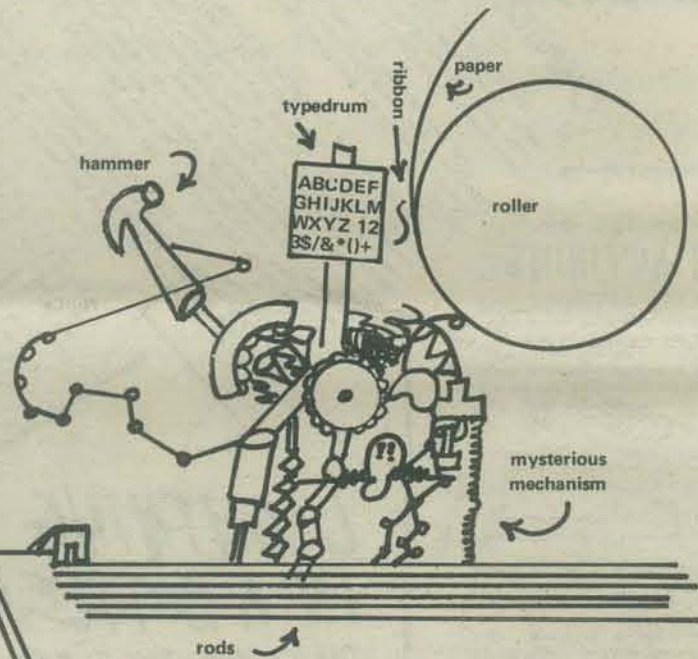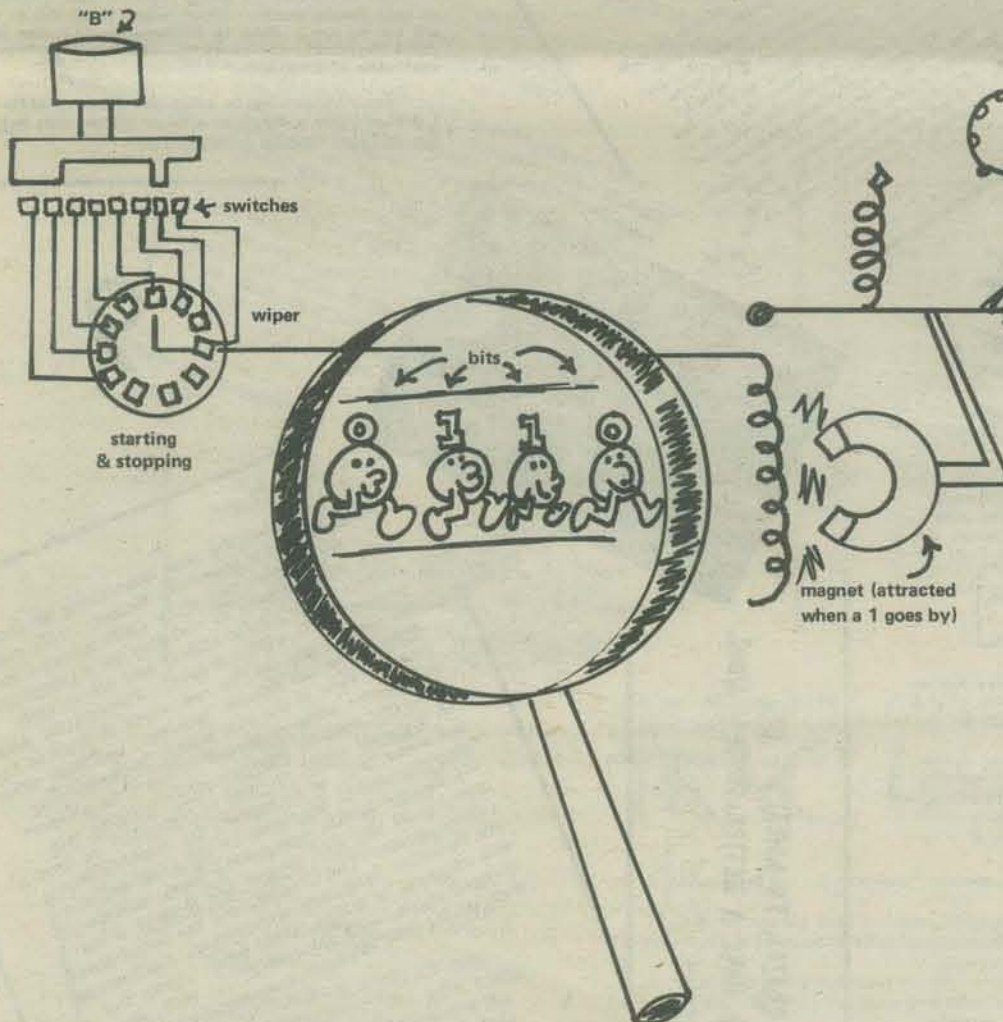
When the cover of an ASR 33 is removed, the coding switches can be seen at the front right hand side of the keyboard, the serial transmitter (which picks up these positions and transmits them one at a time to the printer) as a rotating three legged spider at the right rear, and the decoding magnetic relay at the left center. The print control blades run across the bottom of the printer. The print head itself moves across the paper.

Although the keyboard and printer of a teletype are contained in the same case, they are actually two completely separate units sharing a common drive motor connected by a short communications line, the same line that can be used to connect the dual device to a second teletype or a computer. One way of connecting the units is by directly wiring them together.

MAXIMUM LENGTH OF DIRECT WIRE CIRCUITS

Conventional teletypes operate by passing a current of the order of 20 milliamperes through the relay. This small current can be carried over long distances if the wires are of large enough size. We have operated teletypes over distances of 2000 feet of wire without difficulty but there are increasing problems with noise and dependability as the distance grows longer. This mode of transmission is called the "current loop mode" and is one of the ways computers communicate with the outside world. It is usually used only for the lowest speed lines (ten characters/second or 110 bits per second or 110 baud).

Another mode of transmission is the industry standard designated as RS 232. This is a voltage level signal of about five volts, rather than the current loop described above, and is expected to be used for lines shorter than 50 feet. We have used this for three times the length, but this becomes noisy and undependable unless the area is electrically quiet (no motors nearby, no flourescent lights, etc.). Nearly all devices faster than 110 baud work with RS 232 interfaces These two modes, "current loop," and "RS 232" are the usual means of connecting terminals to computers and most computers provide and accept both signal levels at no extra charge. Ask about it as well as "baud rate" however, when discussing hardware with a manufacturer. If you wish to operate over long distances, or if you want the versatility inherent in the phone system, you must handle the signals in special ways and use the facilities of the menacing "GRAMMA BELL."

THE TELEPHONE AND THE MODEM

The phone system carries only audio messages, such as voices or audible tones; thus, the data to and from a computer terminal cannot be put on these lines without some special conversion. That conversion is handled by a modulator, which creates an audible tone, and then varies (modulates) its frequency to carry the same data as would be carried by the direct wire system described above. At the other end of the transmission path another device demodulates (changes back) the signal to the normal computer levels. Both the modulator for signals headed "north" and the demodulator for signals headed "south" are normally contained in a single package called a MODEM for "modulator-demodulator."

Communications can be carried both ways at once (this is called full duplex) or only one way at a time (half duplex). (An earlier system called simplex is no longer in use.) In either case, the hardware originating the call (usually the teletype) sends a low frequency tone and receives a high frequency tone and the hardware answering the call (usually the computer) sends a high frequency tone and receives a low frequency tone. Thus the MODEM must be either an ORIGINATE or an ANSWER device. Some may be used either way. They cost more. It is cheaper to purchase Originate-only MODEMS for the teletypewriter and and Answer-only MODEMS for the computer end.

A good Originate-only MODEM is available from the COM—DATA company, 7544 West Oakton Street, Niles, Ill. 60648. It can connect to either "loop current" or "RS 232" devices and is compatible with the Bell system 100 devices (any devices made by Bell with a number starting with one such as 103G or 113B). The COM-DATA 302 costs less than $300 and since it communicates using only audio tones, it can connect to the phone company equipment using an ordinary handset merely placed into its microphone and earphone cups. I like COM-DATA. I have had good service from them. They are near enough to me for a phone call in cases of trouble. There are, however, several other good sources of "Bell 100 compatible" MODEMS. They all should be able to meet the following specs: Bell 100 compatible Originate-only MODEM: self-powered from 110 volt line; compatible with either RS 232 or 20 ma current loop terminal at speeds up to 300 baud; should have full-duplex half-duplex switch, be acoustically coupled and be compatible with handsets of (your local phone company). Finally, it should have a carrier indicator lamp.

MODEMs are available either wired to the phone line (direct wired) or connected only by sound (acoustically coupled). If they are direct wired, they can be moved only by the phone company but are somewhat easier to use in some peoples' opinion. If they are acoustically coupled, they, and their terminal, may be moved to any phone, can be more easily stolen (sorry about that, but it is true), but are somewhat easier to use in other peoples' opinion. I swear by the latter. Many of our terminals are moved more than once a month.

AT THE COMPUTER END

The MODEM at the computer end should be Answer-only. Unless you intend to have a human pick up the phone, plug it into the MODEM and hang up when the user is through, this MODEM must be wired to the phone line, and be capable of automatic answer and hang up when through. The simplest and most expensive way is with a Bell 103G dataset. This device, about 1' x 9" x 4", connects to the phone line, and your computer's RS 232 interface and it can be used in either originate or answer mode. It will answer when its phone rings, beep and wait 30 seconds for the user to put his Originate MODEM into use, and finally hang up when the user disconnects, all for a "mere" $25/month. If you need more than five modems at the computer site and wish only Answer-mode serivce, GRAMMA's boys will suggest a Bell 113B set. This is 2' x 2' x 18", sits on the floor and has from one to 20 connections between the phone lines and your RS 232 interfaces. This price is $50 per month for the box and $10 per month for each line. A 16 line computer would thus cost $210/month for the phones.

Companies like COM-DATA can supply Answer-only MODEMs at prices which are competitive if you expect to keep your equipment running for more than 18 months or so. My only experience is with two of their unmounted boards purchased for $250 each and wired by a student as an experiment. They work fine and have given no serious trouble. I recommend this route to any person who is willing to build his own cabinetry and do electronic wiring from a blueprint. A PH.D. is helpful but any electrical nut can do it.

If you go this route you must connect to the phone line with a Data Access Arrangement (DAA). The phone company keeps these in stock as CBS or CBT devices (apparently mixed in the same box in order to maximize confusion) and your wired-in modem must be compatible with the one delivered. Speak to the manufacturer and try to get this help with GRAMMA's gang. The phone company does not want you to take this route and will swear that it cannot be done. They will even charge you half as much for the DAA as for their MODEM. If you persevere howeyer, not only will you get your communications service at a good price, but will also learn quite a bit about how it all works.

All of the above is good for service for ten character/second to 30 character/second devices. Faster devices need different MODEMS at present.

Indicator Lamps (one per line)

Operator's Phone

Dial for Operator's Phone

Test Buttons

Bell 113B

Equipment Cabinet (modems inside)

DEFINITIONS

Baud – named after Baudot, early communications expert; means "bits per second." 110 baud = 110 bits per second.

Bit – binary digit; most basic piece of information for transmission. Equivalent to one "ON" or "OFF" state of a switch or relay.

ASR 33 – basic communications device, made by the Teletype Corporation. Converts characters (letters, etc.) to bits using eight bit ASCII code, suitable for all computers except for some IBM machines. Speed ten characters per second. 63 printable characters plus space. ASR means automatic send receive, that is, there is a paper tape reader and punch on the system. The same machine with no paper tape equipment is called a KSR 33 for keyboard send receive.

ASCII – American Standard Code for Information Interchange is a system for converting characters (letters, numbers, and special symbols) into eight bit patterns. The full ASCII character set contains 128 characters; 24 upper case letters, 24 lower case letters, 10 numbers, a space, and 69 special symbols. Some of the special symbols do not print. For example, one is a line feed, one rings a bell, one turns on a paper tape reader. Very few devices utilize all of these special "control" characters of the ASCII set, although nearly all devices use some of them. Some equipment, geared to a standard set up by IBM, uses a different code for translation. That code is called EBCDIC.

Baudot – an older code equivalent to ASCII but using only five bits per character instead of eight. This gave only 32 distinct characters with numbers and symbols handled by special sequencing. A Baudot teletypewriter has only three rows of keys instead of the four found on an ASCII keyboard.

Current Loop – a system in which a 20 milliampere current is equivalent to a logical "0" and 0 milliamperes is equivalent to a logical "1."

RS 232 – a hardware standard consisting of a set of voltage levels equivalent to the "1" and "0" of the logic system designed to keep different manufacturers gear from burning each other out. The standard connector for RS 232 systems is a special plug and socket arrangement with 25 pins and a grounding ring around them with certain pins always used for the same thing. For example, pins no. 2 and no. 3 are always used for serial data transmission and reception. Other pins are used to tell a computer that the phone is ringing, to tell the phone that the computer will answer a call, etc.

