People's Computer Company

may 1975 vol. 3 no. 5

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next issue pcc looks at hardware again

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Renew Now

The Fabulous PCC

Once upon a time there was a dragon. It lived happily in the land for a while, spreading alarum and disquiet and doing all those things that dragons do. And then it laid an egg.

Legend has it that the dragon just appeared one day, materialized out of thin air - a tale even the most credulous of our readers may view with justifiable skepticism, lacking, as it does, the trappings of bees, bushes and bullrushes. The true tale is even stranger .....so strange in fact that no raconteur with respect for his skin or his reputation dare tell it all, but it goes something like this.....

Way back in the dim depths of the past, fifteen years or so ago, a very straight young computer man used to work for a very straight organization up there in the great city in the sky - five thousand feet up in Denver, to be precise to the point of pedantry. His name was Bob Albrecht and the flaws in his character were already becoming patent. He took to teaching youngsters aged 14 or so about computers, an heretical notion for computers were expensive and only for mathematicians, certified data processors and similar lordly beings. The corruption of these unsuspecting minds (including that of one Bob Kahn, who will surface again later) finally tipped our hitherto merely illbalanced hero into the monomania from which he has never recovered. Aroused to the vulnerability of an unwary public, he lumbered forth, vampires byte at the ready.

The scene now shifts some years and miles, to the warm, sunny rocks of california, a proper hatching ground for a dragon, where Lois Jennings and Stewart Brand, soon to be married, were accosted by one Richard Raymond - soon to be known as the limpid wizard of Portola Institute. He spoke swiftly, after the fashion of TV commercials, saying that he posessed in his office a magic spell through which great wonders may be wrought, which he called a letter head. Thus was born Portola, a mighty edifice of edgewise cards behind whose imposing facade sheltered a motley collection of refugees from The Land of The Wicked Taxman. Foremost amongst these, leading their crusade against ignorance and watered beer, were the troops of the computer education division, ably generalled by our hero Albrecht, who had begun to earn his living with his pen and his wits and had a characteristically half starved look. About this time, in a moment of rare lucidity, he married his editor, Mary Jo, relieving her of the tedium of a perfectly good career in an eminently respectable publishing house. Also about this time Leroy Finkel rolled into view, rolled, it must be admitted, somewhat in the manner of wheels prior to the invention of roundness. He was a teacher and a valuable addition, if a little uncouth on the subject of economics.

The troops of the division laboured mightily, struggling with strange beasts long gone from this land, though there are still those alive who can tell of an HP9100A, the bloodcurdling growl of an Olivetti PROGRAMMA 101 or of bits lost in the maw of a Wang 300. The troops laboured, writing and teaching, and money rolled in and Portola prospered and spent it, until one day the limpid wizard enchanted a magic whale, called Ortega Park. Science, in these more enlightened days, has renamed all those legendary monsters, robbed them of all their mystery. You modernists will, of course, recognise the enchanted whale that faced our heroes as a mere commonplace infinite money sink (though of a rare, non-government species). But to them it was a great yawning mouth which threatened to engulf them and all their labours. So they arose in terror and went in a body to speak with the limpid wizard of Portola Institute. "Goodbye." they said, and split.

Alas for our heroes, lacking the wise and kindly counsel of the limpid wazard, they soon fell into evil ways, sullied their mouths with foul words, like 'fair return' and even... profit. But the vilest of their perversions was a dark conspiracy by which they created a Thing. This wicked deed performed by hours of muttering over mighty spells called articles of incorporation, produced a creature recognizable at law as a person, though unnatural, which endures even to this day. They even gave it a name, after the suggestion of Marc LeBrun. He was too young yet, to manage the whole word dymaxion, though he had some notion as to its meaning, but what he said sounded fine to the others and Dymax it became.

Such doings did not go unpunished. A plague was promptly sent upon them called Tecnica. This purported to do good works and taught them about stock promotions and finance and other things of great value to the smart and crafty.

Meanwhile, back at Portola, the limpid wizard had realized his mistake. He dissolved the magic whale and, emboldened by this rare success, enchanted another. This one he called Big Rock Candy Mountain and cast about for the means of feeding it. The Brands were still at Portola, engaged in cataloging the whole earth, an ambitious project. Stewart had the knack of manufacturing money in improbable ways and astounding quantities, Lois the knack of suppressing its prompt evaporation. They suited the wizard admirably. And so the years passed with little noteworthy event. A few characters, more or less dubious, were added to the cast -Pete Sessions, Jerry Brown and Dennis Allison. Lois and Mary Jo became friends, discovered they had a common interest and laid the foundation for a joint, and unenviable, reputation. Many happy hours were spent in the tavern at Peter Harbor, where the Albrechts lived on a 40 foot ketch, but there was still no dragon, and little hint of the egg which was slowly hatching until one day the black cloud of Tecnica lifted, the sun shone and the Jolly DEC Giant strode onto the scene.

Val Skalabrin was a salesman for a thoroughly reputable manufacturer of thoroughly reputable computers and had a PDP8L with 4K, for demonstration purposes. He had built for it, with loving care and exquisite workmanship, a rollaround stand and it soon became a familiar, if unprepossessing, sight, trundling into the Dymax office propelled by the shambling giant. For the giant, it turned out, had a thoroughly amoral streak and delighted to have little children play games on his unwitting employer's property. Dymax, then in the hinterland of Redwood City, thus became a center of subversion, where computer time was wasted on mere fun. There was, it is true, an intermittency about the prescence of the PDP8L which was limiting, but the seed had been sown and the more perceptive (speaking with hindsight) were clearly able to discern the chip chip chip of a hatching dragon.

Then one day the egg split asunder. The Jolly DEC Giant received the dread news that he had been recalled to the grim castle of Maynard, the capitol of Eduland. As he hastened to obey he passed by Dymax, met Bob and gestured to the PDP8L. "Take it," he said, with characteristic generosity, "It's not mine anyway." Bob, who had been at the gin again, stared at this magnificent gift until there crept into his befuddled brain the realization that he had, at last, a computer of his very own, to do with as he pleased - and thus was born a dragon.

continued

Dymax moved, to Menlo Park, but the reputable computer manufacturer soon found the new address and enquired, timidly, after the PDP8L. By this time Bob had taught a course, 'Games Computers Play', at Peninsula School and had the bit firmly between his teeth. Talking swiftly and persuasively he bartered the writing of a book - 'Populution. A Self Teaching BASIC Primer' for the 8L and one TTY, 'Advanced Problems for Computer Mathematics' for another TTY and 4K to drive it and, before the bemused manufacturer could gather its wits sufficiently to hang up on him, three more books on business data processing for a PDP8E. Bob, Leroy and Pete Sessions wrote the books, 20% of Dymax's space was contributed and slowly a computer center grew, to the delight of hundreds of the local school children.

The first stage, PDP8L with 4K and TTY plus one dial up TTY (running on computer time contributed free by HP) was soon outgrown. Addition of another 4K to the 8L made it capable of supporting a second TTY. Comparatively few school children could get to the center, so the computers went to the children, generating a probably unrivalled fund of experience on the transport of TTYs in a VW bus. Still there was not enough equipment so the PDP8E came, with 16K, and the computer center could field two computers and four terminals. More characters appeared, amongst them Dave Kaufman and Howie Franklin, who, it was hoped, would manage the center. Dymax, of course, was a profit making corporation (and making enough to support all this) so it was decided to create another Thing, but this time a Good Thing, called Peoples Computer Company, which would publish a newspaper, run the center and do divers other things allowable under the general non profit corporation laws of the State of California.....

Meanwhile, back at Portola the Brands, having sold the first of the last catalogs of the whole earth and cleared over a million in green stuff in a non profit business, became disenchanted with wizardry and made a point. Anyone who sits on a pile that big has both privileges and responsibilities, so they were divided, with commendable equity, according to their needs and abilities. He took the privilege of spending it and she, being a woman, was given the responsibility of accounting for it. This left her with much spare time, which was fortunate, for lest PCC (now a nearly adult, full fledged dragon) become unruly and mayhap devour its creators, a stern and doughty band was needed to order and control it. So Bob and Mary Jo, the Jolly DEC Giant, Bob Kahn, Marc LeBrun, Dennis Allison and Lois became the first board of directors and, in 1973, PCC was incorporated.

Even before this, the dragon, which was mature to the point of precocity, had laid an egg, though no one noticed until it too was ready to hatch. Dymax, finding the center too much for its limited space, had rented the store next door and called it Peoples Computer Center, or PCC, to avoid confusion with Peoples Computer Company, or PCC. This grew and prospered, so Howie replaced Mary Jo as a director of PCC in order to better run PCC (the other one). All the equipment belonged to Dymax, so a book was undertaken (a method which had the merit of tradition) so that PCC could have its own. The book, published jointly with HP, went to press as the new dragon began to hatch. PCC (Company) had divided into three divisions, the news paper, the bookstore and the center. Bob ran the newspaper, Lois (who had become single, fallen on hard times and married an Englishman) ran the bookstore and Howie the center, with the aid of Joanne Verplank, Dave Rayburn and others. It was decided that the Center (or PCC) should be separated from PCC (the Company) and form a new corporation, Peoples Computer Center (or PCC).

Simultaneously, there came the great flood. The skies opened and it was discovered that the newly installed roof was not all it had been cracked up to be. Over Dymax and the newspaper there was a split 36 feet long, and over the Center it was nearly as bad. The roofer, it appeared, did not roof in the rain, and could not stop the leaks in the dry, so PCC the old dragon, his fire steaming and almost out, to a new home in downtown Menlo Park, selected partly for the wallpaper and mostly for its proximity to the Village Host, which sells draught Anchor Steam Beer and fine Pizzas.

But there was still the question of the book, which had been written to provide equipment, so it was decided that the new dragon should be able to buy the book at cost and retail it, spending the profits on equipment, while Peoples Computer Company, the original Dragon, would sell it through the bookstore and wholesale it, giving half the profit to the new dragon and putting the remainder away in a fund to buy equipment which could help new dragons to hatch.

This is my story and I'm sticking to it until compelled to take the fifth - but if you don't believe it, call 323 6117 and you will get an old dragon, 326 4444 and you will get a young one.....

K.B.

FACT.

THE OLD DRAGON, Peoples Computer Company is a non profit Corporation, incorporated 6/7/73, holding tax exempt status under sections 23701(d) and 509(a)(2) of State and Federal tax codes. PCC is a low budget operation, principally because few people have been paid and the payment has been minimial. Bob has never been paid, Lois is paid $150 a month as business manager and for running the bookstore. A few others have received wages in the past, but, excluding the wages of the staff at the center, this has averaged less than another $100 per month. Office overhead is about $150 per month, plus another $100 for postage. Each newspaper issue costs about $800, printed and mailed. People receive $10 for each page laid out camera ready. PCC is supported by the newspaper subscriptions, the revenue on books sold through the bookstore and much good will. Equipment donated to PCC is used educationally and may be loaned to other non profit organizations, with the requirement that any software developed using it be placed in the public domain.

THE NEW DRAGON, Peoples Computer Center has submitted articles of incorporation to the Secretary of State and applied for tax exempt status. It will consist of the people and equipment of the division which ran the old center and will be totally independent of the old dragon. Its staff currently receive about $6 an hour for teaching, $1 an hour for looking after the place, $2.50 for cleaning it and $8 an hour for programming. Its overhead is about $500 per month. It will be supported by payments for rental of computer time, about a $1 an hour, payments for classes and for programming consultation done for other non profit organizations involved in computer related educational projects.

WTDAYHR or PCC's First Book of Computer Games can be bought from the Peoples Computer Company Bookstore, or Peoples Computer Center, or HP.

- Profits from books purchased from PCCenter (the new dragon) are used to acquire hardware for the center in Menlo Park.

- Profits from books purchased from PCCompany (the old dragon) are split two ways. Half goes to PCCenter (the new dragon) and the other half is placed in a special fund to buy hardware that may be used to help start other centers.

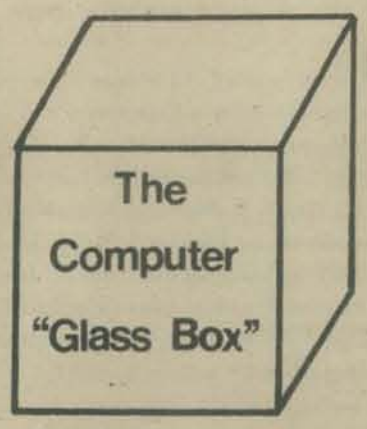
STOP PRESS Secretary of State, after mulling for a week, rejected our proffered articles - name too similar to someone elses and likely to lead to confusion. Our baby dragon is nameless.....

excerpts from

Volume XIV
Number 4

April, 1974

educational technology



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What is a COMPUTER GLASS BOX??? – – – It is a short and quickly comprehensible computer program which is used as a basis for learning. Such a program embodies a concept, a procedure, or an interrelationship and is written as simple and clearly as possible.

This approach uses a computer program more as a "glass box" than a "black" box.† The formal definition of such a program serves to reveal and elucidate concepts; that is, by observing the structure of the program as well as its behavior, key understandings may become *transparent* to the student.

The ideal glass box program has the following characteristics:

- simplicity
- comprehensibility
- flexibility
- generality
- elegance
- provocative implications

By "simplicity" I mean that a single idea of modest scope is to be taught using a brief program (about 10 lines of computer coding taking less than five minutes to type). By "comprehensibility" I mean using clear, readable commands (usually one per line) with well-chosen mnemonic identifiers. By "flexibility" I mean a program design which is easily modified and which can be used naturally with other programs through the use of modular structuring (nested subprograms with explicit resultants). By "generality" I mean using mathematical models which extend to many or all cases. By "elegance" I mean particular choice of expressions which strike aesthetic chords. And, finally, a glass box program is "provocative" when its implications suggest interesting followup discussions.

What can you do with a glass box program? You can:

- examine the program's definition (intuitively)
- analyze the program's definition (logically)
- predict the outcomes of the program
- execute the program on a computer
- scrutinize its behavior
- experiment with applications of the program
- modify or expand the program
- generalize the program
- invent new or related programs
- discuss implications with teachers and peers

For example, consider the following "glass box" program, written in A Programming Language.††

This program††† models – albeit crudely — an emotional reaction.

```
     ∇ TEMPER
[1]    EMOTION ← 0
[2]   NEW: EMOTION ← ⌷ + EMOTION ÷ 2
[3]    →MAD IF EMOTION > 10
[4]    →NEW
[5]    MAD: '**!?!**?!!'
     ∇
```

The program begins with zero EMOTION and then encounters a series of numbers, representing "events" in the life of the program. A low number is low in emotional significance; high numbers are highly emotion-producing.

Each time a number is entered, the program generates a NEW EMOTION based on a simple mathematical model (expressed on line [2]): EMOTION becomes the number just entered plus one half of the previous EMOTION. (In the course of human events, this might be like the ameliorating effect of time on emotional burdens, i.e., "sleeping on your troubles.")

This process continues until a test condition – the "threshold" for mad behavior – is exceeded (see line [3]). The program goes MAD if EMOTION ever becomes greater than 10. (**!?!**?!! printed by line [5] is the computer's programmed vernacular.)

NOTE:

"IF" is an APL user-defined function (subprogram) used to facilitate the reading of branching commands. Its definition is –

```
     ∇ BRANCH ← LINE  IF  CONDITION
[1]    BRANCH ← CONDITION/LINE
     ∇
```

footnotes

† This glass box approach to teaching represents a synthesis of ideas put forth by three others: MIT's Seymour Papert has recommended that children study procedures actively by using a computer programming language (LOGO) as a conceptual framework. Kenneth Iverson of IBM has persistently stressed simplicity and generality in using APL to expose fundamentals in a variety of mathematical and scientific disciplines. IBM's Paul Berry first advocated open use of APL glass boxes as a strategy for teaching in what he called the "functional approach."

†† A Programming Language (abbreviated APL) is a multipurpose computer programming lagnauge developed by Kenneth Iverson of IBM. Originally conceived as a unifying mathematical notation, APL has since been used successfully in many fields, including business, scientific research and education.

††† This program is similar to one written in a simplified FORTRAN by John Loehlin in Computer Models of Personality. New York; Random House, 1968.

To use this program, type its name (TEMPER) and then enter a sequence of numbers. For example:

```
                TEMPER

□:

        4       Where 4 is like
                stubbing your toe
□:

        6       6 is like losing your wallet

□:

        8       8 is like missing the last bus

**!?!**?!!
```

This sequence produced MAD behavior.

