creative computing

a non-profit magazine of educational and recreational computing

Jan-Feb 1975 $1.50

Inner City Variation No. II *Ruth Leavitt*

Palindromes, Magic Squares
Computers in English and Journalism
Reports on PLATO and TICCIT
Games, Puzzles, Reviews

creative computing

P.O. Box 789-M Morristown, New Jersey 07960 (201) 267-5559

Dear Recipient:

You hold in your hands the second issue of Creative Computing. We hope you find it useful and enjoyable!

This issue is being sent to our subscribers, of course, (thank you all for subscribing!) and to every public library in the U.S. If you are a librarian, we encourage you to subscribe to Creative Computing for your library.

Creative Computing is chock full of articles, activities, and views about the use of computers and technology in education. It covers the entire educational spectrum from elementary schools through universities. Creative Computing has been endorsed by 14 major computer education projects and will report on the activities of these projects.

In addition to classroom materials, Creative Computing will also examine the social impact of the computer and technology on our lives. Things like health care, law enforcement, privacy, jobs, elections, credit ratings, etc., all will be scrutinized by Creative Computing.

Libraries may subscribe at the low institutional rate of $15 per year or $40 for three years. Your visitors will be happy to find Creative Computing in your library. But tie a chain around it; we're sure it will be one of your most popular periodicals!

If you're a subscriber, may I ask a personal favor? Frankly, we have a long way to go before we'll break even financially, hence we need more subscribers badly. You can help by:

1. Getting at least two more people to subscribe. Subscription blanks are in the back. This will help tremendously.

2. Posting one or more subscription posters in high traffic locations in your computer center, office, or school. Drop me a line noting the number of posters you can use.

3. Getting your library to subscribe.

Thanks for your help. I'm sure you'll find Creative Computing interesting and fun!

Sincerely yours,

David H. Ahl

David H. Ahl
Publisher

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CREATIVE COMPUTING MAGAZINE • COMMUNITY COMPUTER CENTER • PEPPERMINT PRESS

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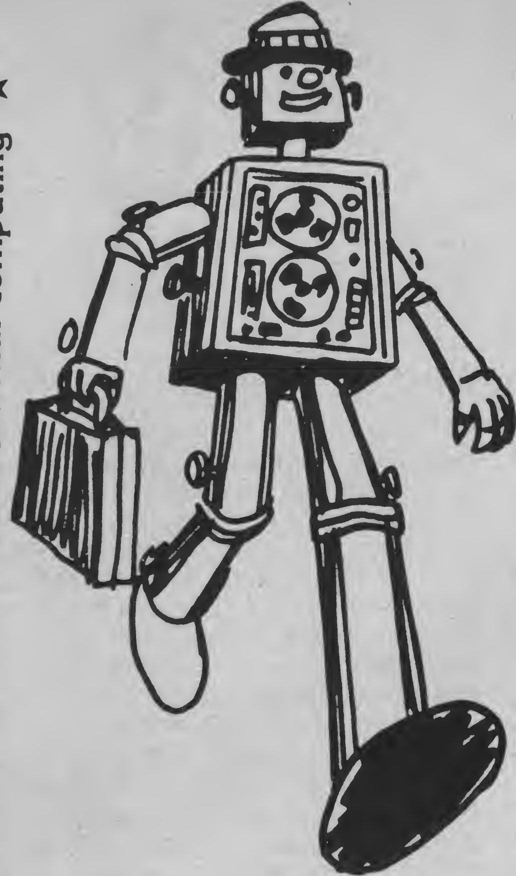
★ a non-profit magazine of educational and recreational computing ★



In This Issue of CREATIVE COMPUTING

ARTICLES

ACTIVITIES & GAMES

HARD-CORE CAI

FOOLISHNESS

DEPARTMENTS

Assorted facts throughout this issue are taken from various United States Government publications, dictionaries, and "Incredible Facts, Amazing Statistics, Monumental Trivia" by Will Eisner, Poorhouse Press, New York.

Volume 1 Number 2

CREATIVE COMPUTING is published bi-monthly by Ideametrics, P. O. Box 789-M, Morristown, NJ 07960. Third class postage paid at Morristown, NJ. Subscriptions: Institutional 1-year $15, 3-year $40; Individual 1-year $8, 3-year $21; Student 1-year $6, 3-year $16. Foreign postage $1.50 per year additional. Single copies $1.50.

THE COVER

The cover is by Ruth Leavitt, Minneapolis, MN and is titled "Inner City Variation No. II". This design has been used to produce three forms of finished work: 1) an oil painting (36" x 48") on exhibition in the "Color" show, Minnesota Museum of Art, 1974, 2) a serigraph and 3) layered plastic on foil. These latter two are currently on exhibition at the College of St. Catherine, St. Paul, Minnesota.

The design was produced with an interactive FORTRAN IV program outputting onto microfilm. The cover is one layer of the color separation used for the serigraph. The design is one of a series exploring plastic deformation of three-dimensional projected objects. Other series by the artist have related to both two- and three-dimensional designs. The microfilm gives only the line drawings; the artist fills in the shaded areas giving mass and depth to the finished work.

Ruth Leavitt's works have appeared in eighteen exhibitions since 1969, including two one-woman exhibitions. The cover work was supported, in part, by a grant from the National Endowment for the Arts.

CREATIVE COMPUTING Editorial

Is Breaking Into A Timesharing System A Crime?

Is it a crime to practise the art of attempting to defeat the software security of a time-sharing computer? There are several cases that we should consider here: in the first case the user is solely concerned with demonstrating that the software is not secure and once he has done this he delights in revealing the circumstances to his computer centre (and probably suggests what they should do to avoid such breaches of security in the future.) Secondly a user may simply abandon all interest as soon as he has achieved his object but fails to tell anyone and fails to keep secure the knowledge that he has gained. In the third case we consider a user who deliberately breaks the security of a system so that he can vandalise data belonging to other users and finally we must consider the case of the user who gains illegal access to data for personal gain.

In an educational environment we must consider these cases in the same way that we might consider the case of a boy who attempts to defeat the combination lock on someone else's bicycle. Any boy who behaves like this is certainly foolish for his motives are almost certain to be misunderstood by anyone in authority who catches him. But we must not make crimes where none exist for in all probability the motivation is the intellectual challenge not the thought of subsequent gain. How then ought we to advise our students on this issue?

It seems to me that we should not attempt to dissuade our students from practising this art, for we shall not succeed in stopping all cases only those that are least harmful to the system. The student in the first category might well be of benefit to users gnerally (although the computer centre may not think so for undoubtedly he makes more work for them). The student who commits acts of vandalism on the other hand is a public nuisance and will probably be recognised as such by his colleagues who simply want to use the system. Admittedly any kind of vandalism can sometimes be classified as a "joke". But here the general rule that, once is fully, twice is a nuisance and three times is wicked, holds good.

It is going to be counterproductive to take these so-called jokes too seriously since in all probability scolding will simply make it seem more funny. Breaking the security of the system for material gain in practice is unlikely to happen for it is difficult to see what a student could hope to gain by it. Although theoretically a teacher might leave a confidential examination question on the system, in practice he would be very unlikely and somewhat foolish to do so. There can be very little to be gained from illegal access to the system since legal access must and should be so easy so that although any lack of security in an educational time-sharing system must worry people, there is probably little likelihood of any great harm being done provided we keep a snese of proportion.

Of course it should be impossible for any student to succeed in breaching the security barrier and as time passes we shall probably find that it is virtually impossible to succeed. Is attempting to defeat the manufacturers security software a waste of computing resources? That is another matter entirely and one perhaps we could discuss on a future occasion. Has anyone any views?

In Hatfield, the Computer Centre at the Polytechnic is well aware of these problems and, like many educational services, is short of resources to cope with them. Maybe they should be protected from the onslaught of students who always seem to have a desire to take things to pieces to see how they work. We talk about teaching the social implications of computers and perhaps lesson time spent on this issue and related topics might help to give students a better appreciation of all the problems.

W. Tagg

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PATIENCE!

It takes about 6 weeks for us to process a new subscription. Then each issue goes out in two or three waves about 10 days apart. Third class mail takes between 5 and 25 days for delivery. And we only publish every other month.

What all this means is that a new subscriber could potentially wait up to 3-1/2 months between mailing us a subscription and receiving the first issue. Also, one subscriber might receive a particular issue as much as 3 to 4 weeks before a subscriber next door.

But don't fret. Ultimately you'll get yours!

Input/Output

Dear Editor:

Would you please send me any information on a charter subscription to your new publication. I'm a very big kid and would like very much to be part of this learning opportunity.

Edward J. Kobos, Jr.
Mohawk Valley Community College

Dear Editor:

Congratulations! I received and read the first issue of *Creative Computing* with great enthusiasm. It seems to be well on its way to being a valuable asset to students, instructors, and computer users in general.

Keep up the good work!

Mike Renzi
Data General Corporation

Dear Editor:

Thank you for sending us the first issue of *Creative Computing*. It is an excellent beginning and I hope that you will keep up the good work.

Edward S. Cornish, President
World Future Society

Dear Editor:

After reading the first issue, I am very enthusiastic about the future of CREATIVE COMPUTING. I think it fills a gap that existed in the material available to those interested in using computers in the classroom.

Carolyn W. Evans
Medical College of Georgia

Dear Editor:

Congratulations on your charter issue. It is great to see at long last a first-rate, exciting magazine concerning coputers in education. Promise me you will keep up the good work.

Allan B. Ellis, President
Education Research Corp.

Dear Editor:

CONGRATULATIONS on the birth of Creative Computing!! The first issue is dynamite. While its readership may account for only a small percentage of the computing done in America, I'm convinced that it will contribute a much greater percentage of the creativity contained therein. Creative Computing will provide an important communication point to facilitate and magnify this contribution.

Scott B. Guthery, President
Computer Recreations Corp.

Dear Editor:

For some time now I have been wanting to print you a letter; however, of late I have had to steal cycles just to read in the latest *Creative Computing.*

I'll bet that half of you don't even know where I work or that my work is my life. Of you who know me, how many of you think of me as a number. This afternoon I have come to a hard stop to let you know that I too have feelings.