Parallel Transmission – a system in which each bit of data is presented on its own wire. All of the data is available at once. Eight bits of data require nine wires, eight data leads and a ground.

Serial Transmission – a system in which all bits of data are presented on one pair of wires, one after the other. The data are presented at equal time intervals equal to the reciprocal of the baud rate.

Modem – a modulator-demodulator, to convert the voltage level bits to and from the tones (audio signals) that can be carried over the common carrier network (phone company). When a call is made, the modem originating the call must be in Originate mode, and the modem answering the call must be in Answer mode.

Full Duplex – modems can communicate both ways at once. The full duplex mode takes advantage of this capability. Its most noted feature is that the user can be typing into the computer at the same time as the computer is printing on the page.

Half Duplex – a mode of operation where the line is used only one way at a time. This does not take good advantage of the capabilities of the system, but is the mode used by some computer systems, mainly the larger ones as it puts least load on the computer.

DAA – a Data Access Arrangement is required by some phone companies to protect their equipment from damage by "foreign attachments." It is a box which keeps circuit problems in the wired-in modem from affecting the phone company equipment, and must be used between a non Bell modem and the phone system if the phone company requires it.

This article is the beginning of an experiment in Participatory Design. I want to lay out the basics of a design idea and have as many people as possible contribute bits and pieces to a final workable design. If you'll send me your design attempts for part or all of the thing, I'll recycle them back out to you in the next issue. Pretty soon a lot of us will have developed the design to a point where we can apply it to our own problems.

HOW ABOUT DESIGNING AN...

Audio cassette replacement for punched paper tape — something most people need who do computer terminal work and hate the slowness, noise, mess, waste and crinkles of punched paper tapes. (Remember the last time you stepped on your BASIC loader tape while it was chattering through your Teletype at one inch per second?)

➡ DISCUSSION ◀

There have been lots of schemes for recording serial data on ordinary audio cassette machines, and they all have to take one problem into account — the time distortion that occurs when the cassette speeds up or slows down. Data is usually sent to a terminal asynchronously. There's a start bit that starts a timer in the receiving equipment, and after a certain time the receiver decides that it must be in the middle of the first data time slot. So it reads the state of the data line at that time. Then it waits a little while longer until the time when the receiver feels it ought to be in the middle of the second data time slot. Gulp goes the data.

Problem is, if the transmitter is a little off speed, the gulps occur off center in the transmitter's time slot. The next time slot error is even worse, since the receiver has no way of adjusting itself. By the time the eighth data bit is reached, you'll have an error if the two ends are off by one part in sixteen.

Most cheap audio cassette players can't guarantee that kind of speed reliability.

Enter Don Lancaster (the same guy who designed the TV Typewriter), carrying a 40-legged bug called a UART. This is a large-scale digital integrated circuit that performs serial asynchronous transmission and reception (see box for further details).

"Aha!" says Don, "I've noticed something about the UART that may have escaped you. You know that it requires a clock signal at exactly sixteen times the receiving (or transmitting) baud rate, right?"

Right. So?

"What that really means," continues Don, "is that no matter what the speed, sixteen clock cycles into the receiver clock marks off one bit of data."

Uh huh. (There seems to be a strange glint in his eye . . .)

"So if you had a clock frequency of sixteen times that baud rate recorded on the same tape as the data, and you used that clock to run a UART to receive the data, the clock would always be at the right speed for the data, no matter how sloppily the tape ran!"

But we don't have a stereo tape . . .

"No need for two channels. Just record the data as an amplitude modulated signal on a carrier frequency of sixteen times the baud rate. From one tape channel you have sixteen cycles per bit, loud or soft depending on whether the data is 1 or 0, but always there!"

You mean . . .

"Right! Just amplify and limit the carrier and feed it to the clock input of the UART. Demodulate the data with an AM detector and feed it to the serial input of the UART. Out comes eight bits all lined up properly on the parallel output pins!"

Wow! What an idea! Now all we have to do is solve the little problems . . .

* * * * * *

LITTLE PROBLEM NO. 1

The UART receiver presents its data to the world as up to eight parallel bits. But if we want to use it as a paper tape replacement at a terminal, we have to come out with serial data.

Solution: use the other half of the UART, the transmitter. Feed it a nice, constant clock from an oscillator and tie its data and control inputs to the receiver's outputs. Then when a word of data comes in from the receiver, it gets squirted out to the computer at just the right speed.

To avoid tape overrunning the transmitter, the receiver should be set for one stop bit and the tape recorded with two stop bits. That allows for up to a ten percent speed difference without stumbling.

BOYCOTT PAPER TAPE

Universal Asynchronous Receiver - Transmitter .... Universal

V_SS	1	40	TRC
V_GG	2	39	EPE
V_DD	3	38	WLS_1
RRD	4	37	WLS_2
RR_8	5	36	SBS
RR_7	6	35	PI
RR_6	7	34	CRL
RR_5	8	33	TR_8
RR_4	9	32	TR_7
RR_3	10	31	TR_6
RR_2	11	30	TR_5
RR_1	12	29	TR_4
PE	13	28	TR_3
FE	14	27	TR_2
OE	15	26	TR_1
SFD	16	25	TRO
RRC	17	24	TRE
DRR	18	23	THRL
DR	19	22	THRE
RI	20	21	MR

heat resistant

a normal ASCII letter "J"


```
START                      STOP
BIT    DATA TIME SLOTS     BITS
;  :1 :2 :3 :4 :5 :6 :7 :8 :  :
```

0 0 1 0 1 0 0 1 0 1 1

DISASTER!!

```
:  :1 :2 :3 :4 :5 :6 :7 :8 :  :
```

this one's a little too fast....

(what's a ● UART?)

Several manufacturers make a standard MOS chip to perform the functions of a serial-line transmitter and receiver. Western Digital Corp. was first with the TR-1602B, and General Instruments is another, calling theirs the AY-5-1012.
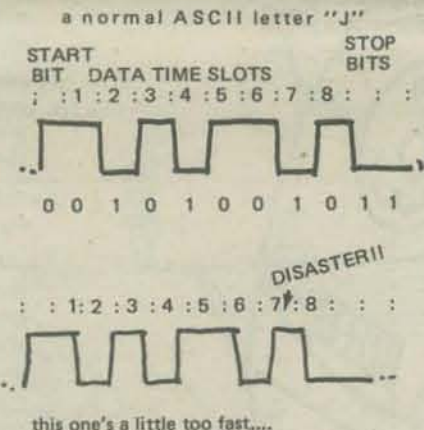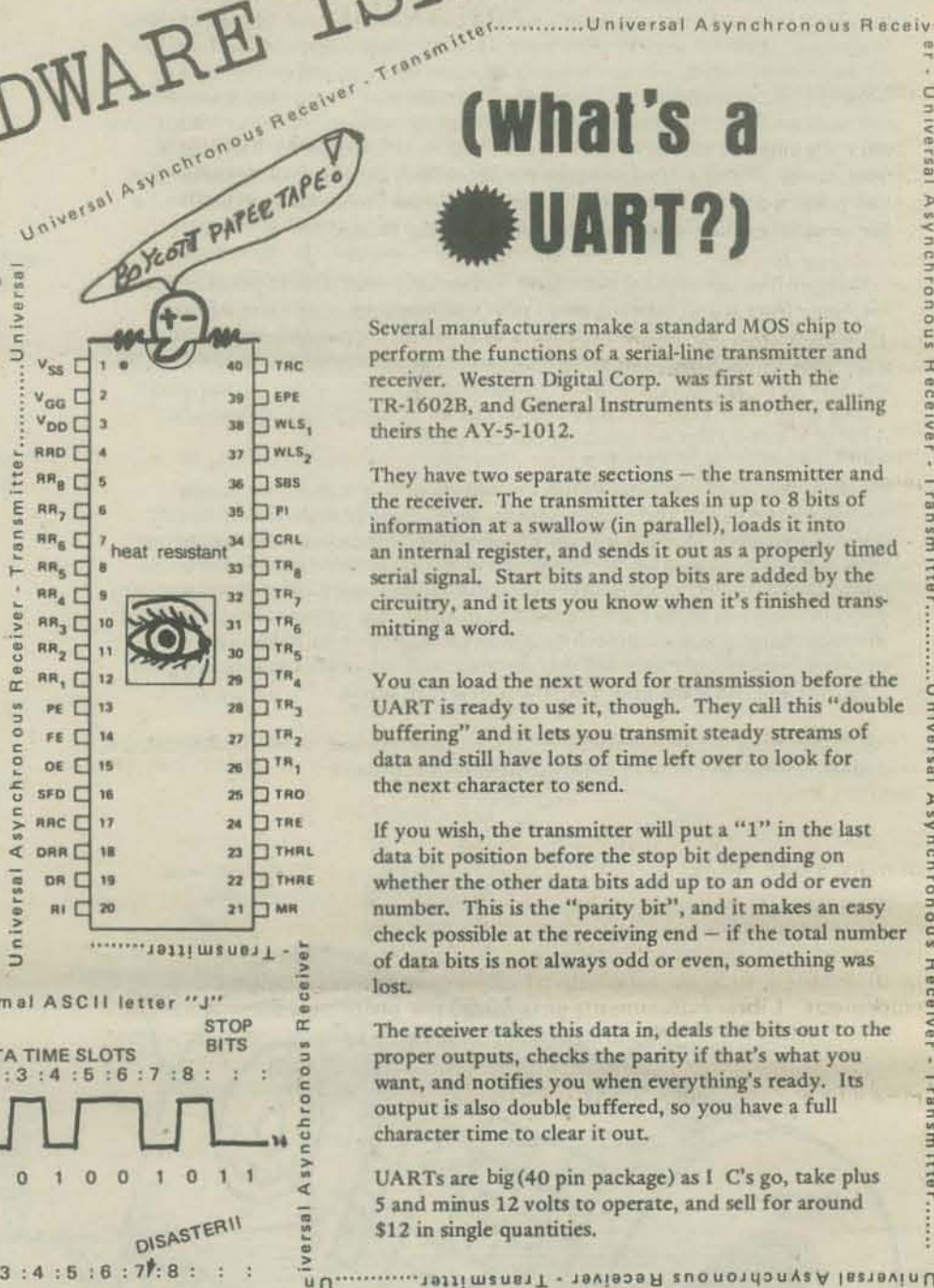
They have two separate sections — the transmitter and the receiver. The transmitter takes in up to 8 bits of information at a swallow (in parallel), loads it into an internal register, and sends it out as a properly timed serial signal. Start bits and stop bits are added by the circuitry, and it lets you know when it's finished transmitting a word.

You can load the next word for transmission before the UART is ready to use it, though. They call this "double buffering" and it lets you transmit steady streams of data and still have lots of time left over to look for the next character to send.

If you wish, the transmitter will put a "1" in the last data bit position before the stop bit depending on whether the other data bits add up to an odd or even number. This is the "parity bit", and it makes an easy check possible at the receiving end — if the total number of data bits is not always odd or even, something was lost.

The receiver takes this data in, deals the bits out to the proper outputs, checks the parity if that's what you want, and notifies you when everything's ready. Its output is also double buffered, so you have a full character time to clear it out.

UARTs are big (40 pin package) as I C's go, take plus 5 and minus 12 volts to operate, and sell for around $12 in single quantities.

LITTLE PROBLEM NO. 4

The amplitude demodulation — minimizing the effect of noise spikes.

LITTLE PROBLEM NO. 5

Extracting the clock signal without interference from noise or low signal levels. A big amplifier with a limiter would amplify noise up to signal levels. A phase-locked loop would be nice but a little expensive, though it would eliminate noise problems. Maybe a series of small amplifiers and limiters, with trigger thresholds for noise rejection?

LITTLE PROBLEM NO. 6

Controlling tape motion. Most cassette recorders have a remote on-off switch which stops the motor. This could be replaced by a pair of relay contacts which plug into the same jack. Will control be manual? Manual start and automatically maintained until the signal stops? What kind of relay to use? Can something other than a relay be used?

LITTLE PROBLEM NO. 2

Recording the data on the tape. Don suggests a 15 db difference from "1" to "0". This works out to "0" being 17 percent of the "1" carrier amplitude.

LITTLE PROBLEM NO. 3

Controlling the amplification of the signal received from the tape. Possible approaches include: (a) an automatic gain control circuit; (b) a level indicator so you can adjust the Play level properly and see if it falls below the minimum during playback; (c) receiver circuitry with enough "dynamic range" to allow for a wide range of input signal levels.

START START START START

Now let's get going — if you feel you can do some of the design, or all of it, do what you can and send it in to me care of PCC, Box 310, Menlo Park, Ca. 94025. Everybody who contributes gets credit; I'll try to smooth things together somewhat, and maybe we'll have three or four good designs to chew over next time. Don't delay — we'll need your contributions in a week or two!

Lee Felsenstein

New World Computer Services, Inc.