But, suppose you try entering the same numbers in a different order:

```
                TEMPER

□:

        8

□:

        6

□:

        4

□:

        →
```

Here the program does not display **!?!**?!!. Apparently, (for this model) the sequence 8 6 4 is "tolerable," whereas the previous sequence 4 6 8 clearly was not tolerable!

(Again, this suggests an analogy with human behavior: experiencing the most emotion-packed events first and then tapering off may be more tolerable than the reverse.)

Other variations of input also suggest interpretation in terms of human psychology. Sandwiching a low-emotion event between two high-emotion events, say 7 2 7, can make the total events tolerable; by contrast, the sequences 7 7 2 and 2 7 7 produce mad behavior.

The mathematics underlying this TEMPER model can be exposed quickly and naturally. For example, after some experimentation with the program, a child might wonder: How many 5s can the program take before it "blows its top?"

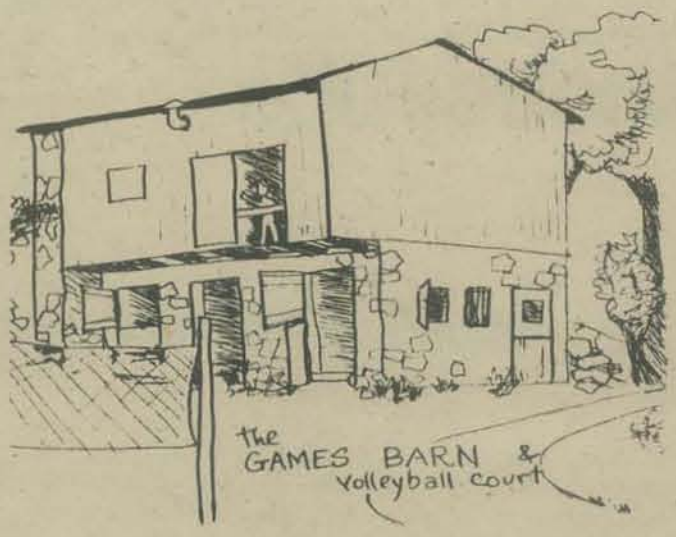
```
                TEMPER

□:

        5

□:

        5

□:

        5

□:

        5

□:

        5

□:

        5

□:

        .
        .
        .
```

A sequence of 5s builds up EMOTION to higher and higher values, but never reaches 10. Why not?

$$5\times\left(1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\cdots\right)=?$$

Some simple modifications of the TEMPER program you might make are: (a) change the threshold, e.g., from 10 to 25 for higher tolerance, or to ?25 (a random number) for unpredictable behavior; (b) modify the model, e.g., from EMOTION ÷ 2, to EMOTION ÷ 3, to express stronger "forgetting," (c) adapt the program for use by others, e.g., inserting conversational statements such as "ENTER NUMBERS FROM 1 TO 9" or even "CAUTION! THIS PROGRAM MAY BECOME EMOTIONAL", and (d) make the program dynamic, e.g., automatically resetting EMOTION to 0 after an emotional catharsis. Other possible extensions of TEMPER include: (a) writing related programs, such as a version with multiple emotional dimensions like ANGER, FEAR and LOVE, and (b) writing companion programs, such as two TEMPER-like programs which interact with each other so that one's output is the other's input.

Have fun watching your TEMPER!



THE GAMES PRESERVE

A NON-PROFIT CORPORATION

The Games Preserve was founded in 1971 to promote the use of games in education, therapy, business and industry. We provide institutions and individuals with the environment and guidance helpful in the exploration of the gaming process.

BERNARD DE KOVEN

Premise: We're playing this game because we want to. We chose this game because we both like playing it with each other. It doesn't mean anything else – it's only a game.

Logical Conclusions: If you win all the time, we aren't playing the right game. The challenge, the possibility of equality, is gone. So, we can change the game or play another one. If you lose all the time, same thing. If we tie all the time, we've broken the game. The possibility of equality becomes a fact, so we lose interest. If we're not quite sure who's going to win, we've got the game. Winning and losing helps us to make a judgement about the game. It doesn't help us to judge each other. Win/loss is a game rule. Win/loss is a tool to help us find the fight game. The game is a tool which we can use in our search for ways we can play together. The game is less important than we are.

Field Survey: There are thousands of games. There are as many ways to play each game as there are people to play with.

Random Sampling: Chuck (6) and Shael (7) are playing Monster. Bernie (33) is the monster. Bernie chases Chuck. Chuck runs to the steps, screaming: "Steps are base!" Bernie chases Shael. She runs around the table. The chase dizzies the twain. Bernie changes direction.. Shael says: "You have to keep going the same way." Bernie looks for Chuck. Chuck runs back to the steps. Bernie is becoming an exhausted monster. Slowly, monsterly, he approaches Shael. Chuck shoots Bernie. Bernie dies, gratefully. Shael says: "If we kiss you, you come alive again." Shael and Chuck disseminate. Bernie revives. Chuck shoots. Bernie embraces death. Shael kisses. Bernie menaces. Shael shoots. Bernie et ceteras.

Intellectualization: We've found a new way to play monster. At first, Bernie was too threatening. Fast and huge was the monster. Thus, his victims sought the safety of rules: steps, direction. Then we discovered the power over life and death. The victims regained absolute control, and the monster the sweet repose of occasional demise.

Radical Departure: If the rules we played by vecame the rules for monster, other people might not want to play. They might find it more fun to take turns being monster, to chase the monster, to transform the monster into a potato chip and eat him. On the other hand, if the rules we discovered provided many people with a way to play, our way would become the "real" game. Other ways would be considered variations. Until it happened that one of the variations took on its own identity. Let's play Potato Chip.

Generalization: Once a game is named and popularized, it becomes "real." The real game is no more real thany any other game. It's real because it can be understood easily and played enjoyably by many different people. Most games that we consider real are transmitted in the form which is easiest for the most people to comprehend. That form may not necessarily be the best form of the game. It is simply one that is most recognizable..

Logical Deduction: Therefore, any game is a variation, and open to further variation. Though a particular form of a game may be particularly elegant, it in no way precludes the possibility that a less elegant form may be more satisfactory for those who have agreed to play. It might be more fun for us to play a game of chess if we change colors every third move, or we rearrange the pieces, or we decide that a stalemate is better than a checkmate, or if the kings moves are decided by the roll of a die, or if we play on a bigger board, or a circular board, or if the pieces are capable of moving themselves, or if each player is a piece, or if we have to describe why we make each move, or if we work together to discover the best of all possible strategies, or create a new notation system, or play checkers.

Relineation of Objectives: A game provides us with a place to meet. If we have the freedom to negotiate for the kind of rules we both want to play by, we have the freedom to renegotiate and reaffirm the game contract. We are released from having to prove ourselves according to criteria which may be outside of our reason for playing. We are provided with a tool which allows us to question any criterion and evolve goals which we both find meaningful. We become more important than the game we are playing.

Ramification A – Rule Making: Perhaps one of the most complex of cognitive activities is the development of a rule. Determining the efficiency of any rule requires full engagement of the scientific process: abstraction, generalization, testing, specification. Since the goal is to arrive at an enjoyable game, the affective domain is also fully engaged.

Ramification B – Curriculum: If we agree that we are more important than the game we are playing, the function of curriculum, therefore, becomes to provide optional, negotiable structures whose efficacy is determined by how frequently they are chosen by some. Curriculum becomes a descriptive rather than proscriptive tool. It provides the teacher/facilitator with information about the structures of learning each child finds the most satisfactory.

Ramification C – Exercise of Knowledge: When we meet in a game, we bring to it what we already know. For us to enjoy playing the game together, there must be come equality in the information we haye prior to the game. We must both know the rules we are playing by, the elements of chance or strategy, the principles of combination and permutation, the significance of position. Our access to the symbology of game communication must be shared, for what we learn through the game is how we can recombine the information at our disposal. Thus, through the game, we discover, create, expose, test, evaluate and share new synthethis. We engage in a symbolic debate whose outcome is determined more by the way in which pieces of information are related than by the information itself. Thus, the knowledge we gain is in the art as well as the act of cognition.

Ramification D – Acquisition of Knowledge – The Play Mind: I voluntarily, temporarily suspend certain goals. Thus, I am: (1) aware that I have made a choice, (2) aware of the temporarility of the act of suspension and, therefore, understand that there will be an end point, and (3) aware that I have negated a set of goals which I would otherwise pursue. I know that I am playing, and that I am chosing to do nothing else but play. The temporary suspension of goals allows the play mind to explore certain boundaries which it would otherwise assume to be unchallengable. My understanding of marbles is bounded by my assumption that marbles are for rolling. If I suspend the act of rolling

"It's simulation. But if the building moves, then it's something else–"

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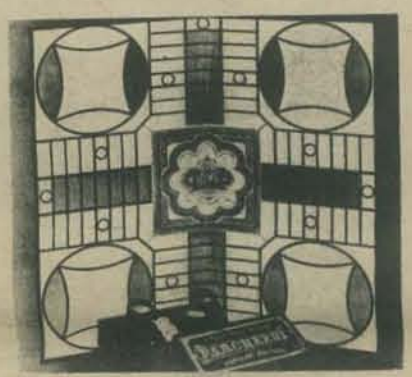
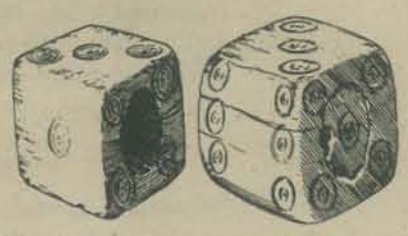




and the subsequent set of goals, I might discover that I can also drop marbles like bombs. The exploration of these boundaries leads to a meeting between fantasy and reality, between the perceived and the believed, between object and image, coincidence and distinction. This meeting, which most characterizes the play mind, is paradox, the resolution of which is suspended in fascination. Eventually, the play mind discovers a common goal – one that is shared by both sides of the boundary. This goal, or set of goals, temporarily replaces those which the play mind has suspended. As a result, the play mind enters the game state in which it explores the relationship that exists between those parts which are in pursuit of the newly perceived goal. Thus, the marbles become bombs, my hand the airplane, my voice the control tower and the explosion, while other marbles become targets. New information is made available through this pursuit, and then synthesized into the game. This information takes precedence over the embodiment of the game. Thus, the play mind might willingly relinquish marbles for the sake of blocks. The resulting configurations of blocks scattered on the floor might lead the fascination away from bombing, towards the creation of bomb-proof structures. As the play goal and the consequent relationship become identified, the embodiment also becomes fixed. A game has been created in which the relationship between bomb and shelter is explored through the medium of blocks. The play mind has established a fiction which allows it to pursue a particular reality.

Reminder: The conception of the play mind is, in itself, fictional. It was created for the sake of illustration. The affect of defining any state of mind is to separate it from another. The result is a mechanical analogy. It need not be taken seriously.

Consideration: A teacher who wishes to determine whether or not a game is useful in teaching reading looks to see if the pieces have letters on them. A teacher seeking a math game looks for numbers. Though a child can instantly "read" the position on the checkerboard, can successfully project the impact of a move into a situation which might occur twelve moves later, can trace the evolution of a position to a move that occurred twelve moves before, though all of this is true, it bears no relation to the curriculum as perceived by the teacher. On the other hand, scrabble should be perfect. It has letters. It builds vocabulary. It is a reading game. Of course, it also has numbers. Scores are doubled or tripled according to placement and position of the letters. The best word is determined by its relative score value. So maybe it's a math game. So maybe it really shouldn't be used because I don't know what kind of game it is.

Hypotheoretical Definition: A game is for the act of fascination. Its purpose is to facilitate wonder.

Design Implications for the Educational Gamemaster: (1) construct a program which responds to the impulse to play and provides optional embodiments for the game, (2) begin the program with a sense of wonder and end it with an opportunity for surprise – let the game express your own amazement, and let it provide the player the option to discover his, (3) provide children with the skills to design their own games – begin by including the opportunity for constructive cheating, (4) let the terminal be the medium for the messages of play.

Notes: Nothing said in this piece was meant to be particularly new or startling. My objective was to reconfirm the experiences that brought you to games and brought us together in this paper.

THE GAMES PRESERVE

RD 1 Box 361
Fleetwood, Pa.
19522

MUSIC OF A SORT

By

Steven Dompier

IT WORKS!

I received my ALTAIR 8800 in the mail at 10 am, and 30 hours later it was up and running with only one bug in the memory! That turned out to be a scratch in a printed circut land that took 6 more hours to find. After that was fixed, everything worked!!

Now, what do you do with a machine that so far has no I/O boards or peripherals?? Well, there's always the front panel switches and machine language, so I was soon busy making up programs to test all of the 8080's functions; and getting a good set of caluses on my ten input devices! There's a lot of 8080 instructions!!

ZZZIIIPPP!

I had just finished setting in a 'sort' program, and at the same time I was listening to a weather broadcast on a little transistor low frequency radio, which was sitting next to the Altair. I hit the 'run' switch on the computer and it took off sorting the same list of numbers over and over again.

At the same time my radio also took off !!
The computer was sorting numbers and the radio was going ZZZIIIPP! ZZZIIIPP! ZZZIIIPP!!!

"Well what da ya know!
My first peripheral device!!!"

The radio was picking up the switching noise of the 8800! I tried some other programs to see what they sounded like, and after about 8 hours of messing around I had myself a program that could produce musical tones and actually make music; of a sort. (Or any other program you have!)

MUSIC!

The closest sheet of music that I could find was "THE FOOL ON THE HILL", by the Beatles, so I translated it into OCTAL code, picked up the Altair, and headed down to Menlo Park for the 3rd meeting of the 'BAACUG-HBCC'.* I thought everyone there should see just what a computer can do!

* Initalization of "BAY AREA AMATEUR COMPUTER USERS GROUP-HOME BREW COMPUTER CLUB"

RECITAL!

This being the Altairs' first recital , it was a bit shy at first, and refused to power up. (Even though Freds tape recorder was plugged into the same wall outlet and working just fine.) One forty foot extension cord and half an hour later we were ready. Freds tape machine turned out to be running on its own battery power, and all of the wall plugs were dead!

The recital then proceeded with nary a glitch, much to everyones delight. (Although during the demanded encore, the machine did break into its own rendition of 'Daisy', apparently genetically inherited.)

PROGRAM TO MAKE AN ALTAIR 8800 PLAY MUSIC

```
000   LXI H    041
001   b2       xxx  -  ADDRESS OF FIRST
002   b3       xxx     DATA ENTRY
003   MOV A,M  176
004   CPI      376
005   b2       377  -  START OVER DATA
006   JZ       312
007   b2       000
010   b3       000

011   MVI D    026
012   b2       xxx  -  TEMPO DATA
013   DCR B    005
014   JNZ      302
015   b2       020
016   b3       000
017   MOV B,M  106

020   DCR C    015
021   JNZ      302
022   b2       013
023   b3       000
024   DCR D    025
025   JNZ      302
026   b2       013
027   b3       000

030   INR L    054
031   JMP      303
032   b2       003
033   b3       000
```

TO RUN THE PROGRAM:

To run the program, push the 'RESET' switch, then push the 'RUN' switch.

To stop the program, push the 'STOP' switch.

TO MAKE YOUR OWN MUSIC:

Begin loading your music data anyplace after address 034. Be sure to load the starting address into H&L at address 002, 003.

Each data entry will be one beat of music.

OCTAL CODES FOR NOTES

C	252	LOW OCTAVE
C#	240	
D	230	
D#	220	
E	211	
F	200	
F#	172	
G	162	
G#	154	
A	146	
A#	140	
B	132	
C	125	MIDDLE OCTAVE
C#	120	
D	114	
D#	110	
E	105	
F	100	
F#	075	
G	071	
G#	066	
A	063	
A#	060	
B	055	
C	053	HIGH OCTAVE
C#	050	
D	046	
D#	044	
E	042	
F	040	
F#	036	
G	034	
G#	033	
A	031	
A#	030	
B	026	
C	025	
Q	002	Note; This is the quietest of the data notes. It can be used for spaces and rests. You may also like to put a number of these quiet 'notes' at the end of the music data, to give a space between playings.