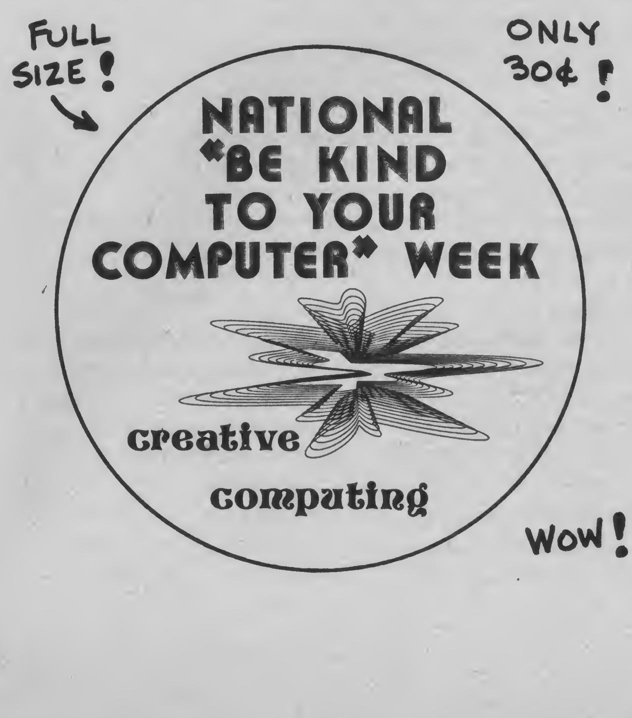
How would you like to be poked all day long? They twist my dials until I think I'm going to lose them. If they aren't cramming cards down my stacker, someone is either mounting or dismounting me. Furthermore, when the students and the staffers (those staffers, they really take the cake) feed me data, they slip in garbage, can you imagine! And, on top of all this abuse, to add insult to injury they swear at me when I am not feeling well.

Now, I think that this is unjust treatment and on behalf of all my hardware brothers, I proclaim that the first week in February shall henceforth be known as National "Be Kind To Your Computer" Week.

Symbolically yours,
IMA Computer

Ed: I agree, computers are sensitive and in order to help you celebrate we have made up a special button for all the offenders.

Reader: I confess, please send me a Be Kind To Your Computer button, I have enclosed 30¢ in coin or 3 stamps to cover postage and handling. I also promise to be kind to my computer and wear my button proudly.



MADLIB~A GAME

Madlibs are a creation of Roger Price and were designed as a hilarious party game. In playing the game, the leader has a sheet of paper similar to the one below, with a short story written on it but with certain words missing. In turn, he asks each person in the room to supply one word, *before* reading the story. The first person may be asked for an adjective, the second for a noun, etc., until all the blanks are filled in. The leader then reads the story to the group in a hearty, booming voice.

FABLE

Once upon a time a__________(adj.)dog got hold of a __________(adj.)bone. He was walking across a__________(adj.) bridge and saw his__________(adj.)reflection in the water. "__________(exclamation)!" he said, "there is another __________(adj.)dog with another__________(adj.)bone. I'll make a__________(adj.)grab, take his and then I'll have two __________(adj.)bones." With that the__________(adj.) dog jumped into the water and__________(adverb)drowned.

MORAL: A__________(noun)in the__________(noun)is worth two in the__________(noun).

With Madlib, you can exercise some real creativity with synonyms. Consider: instead of saying "big" use another word like "huge," "tremendous," "enormous," "bulbous," "bulging," "massive," or "boundless."

Exercise 1

For each of the following words, write 10 synonyms. Use the most ludicrous synonyms you can think of. Try to do it by yourself, or use a dictionary or *Roget's Thesaurus*. Compare your word lists with those of other class members.

small	rough
old	ugly
witty	brain

Exercise 2

Play MADLIB on the computer. Set the tone of the finished story by using all ugly sounding words or all political words or all buzzwords from one profession. Compare your stories with those of other class members.

The MADLIB program was originally written by Henry Gallo, a high school student in Huntington, NY. It was extensively modified by David Ahl.

SAMPLE RUN

```
RUN MADLIB
MADLIB STORY-WRITER BY DAVE AHL BASED ON A PROGRAM
ORIGINALLY WRITTEN BY HENRY GALLO, JOHN GLENN HS.

O.K.  WE'RE GOING TO WRITE SOME MAD-LIB STORIES
TOGETHER.  YOU SUPPLY THE WORDS, I SUPPLY THE PLOT.

FIRST I NEED 11 ADJECTIVES.  ADJECTIVES MODIFY
A NOUN, E.G., RED, DIRTY, LARGE, ETC.
? HORRENDOUS
? UNUSUAL
? UGLY
? RANCID
? OVERFLOWING
? SMELLY
? IMPROPER
? DIRTY
? UNDIGESTED
? GROTESQUE

? FRANKFURTER

HOW ABOUT TWO FIRST NAMES OF MEN
? FRANK
? WOLFGANG
THE FIRST NAME OF A GIRL
? BERTHA
AND SOMEONE'S LAST NAME
? WASHINGTON
A GEOGRAPHICAL LOCATION
? ROXBURY SLUMS
A LIQUID
? MOXIE
AND FINALLY, AN EXCLAMATORY WORD OR TWO
? OH PSHAW

VERY GOOD!  WOULD YOU LIKE A NEWSPAPER AD (1),
A WESTERN (2), A STORY ABOUT THE ARMY (3), OR
A WATERBED (4).  WHICH ONE, 1, 2, 3, OR 4? 1


                DAILY GRUNT CLASSIFIEDS

FOR SALE: 1957 SEDAN   THIS HORRENDOUS CAR IS IN A UNUSUAL
CONDITION. IT WAS FORMERLY OWNED BY A UGLY SCHOOL TEACHER
WHO ALWAYS DROVE IT SLOVENLY. THERE IS A RANCID GROUNDHOG IN
THE BACK SEAT. IT HAS A CHROME BEER CAN ON THE HOOD, A OVERFLOWING
PAINT JOB, SMELLY TIRES AND THE BACK OPENS INTO A IMPROPER
GARBAGE CAN. WILL CONSIDER TAKING A SLIGHTLY USED INSECT IN TRADE

LOST: IN THE VICINITY OF ROXBURY SLUMS, A DIRTY FRENCH
POODLE WITH UNDIGESTED HAIR AND A GROTESQUE TAIL. IT ANSWERS
TO THE NAME OF BERTHA. WHEN LAST SEEN IT WAS CARRYING A
AARDVARK IN ITS MOUTH. A BLEEDING REWARD IS OFFERED.


                 AN ADULT WESTERN

TEX WASHINGTON, THE MARSHALL OF FRANK CITY RODE INTO TOWN. HE
SAT GREEDILY IN THE SADDLE, READY FOR TROUBLE. HE KNEW THAT
HIS HORRENDOUS ENEMY, WOLFGANG THE KID WAS IN TOWN. THE KID WAS
IN LOVE WITH TEX'S HORSE, BERTHA.  SUDDENLY THE KID CAME OUT
OF THE IMPROPER NUGGET SALOON.

'DRAW TEX,' HE YELLED HEAVENLY.

TEX REACHED FOR HIS INSECT, BUT BEFORE HE COULD GET IT
OUT OF HIS AARDVARK THE KID FIRED, HITTING TEX IN THE BELLY BUTTON
AND THE KNEECAP.

AS TEX FELL HE PULLED OUT HIS OWN DECTAPE AND SHOT THE KID
 17 TIMES IN THE PIGTAIL. THE KID DROPPED IN A POOL
OF MOXIE.

'OH PSHAW,' TEX SAID, 'I HATED TO DO IT BUT
HE WAS ON THE WRONG SIDE OF THE FRANKFURTER.'
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PROGRAM LISTING

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10 PRINT "MADLIB STORY-WRITER BY DAVE AHL BASED ON A PROGRAM"
15 PRINT "ORIGINALLY WRITTEN BY HENRY GALLO, JOHN GLENN HS.":PRINT
20 DIM A$(11),B$(5),C$(10):RANDOMIZE
30 PRINT "O.K.  WE'RE GOING TO WRITE SOME MAD-LIB STORIES"
40 PRINT "TOGETHER.  YOU SUPPLY THE WORDS, I SUPPLY THE PLOT.":PRINT
60 PRINT "FIRST I NEED 11 ADJECTIVES.  ADJECTIVES MODIFY"
70 PRINT "A NOUN, E.G., RED, DIRTY, LARGE, ETC."
80 FOR I=1 TO 11:INPUT A$(I):NEXT I
90 PRINT:PRINT "NOW I NEED 5 ADVERBS.  THEY MODIFY VERBS"
100 PRINT "AND END IN 'LY' (SLOWLY, GREEDILY, ETC.)"
110 FOR I=1 TO 5:INPUT B$(I):NEXT I
120 PRINT:PRINT "O.K.  NOW 10 NOUNS, E.G., TELETYPE, INSECT, COAT, ETC."
130 FOR I=1 TO 10:INPUT C$(I):NEXT I
140 PRINT:INPUT "HOW ABOUT TWO FIRST NAMES OF MEN"D$:INPUT E$
160 INPUT "THE FIRST NAME OF A GIRL"F$
170 INPUT "AND SOMEONE'S LAST NAME"G$
180 INPUT "A GEOGRAPHICAL LOCATION"H$
190 INPUT "A LIQUID"I$
200 INPUT "AND FINALLY, AN EXCLAMATORY WORD OR TWO"J$:PRINT
220 PRINT "VERY GOOD!  WOULD YOU LIKE A NEWSPAPER AD (1),"
230 PRINT "A WESTERN (2), A STORY ABOUT THE ARMY (3), OR"
240 INPUT "A WATERBED (4).  WHICH ONE, 1, 2, 3, OR 4";N:PRINT
250 IF N>0 AND N<5 THEN 270
260 INPUT "COME ON NOW -- 1, 2, 3, OR 4";N:GOTO 250
270 PRINT FOR I=1 TO 6:ON N GOTO 300,400,500,600
300 PRINT "                    DAILY GRUNT CLASSIFIEDS":PRINT
310 PRINT "FOR SALE: 1957 SEDAN.  THIS "A$(1)" CAR IS IN A "A$(2)
320 PRINT "CONDITION. IT WAS FORMERLY OWNED BY A "A$(3)" SCHOOL TEACHER"
330 PRINT "WHO ALWAYS DROVE IT "B$(1)". THERE IS A "A$(4)" "C$(1)" IN"
340 PRINT "THE BACK SEAT. IT HAS A CHROME "C$(2)" ON THE HOOD, A "A$(5)
350 PRINT "PAINT JOB, "A$(5)" TIRES AND THE BACK OPENS INTO A "A$(7)
360 PRINT C$(3)". WILL CONSIDER TAKING A SLIGHTLY USED "C$(4)" IN TRADE"
370 PRINT:PRINT "LOST: IN THE VICINITY OF "H$", A "A$(8)" FRENCH"
380 PRINT "POODLE WITH "A$(9)" HAIR AND A "A$(10)" TAIL. IT ANSWERS"
385 PRINT "TO THE NAME OF "F$". WHEN LAST SEEN IT WAS CARRYING A"
390 PRINT C$(5)" IN ITS MOUTH. A "A$(11)" REWARD IS OFFERED.":GOTO 700
400 PRINT "                    AN ADULT WESTERN":PRINT
410 PRINT "TEX "G$", THE MARSHALL OF "D$" CITY RODE INTO TOWN. HE"
420 PRINT "SAT "B$(2)" IN THE SADDLE, READY FOR TROUBLE. HE KNEW THAT"
430 PRINT "HIS "A$(1)" ENEMY, "E$" THE KID WAS IN TOWN. THE KID WAS"
440 PRINT "IN LOVE WITH TEX'S HORSE, "F$".  SUDDENLY THE KID CAME OUT"
450 PRINT "OF THE "A$(7)" NUGGET SALOON.":PRINT
460 PRINT "'DRAW TEX,' HE YELLED "B$(3)".":PRINT
470 PRINT "TEX REACHED FOR HIS "C$(4)", BUT BEFORE HE COULD GET IT"
475 PRINT "OUT OF HIS "C$(5)" THE KID FIRED, HITTING TEX IN THE "C$(6)
480 PRINT "AND THE "C$(7)".":PRINT
485 PRINT "AS TEX FELL HE PULLED OUT HIS OWN "C$(8)" AND SHOT THE KID"
490 PRINT INT(50*RND+3)"TIMES IN THE "C$(9)". THE KID DROPPED IN A POOL"
492 PRINT "OF "I$".":PRINT:PRINT "'"J$",' TEX SAID, 'I HATED TO DO IT BUT"
495 PRINT "HE WAS ON THE WRONG SIDE OF THE "C$(10)".'":PRINT:GOTO 700
500 PRINT "IF YOU PLAN ON JOINING THE ARMY, HERE ARE SOME "A$(11)
510 PRINT "HINTS THAT WILL HELP YOU BECOME A "A$(10)" SOLDIER.":PRINT
520 PRINT "THE ARMY IS MADE UP OF OFFICERS, NON-COMS AND "C$(1)"S."
530 PRINT "YOU CAN RECOGNIZE AN OFFICER BY THE "C$(2)"S ON HIS"
540 PRINT "SHOULDERS AND THE FUNNY-LOOKING "C$(3)"S ON HIS CAP."
550 PRINT "WHEN YOU ADDRESS AN OFFICER, ALWAYS SAY "C$(4)" AND SAY IT"
555 PRINT B$(5)".  IF YOU GET A "A$(9)" HAIRCUT, KEEP YOUR "C$(5)"S"
560 PRINT "SHINED, AND SEE THAT YOUR "C$(6)" IS CLEAN AT ALL TIMES."
565 PRINT "YOU WILL BE A CREDIT TO THE SLOGAN:":PRINT
570 PRINT "                 THE ARMY BUILDS BETTER "C$(7)"S!":PRINT
575 PRINT "AT ROLL CALL, WHEN THE "A$(8)" SERGEANT CALLS YOUR NAME,"
580 PRINT "SHOUT '"J$"' LOUD AND CLEAR.":PRINT
585 PRINT "YOU WILL BECOME FAMILIAR WITH WEAPONS LIKE THE .30 CALIBRE"
590 PRINT C$(8)" AND THE AUTOMATIC "C$(9)".":PRINT
592 PRINT "FOLLOW THIS ADVICE AND YOU MAY WIN THE......"
595 PRINT "*********** "A$(7)" CONDUCT "C$(10)" **********":GOTO 700
600 PRINT "BUST-A-BUTTON AND DUCK DEPT. STORE":PRINT"DIX HILLS, NEW YORK"
610 PRINT:PRINT "DEAR SIRS:":PRINT
620 PRINT "LAST WEEK I PURCHASED A "A$(2)" CONTOUR WATER BED IN YOUR"
630 PRINT "STORE. I GOT IT ESPECIALLY FOR MY "A$(4)" HUSBAND WHO SLEEPS"
640 PRINT "VERY "B$(1)" AND SAYS THAT "A$(6)" WATER BEDS THAT HAVE"
650 PRINT C$(1)"S IN THEM MAKE HIS "C$(3)" ACHE. WHEN THE BED"
655 PRINT "ARRIVED MY HUSBAND TESTED IT "B$(2)" AND SAID THE "A$(8)
660 PRINT C$(5)" WAS BENT AND KEPT PRESSING INTO HIS "C$(6)". HE SAYS"
665 PRINT "THIS COULD LEAD TO A "A$(10)" CONDITION OF THE "C$(8)".":PRINT
670 PRINT "I WOULD LIKE TO EXCHANGE THIS "A$(9)" BED FOR ONE THAT"
675 PRINT "WILL ALLOW MY HUSBAND TO SLEEP "B$(4)" AND WON'T MAKE"
680 PRINT "HIS "C$(10)" SORE.":PRINT:PRINT TAB(30);"YOURS "B$(5)","
690 PRINT TAB(30);F$" "G$:PRINT
700 PRINT FOR I=1 TO 6:INPUT "WANT ANOTHER STORY (YES OR NO)";Y$
710 IF Y$="NO" THEN 900
720 INPUT "WANT TO USE THE SAME WORDS (YES OR NO)";Y$:PRINT
730 IF Y$="YES" THEN 220 ELSE IF Y$="NO" THEN 60
740 INPUT "COME ON NOW -- 'YES' OR 'NO'";Y$:PRINT:GOTO 730
900 PRINT:PRINT "O.K.  SEE YOU AGAIN SOMETIME!"
999 END
```