Bob Wallace, designer

PO Box 5415, Seattle, Wa. 98105

Gentlepeople:

There is currently much interesting activity in the field of community computer use. People are doing learning exchanges, community memory systems, information networks, mailing lists and typesetting for non-profit groups, on-line conferencing, and other projects using computer technology as a community communications medium. To promote information flow in this area, a "Comindex" is being distributed. This is a global directory of groups and people interested in the use of computers as a community communications tool, and a list of papers, articles, and other information available for copying costs. The Comindex will also try to include other areas of alternative computer use such as access to hardware, simulation of systems, creativity in graphics and games, computers in education, and social/political research.

There is no charge for being listed in the directory. A listing should be done on a 3 x 5 card. The name, address, and (optionally) phone number and times to call are put on one side. On the other, give the name again and interests, projects, needs, resources, skills, fantasies, and so on. Also, list any of the keywords given below that apply. If you are actively engaged in a project, circle the keywords applicable to it. A group or organization, as well as listing itself, may list staff members or other interested people, too. The Comindex is divided into group, individual, and library material sections, plus keyword and location indexes.

A paper or article to be distributed is listed in a similar way. One side of a 3 x 5 card has the author's name and address, and ther other has a title, any keywords, and a paragraph description. Interesting reprints from copyrighted material can be distributed, provided the author is contacted (and invited to be listed) first. Audio cassettes may also be distributed, such as recordings of interesting seminars, talks, or workshops. Library documents cost $0.50 per order plus 5 cents a page; audio cassettes are $3.00. These amounts are also paid to the contributor the first time something is ordered. Other media, such as computer programs or video tapes, may be listed.

Subscription to the Comindex is $2.00, for one full directory and three updates. Usually subscribers are also listed; however, a subscriber may choose not to be listed by writing "private" on the address side of the 3 x 5 card. Also, a listing with "public" on the address side goes into another index for possible publication in magazines and newsletters. Groups able to respond to general questions, or putting out a newsletter, are encouraged to be in the "public" index. The assumed type of listing is "network," and implies publication in the Comindex only. Mail may be directed to: Comindex, Box 5415, Seattle, Wa. 98105.

Keywords:

mailing list	terminals
typesetting	processors memories
bookkeeping	hardware design
social-research	electronics
local-data-base	cybernetics systems
information-network	programming lanugages
learning exchange	time sharing
community memory	information retrieval
people's access	graphics art
conferencing	games
computer utility	simulation
video cable	education
radio ham	privacy politics
interfacing modems	

This is a sample listing of groups and individuals interested in alternative uses for computers, from the Computer Alternatives Index.

RESOURCE ONE
1380 Howard St.
San Francisco, Ca. 94103
(415) 864-8663

Has SDS-940 time sharing system, ROGIRS information retrieval software. Does community memory with 6 terminals, mailing lists, coop recordkeeping, social service referral directory, reports and typesetting, accounting, urban data base, legal/medical group services, consulting.

LEE FELSENSTEIN
1807 Delaware St.
Berkeley, Ca. 94703
(415)845-4736

Worked with Resource One. Designing cheap terminal and modem. Also into community decision making aids.

RAIN ECO-NET
Environmental Education Center
Portland State University
P.O. Box 751
Portland, OR 97207
(503)229-4692

Access to PDP-11 time. Working on SHARE-1, a proposed computerized eco-exchange system being done at OMSI. Will exchange information among members and compile directories and mailing lists.

BILL MAYHEW
CHILDREN'S MUSEUM
Boston, MA 02130

Public access computer facility, using the UNIX system on a PDP-11.

NEW WORLD COMPUTER SERVICES
Bob Wallace
P.O. Box 5415
Seattle, WA 98105
(206) 522-7872 6 PM - 7 PM

Designing user language, software and hardware for community/network system. Compiling computer alternative information.

COPTHORNE MC DONALD (WØORX)
P. O. Box 483
Rochester, MN 55901

Organizes ham radio network; slow-scan TV info; interested in computer - ham radio links, such as a homestead information service.

RICHARD MINOR
Audient Concepts
W. 4823 Princeton Place
Spokane, WA 99205

Building Radio Electronics 'TV Typewriter'; Audio and video electronics skills, including hardware evaluations.

PEOPLE'S COMPUTER COMPANY
P.O. Box 310
Menlo Park, CA 94025
(415) 323-6117

Public access to computers; classes and cheap time available using BASIC. Also oriented toward educational uses of computers, gaming and simulation, space war, hardware evaluations. Newsletter, $5 for 4 issues.

WHAT IS PCC?

The People's Computer Company is a community of people and equipment located in two storefronts in Menlo Park, California. We are a non-profit educational corporation, promoting the recreational use of computers and acquainting people with computers in a low-key, non-threatening way.

A core group of about four people is involved with the People's Computer *center* on a regular basis. We run classes, trips, and parties, keep the center open for renting time, and try to let people know that we exist. Another group in the company produces the People's Computer Company *newspaper*, now in its third year of publication and covering a broad range of computer-related activities. Still others operate a mail-order *bookstore* and keep in touch with groups attempting to start centers and build home computers.

CLASS

In the last issue, we featured one of our after-school classes *Play Games at PCC*, for 5 to 8 year olds. We also teach classes in computer games - *Beat the Computer* - and in programming.

Schools contract with us to teach similar classes during the school day. This issue we're featuring three such classes - *Beat the Computer* for fourth and fifth graders, *Play Games* for first and second graders, and *Computer Math* for high school juniors and seniors.

We meet with the classes once a week, for an hour or two, and design each session to fulfill the specific needs of that group.

In the near future we will repeat classes in computer games and computer math, and will hold new ones in programming and math lab adventures.

MURDOCK SCHOOL, CUPERTINO

WEST SCHOOL, HILLSBOROUGH

SACRED HEART HIGH SCHOOL, MENLO PARK

A FANTASY OF FUTURE FORMS

IT IS A FRIDAY EVENING, SOMETIME IN THE LATE 1970' S. THE PEOPLE'S COMPUTER CENTER OF MENLO PARK HAS EXPANDED TO TWO MATCHING STOREFRONTS; THE NEW ONE IS CALLED THE ANNEX. THERE ARE NOW FIVE FULL--TIME TEACHERS, TWO HARDWARE PEOPLE, LOADS OF YOUNG PEOPLE, AND PARAPROFESSIONALS.

FRIDAY THE GANG'S ALL HERE

It's Friday evening at the Menlo Park People's Computer Center, the time of the week when the community gets together for its weekly meeting in THE ANNEX. The assembly is mostly in its late teens thru middle twenties.

The chairperson is an eleventh--grader named Duane. Duane is one of the pillars of the People's Computer Center. He teaches a couple of classes each week and is in charge of the Center on weekends. Want to know where something is or who knows what? Ask Duane!

A cap pistol in Duane's hand gives out a loud C R A C K K K and a tiny puff of smoke. Everyone jumps at once, leaving the floor to Duane.

"Hi everybody. The Friday Meeting is now open for agenda suggestions."

Topics for public discussion, reports, and discipline are suggested. When one is accepted, it is written on a huge blackboard entitled AGENDA.

Someone in the assembly casually proposes moving the Center across the Bay to Berkeley. After some laughter, a voice from the back counter-suggests moving *Berkeley* to the *Center*.

Duane suggests combining some of the topics to make room for more on the blackboard. By tradition, when the board is full no more topics may be added or discussed.

Six topics make it onto the board.

"Hey, Duane" shouts Andy from the front of the room, "I move we get a second blackboard!"

Duane replies, "All in favor of Andy finding, buying and *donating* a second blackboard, stand up."

The room erupts as everybody rises from floor pillows, chairs, or from just lounging against the walls and desks to shout approval.

Andy, red in the face, just grins.

The first topic on the agenda is the weekly report. One by one, the teachers report on the week's classes and field trips from local schools. Duane tells how the past weekend went ($ 120 income from new memberships and $ 614 terminal rental from Friday Open House, Saturday morning and all day Sunday) , the special affairs person tells of two public demos given elsewhere in the Bay Area, and the club coordinator tells his story. When anyone speaks too long, someone always begins clapping or stamping their feet.

Fifteen minutes later, Duane's pistol signals topic # 2, finances. Money in, money out, who spent what, costs & incomes broken down per project (classes, clubs, public demos, rent, insurance, supplies, the hardware shop, etc.) It's the middle of December, and profits have been peaking the last month or so. Someone will think of something to spend the old $ on.

#3 is all about future projects in the planning. A new book is being written by the teachers and they are asking for $ 200 for photographic materials. A group of visitors from Los Angeles is coming up and need places to stay for a week. The sci fi librarian and board games club need new stock.

Topic # 4 is a group discipline problem. Several new members have been taking out large numbers of books from the sci fi library *without bringing any back*. The librarian states his case and the young members, quite embarrassed, say something about a school report. The assembly votes to bar them from the Center for two months.

For topic # 5, some members from Berkeley who want to open up a local chapter, ask for an equipment loan plus some operating capital. They propose making the money a grant, to be matched by themselves. The total will be matched by the Berkeley City Council. The motion is discussed and tabled until some legal questions can be cleared up.

The people standing in the back are starting to get restless.

Someone shouts, "Let's eat !" and the murmurers agree.

The topic under discussion (last on the blackboard) is a rehash of an old debate. A local school is again proposing to set up and teach its own computer games classes, using the Center as its base. Harold, one of the "old--timers", is arguing that the Center can make more money by running the classes itself. Jane, another "old--timer" wants to give it a try.
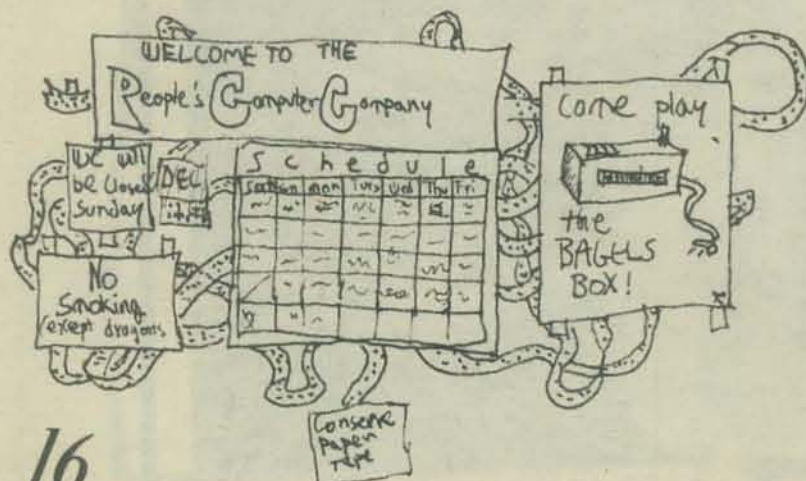
Duane fires his cap pistol three times and has Harold and Jane sum up their arguments. The motion is defeated, but by a narrower margin than last year.
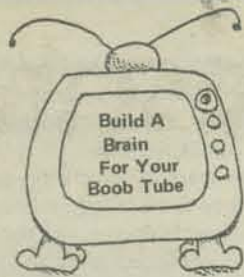
The cap pistol fires one last time and everyone heads out to go down the block to the Coffeehouse for dinner.

Almost everyone. Duane is staying behind to run the Center during Friday Open House.

There's a new minicomputer, with full--color screen and 64 K memory, on loan from its manufacturer. Word has spread fast.

It's going to be an exciting night and Duane wouldn't miss it for the world.

Text: David Kaufman
Graphics:Albert Bradley

Build A
Brain
For Your
Boob Tube

I am building the TV Typewriter, and the Mark-8 mini comptuer as described in Radio Electronics. I am also building a cassett mass storage system as described in MP Publishing Co. publications. I am working on these projects and hope to get them done sometime in '75. I am designing a Hex from Keyboard to Mark-8 converter. I intend to get the Mark-8 to at least 4K and hope to write a BASIC or FORTRAN compiler for it. Does anyone know where I can get a book(s) on compiler writing or have any suggestions? I would also like to know if anyone has suggestions for this type of computer system.

Larry Miller
826 Halstead Blvd.
Jackson, MI 49203

MARK 8

I've come to the foolish conclusion that I can build my own computer, my own PDP-8 no less. I guess I don't know enough to know that this is impossible.

So I've been reading all sorts of books like Digital's "Introduction to Programming," Bartee's "Digital Computer Fundamentals," Signetics Data Book on TTL's, Texas Instruments "Designing with TTL Integrated Circuits" the computed plans in Radio Electronics and Popular Electronics and a host of other stuff. The trouble is I don't want to spend ten years designing, building and debugging a system.

So what would be nice is some information about how a specific mini computer is built. Something on the order of diagrams or circuit descriptions. Like maybe a repair manual or something. Information about the PDP-8 would be nice because there is a lot of software for it. So my question becomes where or how can I find this kind of information. Digital mostly sends me pretty brochures.

I would like to build something like a PDP-8 instead of Titus's machine using an 8008 processor chip (Radio Electronics), mostly because I'd like to know what's going on inside and I like a 12 bit format better.

Besides, just wanting to build a computer for the fun of building a computer, I want to make it available to people around here. I think it's important that people understand something about these beasts so they don't become instruments of fear in their lives. Besides they're fun.