Data For "THE FOOL ON THE HILL" Beatles

Address	Data	Address	Data
040	105	120	055
041	105	121	053
042	125	122	071
043	100	123	066
044	071	124	100
045	063	125	071
046	063	126	071
047	063	127	100
050	071	130	071
051	063	131	066
052	055	132	066
053	053	133	071
054	053	134	100
055	055	135	100
056	071	136	100
057	063	137	071
060	046	140	066
061	046	141	060
062	046	142	060
063	071	143	066
064	063	144	071
065	046	145	066
066	046	146	066
067	053	147	060
070	042	150	053
071	046	151	046
072	046	152	046
073	063	153	046
074	071	154	046
075	063	155	044
076	053	156	046
077	053	157	053
100	063	160	053
101	053	161	053
102	071	162	053
103	063	163	053
104	063	164	002
105	071	165	002
106	063	166	002
107	046	167	377
110	046		
111	046		
112	053		
113	042		
114	053		
115	046		
116	046		
117	053		

Data for "DAISY"

Address	Data	Address	Data
170	034	250	040
171	034	251	042
172	034	252	046
173	042	253	034
174	042	254	034
175	042	255	042
176	053	256	046
177	053	257	053
200	053	260	053
201	071	261	053
202	071	262	053
203	071	263	046
204	063	264	042
205	055	265	042
206	053	266	053
207	063	267	063
210	063	270	063
211	053	271	053
212	071	272	063
213	071	273	071
214	071	274	071
215	071	275	071
216	071	276	071
217	071	277	071
220	046	300	053
221	046	301	053
222	046	302	042
223	034	303	046
224	034	304	046
225	034	305	071
226	042	306	053
227	042	307	053
230	042	310	042
231	053	311	046
232	053	312	042
233	053	313	040
234	063	314	034
235	055	315	042
236	053	316	053
237	046	317	046
240	046	320	046
241	042	321	071
242	046	322	053
243	046	323	053
244	046	324	053
245	046	325	053
246	046	326	002
247	042	327	377

NOTES:

TEMPO; The tempo is controlled by the value placed in address 012. Start out by trying 040.

TO PLAY BACKWARDS: Put 377 in front of all music data.(to cause looping) Change address 001 to read the END of the music data. Change address 030 to DCR L (055).

TO PLAY ALL OF THE MEMORY: Change address 001 data to a NOP (000) Change address 004, 005, 006 to NOP (000) This will cause program to read all of the memory, including the program instructions themselves.

RADIO INFORMATION: A low frequency radio around 330 KC works best, but any AM radio will pick up the music at quiet places on the dial.

Set the radio on or very close to the computer, start the program, and turn the dial on the radio until you get good sound. Some places will be much better than others, and some will pick up different sounds from the computer. Also, try moving the radio to different positions on or around the computer. Just rotating the radio 90 degrees can make a lot of difference in the sound you will get.

With a little experimentation, you can make all kinds of interesting sounds. ie; sirens, ray-guns, etc.

Steven Dompier
2136 Essex St.
Berkeley, Calif. 94705
(415) 841-1868

COMPUTERS FOR KIDS

Thanks for getting the copy of WHAT TO DO . . . etc. to me. I will use it as an exhibit at the OCESS workshop at the Center of Science and Industry on the 12th.

I am also going to distribute the copies of PCC you so generously supplied. I will be attending a meeting of the Texas Instruments Minicomputer users group in Dayton next week and I'll distribute some there too.

I started my Systems Programming class (CIS 641N) at Ohio State last night with 'chip Basic' for the 8080 as an alternative class project - - I think we can probably accomplish it using the University of Illinois implementation as a model. Anyway, we will also have a floating point package available by the end of the quarter. Any of your readers that might be interested can drop me a line.

The local Western Electric plant here has volunteered a PDP - 8 for the Center of Science and Industry which gives us a start on our kid's lab project. I hope we get an ASR with it. I'll give more details when I get more time.

Thanks again,

Fred Hatfield

Computer Data Systems, Inc.
1372 Grandview Ave.
Columbus, Ohio 43212

(614) 486-0677

A "QUESTIONABLE" LETTER

I'd be interested in gathering info. on the various public access projects that are in operation around the country. Would you like to publish a questionairre along the lines of the enclosed draft ? I'd be willing to tabulate and survey the results for my part.

I'm inspired to do this because I recently learned of two public access projects in Canada and wonder how many others there are that I'm unaware of.

Sincerely,

Larry Press
128 Park Pl.
Venice, Ca. 90291

P.S. Dave Ahl will also run a version of this questionaire in "Creative Computing"

PEOPLE STARTING CENTERS

LO*OP

Here's a letter so you don't have to try to remember all the things I ask you.

First – Thanks for being so encouraging. It's the people to people meetings which really turn me on. Computers are fun but they remain the " means" and won't ever be and end

Second - Here is a " news release" for LO*OP Center. I'm not ready to spread it among the general public but perhaps the PPC readers would enjoy it along with any or all of this letter.

Third - about LO*OP Center - as of today we really are only a **project office**. Our hardware is limited to a telephone, typewriter and a hot plate. I read the PPC articles on buying hardware and found it very helpful. Basically, it led me to the decision: **don't buy anything yet.** I'm going to start with a teletype and a time-sharing account with whomever can provide the cheapest time. This will be more expensive by the hour but cheaper by the month than any in house system I've been able to checkout. Of course, if you run across anyone with a spare machine in Sonoma County I'd love to hear from them - or a timeshare system with a phone north of San Francisco. After we have some users who know what they need and what they can pay, we will probably add an intelligent terminal like the Datapoint. Most of the CAI stuff I'm interested in can run on a 2200 12K Datapoint just fine . However it's maybe a little while before we can play chess. Also, we will outgrow this office and move into a store front by next fall (I hope).

Byebye for now, Liza Loop

LO*OP CENTER
170 E. Cotati Ave.
Suite H
Cotati, Ca. 94928

COMPUTERS IN COTATI

Fun and games, instructions, homework, personal and small business applications -- these are a few of the ways people will be able to use the public computer center planned for Cotati, California.

The LO*OP Center is an educational, non-profit, resource facility, open to people of all ages. Modeled after the People's Computer Center in Menlo Park, Ca., the LO*OP Center aims to bring the technology of the electronic brain out of the domain of the specialist and into the hands of us "just plain folks".

Anyone interested in a novel but challenging pastime will be able to drop in for a game of chess or "Startrek" with the machine. Terminals will be available at a low hourly fee for casual users. More regular users may prefer a monthly membership at the Center or a formal business contract.

Classes in Programming and topics related to the Center's activities will begin as soon as groups of students wish to meet.

Do-it-yourselfers are welcome to teach themselves with the help of the Center's library and Consultants.

Special emphasis will be placed on material for young children which encourages creativity and the knowledge that they are in control of the machine.

A large library of programs of interest to junior high and high school age people has already been developed in centers across the country.

A project office has been established at:
170 East Cotati Ave., Suite H, Cotati, Ca. 94928
(upstairs from Century 21 Realty)

Please satisfy your curiosity by stopping by

Monday and Thursday 9 to Noon
Wednesday 7:30 to 10 pm

or phone 707 795-0405 Liza Loop, director

1. How many public access terminals have you ?
2. Are your terminals owned, borrowed or leased?
3. Is your CPU time owned, borrowed or leased ?
4. Is your project supported by: no one, user's payments, a grant, host institution ?
5. How many hours per week do you provide public access ?
6. Are people available to help during public access hours ?
7. Do you teach classes in terminal operation, programming?
8. How many programs in your public access library ?
9. Are users allowed to program or are they restricted to using library routine ?
10. Which of the following applications do you support:
    1. Game playing programs for recreation and familiarization with terminal operation and functional characteristics of the system.
    2. Local data bases with information on, e.g.
        a. where people work (car pools)
        b. what skills and interests people have
        c. consumer information on local stores-prices, complaints, etc.
    3. How to do it dialogs with reference to local sources of information, people, materials, etc.
    4. On-line opinion polls (with capability for questions and issues to be raised by citizens) on specific local issues such as a proposed zoning change.
    5. On-line suggestion and complaints "box".
    6. Dialogs to guide people in the preparation of forms required by various agencies.
    7. Para-legal/ombudsman dialogs, such as:
        a. How to handle your divorce.
        b. How to get building permits.
        c. How to interpret warranties on retail goods and services.
        d, How to do your own escrow.
        e. What are tennants/landlords rights.
        f. Detecting discrimination in the granting of credit.
        g. Loan payment/interest/term computations.
        h. Help locating sources of credit.
        i. Income tax preparation.
        j. Help in obtaining favorable utility rates.
    8. Consumer guidance dialogs, e.g., how to buy a used car or appliance, with information on local suppliers, consumer reports, etc.
    9. Local want ads.
    10. Dialog to route people to agencies, e.g. drug rehabilitation, family planning, welfare, etc.
    11. Calendar of community events.
    12. Field trips from local schools.
    13. Data Processing for community service organizations.

PEOPLE'S FREE BIT-CRUNCHING FACILITY

There may be many others like me whose only real access to computers consists of batching on a MUM (Monolithic Universal Machine) like the 360-50... More specifically- I'd like to make contributions to PCC but I don't know if anybody would be interested - for example:

> would anybody be interested in a 360 assembler listing of a program that when executed was the functional equivalent of a Tibetan prayer wheel?

I wrote one for a Buddhist friend... It's the 1st religious utility here...

Running on a batch machine seems like kind of a drag, but there are ways of getting around that... However, the setup is not ideal for games and such... One important (at least to me) idea suggests itself -- the sort of thing that the 360 would be well - suited for and that's intermachine conversion and crossassembling...

A) Intermachine conversion-- by this I mean conversion from one machine's internal representation to that of another.

B) Cross-assembling-- You throw into the black box a source listing for the PDP-8, and out comes one one for machine X ...

Both of these ideas would facilitate machine-to-machine communication, and thru that, people - to - people communication... and it seems to me that that's what the whole trip is about (the latter);;;...

I guess where my interests primarily lie is determined by one of my basic beliefs:

A) Computers have great potential for increasing people's personal power ...

B) Wherever people have lots of personal power, "governments" have lots less ... I'm sort of an anarchist, but emphatically **not** the "laissez faire" type ...

By " personal power" I do **not** mean " the power to oppress other people" but " the power to control the direction that one wants to go in".

One thing necessary before a person can feel free to start exploring his/her potential (controlling their direction) is to minimize the amount of non- creative shitwork that seems to pervade his/her life. This is what machines are for... and this applies to the non-computer person as well. Example –

Suppose that you decide to publish this letter (you may, and you may publish the earlier one if you wish) Somebody must read my hen-tracks, and convert them into a format that is more readable by other people. Generally, nowadays, this means transcribing from this letter to a camera-ready form by handtyping... Also, writing this letter is shitwork for me (and would be even more if I typed it on bond paper with conventional formatting) because my thoughts are running much faster than the actual writing - I've only got one "mental buffer" and it fills up and must be emptied before it can be filled again...
The shitwork aspect lies not so much in the content but in the **form** ... handwriting, typing, paper tape, cards, etc.,etc... all involve taking up a persons time in an essentially non creative activity (Calligraphy freaks and other such artists I am **not** talking about eliminating your communication - forms, I'm talking about liberating people.

I guess I'm rambling a bit, but if I had some **halfway decent** I/O devices my thoughts would be a lot more coherent...

My greatest kick, I guess, is writing software (or firmware) that helps acheive objectives in the above... in other words creating **people-augmenting utility routines**... in the **public domain**...

Question about PCC paper-- Do you see yourselves (at least partially) as a **forum** ? Hope so ... particularly I'd like to see more philosophical content in a widely disseminated form (your paper) ... sort of an idea exchange ... How can machines facilitate this ? How can I help ?

I guess that's enough for now ...

I remain, Kurt Cockrum
People's Free Bit-Crunching Facility
3398 Utah
Riverside Ca. 92507

P.S. " People's Free Bit-Crunching Facility" is mainly a mental construct (dream) so far..... the "MUM" more closely approximates reality.....

OASIS

Dear Bob,

My lifelong dream was realized about 8 months ago when I acquired a surplus D-112 built by Digital Computer Controls, Inc. Functionwise the D-112 is "identical" to a PDP-8/ I, and I suspect deliberately copied. After much reworking, I have brought it online with 12 K core and a single TTY interface hooked to a borrowed ASR-33. The EAE option board is missing and I have no leads for replacement as the similarity to a PDP-8 ends beyond the console. I have high speed papertape equip. but as yet neither repaired or interfaced. My major project is music production by computer control and computer assisted composition/performance. I have some rather special purpose "tone generation" hardware interfaced to the "8" that I have designed myself, and a scavenged organ keyboard will be hooked up soon for input. I am quite pleased with the operation of the tone synthesizer and I have augmented it with an interactive language called "MS" which allows real time music production (limited to the even-tempered scale). The hardware is quite simple and greatly reduces processor loading as compared to direct computer synthesis of the tone waveform. Anyway, if anyone there is interested in computer music I would be glad to supply circuit diagrams, program listings, etc. I hope to have a multipart version working soon as well as the ability to control attack envelopes.

At the moment I am researching speech synthesis by computer and would like to hear from anyone with information or an interest in this subject.

My interest in your project is the result of several short articles I have seen in various magazines. Public access to a tool such as the computer is something I feel strongly about. I am professionally employed by Naval Elec. Systems Command, San Diego, in the field of minicomputer applications to communications systems, but I am really interested in more diverse applications. As an "intelligence amplifier" the computer is one of the most wonderful machines invented. Its potential for giving abstract ideas substance (i.e. simulation, gaming, synthesis, calculation) is far out. Several friends and myself are jointly interested in the idea of "computer clusters", or small dedicated computer systems for general purpose use. Several other people that I know have expressed an interest in approaching " the computer" on a recreational / educational basis. Being an avid tinkerer I can keep the D-112 running, and help them bring their ideas to fruition. Please publish this letter if you like as I would enjoy corresponding with people with an interest in computerized **anything**. In San Diego the "OASIS" Computer Center is available to anyone (provided they can get me away from it).

Wayne Holder
2765 Reynard Way
San Diego Ca. 92103

THE SAN FRANCISCO " HOME BREW COMPUTER CLUB"
A Work/Project Oriented Club

We are forming a project oriented computer club in San Francisco which can function as the S.F. chapter of the "Home Brew Computer Club".

Among our **Resources** are:

1. Several large work spaces with well equipped work benches for club members to use. Some electronic help is available for design and inter-face problems.

2. A large stock of electronic parts available on a discount or trade basis.

3. CRT terminals, CRT printers, Serial printers, core memories, 2 Intel 8008's, a Laser, various surplus computer and video gear and electronic/ scientific test equipment available for club use or trade.

4. Vast enthusiasm.

Some of our current **Projects** are:

1. The Temar Electronics' Data Terminal which is in the first stages of production. We need ideas and help to distribute it. Also being developed at Temar are modems and minis and . . .

2. A Bay Area Data Bank for the use of computer amateurs and all other interested parties to exchange ideas, goods and services. The beginnings of this system are now in use at the 24th Street Component Shop and consists of a Cybercom key to tape encoder modified for CRT output. We need more sophisticated machinery, data, and help with data entry.

3. A buyers group (or affiliation with other buyers groups). We would like to be able to buy in OEM quantities. (We can offer a 10% discount to club members on Temar products and engineering services, and on 24th Street Component Shop goods and services.

We need to expand our contacts. We need tinkerers, electronic hobbyists', people who can type, people who can build, and especially people who can help us expand our data base so that eventually, people all over the Bay Area can have practically instantaneous access to each others' goods, ideas and services through a series of inexpensive terminals. If you can help or have anything you want entered into the data bank, please send details to: SETH
4001 24th St.
San Francisco, Ca.
94114

Dear Dragons,

I am looking for time on, preferably, a PDP-8 or equivalent, in the Greater New York area (212).