YOUNGEST SUBSCRIBER?

In going through the *Creative Computing* subscription roles last week, I turned up with who is probably our youngest subscriber. David Kantrowitz of Brookline, Massachusetts is in Grade 4. Anyone younger than that out there?

CHEAP WALLPAPER!

Want a hilarious *Creative Computing* subscription poster (centerfold of November-December 1974 issue) to grace your walls or bulletin board? Send us a dime or 10¢ stamp and you've got one.

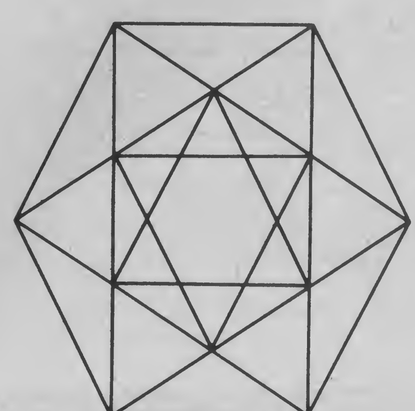
Puzzles and Problems for Fun

▶ A fly and a mosquito start together to circle a building, but the fly circles the building in six minutes, the mosquito in four. How many minutes will elapse before the mosquito passes the fly?

▶ Write down five odd numbers so they total 14.

▶ A man, anticipating the rationing of gasoline, hoarded 100 gallons in a large tank behind his garage. One night a neighbor decided to siphon off ten gallons for his snowmobile. As the gasoline was run off, the villainous neighbor poured water in the tank at the same rate as he was filling his gas can, keeping the contents thoroughly mixed throughout.

If the whole caper took ten minutes, how many gallons of gasoline and how much water did the neighbor end up with in his ten-gallon can?



▶ How many triangles are there in this figure?

Fairy Tales Can Come True...

ONCE THERE WAS a country that had made more technical progress than any other country in the world.

ITS SCIENTISTS, economists, psychologists, engineers and all the like were generating billions of bits of knowledge each year -- knowledge that could help the country make the best decisions to keep its people healthy, wealthy, and wise.

THE PEOPLE, their elected representatives, and the president couldn't keep up with all this information -- and didn't understand most of it anyhow -- and important decisions seemed more and more to be wrong.

SOME SCIENTISTS came up with an invention -- a computer to store all the old facts and the new ones as they came along -- and to make it easy to find the facts and to analyze them.

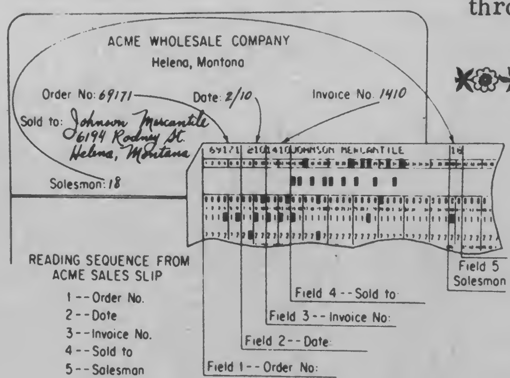
OTHER SCIENTISTS developed ways of organizing facts to be able to manage operations involving many, many people and lots of money. But ordinary people can't talk to computers or use these new systems.

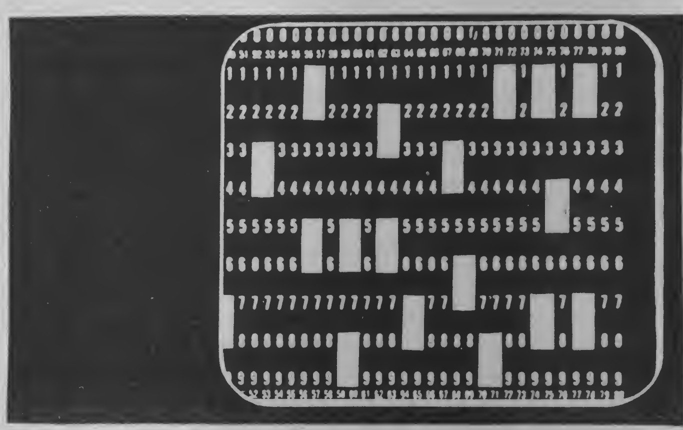
IT TAKES professional scientists to do this job, and so the people, their elected representatives, and the president were coming to depend more and more on these scientists to recommend decisions.

THE SCIENTISTS feel that the facts in the computer have to be complete, even down to the most personal information about each person. The more facts, the more accurate they are, the more correct the decisions will be.

SOME PEOPLE fought back against this. They said that the country was a democracy, that a democracy means the people have a say-so in decision making, that everyone is equal in the country, and that the dignity of individuals is preserved at all costs. They didn't want to see their country run by scientists and computers.

THE SUPPORTERS of the scientists and the computers answered that the democracy was in danger from planlessness and poor administration -- that the world had become too complicated in the two hundred years since the country was formed -- and that the longer people fought the new technology, the greater the chance it would be forced down their throats as a dictatorship completely out of their control.