Don't feel bad about not being willing to or able to answer this letter. Lots of my letters aren't. So I'm used to digging for myself.

Edward C. Epp
Swan Lake Christian Camp
Viborg, South Dakota 57070

Look around, Edward.

I am heavily involved in the microcomputer experience and was glad to read of your PCC Newspaper in Hal Singer's Mark-8 Newsletter.

Technology is unique in that any possible technical advance is almost inevitable; one prediction puts CUP's now worth $250,000 into chip sets at $2,500 in ten years. I personally expect hand-held full-scale machines with hard-copy graphic capability in five to seven years.

Society stumbles on, and is not even vaguely aware that its basic fabric will be changed by this new technology; schools, of course, and computer addicts! Simulated soap-opera worlds of gods and lust in software may fragment the individual — but I am rambling.

Terry F. Ritter
Dantco
2524B Glen Springs Way
Austin TX 78741

There is an organization that you may already know about, but in case you don't . . . a few months ago Radio Electronics ran a construction article for a small computer built around the Intel 8008 microprocessor. This prompted the formation of a user's group by Hal Singer, Micro-8 User's Group, Cabrillo High School Computer Center, 4350 Constellation, Lompoc, Ca. If you send him some SASE's you'll get the mimeographed newsletter, which has had three editions so far. It looks to be developing into a good thing, with about 200 members offering advice on construction, schematics for modems and other such, where to get cheap ICs and other parts, etc. Naturally it's pretty hardware-oriented so far — lots of people trying to get the little machine running — but some software stuff has begun to creep in. Hopefully this will evolve into a real "home computer" group and will go on to machines a little better than the 8008, which is slow and already obsoleted. You might want to get in touch with Singer.

I'm glad to hear that you're considering getting more into home computers. Something you might think about someday is acting as a quantity buyer for the likes of us individuals — the OEM discounts are often very steep for quantities beyond unit 1. One machine made commercially that might be of some interest to people is the Fabri-Tek MP12, which is a 12-bit machine selling for less than $1000 in quantities greater than 100 and which uses the PDP/8 instruction set.

Jim McCord
330 Vereda Leyenda
Goleta, Ca. 93017

ART

It is my understanding that your group published a newsletter dealing with computers and applications. Our school is linked by teleprinter to a computer at the University of Wisconsin, La Crosse. I am interested generally in anything you might have available that an art teacher could use. Specifically Vol. 2, No. 6 of your newsletter, or any other books or addresses relating to computers and art. I am willing to utilize school funds to a certain degree to purchase these materials if necessary.

Any help from you in this matter would be greatly appreciated, as I am at a loss as to who else I might turn to for such information.

Barry Wetterneck
La Farge, Wisconsin 54639
La Farge Area Schools

Computers/People

Computer assistance is a fact of life in business and industry, and increasingly important in education at various levels. A majority of the population, however, neither use nor understand computers, and I daresay that many who are assisted by computers are unaware of the capabilities and inadequacies of the machines aside from the particular task at hand.

In Minnesota, the Hennepin County Library System has embarked on a trial program of computer availability to the public as one of a wide range of public information services. In October, the Library installed a CRT terminal in each of two branches in the southern and western suburbs of Minneapolis. Persons holding library cards may sign up for 25 minute blocks of time beginning on the hour and half-hour, using their own I.D. for any computer to which they have access, or using an open library I.D. after 4 PM. Assisting the Library in this effort is the Minnesota School Districts Data Processing Joint Board (TIES). The times of peak library usage and low timesharing usage at TIES mesh nicely. Each library has an I.D. on a TIES system available after 4 PM daily and all day Saturday.

The library as people's computer center? Why not? Can public libraries afford not to offer computer-based information in addition to that stored in print and audio-visual media? The idea is at once exciting and thought-provoking. What of the high cost of such service? To what computers and data shall the terminals have access? Who will use such a service? What implications for library staff?

The Library and TIES are cooperatively supporting an initial trial period from October to December, 1974, to determine some partial answers to those and other questions. Users of the service will fill out questionnaires, the aggregate of responses to which should provide a general picture of the user group, including such information as the geographic distances people are willing to travel, the major occupational categories represented, and their subjective reactions to the service.

Planning for this service began last spring with an advisory group including local school district personnel in addition to TIES and Library staff. Inservice training for over 30 library staff members by TIES personnel was provided during the summer, familiarizing them with terminal operation, library programs and documentation, and common problems.

We can, of course, expect high student interest, because the plan offers terminal access at times when schools are locked. On the other hand, how does usage get spread to the great majority of non-users, the adult public not in school, to attack the objective of general computer awareness for the public? One means is by offering free public familiarization sessions, which is being done weekly at both sites. The one-hour sessions include a lecture and demonstration of procedures, which are given Thursday and Friday evenings, individual assistance is also available from librarians during other non-busy hours.

Another development in Minnesota is a plan by the Future Studies Department of the Science Museum of Minnesota to provide a permanent display, including computer terminals, in the Museum. The display will invite usage by museum visitors, who will interact with a set of programs designed to allow exploration of the implications of alternative futures and to introduce various uses of computers. This display will compliment the Library program, providing an introductory experience which users could extend on their own through library facilities.

The effect of these programs is difficult to predict, but the implications far-reaching. As data are gathered, we will be reporting on the results.

*Don Holznagel
TIES
1925 W. County Rd. B2
Roseville, MN 55113*

"Computer Jocks" at Dartmouth College develop their own jerseys. About 20 of the most active and proficient students at the Kiewit Computation Center are awarded a sweater with a "K" on the front and their own six to nine-digit computer user number on the back.

from the Wall Street Journal

BICYCLE GEAR RATIO

Today's derailleur bicycles are typically ten speed models. They usually have a wide range of gears which make for easy pedaling under many conditions.

In case you've always wanted to know how fast you could go in a certain gear, here's a computer program that will tell you.

It asks for the number of front and back teeth of the gear you're in, as well as the diameter of your wheels in inches. Cadence is specified for a certain range of values. Bicycle racers usually pick a certain cadence and stick to it under any circumstances. If a racer is cranking at 120 rpm he must downshift when he comes to an incline so as to maintain that cadence. He will certainly slow down but he won't lose that important rhythm.

Line 100 computes the circumference of the wheel in feet. Line 160 computes the distance travelled by the wheels in fpm (feet per minute) and Line 170 converts fpm to mph.

Happy cycling!!!

Steve Rogowski
Waterford-Halfmoon High
Waterford, New York 12188

announcement

COMPUTER SCIENCE FAIR FOR HS STUDENTS to be held at the 1975 National Computer Conference and Exposition in Anaheim Convention Center, Anaheim Convention Center, Anaheim, California, May 19 — 23, 1975.

High school students are invited to submit projects for exhibition at the 1975 NCC.

Projects may fall within any of the following categories:

1. Design and construction of computers or components.
2. New applications of computers.
3. Applications Programming.
4. Systems Programming (compilers, assemblies, etc.)

Prizes will be given to those students whose projects are judged first and second in each of the above categories and, in addition, one grand prize (HP 65) will be given.

Those interested in submitting a project should request more information from:

George Vassilakis
Computer Science
University of Southern California
Los Angeles, California 90007

or

Charles B. Ray
Computer Cneter
Caltech
Pasadena, California 91125

```
10  'THIS PROGRAM WILL COMPUTE THE SPEED'
20  'WITH WHICH A BICYCLE WILL TRAVEL'
30  'GIVEN A SET OF VARIABLES!'
40  PRINT
50  'HOW MANY FRONT TEETH,BACK TEETH'
60  INPUT F,B
70  R=F/B
80  'WHAT IS THE DIAMETER OF THE BACK WHEEL IN INCHES';
90  INPUT D
100 C=3.141593*(D/12)
110 'WHAT CADENCE RANGE DO YOU WISH - BEG, END, INCR'
120 INPUT A,B,E
130 PRINT 'CADENCE'
140 PRINT
150 FOR N=A TO B STEP E
160 L=C*R*N
170 PRINT N;' RPM GIVES ';L;' FPM WHICH IS ';L*.0113636;' MPH'
180 NEXT N
190 'ANY MORE TO DO';
200 INPUT A$
210 IF A$='NO' THEN 300 ELSE 40
300 END


HOW MANY FRONT TEETH,BACK TEETH
? 32,18
WHAT IS THE DIAMETER OF THE BACK WHEEL IN INCHES? 27
WHAT CADENCE RANGE DO YOU WISH - BEG, END, INCR
? 40,90,10
CADENCE

40 RPM GIVES    502.65488 FPM WHICH IS    5.7119690 MPH
50 RPM GIVES    628.31860 FPM WHICH IS    7.1399612 MPH
60 RPM GIVES    753.98232 FPM WHICH IS    8.5679534 MPH
70 RPM GIVES    879.64603 FPM WHICH IS    9.9959457 MPH
80 RPM GIVES    1005.3098 FPM WHICH IS    11.423938 MPH
90 RPM GIVES    1130.9735 FPM WHICH IS    12.85193 MPH
ANY MORE TO DO? NO
```

To bring you up to date on my runnings around. I have gone to the NSF funded program at Brooklyn Polytechnic University. I learned some computer simulations using SIMSCRIPT and DYNAMO. I am sure you have never heard of those languages. I always get soaped into these strange courses. I protested violently to these languages and then promptly disappeared into the minicomp room and learned me some BASIC. I now know alotta BASIC and a little SIMSCRIPT.

The Computer Simulations were fun, sorta. We had to do porjects near the end of the course and mine was landing a little space ship on the moon (it's name was HERBIE). Well, anyhow HERBIE insisted on crashing and destroying all aboard. I think it was sabotage, but I can't be sure. So I was a total failure in a short while. Not to completely put down, I want to the cafeteria and became, in a span of a little while, a proficient pinball person. I was really a pro almost. The summer was not a total waste, I learned analog computing.

MY FUTURE consists of three possibilities —

1. Going to College
2. Becoming a Truck Driver
3. Just BUM around.

I was leaning very heavily toward bumming around, much to the distress of my parents. Then a college friend told me I could go to college and bum around there. It is the best of two worlds. My parents are happy and I am happy.

I have applied to a few colleges, I will tell you the results as they come in. I would like a couple of suggestions to colleges that are out there in California land or around in the West that are pretty heavy computer freaks and known to produce such people. Do not mention Reed College because I cannot get into such a place where intelligent people go.

I have received your new issue and have some protests which should be heard. First of all, a cookies isn't square, I don't care if it is a ZOT cookie. I base my sanity on round cookies and when round cookies start doing funny things I just lose my will to live (which would make a lot of people happy). I compliment the program though. With my BASIC understanding I can comprehend the possibilities of such a game. I don't know how you do it though. You must have the freakiest people down there thinking up great and sickening games to perpetrate on the gullible American Public.

Who is this infamous AARDVARK that has mysteriously appeared on page 6 and 13? He seems pretty stoned, I mean going Zot and everything. If i hadda go ZOT! everytime somebody made a move I'd be stoned too. Does he get paid minimum wage? I have just formed the EQUAL RIGHT FOR AARDVARKS, the ERA. I protest on the flagrant misuse of such a lovable animal.

Hang in there
Mike Pitt
213-17 86 Ave.
Queen's Village, NY 11427

Mike,

It is obvious (and understandable) that you know very little about the habits of the Zotter. I suggest you do more research into just what the Zotter likes to eat and what it finds amusing! It is a hard lesson but you must learn how to abandon your prejudices and see it from the other guy's point of view. I'm sure you meant well but you know about the good intentions and the road to hell.

Smash the circle that has enslaved cookies.

Donuts were not raised to be toruses.

Tektronix Games and Community Computers

I'm not using your regular order form because it had good stuff on the back. I'm not sure how I got the copy I received – it was hand addressed to me at work, but I'm glad I got it!!

My job as the Director of the (admin, mostly) DP center of a Community College in Beverly, Ma., gives me a lot of space to read and talk and listen to a large range of feeling about computers and society.

We're beginning to bring in data entry, trying to "humanize" the college – our current tab equipment puts too many restrictions on students, faculty and staff. I have regularly taken home the DP lab's TTY on weekends for neighborhood children to play with. This has been exciting, both for me and for them. One weekend I took home the Tektronics 4023 CRT we have, and found that my friends' children (11–13) were able to make up some great games, without even being hooked up to the computer!

They quickly learned the cursor movements, and found that the "character delete" caused the cursor to "eat up a whole row" if the cursor was placed at the left of a line of characters.

They they played some "target practice" games where each scattered the initials of their name across the tube, and after moving the cursor to a column that they thought was right over some one else's letter, "dropped a bomb."

Then, using the formating characters, I typed various phrases on the screen and "hid" them behind blank formatted fields , plus I put in some "duds" and made some protected and some not. They then got to move the cursor around as much as they wanted and complete their turn by pressing the character delete key, trying to hit the field attribute code and thereby "expose" the phrase underneath. This kind of activity kept them involved for hours. Also, David did a lot of experimenting himself with the FAC's.