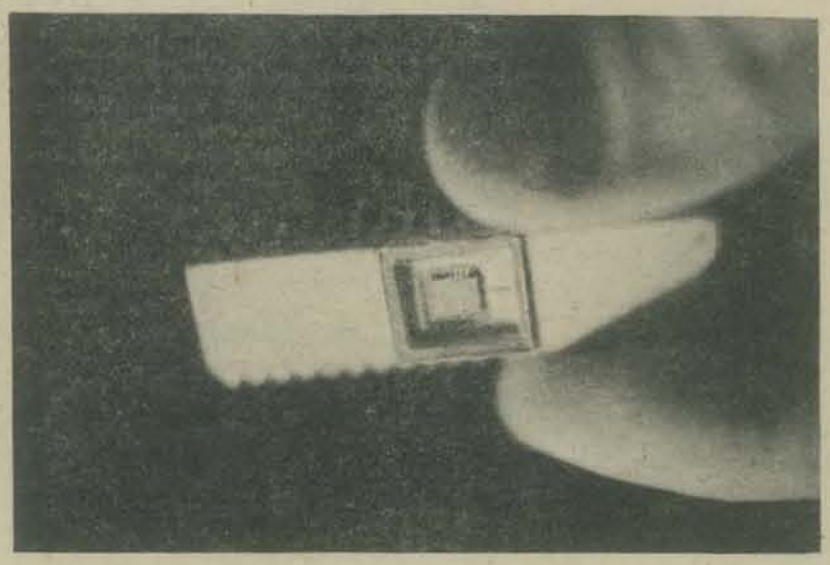
Also I am looking for someone to write to me to trade programs, languages, tips, knowledge, info, etc. (anyone have SPCWAR to run in EDU 25 ?).

Sorosh Ahmed
201 East 28th St.
New York, n.y.
10016

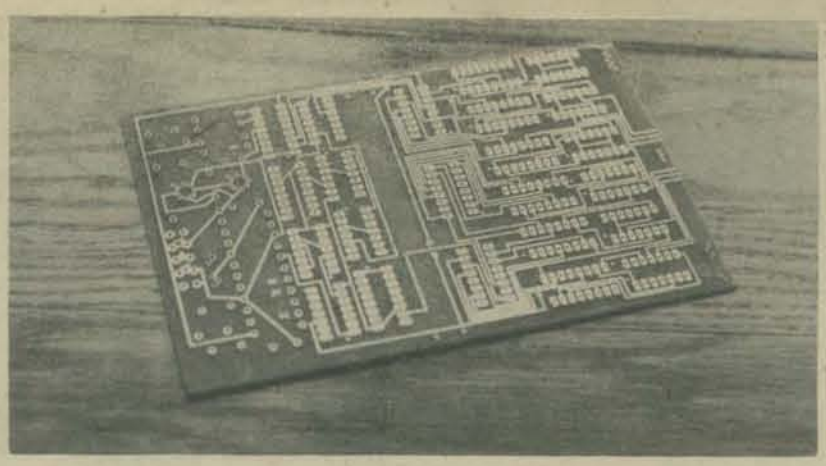
The Inside Story

You probably don't want to risk taking your calculator apart to see what's inside, so these few pages give you the picture without your having to pry apart your case.

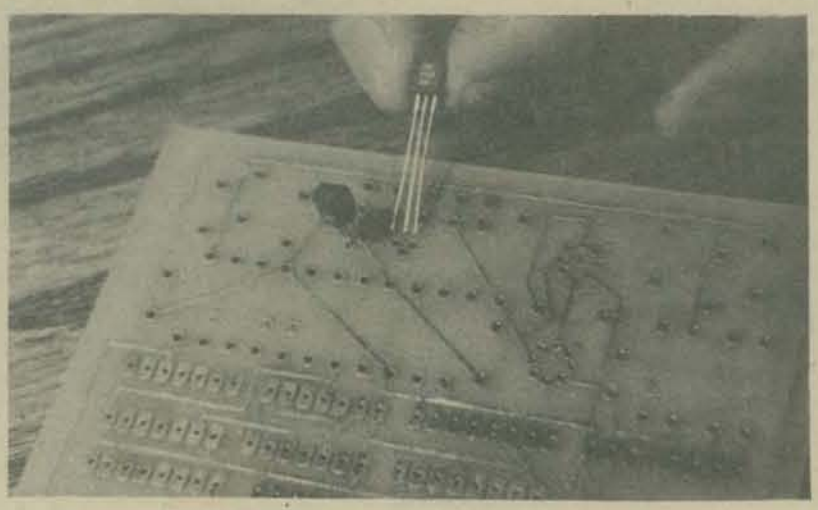
Here's a picture of the "brain" of a calculator, the chip that does all the calculations. The tiny glints that you see are minute wires that run from the chip to the "legs" that carry current to and from the circuit board.



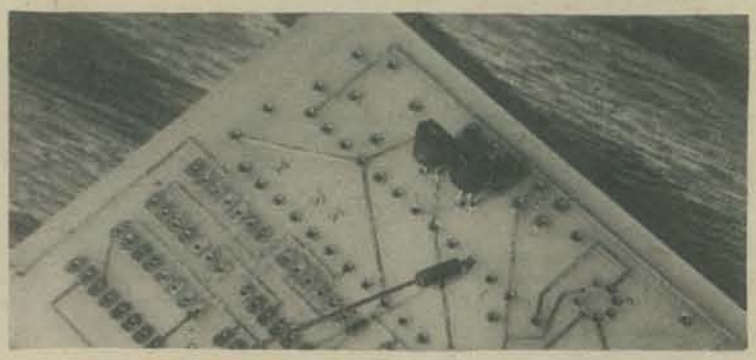
The chip fits on a circuit board like the one you see below. All the wiring has been plated on – only the components remain to be soldered.



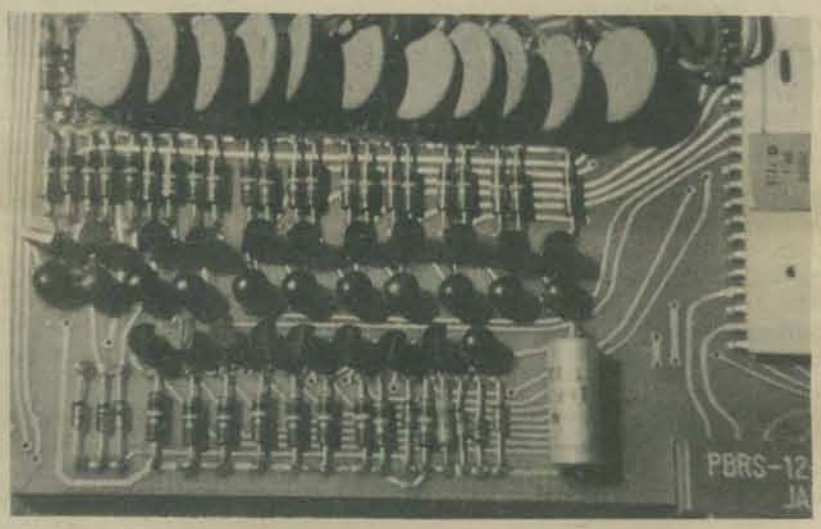
The components are added to the circuit board by "plugging them in". Here the three legs of a transistor are about to be placed in the three holes they fit in.



Two transistors are in, and one leg of the resistor has been put in the circuit board. Notice how long the "leg" of the resistor is. When all the pieces are in the board, the extra lengths of wiring will be cut off, and the back of the board will be soldered.

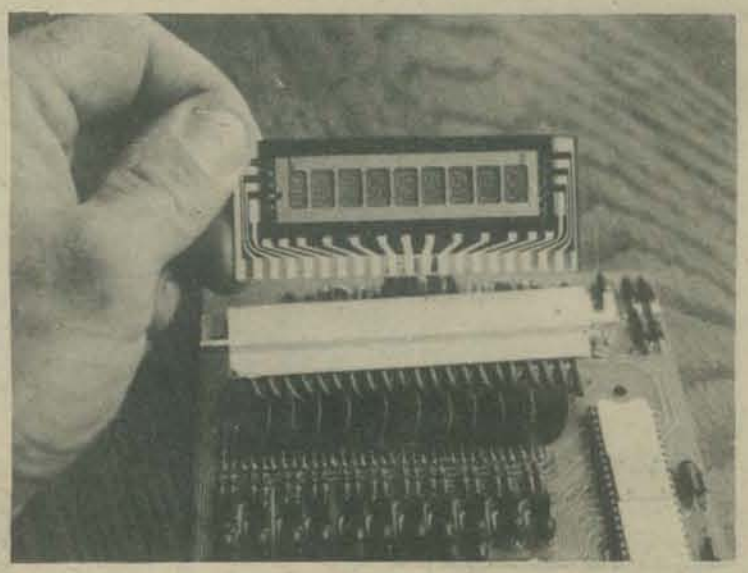


Here is the circuit board completed. The black "water tanks" in the middle are transistors. The striped "tootsie rolls" are resistors. The big can in the lower right is a capacitor. The miniature frisbees at the top of the picture are also capacitors. You can see the 40-legged "brain" on the right of the picture.



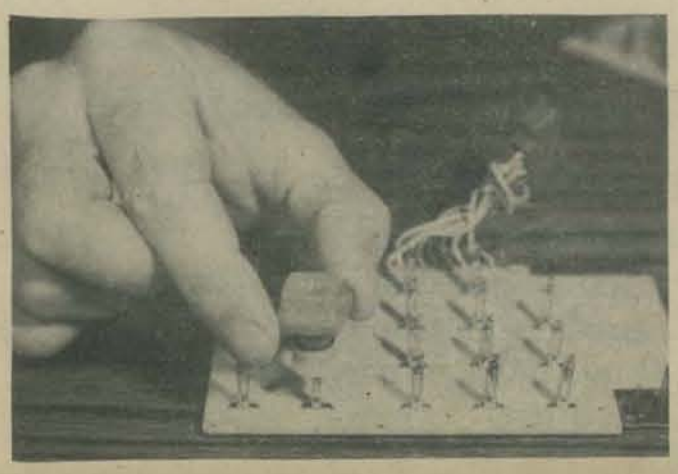
After the circuit board has all the electronic components on it, the display can be plugged in. Each of the thick, white lines is a "wire" that is "painted" on the glass of the display. When a pair of these "wires" is electrified, it lights up one of the seven segments of a digit.

You can see the completed circuit board with the "brain" on it underneath the display.

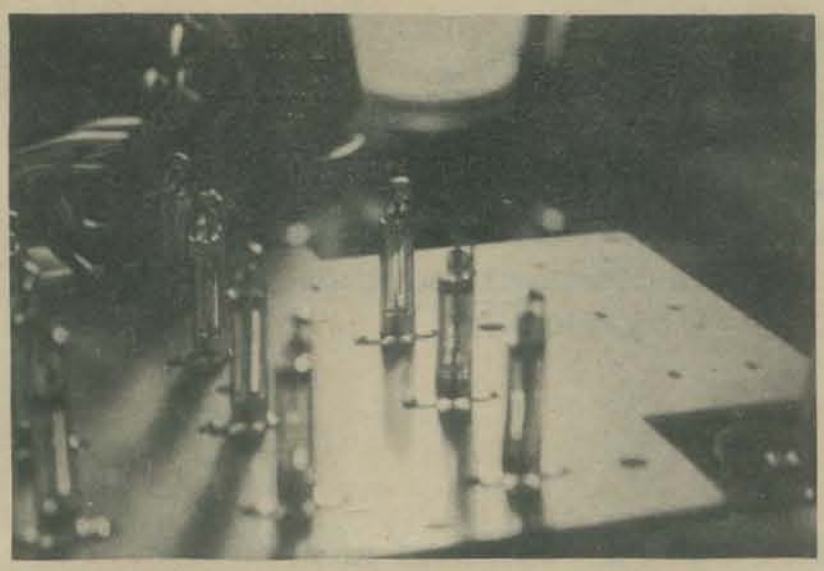


Here is a key seen from underneath. The spring wrapped around the stem pushes it back up after you've pushed the key down. The "doughnut" on the end of the key is a magnet.

The stem of the key is hollow, so the key can go up and down over a reed switch. Each of the "posts" in this picture is a reed switch that fits beneath a key.



This close-up shows an open reed switch inside its little glass housing. When the "doughnut" magnet on a key goes over a reed switch, it closes the switch and sends a little pulse of current to the "brain".



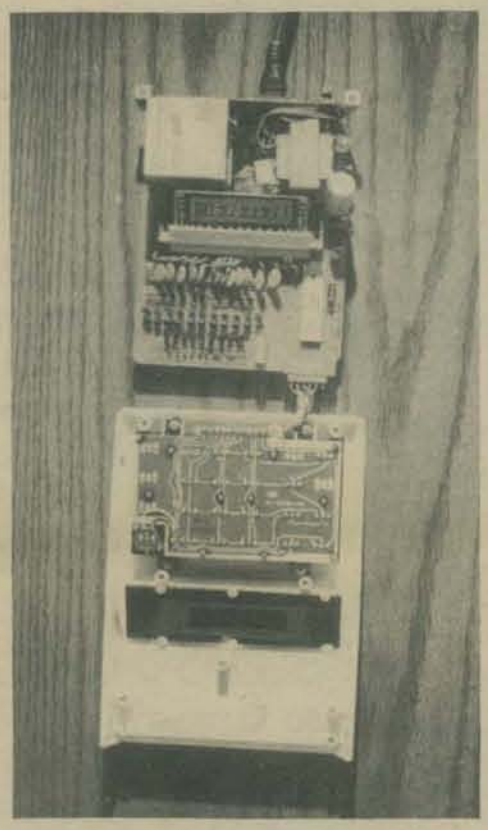
The above was taken from the book *Games, Tricks and Puzzles for a Hand Calculator* written by Wallace Judd and published by Dymax (1974, paper, 91 p.). We have reproduced the Table of Contents and ordering information can be found on the PCC Bookstore page.

Here you see the reed swithces with the 7 key on the switch it should go on. The tops of the 8 and 9 keys have been taken off to show you how the caps fit on the stems. The keyboard just fits over the reed switches, with each key fitting over the proper reed switch. The empty holes in the keyboard are for memory keys which this model doesn't have.

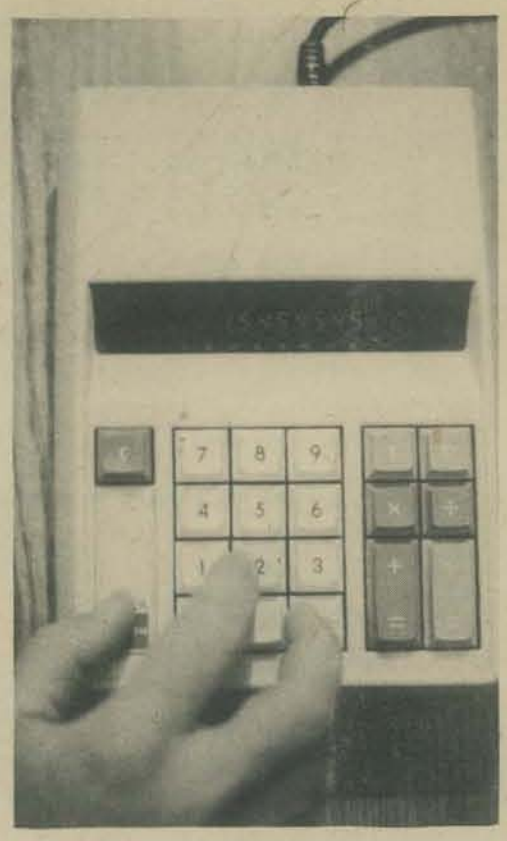
Here is the fully-assembled calculator before it's folded into its case. The digits in the display show it's working.

The bottom part is the back of the keyboard, with the top casing laying face-down on the table.

The white "box" above the display is the battery. You can see the twisted wiring that attaches the keyboard to the circuit board.



And here is the assembled calculator. Yours may be smaller, and look a little bit different on the outside, but inside it's probably a lot like this one.



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

BAGELS

From: WTDAYHR
PCC's FIRST BOOK OF COMPUTER GAMES
Get it from PCC Bookstore

```
WOULD YOU LIKE THE RULES?YES

I AM THINKING OF A THREE DIGIT NUMBER.  YOU CAN GUESS WHAT
NUMBER I HAVE IN MIND AND I WILL TELL YOU:

PICO   - ONE DIGIT IS IN THE WRONG PLACE
FERMI  - ONE DIGIT IS IN THE CORRECT PLACE
BAGELS - NO DIGIT IS CORRECT

OKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :370      PICO
GUESS # 2     :789      BAGELS
GUESS # 3     :102      PICO PICO
GUESS # 4     :014      FERMI
GUESS # 5     :213      PICO
GUESS # 6     :025      FERMI FERMI
GUESS # 7     :026

YOU GOT IT

AGAIN?YES
```

Pico Pico means 2 digits in the wrong place.

Fermi Fermi means 2 digits in the correct place.