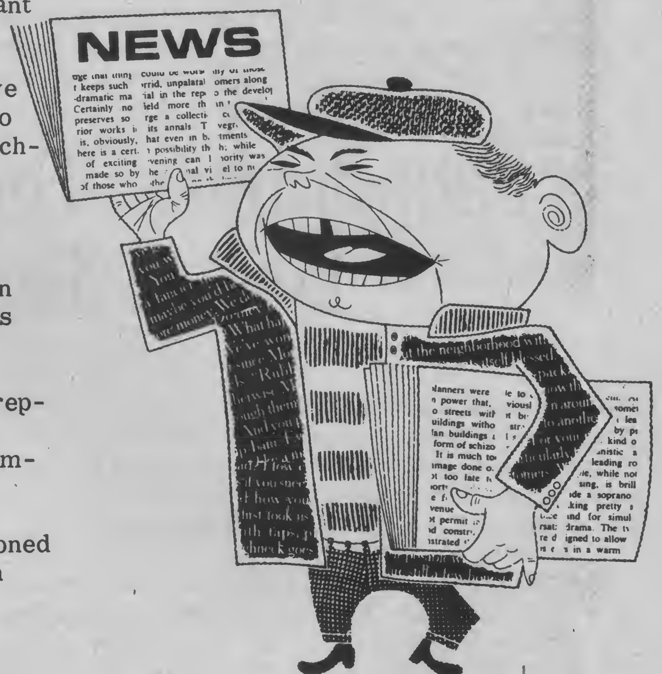




...It Depends on You

SAVE THE NEWSPAPERS FOR A WEEK. THEN CUT OUT ARTICLES THAT YOU BELIEVE GIVE EXAMPLES OF EITHER SIDE OF THE FOLLOWING ISSUES.

Causes and effects in an advanced technological society are so widespread and so hard to match together, that experts and techniques ordinary people can't understand ARE/ARE NOT needed to separate the important from the unimportant in order to make intelligent decisions.



The real danger IS/IS NOT an increasing tendency to leave decisions that the people and their representatives used to debate and decide to groups of independent experts and technicians, elected by nobody and responsible to nobody.

If our society is becoming more indirect -- we're having more trouble trying to see the connections between what happened and what caused it -- then direct participation in government and decision-making IS/IS NOT becoming less relevant.

The idea that an election for president every four years represents a chance to speak out on all the decisions society faces for the next four years IS/IS NOT adequate to contemporary needs.

There IS/IS NOT a way that participation in the old-fashioned use of the word can substitute for the experts and modern decision-making techniques government must use today.

ORGANIZE A DEBATE ON THE FOLLOWING:

RESOLVED: The nation needs a new version of democracy and new political institutions more adequate to the realities of a modern technological society than what exists at present.

CHOOSE TWO SPEAKERS FOR EACH SIDE, ONE TO PRESENT THE ARGUMENTS, AND ONE TO REBATE THE OTHER SIDE'S ARGUMENT.

THE SPEAKER FOR THE AFFIRMATIVE SPEAKS FIRST.
THE SPEAKER FOR THE NEGATIVE SPEAKS NEXT.
THE SPEAKER REBUTTING THE AFFIRMATIVE SPEAKS NEXT.
THE SPEAKER REBUTTING THE NEGATIVE SPEAKS LAST.

USE ANYTHING IN THIS PAMPHLET FOR EVIDENCE, AS WELL AS ANYTHING ELSE YOU CAN FIND THAT IS RELEVANT.

THE REST OF THE CLASS WILL ACT AS A JURY.

Problems for Creative Computing

by Water Koetke

The problems to be discussed in this column are those that seem particularly well suited not just for computing, but for creative computing. They will cover a wide variety of topics and subjects, and all are intended for both students and teachers — for anyone turned on by challenging problems, games or programs.

Your reactions will be very much appreciated. Suggestions for future columns, solutions to problems discussed, new problems, extensions and experiences with problems discussed are all solicited. Please address all correspondence to Walter Koetke in care of *Creative Computing.*

The challenge of creative thought is before all of us — this column is intended for those who choose to demonstrate that creative thought is also behind them. I hope you find the ideas rewarding.

Palindromes: For Those Who Like to End at the Beginning

Egad, a base life defiles a bad age
Doom an evil deed, liven a mood
Harass sensuousness, Sarah
Golf; No, sir, prefer prison-flog
Ban campus motto, "Bottoms up, MacNab"

A palindrome is a work, verse, number or what have you that reads the same backward as forward. The unit in a palindrome may vary. Each of the five lines in the poem at the beginning of this article is itself a palindrome using a letter as the unit. However, a palindromic poem might be written for which the entire poem is a palindrome rather than the individual lines. The unit in a palindrome might also be a word as in:

> *Men wanted warning before police approached;*
> *squealer approached police before warning wanted men.*

The length of plaindromes is, of course, dependent upon the author's cunning and patience. Whether a simple "Mom" or the "Ethopoiia Karkinikie", a palindromic Greek poem of over 400 lines published in 1802, all palindromes seem to merit special admiration. Howard Bergerson's book referenced at the end of this article is a very comprehensive collection of palindromes of many types. His work will be a classic for those interested in literary games. The six palindromic sentences in this article all appear in Bergerson's book.

Palindromes are appropriate as the subject of introductory programs involving string manipulation. For example, writing a program to recognize a palindromic sentence using a letter as the unit requires character manipulation. Writing a program to recognize a palindromic sentence or paragraph using a word as the unit requires both character and word manipulation. This is particularly interesting if the sentence or paragraph is entered one line rather than one word at a time. The creation of palindromes is likely to remain in the province of a human and not a machine endeavor. One may devise clever programs to assist that endeavor, but human creativity supported by a well thumbed dictionary shall remain the most essential resources.

Numeric palindromes are those numbers that read the same backward as forward. The examination of these numbers is a field rich with possibilities for creative computing.

Consider all palindromes that can be written in the form N^k where N and k are positive integers. Would you expect that N is also a palindrome; Let's consider the case of k=2. 14641 and 484 are both palindromes that can be written in the form N^2:

$$14641 = 121^2$$
$$484 = 22^2$$

And both 121 and 22 are also palindromes! Is this always true; And what about other values of k; Is the cube root of a palindromic cube also a palindrome; Is the fourth root of palindromic fourth power also a palindrome?

These questions are of interest because only partial answers have been given. When k=2—if N^2 is a palindrome then N is often, but not always, a palindrome. When k=3—the only known palindromic cube without a palindromic cube root is 10,662, 526, 601, but there may be others yet undiscovered. When k=4 —all known palindromic fourth powers have fourth roots that are palindromes, but what about those that are yet unknown; When k=5 —this one's a little harder as there are no known palindromes that can be written in the form N^5. Clearly the answers to these questions are a proper subject for creative computing—and just as clearly, the fundamental principles required to generate a formidable attack on the answers require no more than high school algebra and the resource of computing facilities.

There is a conjecture concerning palindromes that raises another unanswered question. Begin with any positive integer. If it is not a palindrome, reverse its digits and add the two numbers. If the sum is not a palindrome, treat it as the original number and continue. The process stops when a palindrome is obtained. For example, beginning with 78:

```
     78
+    87
    165
+   561
    726
+   627
   1353
+  3531
   4884
```

The conjecture, often assumed true, is that this process will always lead to a palindrome. And indeed that is just what usually happens. Most numbers less than 10000 will produce a palindrome in less than 24 additions. But there's a real thorn in the side of this conjecture—196. No one really knows whether a palindrome will be produced if the beginning number is 196.

Writing a program that explores this conjecture can be a valuable experience on several levels. A program that examines the integers 1 through 10000 is a worthwhile student project because it requires the ability to deal with numbers of up to 14 digits. The numbers 196, 691 and the resulting sums and their reversals would, of course, have to be excluded from this program. The exploration of 196 really should be a category of its own. Pursuit of this problem will lead the student down several interesting side roads, lure him into doing some original mathematics, and certainly teach him much about computing. Solution of this problem should certainly merit an A since it will bring him recognition that extends well beyond his classroom. Personally, I'm quietly hoping that the problem of 196 is solved by a secondary school student just as the three largest known perfect numbers were discovered by a secondary student with access to computing facilities, but that's a different subject isn't it?

Related References

Bergerson, Howard W.; *Palindromes and Anagrams;* Dover Publications, New York; 1973.

Gardner, Martin; "Mathematical Games"; *Scientific American;* New York; August 1970; pages 110-114.

Kordemsky, Boris A.; *The Moskow Puzzles;* Charles Scribner's Sons, New York; 1972, page 172.

MORE ABOUT PALINDROMES

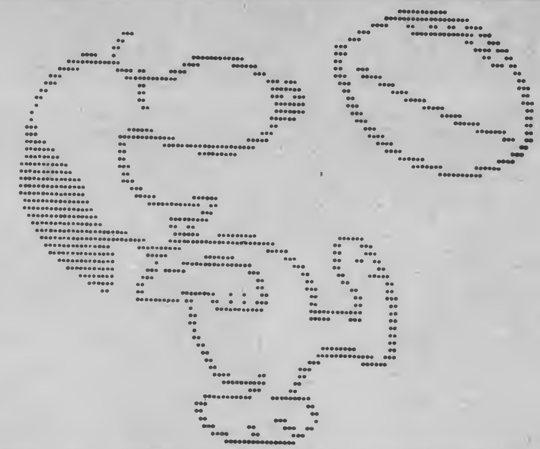
The January and June 1974 issues of *Games & Puzzles* contained some additional discussion about palindromic numbers on Darryl Francis' Puzzle Pages and in letters from R. Hamilton and Jonathan Kessel.

R. Hamilton notes in his letter, "Of the 900 three digit numbers, 90 are themselves palindromic, 228 require just one reversal to form a palindromic number, 270 require two reversals, 143 require three reversals, 61 require four reversals, 33 require five reversals and 75 require more than five. These remaining 75 numbers could be classed into just a few groups, the members of which after one or two reversals each produce the same number and are therefore essentially the same. One of these groups consists of the numbers 187, 286, 385, 583, 682, 781, 869, 880 and 968 each of which when reversed once or twice form 1837 and eventually form the palindromic number 8813200023188 after 23 reversals (The nos. 89 and 98 also belong to this group.) The most interesting group consists of the numbers 196, 295, 394, 493, 592, 689, 691, 788, 790, 887 and 986 which form 1675 after a few reversals but after 100 reversals fail to produce a palindromic number forming the non-palindromic 44757771534490515617290699271561508443627774644."

Jonathan Kessell notes, "However, what you didn't mention, maybe because it is rather obvious, is that if 78 and 96 both yield 4884, then 87 and 69 will do so, too. Thus, not only 89 gives 8,813,200,023,188 after 24 reversals, but so does 98. You may also be interested to know that 249 integers less than 10,000 fail to produce a palindrome after 100 reversals. The smallest of these numbers is 196; indeed, even after as many as 4,147 reversals, this number still fails to generate a palindromic number. (Just how many reversals are necessary for 196 to produce a palindromic result? — DF.) The numbers 6,999 and 7,998 produce the longest palindrome: 16,668,488,486,661 — out of all the numbers from 1 to 10,000, that is. It takes twenty steps to produce this palindrome from both of the numbers.