We also played a version of Star Trek available on the Mass. State College Computer Networks CDC Cyber 72. Was fun, but definitly limited compared to the version described in Bob Leedom's letter.

Besides working toward humanizing computer systems (see Comm ACM, Nov. 74 for a good article) at work, I've been doing some wrestling with their use in some of the alternative society/culture activities I'm into: Food cooperatives, collective/communal living, rural/suburban/urban "community" issues, and personal growth issues. I keep coming up against the desparity between the potentials you're exploring in the paper and the realities of most of the manufacturers of computer components and units. They're big – they're hierarchical, and they're mostly in it for the buck. And the construction of even the smallest machine eats up a lot of materials that might go elsewhere. How can we work toward opening up the process of making decisions about "the new, improved model 3X40 super duper upgraded gizmo"? More than IBM's market survey and profit decisions must be input to that process if we are to keep (or possibly begin) making computers useful to US!

I've rambled on and on, not too much hard data to back up my opinions. The article by Jeff Weisbecker started me off and spurred me to write.

Hope you can use this to encourage others in the alternative uses of computers.

John Rible
North Shore Community College
3 Essex St.
Beverly, MA 01915

John – see page 13, this issue. We will put Community stuff in every issue from now on.

How to Recycle Sardine & Tuna Cans and Peanut Can Lids

Well I enjoyed the 1973-74 issues of the PCC and am writing to tell you I'd like another subscription for the 1974-75 season. While I'm still on the line, I'd like to tell you as much as I can about our computer organization (which isn't really much) and tell you what I have to do to stay in this mess.

The name of our organization is the RVCC, or the Rouge Valley Computer Center. Our former computer was the HP2000E, with a total of 6 terminals at 3 school's. But our needs have expanded, with the use of our Title II project, which (along with the whole business) is funded by our local IED (Intermediate Educational District). The Title II project is here to get slow learners in the elementry grades (usually in the 1st, 2nd grades) to be taught by computers, thus keeping other students going in a progressive rate and not slowed down by teachers helping the slow to learn. We here have formulated a system of grade keeping programs and other programs which keep data stored pertaining to student progress and teacher involvement. Hewlett Packard has developed another system of learning programs which we will use. Together with the HP2000F we will go to all of our 13 elementary schools in Medford with terminals and learning programs.

Other than our Title II project, our new HP2000F (which cost us 75000 dollars in green cash) will serve in the Medford Mid High School (of which I am a student), Medfore Senior High School, and I believe the Central Point High School. At the Medford Mid Hi, we have two computer teachers, both of which double as math teachers. As far as our civilization in the use of the computer, we almost use our computer to it's fullest. Any one in our school can use the terminals and play games or take quizzes in any area he chooses. We have Math, Social Studies, Science and a couple of language quizzes.

But our main problems are in the people of our school. No one realizes the computer's aspects in studies, and fun. Only the select who go thru the computer class and like the computer will ever use it. I'm sure that many people can enjoy and benefit by our computer if they know about it. But every day I find myself going to my first period class with an arm full of newly completed tapes, people ask "What is that?"

Your magazine has given me many ideas for programs, from the PROGRAMMERS TOOLBOX to the programs of TAXMAN and your imaginary characters. By the beginning of school, I'll have many programs (about 10) which may even have enough good stuff in it to be put on our graoup (on the 2000F, it is available by GET-*PROG) library.

I also wanted to tell you about one of my problems with the storage of tapes. Now when I finish a program and have it all corrected, I have it punched and saved for future times. My trouble was that I couldn't find a decent place to keep my tapes. Not easy to find, not easy to file. But after looking around, I found the sardine can. I stacked easy and looked nice, easily identifiable by dymo tapes and easily put in boxes with their lists and runs. My only trouble was dust getting into the tapes. I had no trouble finding an answer for that, just cover them up with something. But when I found myself carrying tapes, the sardine cans proved bad. Unless you had the tapes stuffed, you dropped the tapes. So I found the tuna can, along with the peanut can lid. The tuna can didn't do much for me, except for a good place to snap on the lid. If I could find a lid for the sardine can, I'd use that instead. But, my advice is to store tapes in sardine cans, and carry tapes in tuna cans with the 6½ oz. lid from peanuts cans.

Byron V. Caloz
4837 Griffin Creek Rd.
Medford, OR 97501

Byron – how about a picture of you inundated with sardine cans, tuna cans, peanut can lids and ...of course... paper tape.

OK, OK – We'll Print It.

I being a struggling ne..spaper carrier, am trying to earn enough money to buy a TTY. Alas and alac, I don't think I'll have enough money till I'm too old to remember how to program. Does anyone out there in Readerland have a used TTY they want to sell!

AND if anyone AT ALL is willing to write to me to trade programs, languages, tips, knowledge, computer codes, information, etc. please do so.

Please print this letter OR my alter ego, The Perfect Program Purger, otherwise known as The Funky File Fouler-upper or TheCaped Computer Crasher or The Stupendous Software Stomper or the Masked Memory Monster or whatever you want to call him will strike at PCC.

Bob Zeidman
9801 Clark St.
Phila. Pa. 19115

Instead of a TTY, How About a TV Typewriter? or Tom Swift Terminal?

A Review

Fundamental Programming Concepts" by J.R. Gross and W. S. Brainerd, Harper & Row (72) $8.95

According to the preface, the book provides a wide variety of imaginative applications in programming problems. True. For an advanced high school class or a college course, this book would be appropriate. However, after reading the book a person would not confidently approach a terminal to try his programs without having some lab manual, e.g., "My Computer Likes Me", with directions on how to get started. In short, FPC alone would not be a complete self-teaching guide for someone without programming experience.

George Dubay
Prof. Math/Stat Dept
University of St. Thomas
3812 Mortrose Blvd.
Houston TX 77006

CHATTER from CHAT

I have re-read with great interest, your article "Tilting at Windmills or What's Wrong With BASIC?" from the December 1972 issue of PCC. I understand BASIC better than I did at my first reading, but not sufficiently to creatively assist you in building "a model of the "ideal" educational/recreational language."

The ideas defined in your article are certainly to the point; these notions must be a part. My particular interest is in applying computers to instruction outside the fields of mathematics or science. I see the need for a more comprehensive definition of "symbols," my most important need. I also expect that I need a variety of data structures not available in BASIC.

We have begun a new ESEA Title III project, CHAT that seeks to support instruction in all subject areas. We're using a Data General Nova 1200. Their BASIC allows the calling of an assembly language subroutine. But aside from this degree of flexibility, it is as limited as any other BASIC.

We have a high level of support from the company. It would appear that they are becoming more interested in educational sales. We are considering some drastic changes in our compiler at some point down the line. Given sufficient support, we might even consider building one from scratch.

We would appreciate it if you could keep us informed of your efforts. We agree whole-heartedly with your definition of the need for better languages. If we can assist you in any way, we'd like to do it. Perhaps there is a way in which we can help. We'll work to that end.

Bob McElwain
CHAT Project
Sylmar High School
13050 Borden Avenue
Sylmar, Ca. 91342

December 30th, 1974

Dear P.C.C.,

It is an old but valid marketing rule that a 98 cent baking tray will sell to a car owner for $1.98 to catch oil drips or to a photographer for $3.98 to mix chemicals in. Since computers are very expensive, everything associated with them is over-priced.

With apologies to my good friend Jane Gawronski [letters, Nov 3 #2], if you need to move terminals, ask your local hardware store for a garbage-can cart. $5 seems a fair price.

Yours sincerely, J.P. Martin Clinton

games

Every now and again, I manage to come up with an idea for a game for a computer. Unfortunately, I am only a small dragon, crippled by the facts that the only language I know is APL (although I am now learning BASIC, Autocoder (ugh), and FORTRAN from an Explorer troop in my vicinity) and it is very hard for me to get a hold of a terminal, much less a CRT. I am a humble dragon, I have decided to share my ideas with you, since you seem to be pretty whifty when it comes to games. I hope that you will be able to use them and share them with mankind. My first brain storm involves writing a program which simulates a pinball machine (using a CRT, of coures). I think that this would be a relatively simple matter. My second idea concerns drawing a picture of the spacecrafts altitude for use with LUNAR. Along the same line, I was surprised to discover that none had written a car rally type game. At the end of each turn, the player would be given time to turn the carriage back to a predetermined spot, from whence the computer would return and space the proper number of times, thus plotting the cars new position. I have some more detailed explanations of this, but I am afraid I would only divulge my naivete by doing so. I really like your mag. — why don't you have a joke section.* My order is enclosed. I have noticed the way you turn most of the questions that are asked of you around, and have taken pains not to permit you to do so.

Steve Follmer
623 Coram Rd.
Huntingdon Valley, PA 19006

*Steve, you are now in charge of joke section.

qubic

Thanks for the info about my questions. I'm kind of sorry that the analysis of QUBIC was done by someone else. I thought I was the first one to do a Six or Seven level Qubic game. It beats HP's game 2 out of 2 games. It uses decision 4 level strategy. Has anything been done like that before? *I don't know, Andy. Anyone?*

What's you latest policy on sending listings? There are a few I'd like. ***

Your newspaper is very good, PILOT 73 was interesting. I am now writing one with all the listed functions (C:, U:, and so on). When it's finished, do you want a copy? *Yes* (Written in BASIC of course.)

I guess that's about it for now. Unless you have a WATS line to Phila.?

Andy Finkel
12002 Pandrail Place
Phila. Pa. . 19116

* Next issue ... The Big Games Book Revealed!

tty repair

I'm writing in regard to the letter in the last issue of PCC on page 21, from Larry Press of Venice, Ca. on TTY REPAIR.

The list was very good but did not include the wiring diagrams such as WDP 0101, WDP 0033, WDP 0316 and maybe others which are indispensable according to our serviceman. Normally these come with a new TTY but with a used one you might not have them.

Bruce Palmer
Laboratory Equipment Specialist
The University of Wisconsin
Platteville, Wisc. 53818

Rocky Mountain Hi

After one year of reading your "paper" I find it very valuable in my work. I'm a math teacher (and dept chairman) who is concerned that math and science teaching in the high school will never be the same. The influence of computers began about 3 years ago for us and I'm continuing to push for more.

At the present time we offer a one semester computer course, a one year computer course, a second year algebra with computers and are beginning a two year sequence of math with computers (10 and 11th grades) for the liberal arts students. BASIC is the prime language, I sure would like all the free listings but will settle for NUMBER, LETTER, STARS and TRAP.

Bob Schenk
Pikes Peak Regional Science Fair, Inc.
Colorado Springs, Colorado

I'm on a sabbatical leave this coming year and will be working at the Denver University Math Lab with Dr. Ruth Hoffman. Most of the work involves computers and I am sure we will be in contact with you about using some of your games etc. Another teacher, Dan Myers, and I wrote and published a self-teaching programming text in BASIC. We have sold over 500 copies here and in Denver. Would you be interested in seeing a copy? *yup.*

NUMBER, LETTER, etc. were printed in Sept 74 issue. And, next time, we will finally annouce (whoops— should be announce) the PCC Games Book.

I can say that I hate People's Computer Company. To put it more correctly however, I should say that because of your newspaper (I was so impressed) I just lost 6 dollars. After receiving the first issue of my subscription, I want to be sure and receive the back issues. Your newspaper is just fantastic! The only thing I am sorry about is that I did not discover it sooner.

I did however have a couple of questions which I did want to ask you. On page 21 of Vol. 3 No. 1, you have an editorial written by Eric Haines asking for some FORTRAN programs. I would like to help the guy out, but you forgot to include his address! So, could you please send me his address?

Another question I had was as to whether the tapes *this one* you sell "paper tape" or whether they are magnetic cassettes. Also you make reference to back issues for info on various games, but some programs like "Hunt the Wumpus" and "Star Trader" are not mentioned. Will these listings appear in the back issues that I just requested? *Wumpus, page 24.*
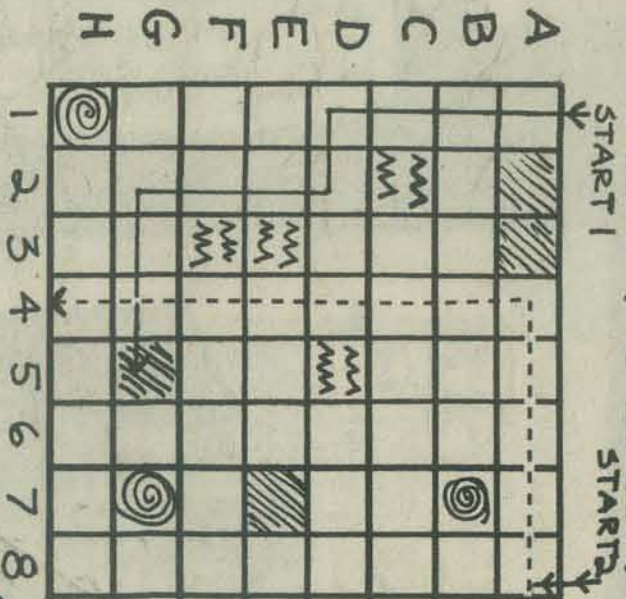
Well, keep up the good work, and keep on bringing us those great issues.