Computers No.: 026 026
My Guess: 102 025
Pico Pico Fermi Fermi

Pico Fermi means a digit in the wrong place & a digit in the correct place.

```
OKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :123      PICO
GUESS # 2     :345      PICO
GUESS # 3     :637      PICO FERMI
GUESS # 4     :738      FERMI
GUESS # 5     :936

YOU GOT IT

AGAIN?YES
```

O.K. now I know that 3 is the Fermi. Why? Well, suppose 3 is not the Fermi. Then it could not be the Pico in guesses 1 & 2. In that case, 1 or 2 must be in the number (#1) & 4 or 5 must be in the number (#2). So... don't you see... guess 3 should have been Bagels.

Since 3 is the Fermi, then 7 and 8 are not in the number - so 6 must have been the Pico in guess #3.

```
OKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :123      BAGELS
GUESS # 2     :456      FERMI
GUESS # 3     :478      PICO PICO
GUESS # 4     :786

YOU GOT IT

AGAIN?YES
```

Ha! 4 is not in the number. (No Fermi in #3.) So 7 & 8 must be in the number, but in the wrong places &, the Fermi in #2 must be 5 or 6. Therefore (as the mathematicians sometimes say), the computers number must be 786 or 837. Why not 738?

```
OKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :098      BAGELS
GUESS # 2     :765      FERMI
GUESS # 3     :743      FERMI
GUESS # 4     :712      PICO PICO FERMI
GUESS # 5     :172      PICO PICO PICO
GUESS # 6     :721

YOU GOT IT

AGAIN?YES
```

Whoops I wasted a guess. I should have looked at guess #2 & guess #3.

```
OKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :123      FERMI
GUESS # 2     :456      FERMI
GUESS # 3     :157      FERMI
GUESS # 4     :186      FERMI FERMI
GUESS # 5     :106      FERMI FERMI
GUESS # 6     :196

YOU GOT IT

AGAIN?NO
```

Must be 1 or 5, but not both.

7 is not in the number. How do I know?

Must be 1 and 6.

Try your hand at these. Answers at bottom of page upside down.

A.

```
GUESS # 1    :789    PICO
GUESS # 2    :127    PICO
GUESS # 3    :374    BAGELS
GUESS # 4    :851    BAGELS
```

Name <u>two</u> digits that are in the number.

B.

```
GUESS # 1    :937    PICO PICO PICO
GUESS # 2    :379    PICO PICO PICO
```

What is the number?

C.

```
GUESS # 1    :123    PICO
GUESS # 2    :214    FERMI
GUESS # 3    :256    BAGELS
GUESS # 4    :718    FERMI FERMI
GUESS # 5    :719    FERMI
```

What is the number?

D.

```
GUESS # 1    :639    FERMI
GUESS # 2    :678    BAGELS
GUESS # 3    :135    BAGELS
GUESS # 4    :940    FERMI FERMI
GUESS # 5    :240    PICO FERMI
```

What is the number?

A VARIATION OF BAGELS. We call it "BEYOND BAGELS."
Instead of Pico, Fermi & Bagels, you get a numerical score.

You get 1 point for each digit in the wrong place &
2 points for each digit in the correct place.
For example:

Computer's No.	Your Guess	Score	
738	123	1	
738	546	0	
738	805	1	
738	234	2	
738	897	2	
738	789	3	
738	798	4	
738	387	3	
738	783	4	
738	738	6	That's it!

LISTINGS? SEE PCC,
BAGELS VOL 3 #1 SEPT 74
BEYOND BAGELS VOL 3#2 NOV 74

BAGELS WAS WRITTEN BY PEOPLE
AT LAWRENCE HALL of SCIENCE
IN BERKELEY CALIFORNIA
BEYOND BAGELS WAS INVENTED BY PCC

15

A. 2 & 9. We also know, 9 must be in 1st or 2nd place (guess #1) & 2 must be in 1st or 3rd place (guess #2). The third digit must be 0 or 6.

B. 793 C. 018 D. 920

LETTERS

THE PHANTOM DISK

You people down there in sunny California, do you read *The Last Whole Earth Catalog?* If you don't, you'd better! HP and Wang gotta place in there, but doggone it, you don't ! Are you goin' let Wang bang up the computer world, while you are sitting idly by? Why don't you send a sample issue to them, with a descriptive article about what you do. And what you do well!

Back down to us, here at the Mid High of Medford. As you may have read in your last letter from I, we operate as Title I, a federally sponsored program to help slow learners in of all things, learning!! We do this with the aid of the HP 2000F which is real helpful. Lately, all we have been doing is watching the computer's main console flash "DISC RETRY READING AT 00024 BLOCKS", at us. You know, when someone wants a program; or is reading or printing into a file. Well, since every one does this at least every few seconds (most of our programs praise and work with the almighty file), we'd get about 30 Disc Retry's in a row, before the Computer says "DISC FAILURE SEEKING TO BLOCK 000024" or something like that.

Soon, our HP-2000F was known duly as El Crash-0. Any who, we'd be grading tests using the card reader, and then printing results in a file; all day. Finally, with the last card stack being read, we were ready for sleep. BOOM (or crash) . . . The HP 2000F crashes.

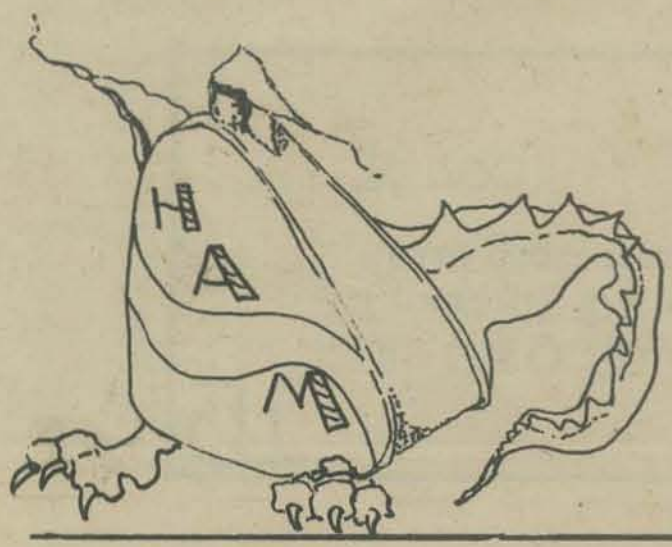
We got it fixed, with the help of John (don't know his last name) from the HP Co. You see, we installed a new disc system (3 discs instead of one), and our problems were gone. See, El Crash-0 looked for programs and files in disc 2 or 3, when we had no disc 2 or 3. It sure seemed hysterically funny to Dr. Nelson when we found this out. Any time someone entered the room, he'd tell this story to them; whether this person knew about computers at all or not!

Another hint for the tape worm (or also known as the punch bug) who has a million program tapes; to save the leader of the tape when it is rolled up, from dirt, and unravelling do the following – First get masking tape. Then tear off a piece about large enough to wrap around your tape twice. Then tear a piece for wrapping once. Place the tapes (masking) back to back, sticky to sticky side, with the ends together. This is your 'belt' for securing tapes. To make it better looking, you should cut the ends, (where the two masking ends meet) square. Where the smaller masking tape ends (and the larger continues), cut the smaller tape square at that end. And at the longer tapes end, cut it square then fold it into a triangular leader. To use this belt, just wrap the non sticky part around the punched tape and cover the non sticky part with the sticky side as you wrap.

Well that's that! We've been making programs here at Title I which help the slow learners have fun (it's kind of a reward after a good computer lesson).

Best Regards to all Dragons,
and especially for all "HAM DRAGONS"

Byron V. Caloz WA7SWK
4837 Griffin Creek Rd.
Medford, Oregon 97501



HP 3000

Your magazine is a little hard to follow but refreshingly sincere. I read your hardware back issue with great interest. I work at HP as systems engineer (Skokie, Ill) so I have an interest in your materials, particularly the 3000.

I've worked with the HP 3000 for over 2 years and while it has had its problems I think it has now "arrived." We claim it will support 32 users (who use the new compiling BASIC). Compiling BASIC will generate programs which will run 20–100 times faster than 3000 BASIC interpreter. The 3000 offers essentially the same computing power as an IBM370/125 for a lot less money. (Maybe even 370/135).

In the last year its biggest enhancements have been software including data base language IMAGE (similar to Cincom TOTAL on 370/145) and QUERY (data base verification, retrieval and reporting language), 1968 ANSI COBOL, RPG II with linkage to IMAGE and subroutines in other languages, remote job entry (RJE) to IBM 370 as 2780/3780, and student information system (SIS/3000) which provides a high school data base for attendance, grades, and family information.

No doubt you can get better information than this through some of your present contacts in Palo Alto and Cupertino, but Ijust wanted to say that the 3000 CX (new pricing 11/74) family of computers is going to start hanging tough in education as in other applications.

Conrad E. Iungerich
2212 Dewes Street
Glenview, Ill. 60025

CLONLARA

We are a seven year old free school that has recently been given a Hazeltine terminal and printer. We had a brief grant for processing time, during which we developed some simple games – both academic and artistic. Our grant has expired and we are in the process of seeking new funding.

Do you know of any group or organization that might be interested in funding our situation? If you know of any and could let us know, we will pursue the matter from there. We would be interested in doing experimental or developmental projects if someone was interested in using us for that purpose.

Have you developed any computer programs or package for early elementary students? Do you know of any other persons or groups who have? We are particularly interested in beginning to teach the children who are interested how to program by themselves for their own purposes. Have you had any experience with this, or do you know of anyone who has? *Use INCHWORM*

I thank you very much for whatever information you can pass along, and look forward to hearing from you.

Craig K. Harris, Coordinator
1289 Jewett St.
Ann Arbor, MI 48104

Live Long & Prosper, People of PCC

I looked at RSTS BASIC. There is one thing I must say – sometimes is doesn't even look like BASIC!! But I guess I'll learn that, even though I don't have much access to the 11, so I'll have to stick to HP.

I assume by this time you've seen HP 3000 BASIC. How do you like it? I think it's pretty good, with a lot of bells, etc. added, but with very few basic improvements. Most functions, such as ADVANCE, PIX(X), REDIM, etc., are nice to have, but those subroutines are easily written. A few, like string arrays, multi-line FuNctions, and saving the buffer are very useful. BUT (but has to be in capitals!) it is sooooo slow. With all 16 users on, you could type 'CAT' and wait ten minutes before you get a response. Why can't it have the speed of the 2000F? With 3000 BASIC and the 2000F speed, you would really have something. One thing I really wish it had is unlimited string length. That's a really great feature; too bad it is missing.

Peace Be With You . . . It is the Will of Landru
Keep on Treking

Andy Finkel
12002 Pandrail Place
Philadelphia, PA. 19116

NEW MEMBER OF SHAFT

Society to Help Abolish Fortran Teaching

Hi, what's up. After working on a BASIC time sharing system for a few days I can finally understand all your anti-FORTRAN propaganda. I can envision the day when system programmers, due to a lack of disk space, delete payroll files, to add more advanced versions of Star Trek. Gee, what a let down to go back to my batch FORTRAN environment.

Also what is this PCC Games Book? I can't wait 2 whole months to find out. My guess is that it contains listings of all your games. How much is it? *(See PCC Bookstore)*

While I'm writing a letter, I have to ask you one more question. I already have the two "classic" sources of computer problems, *Problems for Computer Solution, A Collection of Programming Problems and Techniques,* but, what I'm looking for a a book that has long problem (suitable for entering in contests, possibly). Have any suggestions? I sure would appreciate it. *(Get ADVANC PROBLEMS FOR COMPUTER MATH, DEC, 146 Main S Maynard, Ma. 01754)*

Robert Marjan
91 Cooper Rd.
Rodchester, NY 14617

articles wanted for ART issue!

ANNOUNCEMENT

Are you using the computer in art work? If so, please note that *Creative Computing* has a special art issue coming up next spring (Mar-Apr 1976). Why not contribute to this issue? Contributions should be 250 to 1500 words – or more if you have a lot to say! Typed, double-spaced. Please consider the questions below in preparing your article.

Get your material in EARLY. Absolute, final, last cut-off date is October 15, 1975 but don't wait 'till then. Also, early material has a much higher probability getting a good spot in the issue. DO IT TODAY!

How/why did you become involved with the computer (in producing art)?

What is your art background?

What role does the computer play for you . . . simulation, tool, etc.? What is your role?

Are your computer works related to non-computer art?

Do you have a final image in mind when work begins?

Could your work be done without the aid of a computer? If yes, why use the computer?

To what extent are you involved in the technical production of your work, for example, in programming?

Do you feel art work created with a computer has now or will have an impact on art as a whole in the future?

Do you intend to continue using the computer to create art pieces?

Do you recommend the use of the computer for others in creating works of art?

Along with your article, opinion, or other good words we would like illustrations, graphics, and photos of your work. Reproduction quality please (sharp B & W artwork, glossy B & W photos 5 x 7 or larger, preferably 8 x 10).

READERS AND WRITERS!! Please submit additional questions you'd like us to focus on.

Please send all material, artwork, responses, questions, etc. direct to the *Creative Computing* art issue guest editor:

Ruth Leavitt
5315 Dupont Ave. South
Minneapolis, MN 55419
(612) 825-9005

Have you ever wondered if there are any French lessons that would run on your HP computer system? Or how about a career information system, or metric conversion exercises? If you have asked about the possible existence of such materials, you may have found that the answers are not readily available.

In response to an apparent need for information of this type, Hal Peters of HP Data Systems is launching THE HP CLEARINGHOUSE FOR APPLICATIONS OF COMPUTERS TO EDUCATION.

The basic objective of this project is to establish and maintain a comprehensive list of educational applications that will run on HP computer systems (both 2000 and 3000 series), as well as selected books and other computer-related documents that would be of potential interest to HP users.

Initially at least, the Clearinghouse will collect and disseminate information only—the materials themselves would continue to be distributed by the current source agency: the user who developed the package, the HP 2000 or 3000 contributed library, or as standard HP supported products. The aim is to have information about items from all such diverse sources available from a single place, that is, the Clearinghouse.

The first step in establishing the Clearinghouse is under way. Information is being collected via Information Submittal Forms such as the one included in this issue of the Newsletter.

This information will be entered into an on-line data base, from which catalog listings will be generated at periodic intervals, and distributed for a nominal charge.

If you have materials that you would like included in the Clearinghouse, please complete the Information Submittal Form and return it to:

Harold J. Peters

HP Clearinghouse
Education Marketing
Hewlett Packard
11000 Wolfe Road
Cupertino, CA 95014

MECC TO SPONSOR COMPUTER ARTS CONTEST

In conjunction with the 1975 annual conference of ACM (the Association for Computing Machinery), MECC is sponsoring a "computer arts" contest. The conference, to be held in Minneapolis on October 20-22, 1975, will attract world leaders in computer science for information interchange and dissemination.

The full rules for the "computer arts" contest will be released in the near future. The following is a preliminary set of guidelines to allow potential participants additional time to prepare entries:

1. The contest is open to any student in Minnesota secondary schools, 7th through 12th grades.
2. The entry may be in any field of the fine arts, including but not limited to "visual" art, literature, poetry, choreography, and music.
3. The work of art must be generated by a stored program on a digital computer without human assistance or manual intervention after the program is initiated. Participants may choose the programming language or machine to be used in his or her program.
4. The work of art must be submitted, together with the generating program and a general description of the technique, to Dr. K. E. Brunbaugh, MECC Field Services Manager, 1925 Sather Street, St. Paul, Minnesota 55113, on or before September 15, 1975.
5. Judges will be appointed by the Executive Committee of ACM. Decisions of the judges will be final. All entries become the property of ACM. The nature of the prizes is

MECC Systems Update
1925 Sather
(Hwy. 280 at Roselawn)
Lauderdale, Minnesota 55113

WORKSHOP

Games Computers Play

X 407 (2)

Spend a weekend matching wits with a computer. Participants will play: CHOMP—a cookie-eating game; STARS and BAGELS—number-guessing games; MUGWUMP and HURKLE—two-dimensional hide and seek; ABAGEL and HANGMAN—word-guessing games; QUBIC—three-dimensional tic-tac-toe; MARKET—a two-company product competition; POLICY—try to influence national economic policy; STAR TREK—save the galaxy from the Klingons!; POLUT—experiment with a polluted lake, river, or pond; and many more. If you want to learn to program, you can do that too, then write your own games and try them on the computer. Games are simulation programs, and simulation and games are becoming important functions of computers in education, business, politics, and many other areas. No previous computer experience is necessary.