Also, there is an infinity of palindromic squares, most of which have palindromic square roots. The smallest nonpalindromic root is 26 — the square root of 676. Similarly with cubes and cube roots. The smallest nonpalindromic cube root is 2,201, the cube being 10,662,526,601. The number 836 may be of interest, too. It is the largest three-digit integer whose square root (698,896) is palindromic. Further, 698,896 is the smallest palindromic square with an even number of digits; also, when turned upside down, the number remains palindromic. The next largest palindromic square with an even number of digits is 637,832,238,736, which is the square of 798,644."

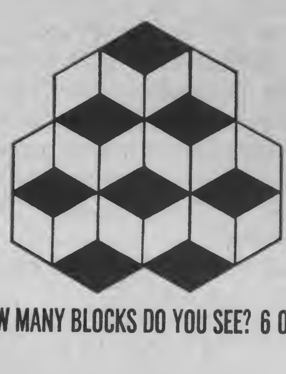
Anyone care to take the study of palindromic numbers further still?



Palindromes (con't)

Tom Karzes, an eighth grader at Curtis Jr. High School, Sudbury, MA wrote a program to take any number and test whether it is a palindrome; if it is not the program goes on to form the palindrome. The program fails with greater than a 7-digit number. Can you write one that doesn't?

```
LISTNH
10 REM *** TOM KARZES, CURTIS JR HS, SUDBURY, MA
11 PRINT \INPUT "GIVE ME A NUMBER";A\PRINT\B=0
20 B=B+1\A=A/10\ IF INT(A)>0 THEN 20
30 FOR C=B TO 1 STEP -1\A=A*10\B(C)=INT(A-10*INT(A/10))\NEXT C
40 D=0\FOR C=1 TO INT(B/2)\ IF B(C)<>B(B+1-C) THEN D=1\NEXT C
50 FOR C=B TO 1 STEP -1\ PRINT CHR$(B(C)+48);\NEXT C
60 IF D=1 THEN 69
65 PRINT " IS A PALINDROME."\GOTO 10
69 PRINT " IS NOT A PALINDROME,"
70 IF B/2>INT(B/2) THEN B(INT(B/2)+1)=2*B(INT(B/2)+1)
72 FOR C=1 TO INT(B/2)\B(C)=B(C)+B(B+1-C)\NEXT C
75 FOR C=1 TO INT(B/2)\B(B+1-C)=B(C)\NEXT C
80 B(B+1)=0\FOR C=1 TO B\B(C+1)=B(C+1)+INT(B(C)/10)
90 B(C)=B(C)-10*INT(B(C)/10)\NEXT C
100 IF B(B+1)>0 THEN B=B+1
110 GOTO 40
120 END

READY

  RUNNH

  GIVE ME A NUMBER? 19

  19 IS NOT A PALINDROME,
  110 IS NOT A PALINDROME,
  121 IS A PALINDROME.

  GIVE ME A NUMBER? 38

  38 IS NOT A PALINDROME,
  121 IS A PALINDROME.

  GIVE ME A NUMBER? 79

  79 IS NOT A PALINDROME,
  176 IS NOT A PALINDROME,
  847 IS NOT A PALINDROME,
  1595 IS NOT A PALINDROME,
  7546 IS NOT A PALINDROME,
  14003 IS NOT A PALINDROME,
  44044 IS A PALINDROME.

  GIVE ME A NUMBER? 96

  96 IS NOT A PALINDROME,
  165 IS NOT A PALINDROME,
  726 IS NOT A PALINDROME,
  1353 IS NOT A PALINDROME,
  4884 IS A PALINDROME.
```



HOW MANY BLOCKS DO YOU SEE? 6 OR 7 ?

1675 — NON-PALINDROMIC?

Mike Lean in England took the number 1675 and reversed it 4850 times with the help of a computer, of course. Those 4850 reversals produced a 2000-digit number which still was not palindromic. Darryl Francis of *Games and Puzzles* thinks it's reasonable to assume that 1675 will never become palindromic however many times it is reversed. Do you agree?

Spell them backward and they stay the same

Read it from right to left and it will be the same as when you read the usual left to right. What will be? A palindrome, that is what.

Here is a sample: WON'T PEWS FILL IF SWEPT NOW?

You can have a lot of fun creating your own palindromes. But before you get started on yours, read these:

TOO HOT TO HOOT.
A POTATO PA?
NO, IT IS OPEN ON ONE POSITION.
STRAP ON NO PARTS.
WAS IT A BAR OR A BAT I SAW?

And this one is more difficult to read aloud:

OH HO HAH HAAHA AHAH HAH OH HO!

You can do the same with numbers. Example: 25952.

When your friends ask you what a palindrome is, tell them, "A palindrome looks and spells exactly the same from left to right or right to left, backward or forward, or forward or backward." In a popular dictionary this example is printed: ABLE WAS I ERE I SAW ELBA.

A few commercial names are palindromes. In California a city is named Yreka; a merchant calls his bakery Yreka Bakery.

And don't overlook single words: HUH. PEP. EYE. ADA. POP. WOW.

At first, making your own will be a slow process, but as you work with them it will become easier. Many adults know at least a few such words, so ask for their help. Friends at school may have one or two. And how about your teachers?

Write all of them down before you forget some. Try to make a long list, so you can show it to friends.

Magic Square

We've all seen examples of magic squares. The most common one is a 3x3 square using the integers 1 through 9 in which the sum of each row, column and diagonal totals 15.

Here are a few manual games involving magic squares. Try them.

Complete this magic square to make the sums of the rows, columns, and diagonals the same.

13	$4\frac{1}{4}$	
$6\frac{3}{4}$		
8		$5\frac{1}{2}$

This is a different kind of magic square. What are its characteristics?

1	12	10
15	2	4
8	5	3

by David H. Ahl

In the computer game of "Magic Square" the goal is to form a sum 15 magic square with you and the computer alternately filling in the integers between 1 and 9. If one player stumbles and puts a number in which causes the sum of a row, column, or diagonal to be something other than 15, he loses.

In forming a sum 15 magic square, there is only one fundamental solution. However, it can be rotated and reversed to form 8 solutions. Because the computer does not play a particularly creative game, all eight solutions cannot be obtained. How many can be?

Can you modify the computer program to play a more interesting game which permits all eight solutions? (Hint: Try randomizing the move position and number generators in Statements 400 and 410.)

Note: In converting "Magic Square" to your dialect of BASIC watch out for multiple statements on a line (indicated by a backslash) and compound IF statements.

```
RUNNH
GAME OF MAGIC SQUARE BY DAVID AHL

PLAYERS ALTERNATELY CHOOSE AN INTEGER (1 TO 9)
THAT HAS NOT BEEN PREVIOUSLY USED AND PLACE IT
IN ANY UNFILLED CELL OF A TIC-TAC-TOE BOARD.
THE GOAL IS TO MAKE THE SUM OF EACH ROW, COLUMN,
AND DIAGONAL EQUAL TO 15.

THAT PLAYER LOSES WHO FIRST MAKES THE SUM OF THE
THREE FIGURES IN ANY ROW, COLUMN, OR DIAGONAL
SOMETHING OTHER THAN 15.

A TIE GAME DRAWS A MAGIC SQUARE!!

THE COMPUTER WILL ASK YOU ON EACH MOVE WHICH
CELL YOU WISH TO OCCUPY, AND THE NUMBER YOU WISH
TO PLACE IN THAT CELL.  YOUR INPUT SHOULD LOOK
LIKE '3,7' IF YOU WISHED TO PLACE A 7 IN CELL 3.

HERE ARE THE CELL NUMBERS:

1 2 3
4 5 6
7 8 9

YOUR MOVE -- CELL AND NUMBER? 2,6

 0  6  0
 0  0  0
 0  0  0

I MOVE TO CELL 1 WITH A 1

 1  6  0
 0  0  0
 0  0  0


YOUR MOVE -- CELL AND NUMBER? 4,7

 1  6  0
 7  0  0
 0  0  0

I MOVE TO CELL 3 WITH A 8

 1  6  8
 7  0  0
 0  0  0


YOUR MOVE -- CELL AND NUMBER? 7,4

 1  6  8
 7  0  0
 4  0  0

SORRY, YOU LOSE -- NICE TRY.

LET'S PLAY AGAIN...
```

```
20 PRINT "GAME OF MAGIC SQUARE BY DAVID AHL"\PRINT
25 PRINT "PLAYERS ALTERNATELY CHOOSE AN INTEGER (1 TO 9)"
30 PRINT "THAT HAS NOT BEEN PREVIOUSLY USED AND PLACE IT"
35 PRINT "IN ANY UNFILLED CELL OF A TIC-TAC-TOE BOARD."
40 PRINT "THE GOAL IS TO MAKE THE SUM OF EACH ROW, COLUMN,"
45 PRINT "AND DIAGONAL EQUAL TO 15."\PRINT
50 PRINT "THAT PLAYER LOSES WHO FIRST MAKES THE SUM OF THE"
55 PRINT "THREE FIGURES IN ANY ROW, COLUMN, OR DIAGONAL"
60 PRINT "SOMETHING OTHER THAN 15."\PRINT
62 PRINT "A TIE GAME DRAWS A MAGIC SQUARE!!"\PRINT
65 PRINT "THE COMPUTER WILL ASK YOU ON EACH MOVE WHICH"
70 PRINT "CELL YOU WISH TO OCCUPY,. AND THE NUMBER YOU WISH"
75 PRINT "TO PLACE IN THAT CELL.  YOUR INPUT SHOULD LOOK"
80 PRINT "LIKE '3,7' IF YOU WISHED TO PLACE A 7 IN CELL 3."
85 PRINT\PRINT "HERE ARE THE CELL NUMBERS:"\PRINT
90 PRINT "1 2 3"\PRINT "4 5 6"\PRINT "7 8 9"
95 FOR I=1 TO 9\A(I)=0\B(I)=0\NEXT I\M=0\W=0
100 PRINT\INPUT "YOUR MOVE -- CELL AND NUMBER";I,N
105 IF I<1 OR I>9 OR N<1 OR N>9 THEN 130
110 IF A(I)=0 AND B(N)=0 THEN 150
130 PRINT "ILLEGAL MOVE ... AGAIN."\GOTO 100
150 A(I)=N\B(N)=1\M=M+1          !AN ACCEPTABLE MOVE
170 GOSUB 960                    !PRINT BOARD
180 GOSUB 800                    !A LOSING MOVE??
200 IF W=0 THEN 230              !GOOD MOVE, NO WINNER YET
210 PRINT "SORRY, YOU LOSE -- NICE TRY."\GOTO 560
230 IF M<5 THEN 400              !A TIE GAME?
240 PRINT "A TIE GAME -- BUT WE'VE DRAWN A MAGIC SQUARE!"\GOTO 560
400 FOR Q=1 TO 9                 !COMPUTER LOOKS FOR A GOOD MOVE
410 IF A(Q)>0 THEN 480           !CELL TAKEN??
420 FOR R=1 TO 9
430 IF B(R)>0 THEN 470           !NUMBER TAKEN??
435 A(Q)=R                       !TRY MAKING THE MOVE
440 GOSUB 800                    !IS THIS MOVE A LOSER?
450 IF.W=0 THEN 500              !A GOOD MOVE!!
460 Q1=Q\R1=R\W=0\A(Q)=0-        !RECORD BAD MOVE IN CASE NO GOOD ONE
470 NEXT R
480 NEXT Q
490 W=1\R=R1\Q=Q1\A(Q)=R         !IF GET HERE, COMPUTER HAS LOST
500 B(R)=1                       !COMPUTER MAKES ITS MOVE
520 PRINT "I MOVE TO CELL"Q"WITH A"R
530 GOSUB 960                    !PRINT BOARD
540 IF W=0 THEN 100              !THE GAME GOES ON....
550 PRINT "I LOSE -- YOU WIN!!"
560 PRINT\PRINT CHR$(7); FOR I=1 TO 15   !RINGS TELETYPE BELL
570 PRINT "LET'S PLAY AGAIN..."\GOTO 95
800 FOR X=1 TO 8                 !SUBROUTINE TO CHECK FOR LOSING MOVE
810 ON X GOTO 820,830,840,850,860,870,880,890
820 J=1\K=2\L=3\GOTO 900
830 K=4\L=7\GOTO 900
840 K=5\L=9\GOTO 900
850 J=4\L=6\GOTO 900
860 J=2\L=8\GOTO 900
870 J=3\L=7\GOTO 900
880 K=6\L=9\GOTO 900
890 J=7\K=8
900 IF A(J)=0 OR A(K)=0 OR A(L)=0 THEN 930
920 IF A(J)+A(K)+A(L)<>15 THEN 940
930 NEXT X
935 GOTO 950
940 W=1                          !A LOSER!!
950 RETURN
960 PRINT\PRINT A(1);A(2);A(3)   !SUBROUTINE TO PRINT BOARD
970 PRINT A(4);A(5);A(6)\PRINT A(7);A(8);A(9)\PRINT\RETURN
999 END
```