Robert S. Marlan
91 Cooper Road
Rochester, NY 14617

Eric Haines
212 N. Riding Drive
Moorestown, NJ 08057

Dear Sir:

I have found a way to beat your highest score of 19 points in 14 steps (refering to Vol. 3 No. 2) on your "INCHWORM" here to there board. My program gets a score of 21, the program is: EEEEESSSSSSEES. Then I beat that with a score of 22 and in 14 steps, that path for a score of 22 is : SSESSSEEEESEES.

I have also found a way to get less then your lowest score, which you said was 6, with my score of 5 and this is also in 14 steps, the program for 5 is: ESESSSESSESEE. Are either one of these good enough to win a reward? Thank you very much.

21

Sincerely,

Carl Wiener

Carl Wiener
25 Maryland St.
Spfld., Ma. 01108
Dec. 12, 1974

---

remember : last time we asked for your ideas... also about **INCHWORM'S** *maximum* path)

maximum

Here's an idea for an INCHWORM GAME. One person makes an island grid with various obstacles (mountains, quicksand, etc.) where INCHWORM can't go. Two starting corners are left empty. Two players prepare a program for INCHWORM to wander around. Now the players try out their programs, alternating between them, one step at a time) whenever the one who got there first goes back one step in the program on his next turn. The other INCHWORM skips one step into an obstacle or goes off the island loses. If they go both do, neither wins. If they both and, the game is a draw. !!!! see example

PROGRAM 1 = SSESSSEENNEENNWW

PROGRAM 2 = WWWWSSSSSSWSWEEEE

(BOTH HAVE 17 STEPS)... Collision at G4.

Inchworm one goes EAST from G4 into space warp at G5 and, "POOF," loses. Inchworm two goes SOUTH to H4. (It continues), it won't cross any obstacles

START↓   START↓

A
B
C
D
E
F
G
H

1 2 3 4 5 6 7 8

MM = MOUNTAINS
◎ = QUICKSAND
▨ = SPACE WARP or whatever

please be my Valentine...

SINCERELY, LEIDMAN
8301 CLARK ST.
PHILA., PA. 19115

ROBERT LEIDMAN

COULD IT START BE THE START OF A NEW CHAPTER?

-EPICO

---

*Minimum path
Sum: 5
PROGRAM: SEESSSESSESEE
Sum: 22
PROGRAM: SSESSSEEEESEES
*Maximum path in 14 steps:

My idea is to set up an INCHWORM type game along the lines of HUMPUS. One person sets up a board with various hazards. Another person is designated as the 'worm'. The object is to get the worm from corner (1,1) to the opposite corner. The person who made up the board now becomes the INCHWORM's eyes because everyone KNOWS inchworms are blind, no play, the worm starts out by moving in any direction, from (1,1). The eyes tell the worm if it comes within one square of any hazard. The worm must then avoid the hazard. If the worm hits the hazard, what ever it is is motivated. In other words, this is the game of HUMPUS, with the 'eyes' person acting as the computer. How's that?

Sincerely,

Eric K. Olson
"The Focal-Basic-Fortran-PAL-APL-Algol-...
...Kid"

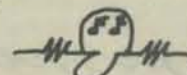**D R A G O N S M O K E**

SPACEWAR FOR EDUSYSTEM 50

We have modified Mike Mayfield's SPACWR
(101 BASIC COMPUTER GAMES by D. Ahl)
to run on an EduSystem 50. We'll send it to
anyone who can send us $2.00 for postage and
handling.
Sincerely,

Lynn Macey

Lynn Macey
Manager PDP/8 Operations
Associated Colleges of Central Kansas
115 E. Marlin
McPherson ks 67460

I keep getting strange, but interesting stuff
from Dave Robbins. THE SKYLINE is
FREE to any " individual involved or interested
in Data Processing in this Miami, Florida area."
(Or, so it seems, people interested in computers
for community service.) Write to Dave at
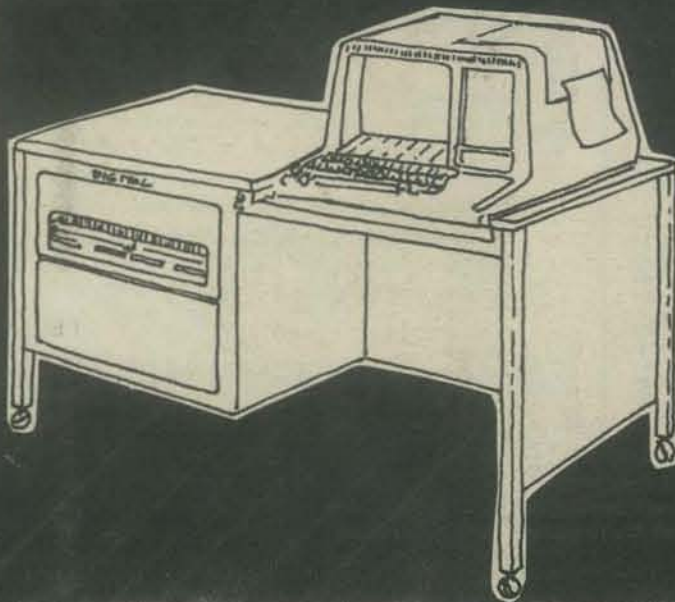INTERACTION ASSOCIATES, INC.
777 NW 72ND. AVENUE
MIAMI,FL 33126

NASA

Got myself a TEACHERS INFORMATION KIT
from NASA. Pictures, film catalogues , booklets
and lots more. Tried some of the films — space
walks, computer graphics, moon stuff . . . turn
the audio off . . . and put on some electronic
music and. . .

They come in three flavors: Elementary, Secondary,
University
Write to : NASA
AMES RESEARCH CENTER
MOFFET FIELD , CA 94040

CLASSIC

Some EDUPEOPLE from DEC (Digital Equipment
Corporation, of course) stopped by and drew us a
picture of CLASSIC, the latest EDUHELPER from
the "MINI —SYSTEMS COMPANY".

PDP 8A with 32K *DECBYTES**
Dual Drive Floppy Disk!
VT 50 CRT Hard Copy Unit. . .

* *A DECBYTE is a 6 bit BYTE. . . that's sort
of like a regular byte with two bits chewed
out.*

PRICE? $7900 THAT'S
ALMOST DEFLATIONARY.

For verification of this wild, crazy offer, write
to
EDUPEOPLE
DEC
146 MAIN STREET
MAYNARD MA 01754

22

MECC

I think Minnesota is really going to do it — put a terminal in every school in the state. If you are interested in this sort of thing, contact MECC (MINNESOTA EDUCATIONAL COMPUTING CONSORTIUM,) 1925 SATHER, LAUDERDALE MN 55113.
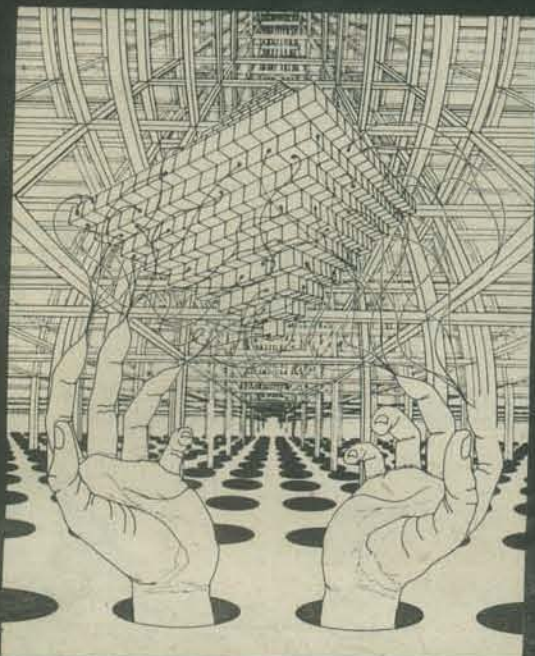
DATABUS

Did I tell you about DATABUS? Heavy stuff for people serious about how to design and program conflict games.   *Bob Felice, SPI, 44 EAST 23RD STREET, NEW YORK,NY 10010.* [Hey Bob — would you please put your address IN DATABUS so I don't have to look it up? Thanx, a DRAGON.]

ON BEING HAD

PRIVACY JOURNAL is new. It tells you what those bastards in washington are doing to you. If you can spare $15, get it. You might even get angry enough to do something overt.

PRIVACY JOURNAL
P.O.BOX 8844
WASHINGTON DC 20003

"Meet a Maytag Who Produces Suds That Will Not Clean Duds," WALL STREET JOURNAL, Dec. 26, 1974 - page 1.

The saga of steam beer will be continued next issue.

SCHOOL COMPUTER SERVICES NEWS

Vol. 1, No. 1 (Oct.'74) and Vol.1 No. 2 (Dec.'74) just crossed my path. Twelve school systems using a GE 265 T/S system. Cost per month (1974—75) - $55 to $135 per terminal.
Published bi-monthly, October — April by the Office of School Computer Services — 326 Poe Hall, N.C. State University, Raleigh, N.C. Editor: Edward G. Blakeway. Articles, suggestions, announcements, items of common interest, are invited.

IEEE COMPUTER SOCIETY

Get your very own PUBLICATIONS CATALOG (Spring - Summer 1974) from IEEE COMPUTER SOCIETY, 5855 NAPLES PLAZA, SUITE 301, LONG BEACH, CA. 90803
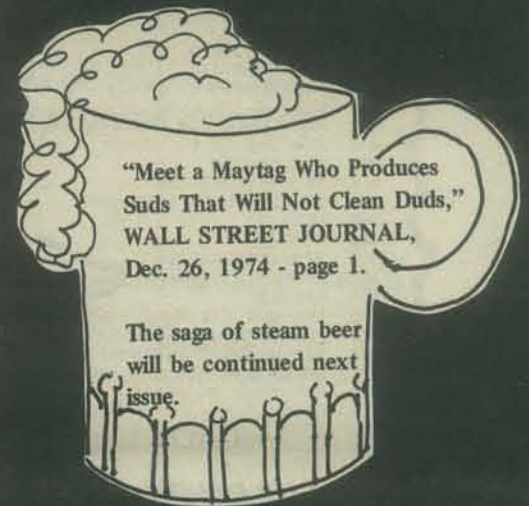
COMPCON 75

We will be there doing the session "Software Power to the People."

✳ COMPCON 75 Spring, February 25-27, San Francisco, California. Tenth IEEE Computer Society International Conference on the theme "Computer Technology to Reach the People." Contact Lowell Amdahl, President, COMPATA, Inc., 6150 Canoga Ave., Woodland Hills, CA 91364; (213) 884-5400.