ROBERT ALBRECHT and JERALD BROWN, People's Computer Company, Menlo Park, and LEROY FINKEL, Computer Center Director, Ravenswood High School, Palo Alto

BERKELEY: June 21–22; 9 a.m.–10 p.m. Sat., 9 a.m.–6:30 p.m. Sun.; room 120, Lawrence Hall of Science; $85, includes computer time and all required materials

If you have questions, please telephone 642-1061 in Berkeley, Suzanne Angioli.

LIFELONG LEARNING
University Extension
University of California
Berkeley, California 94720

COLA

The Computer Organization of Los Angeles (COLA) is a nonprofit organization founded in 1974 by a group of professional educators and technical specialist in educational applications. Its intention is to provide a forum for the exchange of ideas and information about the relationship of modern technology to modern education.

COLA

P. O. Box 43677
Los Angeles, California 90043

the present state of
igneos research
In keeping with our policy of reporting on dragons, and in the spirit of the season . . .

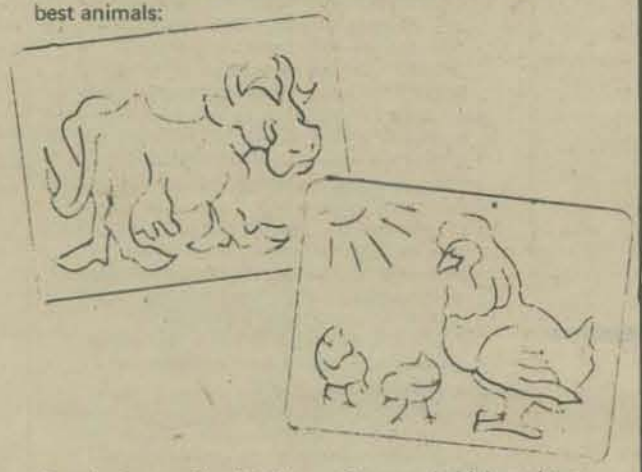
From the January 1975 Issue of

ANALOG

Science Fiction/Science Fact

The TC500 Blues

It's been a while since I last wrote to you, mostly because the old memory bank has been preoccupied with physics formulae lately. Anyway, I went out and depleted my bank account severely and bought myself an HP-45. Ergo, I am enclosing a check for money to pay for the book on tricks and games for hand calculators. In my last letter, I mentioned our ailing Burroughs TC-500. It is still with us. It is lying in state in the computer room at my school. It died last December from the shock brought on by a theft. I wrote a program for it in GP-300 assembler language, and after spending a large period of time running in the phase i tape, phase 2 tape and getting bugs out of my program, I ran it. The program found π using a series. It seemed to be running fine, each progression getting more accurate when a kid tripped over the power cord and bombed the machine. I quickly ran for the bootstrap tape, and went to move the jumper on the FE cord in the back of the TC, and I found, lo and behold, that the gods were angry with me. Someone had stolen the jumper. I fainted from frustration after having wasted 3 days of study halls on the program. The teacher in charge of the computer room did not have a spare jumper and did not call the repairman to come out with a new one. The teacher said we were going to trade it in for a CRT. I'm still waiting. I have gotten over the shock though. I have time sharing access to a B6700 system by good ole 10 cps TTY and access to an old UNIVAC 1108. I like the Burroughs system a lot and it is very good. I have all the I have all the languages on it, ALGOL, FORTRAN, BASIC, COBOL, PL/1, plus numerous others. I enjoy ALGOL and FORTRAN the most and I don't care what all you BASIC lovers think. I am now considering putting my forces to work in writing a Star Trek program. Not your average one, but a 3-D one that makes use of the computers real time clock so things happen while you are trying to figure out what to do. When I get it done (if I get it done) I'll send you a listing, and at 10 cps, it will be a while. Oh, it will be in ALGOL. Would you care for a program that graphs wave interference patterns? It is not a game, but the patterns are nice, with the right parameters. You can hang them up a psychedelic computer printouts made by a computer on a trip. Unfortunately I have no talent for drawing dragons, so I'll draw my two best animals:

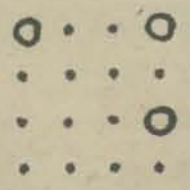


Do what you will with them. Cows and chickens have one redeeming factor over dragons, they don't have flameouts, they don't have hot breath, and they don't get hot under the collar. Best of all when they sneeze they don't burn down the building. Having now had my bit of idiocy.

Robert Goodman
27078 Charles Dr.
Southfield, MI 48076

QUBIC

In reply to the letter by Andy Finkel in January '75 issue, I'm sending a copy of a winning QUBIC game on an HP2000C. The strategy is what I call a protected fork. A fork in Tic-Tac-Toe is where X can win two ways and 0 can only block one of them. HP's QUBIC will not let itself get into a fork, but if the next to the last move completing the fork forms three in a row with some other moves, QUBIC must block the three and ignore the fork, allowing you to complete it and win. You can also double and triple protect a fork (the second and third moves in the fork form three in a row with other moves), but this is unnessary for this QUBIC. Although someone might want to try to program a QUBIC to look for protected forks. Also, maybe QUBIC should build up a protected fork. What if QUBIC blocked every two in a row? In a situation like



which two would it block, and which of the two blocking moves would it use? If a pattern is used after a few games it would be easy to beat it. The best way would be to block randomly, but even that isn't win-proof. If anyone has a "perfect" QUBIC or a way to improve it, I'd be interested in knowing about it.

If anyone would like to exchange any program, ideas, languages, etc., PLEASE WRITE ME.

```
....   ....   ....   ....
....   .0..   ....   ....
X...   ....   ....   0...

YOUR MOVE? 144
MACHINE MOVES TO 444

X0.X   ...0   ....   X..X
.0..   ....   ....   ....
....   .0..   ....   ....
X..0   ....   ....   0..X

YOUR MOVE? 141
THAT SQUARE IS USED, TRY AGAIN
YOUR MOVE? 242
MACHINE TAKES 142

X0.X   ...0   ....   X..X
.0..   ....   ....   ....
....   .0..   ....   ....
XX.0   .0..   ....   0..X

YOUR MOVE? 243
NICE TRY --MACHINE MOVES TO 342

X0.X   ...0   ....   X..X
.0..   ....   ....   ....
....   .0..   ....   ....
XX.0   .03.   .X..   0..X

YOUR MOVE? 241
NICE TRY --MACHINE MOVES TO 223

X0.X   ...0   ....   X..X
.0..   ..X.   ....   ....
....   .0..   ....   ....
XX.0   000.   .X..   0..X

YOUR MOVE? 244
CONGRATULATIONS!
YOU WIN AS FOLLOWS 241   242   243   244
FINAL POSITION:

X0.X   ...0   ....   X..X
.0..   ..X.   ....   ....
....   .0..   ....   ....
XX.0   0003   .X..   0..X

WOULD YOU LIKE ANOTHER GAME? NO
```

3 IN A ROW (144,243,441)
QUBIC BLOCKS

COMPLETES FORK (214,232,241,
QUBIC BLOCKS (242,243

ONE PART OF FORK (214,232,241)
LEAVING OTHER PART (241,242,243)
OPEN

HUMAN TRIUMPHS!

By the way, BULLS & CLEOTS doesn't work correctly. In the RUN, the first guess by the operator, was exactly right, but was only given to CLEOTS.

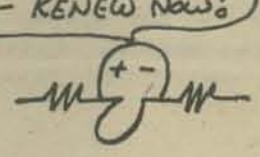
The following makes the CHOMP program into a single array program.

```
350  DIM A(100)
375  LET A(I + (J – 1)*10) = 0
560  A(I + (J – 1)*R) = 1
590  A(I) = –1
660  IF A(I + (J – 1)*R) = –1 THEN 700
670  IF A(I + (J – 1)*R) = 0 THEN 720
890  IF A(R1 + (C1 – 1)*R) = 0 THEN 920
900  IF A(R1 @ (C1 – 1)*R) = 1 THEN 1010
960  A(I + (J – 1)*R) = 0
```

Thank you for going over this long, long letter. I hope you print it.

Robert Zeidman
9801 Clark St.
Philadelphia, PA. 19115

THIS IS THE LAST ISSUE OF VOL. 3 - RENEW NOW!



SOUTHERN CALIFORNIA INSTITUTE OF ARCHITECTURE

1800 BERKELEY ST. SANTA MONICA CALIF. 90404 PHONE 213-829-3482

We are graduate architectural students who have chosen for our thesis project, to program (determine activities, space requirements, square footages, etc.) and to design a small university (5000—10,000 students) that has an information network based on electronic communications technology. Our goal is to use all modes of generating, storing, retrieving, and communicating information, both traditional (books, lectures, etc.) and electronic (computers, AV, etc.) in a responsive educational environment. One that (1) supports and reinforces a wide range of separate or simultaneous activities, (2) allows recognition of and response to continually evolving user needs, (3) allows programmattic changes due to changing curriculum, and (4) provides an adaptable intermedia network that will become metabolically and symbiotically interfaced with each user or group.

Below are areas of inquiry which interest us. We would be pleased if you could help us with these points, by supplying information, giving your opinion, giving us other sources of information, or by passing our request on to someone else:

1. What systems or equipment are your currently using, marketing, or developing.
2. What other projects, proposed or built, are similar.
3. What is the "state of the art" of computer and other electronic communication systems being used in education.
4. What systems being used in other areas, have potential applications in education.
5. For all of the above we would like to know, basic principles of operation, how they are used, and what are their potentials.

Areas of concern that are important to planning the university are:

1. The interlinkages of computer based information systems and the expansion of them.
2. The relationship of such systems with existing and developing communications technologies.
3. How these interact to create a radically new information environment.
4. The new patterns of activity which result from the new information environment.
5. Establishing the criteria for an organizational framework that will be supportive.

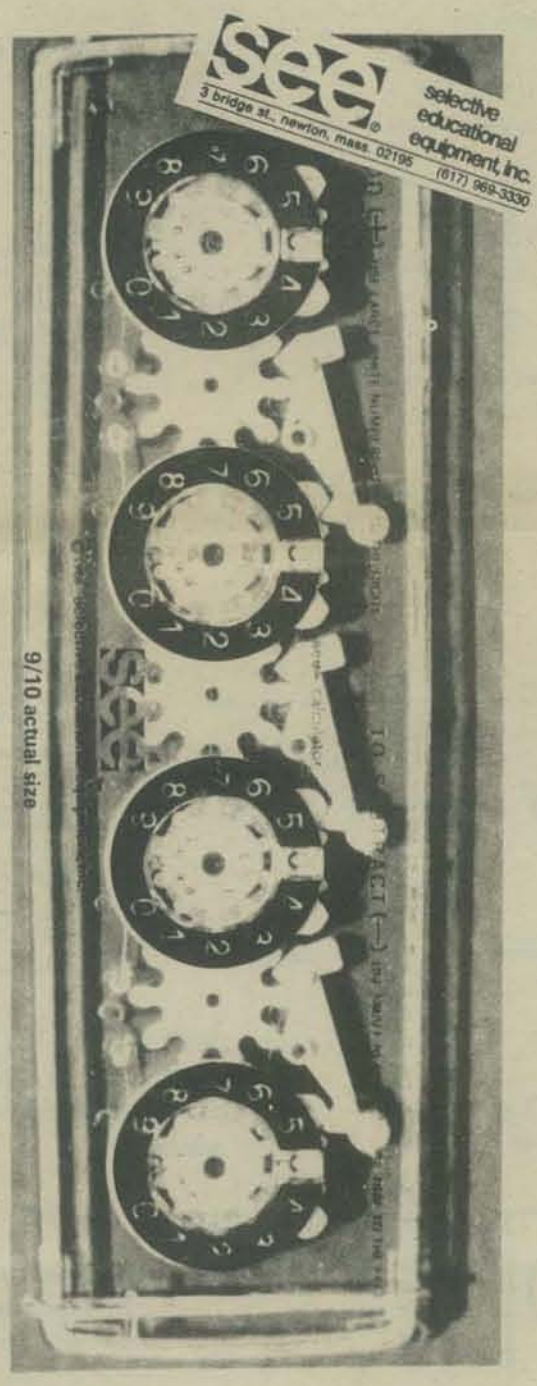
Within the University, the application of new and more effective modes of communication will affect a new social order. The interrelationships between user and information will become more diverse with varying degrees of intensity. User to user information exchange will adjust accordingly, forming patterns, of activity. In order that this process maintain its cybernetic qualities, the priorities for defining space, based upon the criteria for education, and with reference to the technological potentials of information handling, must become consistent with and a reinforcement of these diverse and ever-changing patterns of activity and information flow.

Traditional attitudes about education that manifest themselves in the solution to organization, are no longer appropriate. They assume inherent organizing principles and criteria, valid a priori, and independent of social activity. The range of activities is predetermined and subsequently limited by this organization without seriously considering and allowing for a contingent future. This outdated approach enhances resistance to change. The University cannot be conceived as a series of fragmented and incidentally related space that houses a variety of disciplines, which as a result of linear and piecemeal thinking have well defined, predetermined separations with no substantial interfaces or relatedness. The University will be conceived as patterns of activities, supported by spaces conceived as a communicational field for people, information, and goods, and as a field of environmental controls supporting a wide range of activities in a loose fitting matrix (organizational framework), always adjusting image to content, configuration to information flow.

The University will be part of a computer based information network which links together the information banks of other Universities, new agencies, medical centers, governmental, business, and industrial agencies. Each participating member will provide and maintain the most current and complete information available in their designated areas. This type of network will greatly increase the accessibility of information, will increase the amount communicated allowing more intense usage, hopefully stimulate important dialogue between the participants and facilitate comprehension of their respective interfaces.

We are enthusiastic about this project and hope that you will be able to take the time and provide us with information advice or guidance. Also, if there are areas that you would like to have further explanation of, please let us know.

Michael Brickler
Michael Rotondi
3357 Primera Ave.
Los Angeles, Ca. 90027



An Open Letter to Terry Ritter

It seems that Terry Ritter and I are on opposite sides of machine language vs. assembler, so I may as well wade in. First, though I am going to clarify a couple of terms for the benefit of innocent bystanders.

Absolute (octal or hexadecimal) machine code = a bunch of numbers which, when in good order, and entered in memory, can cause something sensible to be executed.

Symbolic assembler - a tool to produce absolute machine code.

The reason I'm defining these terms is that most of us who make out tedious living writing the stuff refer to symbolic lines of program as machine language, when there is a one to one relationship between the symbolic code and the assembled instruction object code.

Since I agree with friend Ritter on most of his points, I'll take them one by one:

(1) Terry discourages the use of symbolic assemblers in favor of octal or hex look up charts. The late lamented microsystems international just turned over in its grave. That is precisely what the Monitor-8 system does, while running on an Intel 8008. When you type your mnemonic op code in, it looks it up and shoves in the necessary byte right into memory. When it gets enough keystrikes to find out what you intended to do, it supplies the necessary carriage return and line feed. We don't really disagree on the point, but I'm saying that a machine with as little as 2K of ROM can handle the MI system.

(2) The MI system can disassemble as well as assemble. You can go to RAM, pull instructions out and translate them back into mnemonics. There is no loss of characters or mismatch between code in memory and your listing of it.

The point that Terry makes about jump addresses and what happens when you have to insert instructions and the resultant offset effects every jump from there out, is a tough point for me to win, since the MI system makes no provision for it. It does however have the function "DLP" (display location pointer) and if you bracket your code with some NOP instructions you can generally find enough room to do the necessary patches. The procedure is to add a few NOP instructions at the end of every subroutine, or at key places where you feel that you might need room and then when you need to know the address of the location you are about to fill with code, you do your "DLP" and the address is printed right above the place of interest.

I feel that the 8008 is a particularly difficult machine to try to relocate code in. But if you take the suggestion above and leave yourself patching room as you lay your program into memory, you can use the "CPY" (copy) instruction to move whole blocks of code either up or down. Again, the MI system holds up, even if somewhat feebly on this particular point.

Terry says that you can get used to using the octal equivalents and I agree. Even though you don't intend to and do all your work in mnemonics, in a short time you do memorize the octal or hex machine code. In any event it's often handy to know it.

(3) The next point that he makes is about the mismatch between the assembled code and the absolute code, and again I point out that if you can train your machine to read it's own memory and print out mnemonics, you are in the best of all possible worlds. However, I recall having a potluck dinner at PCC last summer, and being asked what I intended to do with my computer. When I said that I wanted to make it reach into it's own memory and modify it, display it, list, and run selected portions of it, several people got up and went elsewhere (as if my deodorant had suddenly failed). Just ask around, you will find guys (I'm serious) who are going to use their home systems to time share 16 users, or to do concurrent I/O with the garage door, burglar alarm, thermostat, and mailbox. However, when you ask them about debugging aids, you get all kinds of mumbly type answers.