Chances are that everyone in the known world over the age of ten has had at least one battle with a computer in his lifetime. There's just something about the arrogant, stubborn refusal of a machine to reconsider even its most blatantly stupid acts that seems to bring out the beast in us. As a result, we spend most of our free time fighting a full scale war against computers. Tragically, it's a war we're all destined to lose. Let's face it: we're only human beings armed with nothing but logic and intelligence. These weapons are no

WE'RE LOSING OUR WAR

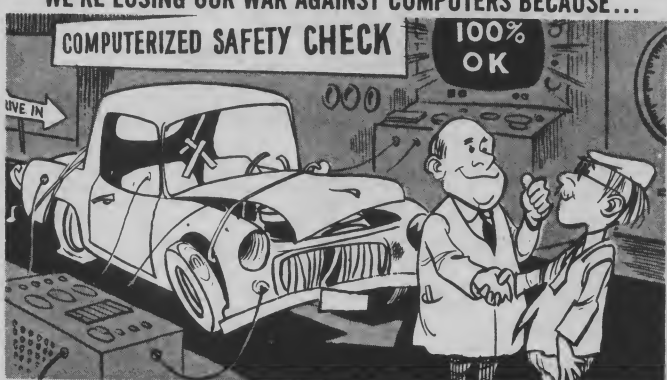
WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...

. . . nothing will change their minds once they're convinced you've sent in 30,000 subscriptions to the same magazine.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...

. . . they invariably continue to list a car as stolen for at least 6 months after it's been recovered and returned.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...



. . . we make the mistake of assuming they never make a mistake.

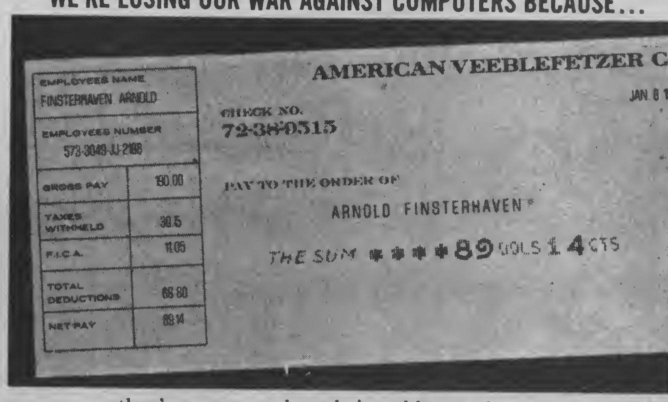
WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...

. . . they remember everything about us we'd like forgotten.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...

. . . their screening of Police M.O. files somehow proves that every left-handed Baptist who owns a De Soto is the Mad Killer.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...



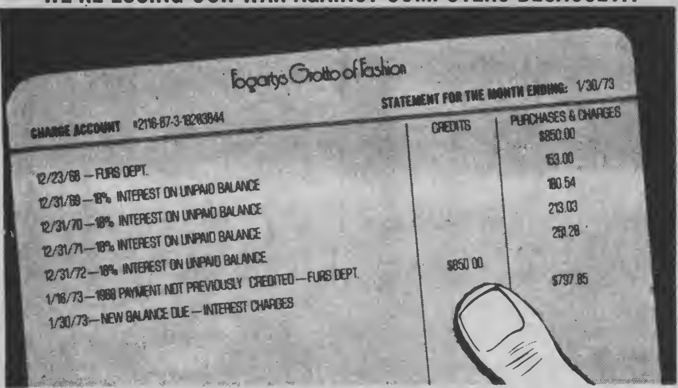
. . . they're so smug about being able to solve complex equations, they won't stoop to learn simple arithmetic.

match for a computer's tireless determination to keep repeating its idiotic goofs until our spirits are broken. Worse yet, we are plagued by a cult of Computer Worshippers among our own kind who perpetuate the ridiculous myth that humans are always wrong. So, in case you're one of those bubble-brained idealists who clings to the belief that righteousness must eventually triumph, just consider how the punch cards are stacked against you in this fight. Then, you'll agree with MAD's battlefront analysts who cite these twelve reasons why

AGAINST COMPUTERS

ARTIST: BOB CLARKE WRITER: TOM KOCH

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...



. . . they take years and years to find their stupid mistakes, and then they expect us to pay for them.

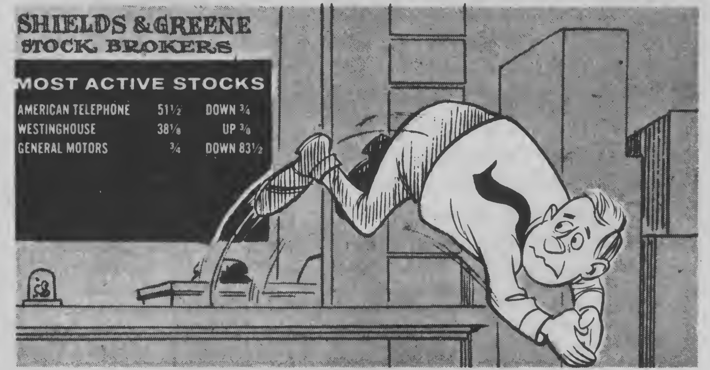
WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...

. . . it's futile to call up and complain about a mistake, since the machine that goofed is the same one that answers the phone.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...

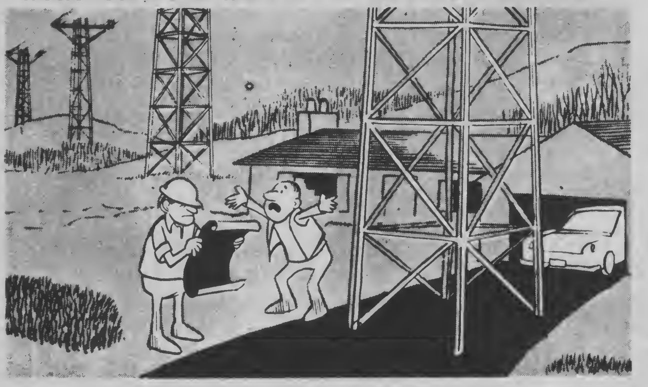
. . . they forget everything about us we wish they'd remember.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...



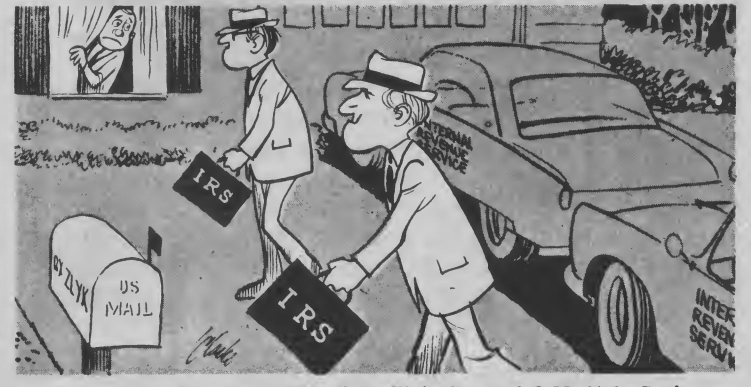
. . . their dumb mistakes can cause us to make fatal mistakes.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...



. . . their opinion of the most efficient way to do things is definitely only their opinion.

WE'RE LOSING OUR WAR AGAINST COMPUTERS BECAUSE...



. . . they assume that Q.X. Zlyk, Q.X. Zlyk, Sr., and Q.X. Slyk, Senior, are three different people . . . two of whom didn't pay their Income Tax.

Computers in the English Curriculum

by Larry Press
University of Southern California

This paper discusses and presents some examples of what I will loosely call the exploration and play mode for computer assisted learning. The examples will all be drawn from the area of English, since the humanities are generally neglected; however, I have had positive results using a similar approach in classes on operations research (1) and Papert (2) advocates exploration and play in mathematics.

Another reason for choosing English is that I hope to stimulate others with substantive backgrounds in English to build upon my ideas. I am not an English teacher and elaboration of my examples should improve then considerably.