WUMPUS

original concept:
Gregory Yob

```
10   REM- HUNT THE WUMPUS
20   PRINT "INSTRUCTIONS (Y-N)";
30   INPUT I$
40   IF I$="N" THEN 52
50   GOSUB 1000
52   REM- ANNOUNCE WUMPUS!! FOR ALL AFICIONADOS ... ADDED BY DAVE
54   PRINT
56   PRINT "      ATTENTION ALL WUMPUS LOVERS!!!"
58   PRINT "      THERE ARE NOW TWO ADDITIONS TO THE WUMPUS FAMILY";
60   PRINT " OF PROGRAMS."
62   PRINT
64   PRINT "      WUMP2: SOME DIFFERENT CAVE ARRANGEMENTS"
66   PRINT "      WUMP3: DIFFERENT HAZARDS"
67   PRINT
68   REM- SET UP CAVE (DODECAHEDRAL NODE LIST)
70   DIM S(20,3)
80   FOR J=1 TO 20
90   FOR K=1 TO 3
100  READ S(J,K)
110  NEXT K
120  NEXT J
130  DATA 2,5,8,1,3,10,2,4,12,3,5,14,1,4,6
140  DATA 5,7,15,6,8,17,1,7,9,8,10,18,2,9,11
150  DATA 10,12,19,3,11,13,12,14,20,4,13,15,6,14,16
160  DATA 15,17,20,7,16,18,9,17,19,11,18,20,13,16,19
170  DEF FNA(X)=INT(20*RND(0))+1
180  DEF FNB(X)=INT(3*RND(0))+1
190  DEF FNC(X)=INT(4*RND(0))+1
200  REM-LOCATE L ARRAY ITEMS
210  REM-1=YOU,2=WUMPUS,3&4=PITS,5&6=BATS
220  DIM L(6)
230  DIM M(6)
240  FOR J=1 TO 6
250  L(J)=FNA(0)
260  M(J)=L(J)
270  NEXT J
280  REM-CHECK FOR CROSSOVERS (IE L(1)=L(2),ETC)
290  FOR J=1 TO 6
300  FOR K=J TO 6
310  IF J=K THEN 330
320  IF L(J)=L(K) THEN 240
330  NEXT K
340  NEXT J
350  REM-SET# ARROWS
360  A=5
365  L=L(1)
370  REM-RUN THE GAME
375  PRINT "HUNT THE WUMPUS"
380  REM-HAZARD WARNINGS & LOCATION
390  GOSUB 2000
400  REM-MOVE OR SHOOT
410  GOSUB 2500
420  GOTO 0 OF 440,480
430  REM-SHOOT
440  GOSUB 3000
450  IF F=0 THEN 390
460  GOTO 500
470  REM-MOVE
480  GOSUB 4000
490  IF F=0 THEN 390
500  IF F>0 THEN 550
510  REM-LOSE
520  PRINT "HA HA HA - YOU LOSE!"
530  GOTO 560
540  REM-WIN
550  PRINT "HEE HEE HEE - THE WUMPUS'LL GETCHA NEXT TIME!!"
560  FOR J=1 TO 6
570  L(J)=M(J)
580  NEXT J
590  PRINT "SAME SET-UP (Y-N)";
600  INPUT I$
610  IF I$="Y" THEN 240
620  GOTO 360
1000 REM-INSTRUCTIONS
1010 PRINT "WELCOME TO 'HUNT THE WUMPUS'"
1020 PRINT "  THE WUMPUS LIVES IN A CAVE OF 20 ROOMS. EACH ROOM"
1030 PRINT "HAS 3 TUNNELS LEADING TO OTHER ROOMS. (LOOK AT A"
1040 PRINT "DODECAHEDRON TO SEE HOW THIS WORKS-IF YOU DON'T KNOW"
1050 PRINT "WHAT A DODECAHEDRON IS, ASK SOMEONE)"
1060 PRINT
1070 PRINT "      HAZARDS:"
1080 PRINT " BOTTOMLESS PITS - TWO ROOMS HAVE BOTTOMLESS PITS IN THEM"
1090 PRINT "      IF YOU GO THERE, YOU FALL INTO THE PIT (& LOSE!)"
1100 PRINT " SUPER BATS - TWO OTHER ROOMS HAVE SUPER BATS. IF YOU"
1110 PRINT "      GO THERE, A BAT GRABS YOU AND TAKES YOU TO SOME OTHER"
1120 PRINT "      ROOM AT RANDOM. (WHICH MIGHT BE TROUBLESOME)"
1130 PRINT
1140 PRINT "      WUMPUS:"
1150 PRINT " THE WUMPUS IS NOT BOTHERED BY THE HAZARDS (HE HAS SUCKER"
1160 PRINT " FEET AND IS TOO BIG FOR A BAT TO LIFT). USUALLY"
1170 PRINT " HE IS ASLEEP. TWO THINGS WAKE HIM UP: YOUR ENTERING"
1180 PRINT " HIS ROOM OR YOUR SHOOTING AN ARROW."
1190 PRINT "      IF THE WUMPUS WAKES, HE MOVES (P=.75) ONE ROOM"
1200 PRINT " OR STAYS STILL (P=.25). AFTER THAT, IF HE IS WHERE YOU"
1210 PRINT " ARE, HE EATS YOU UP (& YOU LOSE!)"
1220 PRINT
1230 PRINT "      YOU:"
1240 PRINT " EACH TURN YOU MAY MOVE OR SHOOT A CROOKED ARROW"
1250 PRINT "      MOVING: YOU CAN GO ONE ROOM (THRU ONE TUNNEL)"
1260 PRINT "      ARROWS: YOU HAVE 5 ARROWS. YOU LOSE WHEN YOU RUN OUT."
1270 PRINT "      EACH ARROW CAN GO FROM 1 TO 5 ROOMS. YOU AIM BY TELLING"
1280 PRINT "      THE COMPUTER THE ROOM#S YOU WANT THE ARROW TO GO TO."
1290 PRINT "      IF THE ARROW CAN'T GO THAT WAY(IE NO TUNNEL) IT MOVES"
1300 PRINT "      AT RANDOM TO THE NEXT ROOM."
1310 PRINT "      IF THE ARROW HITS THE WUMPUS, YOU WIN."
1320 PRINT "      IF THE ARROW HITS YOU, YOU LOSE."
1330 PRINT
1340 PRINT "      WARNINGS:"
1350 PRINT "      WHEN YOU ARE ONE ROOM AWAY FROM WUMPUS OR HAZARD,"
1360 PRINT "      THE COMPUTER SAYS:"
1370 PRINT " WUMPUS-  'I SMELL A WUMPUS'"
1380 PRINT " BAT   -  'BATS NEARBY'"
1390 PRINT " PIT   -  'I FEEL A DRAFT'"
1400 PRINT ""
1410 RETURN
2000 REM-PRINT LOCATION & HAZARD WARNINGS
2010 PRINT
2020 FOR J=2 TO 6
2030 FOR K=1 TO 3
2040 IF S(L(1),K)#L(J) THEN 2110
2050 GOTO J-1 OF 2060,2080,2080,2100,2100
2060 PRINT "I SMELL A WUMPUS!"
2070 GOTO 2110
2080 PRINT "I FEEL A DRAFT"
2090 GOTO 2110
2100 PRINT "BATS NEARBY!"
2110 NEXT K
2120 NEXT J
2130 PRINT "YOU ARE IN ROOM "L(1)
2140 PRINT "TUNNELS LEAD TO "S(L,1);S(L,2);S(L,3)
2150 PRINT
2160 RETURN
2500 REM-CHOOSE OPTION
2510 PRINT "SHOOT OR MOVE (S-M)";
2520 INPUT I$
2530 IF I$#"S" THEN 2560
2540 O=1
2550 RETURN
2560 IF I$#"M" THEN 2510
2570 O=2
2580 RETURN
3000 REM-ARROW ROUTINE
3010 F=0
3020 REM-PATH OF ARROW
3030 DIM P(5)
3040 PRINT "NO. OF ROOMS(1-5)";
3050 INPUT J9
3060 IF J9<1 OR J9>5 THEN 3040
3070 FOR K=1 TO J9
3080 PRINT "ROOM #";
3090 INPUT P(K)
3095 IF K <= 2 THEN 3115
3100 IF P(K) <> P(K-2) THEN 3115
3105 PRINT "ARROWS AREN'T THAT CROOKED - TRY ANOTHER ROOM"
3110 GOTO 3080
3115 NEXT K
3120 REM-SHOOT ARROW
3130 L=L(1)
3140 FOR K=1 TO J9
3150 FOR K1=1 TO 3
3160 IF S(L,K1)=P(K) THEN 3295
3170 NEXT K1
3180 REM-NO TUNNEL FOR ARROW
3190 L=S(L,FNB(1))
3200 GOTO 3300
3210 NEXT K
3220 PRINT "MISSED"
3225 L=L(1)
3230 REM-MOVE WUMPUS
3240 GOSUB 3370
3250 REM-AMMO CHECK
3255 A=A-1
3260 IF A>0 THEN 3280
3270 F=-1
3280 RETURN
3290 REM-SEE IF ARROW IS AT L(1) OR L(2)
3295 L=P(K)
3300 IF L#L(2) THEN 3340
3310 PRINT "AHA! YOU GOT THE WUMPUS!"
3320 F=1
3330 RETURN
3340 IF L#L(1) THEN 3210
3350 PRINT "OUCH! ARROW GOT YOU!"
3360 GOTO 3270
3370 REM-MOVE WUMPUS ROUTINE
3380 K=FNC(0)
3390 IF K=4 THEN 3410
3400 L(2)=S(L(2),K)
3410 IF L(2)#L THEN 3440
3420 PRINT "TSK TSK TSK- WUMPUS GOT YOU!"
3430 F=-1
3440 RETURN
4000 REM- MOVE ROUTINE
4010 F=0
4020 PRINT "WHERE TO";
4030 INPUT L
4040 IF L<1 OR L>20 THEN 4020
4050 FOR K=1 TO 3
4060 REM- CHECK IF LEGAL MOVE
4070 IF S(L(1),K)=L THEN 4130
4080 NEXT K
4090 IF L=L(1) THEN 4130
4100 PRINT "NOT POSSIBLE -";
4110 GOTO 4020
4120 REM-CHECK FOR HAZARDS
4130 L(1)=L
4140 REM-WUMPUS
4150 IF L#L(2) THEN 4220
4160 PRINT "... OOPS! BUMPED A WUMPUS!"
4170 REM-MOVE WUMPUS
4180 GOSUB 3380
4190 IF F=0 THEN 4220
4200 RETURN
4210 REM-PIT
4220 IF L#L(3) AND L#L(4) THEN 4270
4230 PRINT "YYYIIIIEEEE . . . FELL IN PIT"
4240 F=-1
4250 RETURN
4260 REM-BATS
4270 IF L#L(5) AND L#L(6) THEN 4310
4280 PRINT "ZAP--SUPER BAT SNATCH! ELSEWHEREVILLE FOR YOU!"
4290 L=FNA(1)
4300 GOTO 4130
4310 RETURN
5000 END
```

TO BOTTOMLESS PIT

TO BOTTOMLESS PIT

PCC Bookstore

In October of 1974, the first edition of the **Whole Earth Epilog** was published by the POINT foundation and Penguin Books. Bob Albrecht rushed right out and bought a copy. During his initial reading, he selected the following seven titles for the growing bookstore inventory.

Math, Writing & Games in the open classroom - $2.45

Herbert Kohl

from: Vintage Books
        Hahn Rd.
        Westminster, Md.

or: PCC

About writing, creating games and math.

Steps to an Ecology of Mind - $1.95

by Gregory Bateson
from: Ballentine Books
        N.Y., N.Y. 10022
or: PCC
reviewed in PCC Vol 3 no. 2

My Computer Likes Me. - $1.49

from: DYMAX

or :   PCC

A book for basic training of BASIC.

Dragon Shirts - $3.50
from the cover of our Sept. issue
drawn by Nancy Hertert.

Children's sizes - S M L
Adult sizes   - S M L

from: PCC Bookstore
        P.O.Box 310
        Menlo Park, Ca. 94025

Whole Earth Epilog - $4.00

Stewart Brand , ed.

from: Penguin Books
        Ambassador Rd.
        Baltimore, Md.

or: PCC

A big book with a lot of information
on a lot of subjects.

PCC News - $5.00 /yr.

from: PCC
        P. O. Box 310
        Menlo Park, Ca. 94025

Serious Games - $5.95

by Clark C. Abt

from: Viking Press
        625 Madison Ave.
        N.Y., N.Y.

or: PCC

reviewed in PCC Vol 2 no. 5

II Cybernetic Frontiers - $2.00

by Stewart Brand

From: Random House
        Westminster, Md.

or: PCC

The author likes Gregory Bateson and
computers. This book is about both.

DeSchool Primer No. 10 - $3.50

from: Zephyros
        1201 Stanyan St.
        San Francisco, Ca. 94117

or :   PCC

A workbook for traveling in Time and Place

We still have some old favorites too.

BASIC - $3.95

by Albrecht, Finkel and Brown

from : John Wiley and Sons
        One Wiley Dr.
        Somerset, N.J. 08873

or: PCC

A short course in "Computer Literacy."
Everything you need to know for cocktail
parties. (Become an instant expert!)

Computers and Computation - $6.00

from: W.H. Freeman
        660 Market St.
        San Francisco, Ca. 94104

or: PCC

Computer Lib - $7.00

by Theodor H. Nelson

from: PCC

Review: Pages 8 and 9
this issue.

101 Basic Computer Games - $5.00

by David H. Ahl

from: DEC
        Maynard, Ma. 01754

or: PCC Bookstore

Problems for Computer Solution - $7.25

by Fred Gruenberger & George Jaffray

from : John Wiley & Sons
        One Wiley Dr.
        N.Y
        Somerset, N.J. 08873

or: PCC

TTL Cookbook - $7.95

by Donald E. Lancaster

from: PCC Bookstore
        P. O. Box 310
        Menlo Park, Ca.

GAMES, TRICKS,
AND PUZZLES

by Wallace Judd

A nice collection of interesting and informative games which can be done on the simplest of calculators. Sections which are extremely good include "How to Admire a Calculator" which details some of the finer points of calculator capabilities, "The Inside Story" which shows the actual construction of a calculator and thus helps the reader understand typical errors made in calculator assembly and the "How to . . ." section. The "How to . . ." section is perhaps the most valuable section since it shows how to "Find the Power of a Number", "Find Square Roots", "Find Percents" and "Generate Random Numbers" on calculators equipped only with +, −, x, ÷ and = keys.

Table of Contents

I   If you can push the keys — you can do these

The Mathemagician
The Game of Nim
Kitten on the Keyboard
Kaleidoscope of Numbers
The Flip Trip
How to Admire a Calculator
The Inside Story

II   If you've had a little math — you won't take a bath

Analyzing Ads
A Bigger Calculator
Patterns

III   Some algebra from high school — is the only necessary tool

What's Wrong With My Calculator
World Records
Discover the Algorithm

IV   How to . . .