To make the point perfectly clear, the manual on the Monitor-8 system that the now defunct Microsystems International used to publish, contains all the dream things you want, Terry. And it is all made possible by the simple act of making the assembler a combination assembler/dissassembler.

I enjoyed reading your letter. It shows that you have actually fought some of the battles of getting a little code to work on the tiny little beastie.

Gordon A. French
614 – 18th Avenue
Menlo Park, Ca. 94025

The Mysterious & Unpredictable RND

by Bob Albrecht

Part 2

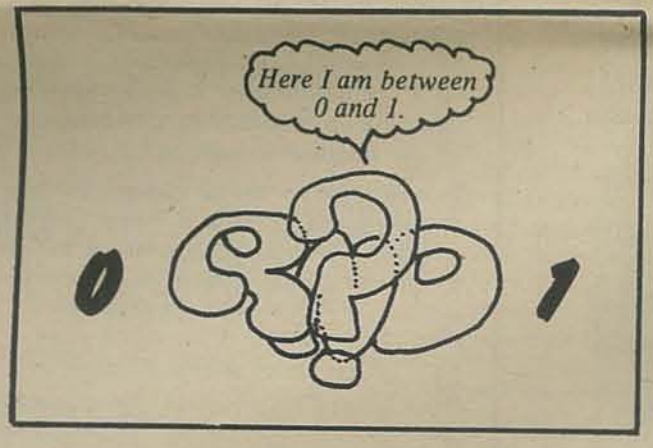
how big? how small?

Last time you may recall, we showed you a program to find the *largest* RND number in a sample of RND numbers. We suggested that you use our program on your computer to obtain samples of RND numbers and then make a conjecture about how *large* a RND number might be.

We also suggested that you write a program to find the *smallest* RND number in a sample of RND numbers and, of course, make a conjecture about how small a RND number might be.

We assume that you have done these things. From *our* experience, it seems that there is some evidence that RND numbers are always between 0 and 1 . . . greater than 0 and less than 1.

Remember, we haven't *proved* that all RND numbers are between 0 and 1. We are simply assuming that they are, based on lots of evidence on *our computer*. What happened on *your* computer?



proportions

Proportions? We will ask our HP2000 to grind out a bunch of RND numbers, but not print them. As it grinds merrily away, our computer will also count the RND numbers that are less than .5.

Huh? OK, we will have the computer grind out (but not print) a sample of N RND numbers and, while doing so, count *only* those that are less than .5. Suppose there are X RND numbers that are less than .5.

N = total number of RND numbers

X = number of RND numbers that are less than .5.

After all the RND numbers (N of them) have been generated, we ask the computer to compute and print the *proportion* of RND numbers less than .5.

$$P = \text{PROPORTION} = \frac{X}{N}$$

Here is our program and a RUN.

```
100  REM *** PROPORTION OF RND NUMBERS LESS THAN .5
110  PRINT "HOW MANY NUMBERS IN SAMPLE";
120  INPUT N
130  LET X=0
140  FOR K=1 TO N
150  LET R=RND(0)
160  IF R >= .5 THEN 180
170  LET X=X+1
180  NEXT K
200  PRINT "PROPORTION OF RND NUMBERS LESS THAN .5 IS";X/N
210  PRINT
220  GOTO 110
999  END
RUN

HOW MANY NUMBERS IN SAMPLE?1000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .489

HOW MANY NUMBERS IN SAMPLE?1000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .499

HOW MANY NUMBERS IN SAMPLE?1000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .506

HOW MANY NUMBERS IN SAMPLE?1000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .506

HOW MANY NUMBERS IN SAMPLE?10000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .503

HOW MANY NUMBERS IN SAMPLE?10000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .4932

HOW MANY NUMBERS IN SAMPLE?10000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .4966

HOW MANY NUMBERS IN SAMPLE?10000
PROPORTION OF RND NUMBERS LESS THAN .5 IS .5011

HOW MANY NUMBERS IN SAMPLE?
```

RND numbers less than .5 are counted in Line 170. If a RND number is greater than or equal to .5, the Line 160 (the IF statement) causes the computer to skip over Line 170 . . . thus not counting that particular RND number.

Look at the RUN. We have several samples, some quite large.

> Rounded to one decimal place, the proportion of RND numbers less than .5 (based on our evidence) seems to be about _____.

Modify our program to compute the proportion of RND numbers less than 2.3 or .7 or 0 or −1 or whatever suits you.

to be continued~

Development of the RND material was originally sponsored by Hewlett-Packard. All programs are written in BASIC for the HP2000 series of time-sharing systems. Thanks, HP, for your help.

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THE NEW GAMES NEWSLETTER

VOLUME I NUMBER 1 (415) 495-3986 MAY 1st, 1975

YOU ARE INVITED to the Third New Games Tournament on May 17, at Speedway Meadows in Golden Gate Park, San Francisco. This Tournament will be a spectacular celebration by the owners of Golden Gate Park, the people of San Francisco. People from all sections of the city will come together to celebrate their differences and play with each other.

NEW GAMES is a non-profit Foundation, and all contributions are tax deductible.

A New Games Handbook will be published in Spring 1976 by Headlands Press, with Andrew Fluegelman, editor. If you have ideas, games, articles, pictures, or suggestions to contribute, please send them to us. We can't offer money, only your name in big type.

WE have just published a 48-page magazine
The Whole Earth Ball and other new games
The Tabloid contains much of the history and growth of the New Games movement, as well as rules for some games, a recipe of a New Games Tournament, and lots of wonderful pictures. It is available for a donation of $1.50 plus 25¢ handling.

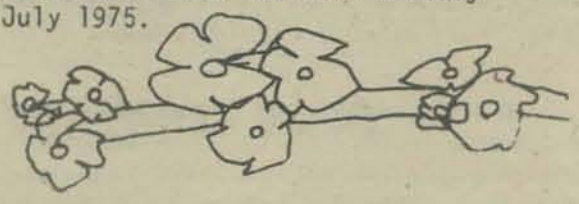
The Rosenburg Foundation of San Francisco has made a grant to New Games Foundation of $9,381.00 to finance the building of a new play structure in Visitacion Valley Playground in San Francisco. New Games Foundation and All Peoples' Coalition are coordinating this project, in which young people from the community will have paid jobs to do the planning and building of their own play environment.

and will be participating in:

- a symposium of "Children in the Urban Environment" in Washington, D.C.,
- the San Francisco Twin Bicentennial Celebration,
- industrial recreation programs,
- and a New Games Tournament sponsored by the involvement Corps, a Bay Area organization working to get people and corporations together;

and have been invited to:

- explore the idea of a New Games Tournament along side of the 1976 World Olympics in Montreal,
- to the countries of Australia and New Zealand in September 1975,
- and to open the American Crafts Fair at the National Parks' Eastern Gateway in July 1975.

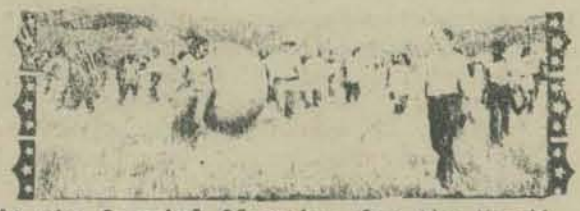


PLAY HARD.
PLAY FAIR.
NOBODY HURT

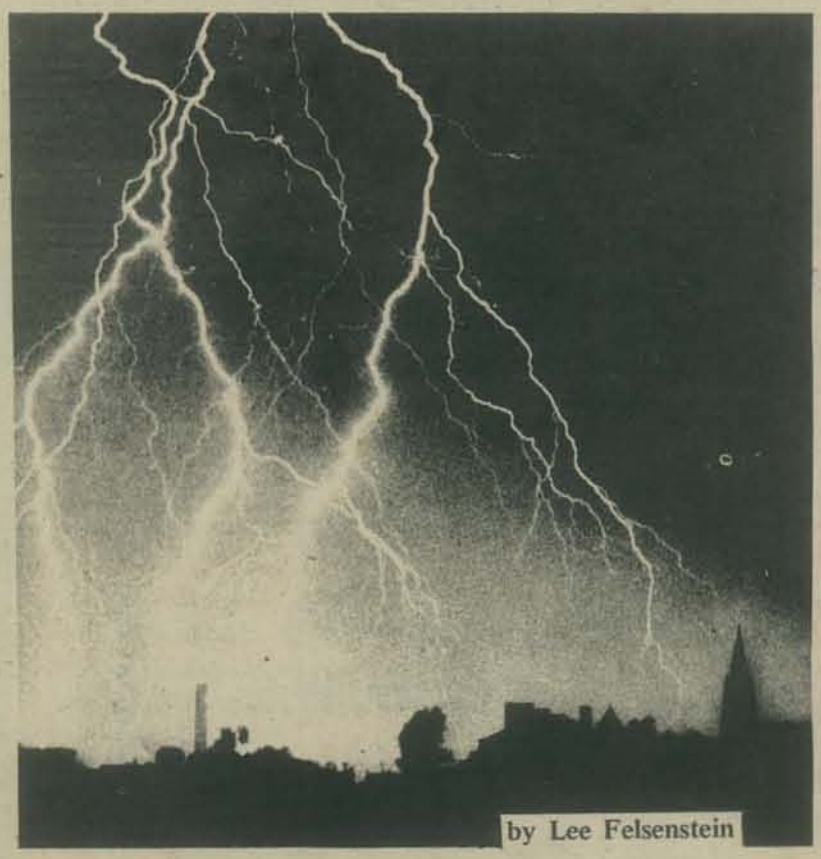
NEW GAMES FOUNDATION
Box 7901
San Francisco, CA
94120

We have a new supply of New Games Referee **T-shirts** for a donation of $3.50.

We have two **color films** of New Games Tournaments available for rental. The first Tournament film runs for 20 minutes and is $35.00 and the Second Tournament film runs for 5 minutes and is $10.00, both plus shipping. They work very well together.



At the Special Olympics for the Handicapped, the rope broke during tug-of-war. The kids, used to New Games' "everyone wins", declared both sides the winner.



snap, CRACKLE, POP!

Or, Static Conducted Safely to Ground

a hardware review of the MITS Altair 8800

by Lee Felsenstein

The Altair 8800 has two things (at least) going for it; it's here and it works. These facts alone will guarantee that it is THE amateur computer for at least the next year. Beyond that time, other machines might appear as competitors, but everything will have to deal with the Altair for comparison. There will be tens of thousands of Altairs out in the field by the time anyone else can come "on line".

Looking inside serial number 020009 (number 9), I was struck by the fact that there was so much open space. There's a big circuit board behind the front panel, a power supply along the back of the cabinet, and a "mother board" which occupies one fourth of the width of the cabinet and holds four sockets.

The processor module plugs into one of these sockets and the memory module plugs into another. Notice that I said ANother and not THE other. Because of the "bus organization" of the system, it doesn't matter which socket you plug things into – it will work just the same.

Each mother board connects to the next one with a lot of very short "jumper wires" if they are adjacent to each other. Once the cabinet is filled, the bus can be extended to another cabinet by a cable. The modules have the capability to deal with up to ONE HUNDRED other modules!

MITS, Inc., the maker of Altair, was sort of swamped by the response to their ads, but by now the confusion of their initial success has been sorted out and the promised accessories are in production and being shipped. Ed Roberts, the designer of the Altair, told me just before press time that the long-awaited 4K dynamic RAM cards are being shipped at about 10 to 20 per day and within a week would be shipped at a rate of 100 per day. The teletype I/O cards are also being shipped now.

Just about everyone who has had contact with MITS in regard to a problem they've had with their machine reports that they were very helpful. They take their support responsibility seriously - many times hunting down machines with incorrect parts and notifying the owners of possible flaws. Their newsletter has a column of questions and answers that seriously deals with real problems -- not just selected cosmetic problems. They're not afraid to admit it when they've goofed.

The same can not be said of the semiconductor industry. When I mentioned to Ed that underground reports had alerted us to beware of "pattern sensitivity" in the 8080 chips (failure of the microprocessor to handle certain sequences of instructions even when it could do each instruction all right separately), he said that it was true, but that no one at Intel would agree that there was such a problem. MITS has apparently been testing every 8080 shipped for this condition, because Ed said that they had found only one failed chip out of 3000 tested.

The one real possible problem which haunted the first machines was noise – little hairy spikes and glitches running around on the signals of the bus where they had no business being. One of them at just the wrong time might have been able to change a "0" to a "1". Ed called it "a problem looking for a place to happen." It was fixed by an extension of the ground circuit after several machines had been shipped. Each owner was sent a "retro-fit kit" to allow them to install this fix. This is admirable maintenance practice, worthy of the big machines.

In general, it appears that the design and construction of the Altair is well above the "consumer level". I asked Ed whether the power supply filter capacitors were computer grade or consumer grade. He said they were high-priced, high quality units, and the price he mentioned made it clear that they were NOT "el cheapos". The 7 volt power supply rectifier diodes can take 10 amperes average current and 50 amps surge. The power transformer was rated at 8 amps.

In at least two of the early model machines we noticed a tendency of the address incrementing circuitry to occasionally fail to advance the memory address when the "examine next" or "deposit next" switches were used. Both of us suspected the switches themselves, but the other guy said he had tested his. I noticed that 74123 one-shot timers were used in the circuit. These little bugs have caused more designers to go mad than anything else. Do others have this problem? Let us (and MITS)know.

Well, I'm working on my own special interface to plug into the Altair bus, and I notice that other plug-ins are starting to crop up. This is one of the most exciting devices yet to hit the amateur electronics market. Look into it yourself and let us know what you think of the 8800.

HARDWARE

new things

more stuff by

Lee Felsenstein

VEN-TEL MICRO MODEM

Been looking for a cheap modem? Now you can get a kit to build one with!

Ven-Tel, 1190 (K) Dell Ave., Campbell CA 95008 is making a modem which is intended for us kinds of computer users. It's based around an LSI "hybrid" chip which they make.

The chip includes all the EIA inputs and outputs, 20-milliampere current loop input for direct connection to Teletypes, and all functions for operating a DAA (auto-answer) device. These options are selectable by the user.

Built up, their modem costs $195 and will work reliably at 300 baud.

Their kit includes the chip (which is a 38-pin wonder), the acoustic coupler hardware, and schematics to allow someone with electronics experience to construct it and the power supply.

They include information on how to wire it up to the Teletype, and can give you a cable pre-built for $20 extra if you need it.

The kit is priced at $110.

Pre-built units have a 12-month warranty. Kits are obviously another matter, since no printed circuit board or power-supply parts are included.

For further information write to Ven-Tel or call (408) 374-1363.

(There's more to come! PCC is keeping track of the kit modem field and will soon have more news as new products are announced.)

The first batch of "plug compatable" memories and interfaces for the Altair 8800 will soon be available. Filling some gaps in availability of MITS devices, the first batch includes a 4K static RAM card, a 2K PROM card for 1702A or 5203 eraseable PROMs, and an all-purpose serial-parallel input/output card.

These will be offered as kits at prices competitive with MITS' price lists by Processor Technology Co., 2465 4th St., Berkeley CA 94710. Their schedule has them available on the first week in June.

The I/O card is particularly interesting, as it includes four channels; three parallel and one serial using a UART. The clock rate of the UART can be set by the computer program at between 35 and 9600 baud. One of the parallel channels can be used to set the controls of the UART.

Quantity discounts are available. Further information may be obtained by writing to the address above.

RGS Electronics, 3650 Charles St., Suite K, Santa Clara CA 95050, is planning to offer a computer kit like the Altair 8800, but built around the 6800 chip (made by Motorola and others). It will be announced this Fall.

According to Ray Stevens of RGS, the machine will be available with or without a front panel, and will include teletype I/O. He is enthusiastic about the interrupt capabilities of the 6800 (which become important when you use lots of I/O devices or very fast I/O devices) as well as its different memory addressing modes. Ray also describes the documentation available from Motorola as "fantastic".

RGS is currently selling an 8008 kit, and has received only 2 complaints out of "50 or 60" sold.

Mini Micro Mart, 1618 James Street, Syracuse, NY 13203 is also offering Altair peripheral kits. They have a single UART card and a four-channel parallel I/O card available, as well as an adapter board to allow the users of their Mark 8 (8008) cards in the Altair.