EXPLORATION AND PLAY

Let me illustrate exploration and play by contrasting it with a more typical drill and tutorial approach to learning parts of speech. A hypothetical drill and tutorial program might present questions such as:

GIVEN THE SENTENCE:
THE BOY RAN TO HIS HOME
WHICH WORD(S) ARE NOUNS?
WHICH WORD(S) ARE VERBS?

The student's response would be matched with "boy", "home", "ran" and judged either *right* or *wrong*. If right, he would be congratulated and presented with a new "frame". If wrong, he could be shown some tutorial explanation of nouns and verbs, and re-tested. The system would record his progress through this sifting, brach network.

A pure drill and practice version, might just list words and ask for a judgment: "noun" or "verb". The mistakes would be marked and a total score tabulated. This could even be done on a timed basis (e.g., 5 seconds per word or try to get as many correct as you can in one minute).

Compare these hypothetical programs to the INSULT dialogue in figure 1. (In reading this, as well as all other printouts in the paper, keep in mind that it was generated sequentially in a conversational manner). The key difference is that there is no "right" answer in figure 1. The student explores — he types in words and gets sentences. The computer never says "right" or "wrong", the student's ear is the judge of his work. He plays as well. The "insults" are funny and he soon learns to amuse himself with sense and nonsense responses. It is only a matter of time until he discovers that he can use dirty words if he will — another source of fun. He can use slang, abuse the computer, etc.

The emphasis in drill and practice programs, as well as much of our non-computer based education, is on getting the right answer. Failure to do so results in a slight re-buff and success a small reward. As Holt (3), has shown at length, concentration upon getting the right answer is

```
RUN
INSULT

HEY STUPID! WHAT'S YOUR NAME ANYHOW??

? LARRY

ALLRIGHT LARRY, WHAT IS YOUR FAVORITE NOUN?
? COW

IT FIGURES!  WELL, WHAT'S YOUR FAVORITE VERB?
? PAINT

HEY LARRY, HOW WOULD YOU LIKE TO PAINT A COW????

DONE


RUN
INSULT

HEY STUPID! WHAT'S YOUR NAME ANYHOW??

? LARRY

ALLRIGHT LARRY, WHAT IS YOUR FAVORITE NOUN?
? HORSE

IT FIGURES!  WELL, WHAT'S YOUR FAVORITE VERB?
? TICKLE

HEY LARRY, HOW WOULD YOU LIKE TO TICKLE A HORSE????
```

counterproductive. Holt has observed it to be a source of anxiety in students and sees it resulting in a low tolerance for ambiguity. He sees concentration upon mechanics and strategies for beating the system rather than understandability. Holt reports much failure correlated with fear; and a machine that says "wrong" is, indeed, rather frightening.

The student is also in a passive role in the drill and tutorial mode — responding to the demands and judgments of the machine. In the INSULT example, the student soon learns that he is in control and actively directs the course of his exploration.

MORE EXAMPLES

I will present 3 more examples of exploration and play programs in English. The first, and simplest, is for small children and is adapted from the TV show Sesame Street. It is illustrated in Figure 2 and the dialogue is self explanatory. It could obviously be generalized by programming other "families" of words.

```
RUN
SESAME

LET'S MAKE THE UN-FAMILY WORDS!  I NEED YOUR HELP.
YOU GIVE ME THE START AND I WILL PUT IN THE 'UN'.

GIVE ME ONE OR MORE LETTERS? R
R PLUS UN GIVES RUN!!

GIVE ME ONE OR MORE LETTERS? F
F PLUS UN GIVES FUN!!

GIVE ME ONE OR MORE LETTERS? OREG
OREG PLUS UN GIVES OREGUN!!
```

Next is the program WISHES, which is illustrated by the conversation of Figure 3. This program is adapted from Koch (4), a fascinating book on teaching poetry writing to grammar school children (it also presents much grammar school poetry). Koch recommends that each session begin with a warm-up such as that on color

```
LET'S WRITE A WISH POEM.
TO WARM UP, TRY PLAYING WITH COLOR WORDS.  FOR EXAMPLE,
WHAT COLOR DO YOU THINK OF WHEN I SAY APPLE? GREEN
HOW ABOUT SKY? BLUE
YOU KNOW, YOU DON'T ALWAYS HAVE TO USE THE REAL COLOR
OF SOMETHING IN A POEM.  YOU CAN USE ANY COLOR YOU FEEL
LIKE EVEN IF IT SEEMS FREAKY OR SILLY.  IF YOU DON'T
COUNT RED OR GREEN, WHAT COLOR SEEMS LIKE APPLES? SILVER
CLOSE YOUR EYES AND SEE IF YOU CAN IMAGINE A BIG,
SILVER APPLE   SEE IF YOU CAN MAKE IT GROW OR DANCE OR
DO SOMETHING SILLY.  JUST TYPE OK WHEN YOU ARE FINISHED.
? OK
THINGS LIKE APPLES ARE NOT THE ONLY THINGS THAT MAKE
PEOPLE THINK OF COLORS.  FOR EXAMPLE, A THIRD GRADER NAMED
JOHN THOUGHT THAT THE SOUND OF A CAR ENGINE WAS
SCRATCHY RED!
WHAT COLOR IS THE SOUND OF A WHISTLE?  BRIGHT BLUE
THE WHISTLE SOUNDS BRIGHT BLUE!
TRY MAKING THE SOUND OF A BALLOON POPPING.  WHAT COLOR
IS THAT? ORANGE
WHAT COLOR WAS THE BALLOON? RED
WHAT COLOR DO YOU SEE WHEN YOU IMAGINE THE FEELING OF A
BIG ICE CUBE ON YOUR TUMMY? DEEP BLUE
YOU ARE REALLY GETTING INTO COLOR WORDS!
NOW LET'S TRY WORKING ON A WISH POEM.  EACH LINE SHOULD HAVE
A WISH IN IT AND IF YOU WANT TO YOU CAN PUT IN COLORS TOO.
JOHN AND HIS SISTER WHO IS IN KINDERGARTEN MADE UP THESE
EXAMPLES TO SHOW YOU:

      I WISH FOR A BIG GREEN 1000 DOLLAR BILL
      I WISH THAT EVERY DAY WAS MY RED AND WHITE BIRTHDAY
      I WISH ALL THE STORES WERE FREE RED BLUE

GET IT?  NOW YOU TYPE IN A WISH.  MAKE IT LESS THAN
ONE LINE LONG, OK?  WHAT DO YOU WISH?
?I WISH I WAS A BIG GREEN BASEBALL
FAR OUT!  TRY ANOTHER ONE.  REMEMBER, IT CAN BE CRAZY OR
FREAKY IF YOU WANT IT TO.
? I WISH IT WAS SUPER YELLOW SUNNY
ALLRIGHT!  WOULD YOU LIKE TO MAKE UP MORE? YES
OK.  GIVE ME AS MANY WISHES AS YOU WANT TO.  JUST TYPE
STOP WHEN YOU RUN OUT OF WISHES.  GIVE ME YOUR NEXT WISH.
? I WISH TO WISH
NEXT
? I WISH FOR MORE AND MORE AND MORE
NEXT
? AND EVEN MORE
NEXT WISH
? STOP

NOW I'LL SHOW YOU A NEW WISH POEM

I WISH I WAS A BIG GREEN BASEBALL
I WISH IT WAS SUPER YELLOW SUNNY
I WISH TO WISH
I WISH FOR MORE AND MORE AND MORE
AND EVEN MORE

THAT'S A PRETTY SLICK WISH POEM YOU WROTE!  CATCH YOU LATER.

DONE
```

```
LET'S WRITE A STORY.  YOU WILL HAVE TO GIVE ME SOME WORDS:

FIRST, WHAT IS YOUR FAVORITE ARTICLE OF CLOTHING? SHOES
OKAY, WHAT IS YOUR FAVORITE NOUN? PICKLE
NOW GIVE ME A DARK, SINISTER ADJECTIVE? HOARY
AND WHAT IS THE MOST EVIL COLOR YOU CAN THINK OF? FLECKY GREEN
BY THE WAY, WHAT IS YOUR FIRST NAME? LARRY
ALLRIGHT LARRY, WHAT IS THE SWEETEST, MOST DELICATE FLOWER? ROSE
NOW I NEED AN ADJECTIVE.  IT SHOULD BEGIN WITH AN 'S' SOUND
AND SHOULD BE REFINED AND GENTLE.  IT COULD EVEN BE A NONSENSE
WORD IF IT SOUNDED NICE? SWEET
NOW I WILL NEED A COLOR WHICH YOU FEEL SYMBOLIZES INNOCENCE? BABY BLUE
NOW GIVE ME A SWEET, GENTLE NOUN? COTTON
OKAY, WHAT IS ANOTHER ARTICLE OF CLOTHING? SHIRT
NOW, GIVE ME A PLURAL BODY PART? TOES
FINALLY, I NEED TO KNOW WHICH ANIMAL SEEMS MOST COMICAL TO YOU? MOOSE


ALLRIGHT, THAT SHOULD DO IT.  HERE IS OUR STORY:


          THE LEGEND OF LITTLE RED RIDING SHOES

     THERE ONCE WAS A GIRL CALLED LITTLE RED RIDING SHOES.  ONE DAY
HER MOTHER GAVE HER A BASKET OF PICKLES TO GIVE TO HER GRANDMOTHER.
ON THE WAY, A HOARY, FLECKY GREEN FROG NAMED LARRY SAW HER.  THE
FROG DECIDED TO GET TO GRANDMOTHER'S FIRST!
    WHEN THE FROG GOT THERE, GRANDMA WAS TENDING HER ROSE
GARDEN, DRESSED IN SWEET, BABY BLUE SNEAKERS.  SHE WAS SWEET AND
GENTLE AS COTTON SO THE FROG ATE HER UP, PUT ON HER SHIRT AND
JUMPED INTO HER BED.
    YOU PROBABLY KNOW THE REST OF THE STORY RIGHT?  THEY GO
THROUGH THE 'MY WHAT BIG TOES YOU HAVE' THING FOR A WHILE, THEN
LARRY KISSES RED, THEY BOTH TURN INTO MOOSES, THEY ARE MARRIED
AND LIVE HAPPILY EVER AFTER.

SIGH ... A HAPPY ENDING
```

words in the first half of figure 3. After the warm-up, the student constructs a "wish poem".

Koch suggest dozens of such warm-ups and many types of poems are illustrated in his book. There are lie poems, dream poems, being an animal poems, comparison poems, I used to/but now poems, and many more. Mine is only a simple example, and many more such programs could be written.