Use Constant & Memory
Generate Random Numbers
Find Square Roots

V   Solutions
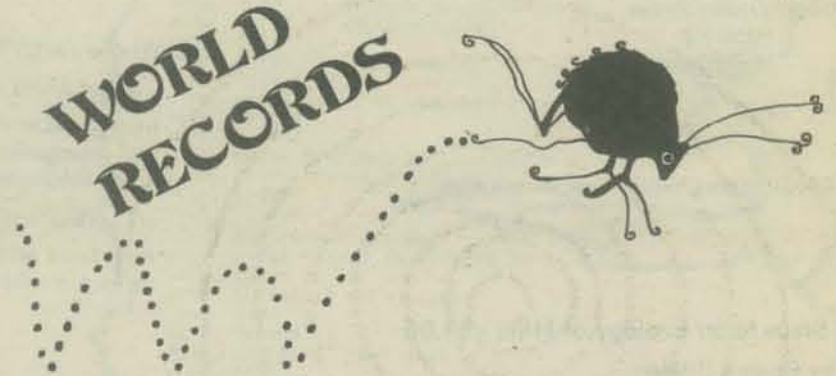
FOR ORDER INFORMATION —
SEE PCC BOOKSTORE PAGE 27

26

THE FLIP TRIP

What did Amelia Earhart's father say the first time he saw her fly an airplane? To find out, calculate the following:
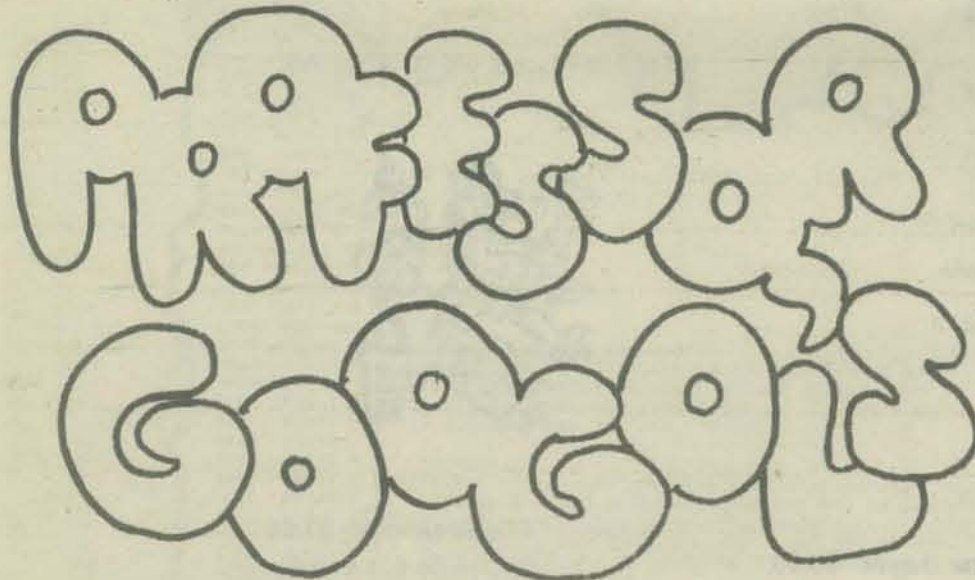
.023 x 3 + 10141 x 5 =

Now read the calculator upside down.

WORLD RECORDS

A flea weighing about .00001 of an ounce can jump 7¾" in the air. If a man could jump in proportion to his weight as well as a flea, how high could a 160 pound man jump?

How to...
Find Percents

To get 5% of a number, key in the number, push the ⊠ key, and then ⊡ ⓪ ⑤ ⊟ If you want 113% of a number, key in the number, ⊠ and ① ⊡ ① ③ ± Just multiply the number times the percentage you want to find the answer. Remember that 40% is .40, 6% is .06, and 425% is 4.25.

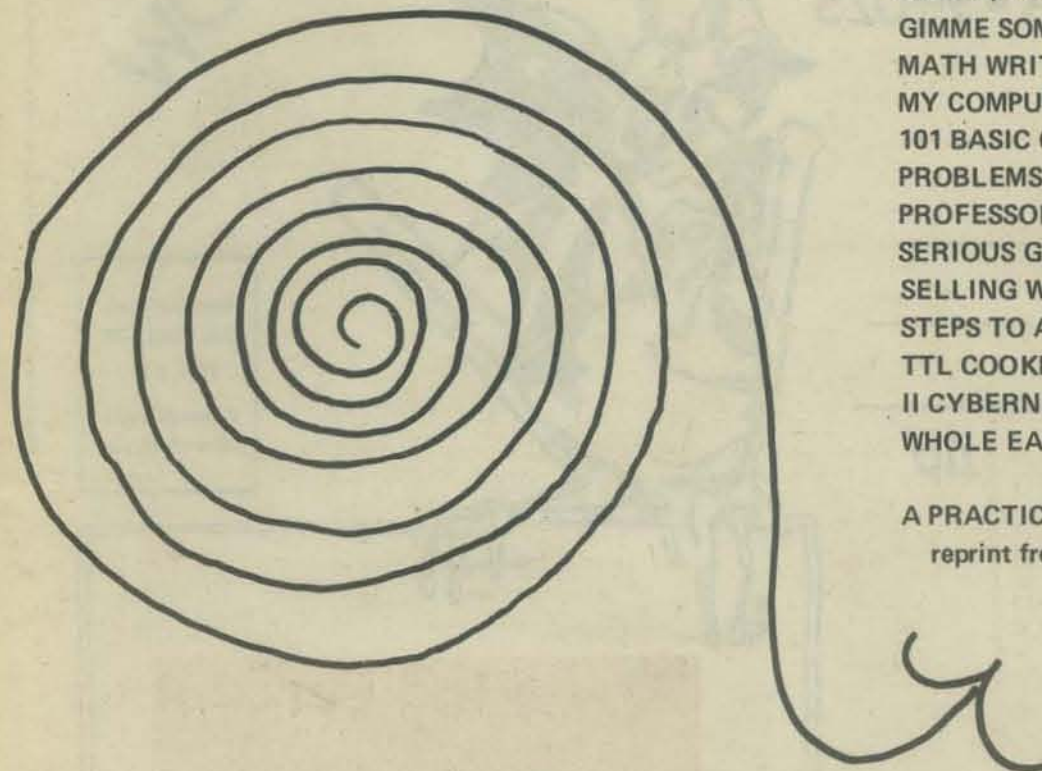**FLYING TIME MACHINE & ATOMIC SPACE CAPSULE MATH PRIMER**

BY SAM VALENZA, JR.

"Why do you sit out here all alone?" said Alice, not wishing to begin an argument.

"Why, because there's nobody with me!" cried Humpty Dumpty.[1]

In compiling this little book, I've tried to accent some basic unifying concepts while at the same time offering the teacher an overwhelming amount of "jumping off spots" from which he can thoroughly explore Basic Algebra. A lot of this is accomplished tongue-in-check, and for that I do not apologize. It is sad to realize that we've arrived at a point where finding some humor in everyday teaching technique may be labeled as experimentation. However, this project is also an experiment in communication, and especially in the visualization of mathematical ideas. In this respect, I feel that I am probing directions not yet explored, but need to be. Thus I am compelled to sympathize with Humpty Dumpty's evaluation of the situation as reported to Alice. I only hope that this book will not share his fate!

PCC Bookstore

BASIC, Albrecht, Finkel & Brown, 1973, p. 323 — $3.95
BASIC BASIC, James Coan, 1970, p. 256 — $5.95
BAS!C PROGRAMMING, Kemeny & Kurtz, 1967, p. 145 — $6.95
COMPUTERS & COMPUTATION, Scientific American, p. 280 — $6.00
COMPUTER LIB & DREAM MACHINES, Theodore H. Nelson, 1974, p. 186 — $7.00
DRAGON SHIRTS, Nancy Hertert, 1974 — $3.50
GAMES, TRICKS AND PUZZLES, Wallace Judd, 1974, p. 100 — $2.95
GIMME SOMETHING TO FEEL, Jane Wood, 1973, p. 125 — $$2.95
MATH WRITING & GAMES, Herbert Kohl, 1974, p. 252 — $2.45
MY COMPUTER LIKES ME, Dymax, 1972, p. 64 — $1.49
101 BASIC GAMES, Ed. David Ahl, 1974, p. 250, — $5.00
PROBLEMS FOR COMPUTER SOLUTION, Gruenberger & Jaffray, 1965, p. 398 — $7.25
PROFESSOR GOOGOL, Sam Valenza, Jr., 1973, p. 144 — $3.25
SERIOUS GAMES, Clark C. Abt, 1970, p.176 — $5.95
SELLING WHAT YOU MAKE, Jane Wood, 1973, p. 111 — $2.25
STEPS TO AN ECOLOGY OF MIND, Gregory Bateson, 1972, p.517, — $1.95
TTL COOKBOOK, Don Lancaster, 1974, p. 328 — $7.95
II CYBERNETIC FRONTIERS, Stewart Brand, 1974, p. 96 — $2.00
WHOLE EARTH EPILOG, Stewart Bran, Editor, 1974, p. 318 — $4.00

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reprint from COMPUTER magazine, 1974 — $1.00

FOR MORE INFORMATION, SEE PAGES 25 and 26 —

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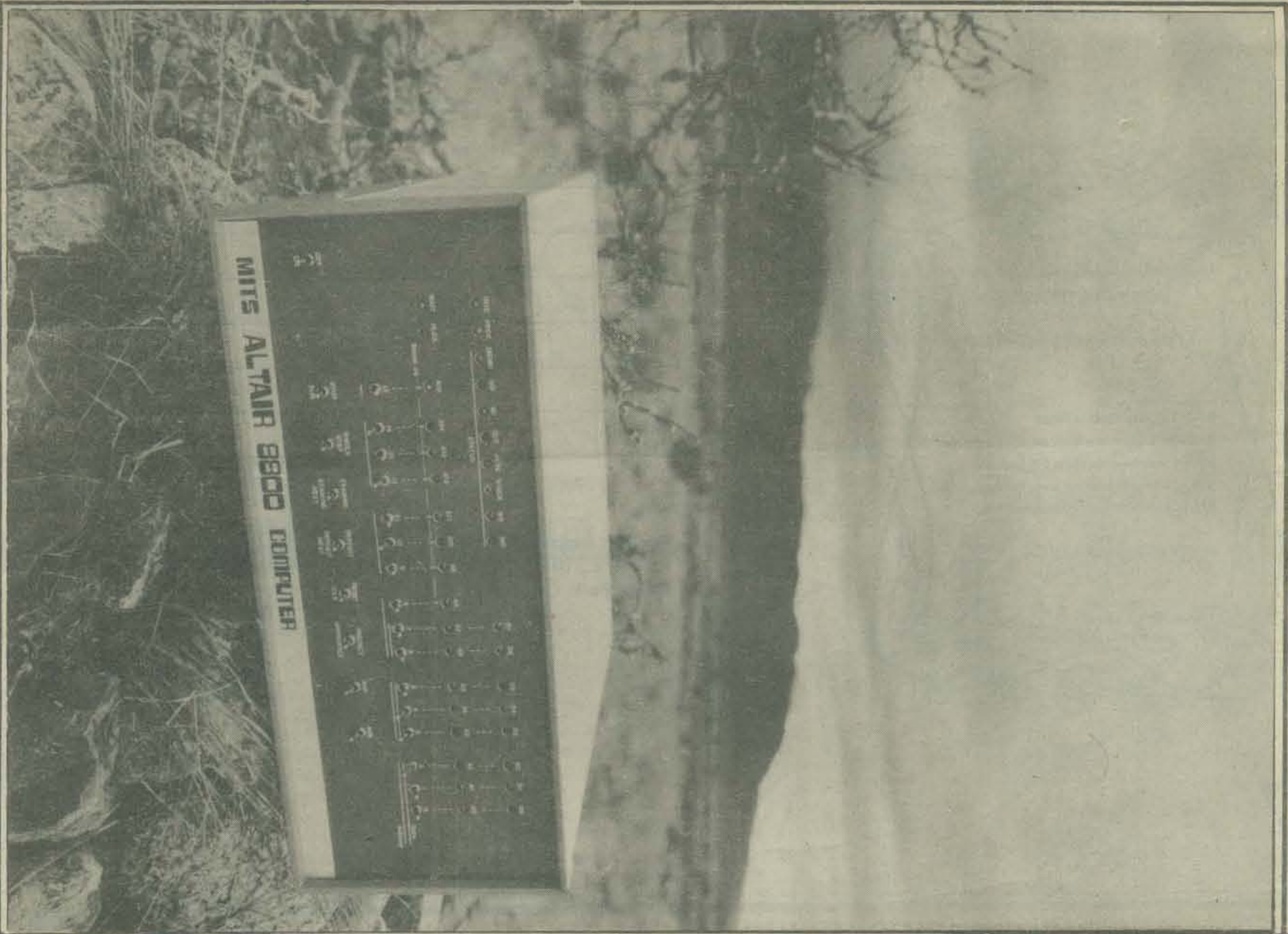
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VOLUME 3 JANUARY 75 NUMBER 3