They're working on a 4K static RAM card, scientific calculator chip interface (which they now have available for the Mark 8) and a cassette interface.

In the future MMM will be offering a card for the Altair which will allow up to 8 Mark 8-sized cards to be plugged in to one Altair slot. This unit will be useful with other machines than the Altair.

Martin Research Ltd., 1825 Halsted St., Chicago Il 60608, has an 8008 micro kit which appears to be really complete. For example, it includes a 16-key calculator-type keyboard and six-digit LED display for entering and examining instructions.

The system is called the Mike 2 and comes in kit form as the Mike 201.

INCHWORM

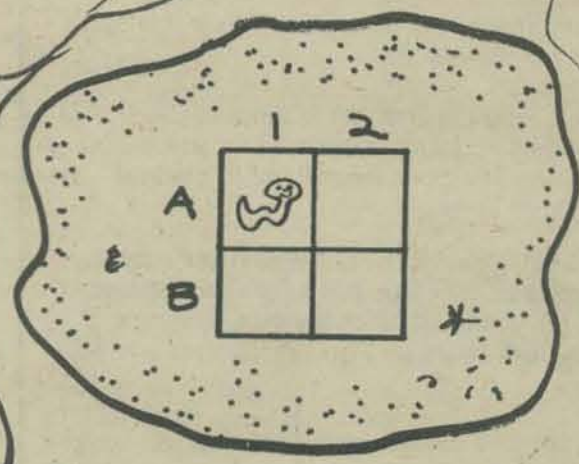
the intrepid explorer

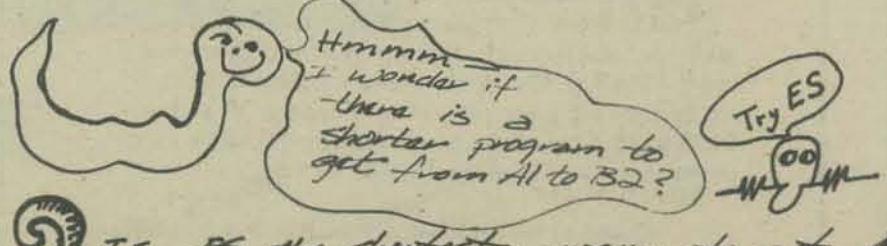
INCHWORM loves to wander, to EXPLORE new spaces. One day, carried by a friendly leaf, INCHWORM sailed to a small island.

"Aha!" says INCHWORM, I think I see something interesting over there in square B2. I shall program myself to go there."

Here he is ... in A1, of course..

And so he does, with this 4 step program: EWSE

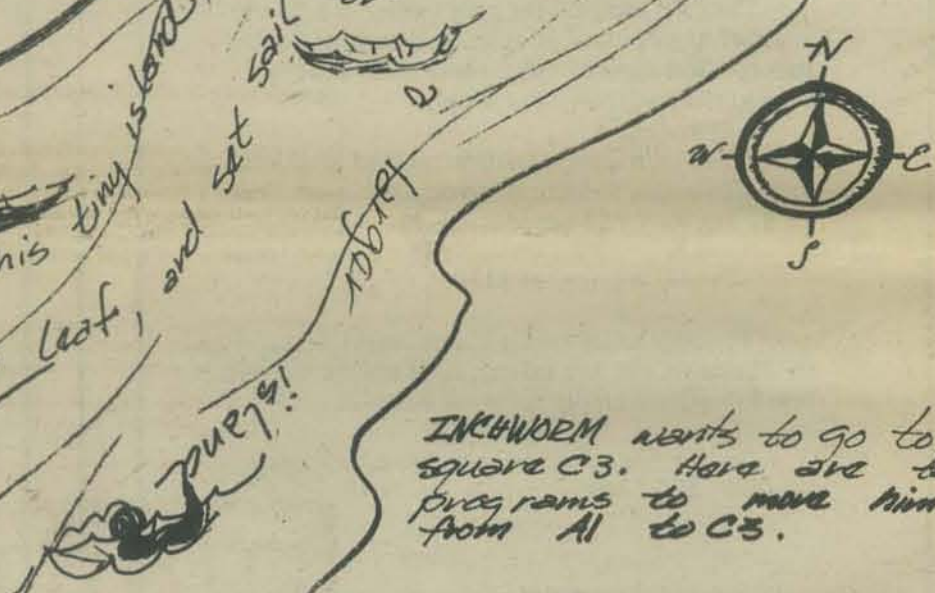




Is ES the shortest program to get INCHWORM from A1 to B2? Remember — INCHWORM can move only in the directions N, S, E, or W

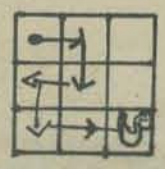
Can you write a different 2 step program to get INCHWORM from A1 to B2?

INCHWORM soon tired of this tiny island, climbed back on his leaf, and set sail for larger islands!



INCHWORM wants to go to square C3. Here are two programs to move him from A1 to C3.

4 step PROGRAM: EESS

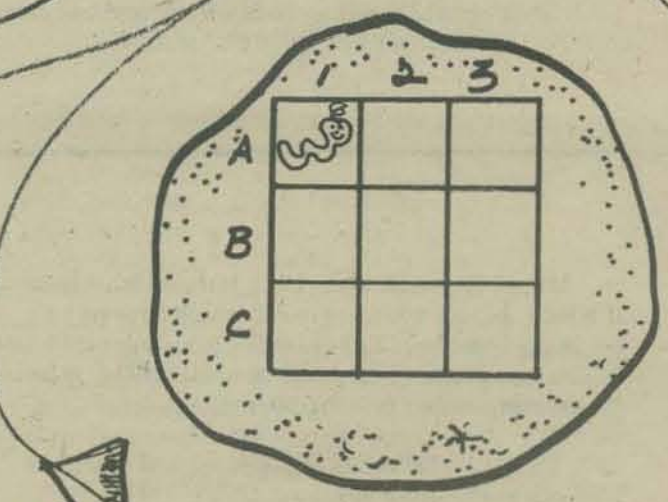


6 step PROGRAM: ESWSEE

We think that, on this island, all shortest programs will have exactly 4 steps.

Write all 4 step programs to get INCHWORM from A1 to C3. How many different 4 step programs are there?

Can there be a program with fewer than 4 steps to get INCHWORM from A1 to C3?



Yup, he landed on square A1 of the new island

NEXT TIME — We will help INCHWORM explore the entire island in a most efficient way!

KITS

We have been looking at a few kits. We will analyse them futher in our next issue, the hardware issue, but meantime here are a few comments.

PAIA GNOME sound synthesizer

PAIA Electronics, Inc.
1020 W. Wilshire Blvd.
Oklahoma City, Ok. 73116

This is not an expensive kit, but there seems a lot in it for the money. Components appear to be good quality (we didn't have time to test them), and the instructions are excellent Lois put it together (first time she had touched a soldering iorn) with no help and little trouble. Circuit board is single sided copper, so the soldering needed care, and there were many connections. There is a lot on the front panel and many connections to the PCB, making this more complicated than most advanced kits - but the excellence of the instructions more than compensated. Included were two little booklets, 11 and 32 pages, with a crisp exposition of sound synthesis.

Figure 1 - Typical Envelopes

Figure 1 shows an attack/decay and an attack/sustain/decay envelope ("envelope" is a term that designates the behavior of the peak amplitude of the sound and in effect the envelope contains the sound). Figure 1 (a) would be typical of a percussion instrument while figure 1 (b) is the situation that you would expect to find in wind or brass instruments. Taken together, attack, sustain and decay are known as dynamics and the dynamics of an instrument make by far the largest contribution to how that instrument will be perceived by a listener.

TIMBRE

all instruments that are capable of sustain intervals don't sound alike - a trumpet doesn't sound ng like a flute - so there are obviously other differences as well. Timbre is the term ordinarily label for some of these differences.

' timbral characteristics of instruments are the result of two interacting phenc hape" of the oscillations produced by the vibrating element and secondl coupling device that transfers the energy from the vibrating e'

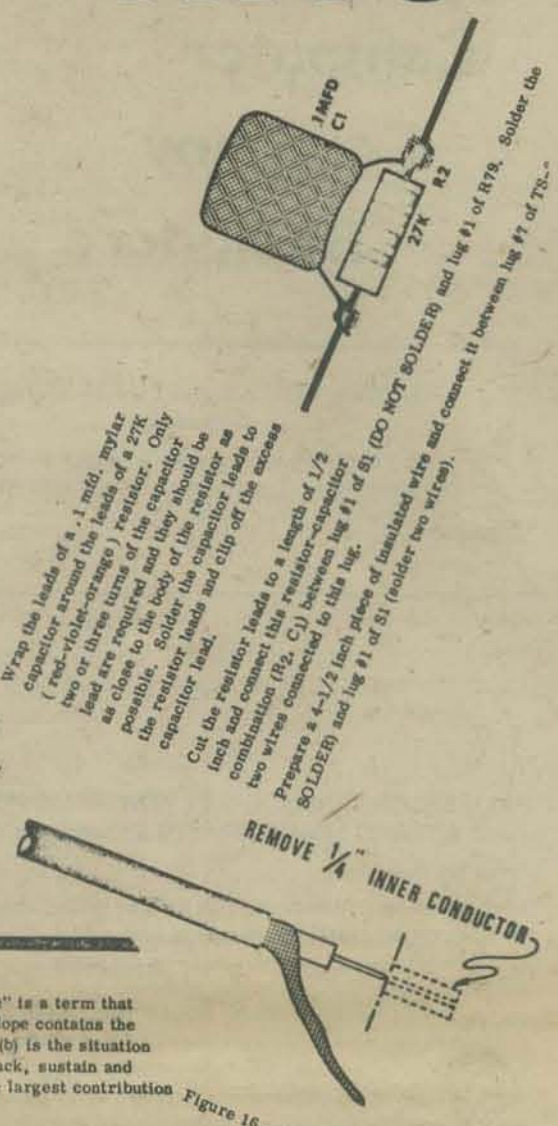


Figure 16 - Co-ax Preparation

SWTPC ASCII Keyboard

Southwest Technical Products Corp.
219 W. Rapsody
San Antonio, Tx 78216

SWTPC ASCII Keyboard proved a little disappointing. The components were good, with the exception of the keys, which were fair. The contacts were copper and exposed to oxidation, which will in a few years, prove irritating. They also lack a good "feel" important to fast typists. The PCB is single sided copper, requiring care in soldering. Keyboards take a lot of abuse, particularly from an excited game player. This one has everything fastened onto the main PCB. It is clearly intended to be strongly mounted, to resist bending, and is strengthed by longitudinal strips, soldered on and used as busses. Solder fatigues. Only time will show whether this unit remains adequate for its duty, but it should long enough for you to be satisfied with it and it is the only keyboard kit at its price.

The following items are available from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX.

#CT-1024 Terminal System Kit with 1024 Memory Card — less cabinet or power supply. $175.00 postpaid.

#CT-E Screen Read Plug-in Card kit. $17.50 postpaid.

#CT-M Manual Cursor Control Plug-in Card kit. $11.50 postpaid.

#CT-P Power Supply for CT-1024 — 115-230 Volt Primaries. $15.50 postpaid.

#KPD-2 Keyboard Kit — 53 Keys. $39.95 postpaid.

SWTPC TV Typewriter

SWTPC TV Typewriter is something of a paradox. Components are good and the PCB boards are tinned and double sided, plated through. This means that soldering is easy and reliable, and that there are very few connections to make, so few possible mistakes. Access is exceptionally good and the board has nice thick lines printed on it, so they won't lift off easily when you solder to them. But the instructions say that it is an advanced kit not for the inexperienced and this is true. The instructions are poor, inadequate if you are new to electronics, and this is a pity because this would otherwise make a good first kit, or better, second after the keyboard. The other reason for calling it an advanced kit is more subtle. Unless you can buy an interface board kit for your computer — you have to design it. So check with SWTPC to make sure that you can get everything you need for your particular system. You probably also need to get inside the TV you plan to use. There are instructions for this, but you may need help here, or you should budget enough to buy a TV monitor.

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Bob Kahn, Lawrence Hall of Science

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PROBABILITY, Koosis

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Wallace Judd

This book is a necessity for anyone who owns or intends to purchase a hand calculator, from the most sophisticated (the HP 65 for example) to the basic "four banger."

COMPUTERS AND COMPUTATION

This is the best book about computers . . . what they are, how they happened, how they work and how they are used. It consists of 26 articles from *Scientific American*, 1950 through 1971.

TTL COOKBOOK, Donald E. Lancaster

TTL Cookbook is an excellent book if you have just run into transistor-transistor logic. It is predominately about digital logic.

PROFESSOR GOOGOL'S FLYING TIME MACHINE AND ATOMIC SPACE CAPSULE, Sam Valenza, Jr.

From the Forward –

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-cheek, 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.

SERIOUS GAMES, Clark C. Abt

Read this book to find out why to play games and simulation games in or out of the classroom.

MY COMPUTER LIKES ME, Dymax

In an easy going, conversational style, this 64 page workbook introduces BASIC to young or old. Designed to be used with frequent access to a timeshare terminal (learn by doing!), we use this large format book in our introductory workshops for people with no previous computer experience or knowledge of programming. The teaching examples are oriented around population problems and demographic data.

COMPUTER LIB, Theodor H. Nelson

From the Summary –

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

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

BASIC, Albrecht, Finkel and Brown

The book is similar (in style only) to Albrecht's popular *Teach Yourself BASIC*, but it is much more thorough and better organized. It is designed as a self-teaching text. The text is very suitable for any grade level, as the examples are not solely based on math, but are taken from business, social science, humanities and simple statistics.

BASIC Programming, Kemeny & Kurtz

On the first day, Kemeny and Kurtz invented BASIC. Then they wrote a book. We don't recommend this book for learning BASIC but we do recommend it as a reference guide . . . applications resource and idea generator for people who already know a little BASIC.

BASIC Computer Games, edited by Dave Ahl

It's not the first collection of computer games says the intro, nor will it be the last, but we sure recommend it for your library.

PCC GAMES (PROGRAM LISTINGS)

Bare program listings of the computer games presented in back issues of PCC. They are written in a standard form of BASIC. When strings are used they are standard HP strings and you may have to modify the programs for your system.

Basic BASIC, James S. Coan

Beginners can learn BASIC from this book but we like it best for its excellent chapters on applications of the BASIC language. The book is full of sample programs and problems.

PROBLEMS FOR COMPUTER SOLUTION,
Fred Gruenberger & George Jaffray

After you learn to talk to computers, what do you talk about? If you want inspiration, try this book. 92 problems, something for everyone – easy, hard, math, non-math, all beautifully written.

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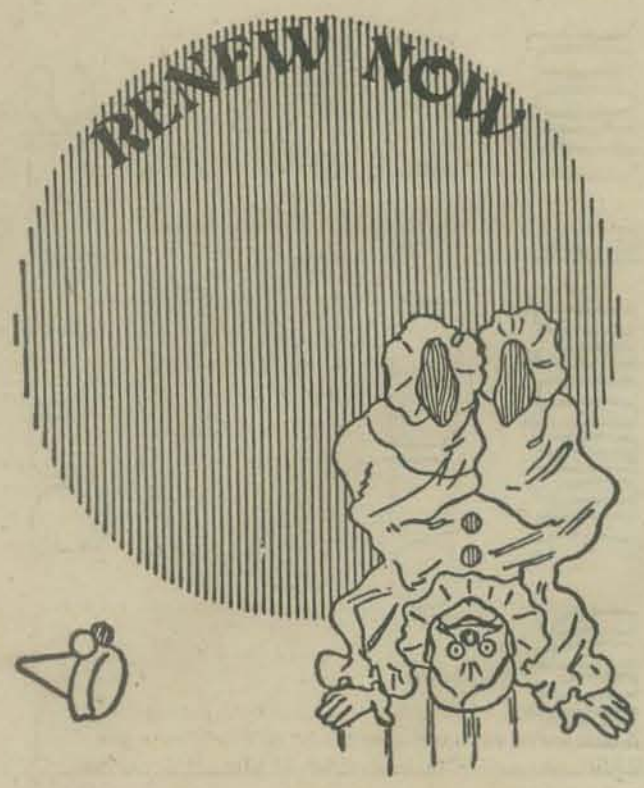

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A special thanks to Candy Nadel for her illustrations on pages 16 and 20.

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