Finally, figure 4 shows a conversation with the program BARTH. This is inspired by John Barth, who periodically tells the reader to insert words of his own choice at various points in his stories. For instance in the story Title (5) we find this sentence:

A person who can't [verb adverb] ought at least to speak correctly, or more esoterically:

> Why do you suppose it is, she asked [long participle phrase of the breathless variety characteristic of the dialogue attributions in nineteenth-century fiction] that literate people such as we talk like characters in a story?

It was my original intent to build the example in Figure 4 around an existing poem, with various words left open to the user, but I was unable to do so. Instead, I invented the "story" which is shown.

Note how easily this sort of program could lead into explicit discussion of formal aspects of poetry. Even in Figure 4, we see examples of allusion, metaphor, alliteration, tone, and euphonia. The following list illustrates the manner in which a similar program might be extended:

a) Onomatopoeia: Give me a verb which sounds like wood breaking.
b) Rhyme: Give me a noun which rhymes with cow or give me a two syllable adjective which rhymes with turtle.
c) Alliteration: Give me an adjective that begins with an "sh" sound.
d) Assonance: Give me an adjective with an "a" sound in the middle.
e) Consonance: Give me a noun which ends with "ts".
f) Euphonia: Give me a smooth, pleasant sounding adverb.
g) Cacaphonia: Give me a rough, harsh adverb.
h) Meter: Give me a 3 syllable adjective with the accent on the second syllable.
i) Imagery: Give me a bright red object (to be used in a visual metaphor). Obviously, non-visual images may be used as well.
j) Metaphor: Give me a soft noun (to be used in a metaphor).
k) Synecdoche: What do you consider the essential part of a tree to be?
l) Or even Barth's long participle phrases ala nineteenth century fiction!

This list was culled from an introductory poetry text, Perrine (6). Note that all of the formal concepts illustrated by a story such as that of Figure 4 do not have to be supplied explicitly by the student, e.g., the allusion to red riding hood. The above list could easily be extended by suggesting that examples of paradox, irony, symbols, metonymy, etc. could be built into the "body" of the story.

CONCLUSION

I've presented four examples of "exploration and play" for English. In each case, there was no such thing as a wrong answer, the user was active, and I attempted to create an air of carefree play. It is my hope that others will develop, use, evaluate, and distribute similar programs. While my programs are intended as examples, I'll be glad to send a paper tape (in HP-2000 BASIC) of any or all of them to anyone who wants one (this offer only holds until I get caught)!

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INSULT

```
10  DIM A$[30],N$[30],V$[30]
15  DIM F$[1]
20  PRINT LIN(2);"HEY STUPID! WHAT'S YOUR NAME ANYHOW??";LIN(2)
30  INPUT A$
40  PRINT "ALLRIGHT ";A$;", WHAT IS YOUR FAVORITE NOUN?"
50  INPUT N$
60  PRINT LIN(2);"IT FIGURES!  WELL, WHAT'S YOUR FAVORITE VERB?";LIN(2)
70  INPUT V$
100  LET F$=N$[1,1]
110  IF F$="A" THEN 400
120  IF F$="E" THEN 400
130  IF F$="I" THEN 400
140  IF F$="O" THEN 400
150  IF F$="U" THEN 400
160  PRINT LIN(2);"HEY ";A$;",HOW WOULD YOU LIKE TO ";V$;" A ";N$;"????"
170  STOP
400  PRINT LIN(2);"HEY ";A$;", HOW WOULD YOU LIKE TO ";V$;" AN ";N$;"????"
600  END
```

SESAME

```
5  DIM L$[72]
10  PRINT "LET'S MAKE THE UN-FAMILY WORDS! I NEED YOUR HELP."
20  PRINT "YOU GIVE THE START AND I WILL PUT IN THE 'UN'."
30  PRINT LIN(2);"GIVE ME ONE OR MORE LETTERS";
40  INPUT L$
50  PRINT L$" PLUS UN GIVES "L$"UN!!"
60  GOTO 30
70  END
```

BARTH

```
1  DIM A$[72],B$[72],C$[72],D$[72],E$[72],F$[72],G$[72],H$[72],I$[72]
2  DIM J$[72],K$[72],L$[72],M$[72],N$[72]
10  PRINT "LET'S WRITE A STORY.  YOU WILL HAVE TO GIVE ME SOME WORDS!"
20  PRINT
30  PRINT "FIRST, WHAT IS YOUR FAVORITE ARTICLE OF CLOTHING";
40  INPUT A$
50  PRINT "OKAY, WHAT IS YOUR FAVORITE NOUN";
55  INPUT B$
56  IF B$[LEN(B$),LEN(B$)]="S" THEN 60
57  B$[LEN(B$)+1,LEN(B$)+1]="S"
60  PRINT "NOW GIVE ME A DARK, SINISTER ADJECTIVE";
65  INPUT C$
70  PRINT "AND WHAT IS THE MOST EVIL COLOR YOU CAN THINK OF";
75  INPUT D$
80  PRINT "BYE THE WAY, WHAT IS YOUR FIRST NAME";
85  INPUT E$
90  PRINT "ALLRIGHT "E$", WHAT IS THE SWEETEST, MOST DELICATE FLOWER";
100  INPUT F$
110  PRINT "NOW I NEED AN ADJECTIVE.  IT SHOULD BEGIN WITH AN 'S' SOUND"
115  PRINT "AND SHOULD BE REFINED AND GENTLE.  IT COULD EVEN BE A NONSENCE"
118  PRINT "WORD IF IT SOUNDED NICE";
120  INPUT G$
130  PRINT "NEXT I WILL NEED A COLOR WHICH YOU FEEL SYMBOLIZES INNOCENCE";
135  INPUT H$
140  PRINT "NOW GIVE ME A SWEET, GENTLE NOUN";
145  INPUT I$
150  PRINT "OKAY, WHAT IS ANOTHER ARTICLE OF CLOTHING";
155  INPUT J$
160  PRINT "NOW, GIVE ME A PLURAL BODY PART";
165  INPUT K$
170  PRINT "FINALLY, I NEED TO KNOW WHICH ANIMAL SEEMS MOST COMICAL TO YOU";
180  INPUT L$
181  IF L$[LEN(L$),LEN(L$)]="S" THEN 200
190  L$[LEN(L$)+1,LEN(L$)+1]="S"
200  PRINT LIN(2);"ALLRIGHT, THAT SHOULD DO IT.  HERE IS OUR STORY!"
210  PRINT
218  PRINT
220  PRINT "              THE LEGEND OF LITTLE RED RIDING "A$;LIN(2)
230  PRINT "      THERE ONCE WAS A GIRL CALLED LITTLE RED RIDING "A$".  ONE DAY
240  PRINT "HER MOTHER GAVE HER A BASKET OF "B$" TO GIVE TO HER GRANDMOTHER."
250  PRINT "ON THE WAY, A "C$","D$" FROG NAMED "E$" SAW HER. THE"
260  PRINT "FROG DECIDED TO GET TO GRANDMOTHER'S FIRST!"
270  PRINT "      WHEN THE FROG GOT THERE, GRANDMA WAS TENDING HER "F$
280  PRINT "GARDEN, DRESSED IN "G$","H$" SNEAKERS.  SHE WAS SWEET AND"
290  PRINT "GENTLE AS "I$" SO THE FROG ATE HER UP, PUT ON HER "J$" AND"
300  PRINT "JUMPED INTO HER BED."
310  PRINT "      YOU PROBABLY KNOW THE REST OF THE STORY, RIGHT?  THEY GO"
320  PRINT "THROUGH THE 'MY WHAT BIG "K$" YOU HAVE' THING FOR A WHILE, THEN"
330  PRINT E$" KISSES RED, THEY BOTH TURN INTO "L$", THEY ARE MARRIED"
340  PRINT "AND LIVE HAPPILY EVER AFTER."
350  PRINT LIN(2);"SIGH ... A HAPPY ENDING"
360  END
```

WISHES

```
10  DIM A$[72],B$[72]
20  FILES WSHFL
30  PRINT "LET'S WRITE A WISH POEM!!"
40  PRINT "TO WARM UP, TRY PLAYING WITH COLOR WORDS.  FOR EXAMPLE"
50  PRINT "WHAT COLOR DO YOU THINK OF WHEN I SAY APPLE";
60  INPUT A$
70  PRINT "HOW ABOUT SKY";
80  INPUT A$
90  PRINT "YOU KNOW, YOU DON'T ALWAYS HAVE TO USE THE REAL COLOR"
100  PRINT "OF SOMETHING IN A POEM.  YOU CAN USE ANY COLOR YOU FEEL"
110  PRINT "LIKE EVEN IF IT SEEMS FREAKY OR SILLY.  IF YOU DON'T"
120  PRINT "COUNT RED OR GREEN, WHAT COLOR SEEMS LIKE APPLES";
130  INPUT A$
140  PRINT "CLOSE YOUR EYES AND SEE IF YOU CAN IMAGINE A BIG,"
150  PRINT A$" APPLE.  SEE IF YOU CAN MAKE IT GROW OR DANCE OR"
160  PRINT "DO SOMETHING SILLY.  JUST TYPE OK WHEN YOU ARE FINISHED."
170  INPUT A$
180  PRINT "THINGS LIKE APPLES ARE NOT THE ONLY THINGS THAT MAKE "
190  PRINT "PEOPLE THINK OF COLORS.  FOR EXAMPLE A THIRD GRADER NAMED"
200  PRINT "JOHN THOUGHT THAT THE SOUND OF A CAR ENGINE WAS "
210  PRINT "SCRATCHY RED!"
220  PRINT "WHAT COLOR IS THE SOUND OF A WHISTLE";
230  INPUT A$
240  PRINT "THE WHISTLE SOUNDS "A$"!"
250  PRINT "TRY MAKING THE SOUND OF A BALLOON POPPING. WHAT COLOR "
260  PRINT "IS THAT";
270  INPUT A$
280  PRINT "WHAT COLOR WAS THE BALLOON";
290  INPUT A$
300  PRINT "WHAT COLOR DO YOU SEE WHEN YOU IMAGINE THE FEELING OF A"
310  PRINT "BIG ICE CUBE ON YOUR TUMMY";
320  INPUT A$
330  PRINT "YOU ARE REALLY GETTING INTO COLOR WORDS!"
340  PRINT "NOW LET'S TRY WORKING ON A WISH POEM. EACH LINE SHOULD HAVE"
350  PRINT "A WISH IN IT AND IF YOU WANT TO YOU CAN PUT IN COLORS TOO."
360  PRINT "JOHN AND HIS SISTER WHO IS IN KINDERGARTEN MADE UP THESE"
370  PRINT "EXAMPLES TO SHOW YOU:";LIN(1)
380  PRINT "     I WISH FOR A BIG GREEN 1000 DOLLAR BILL"
390  PRINT "     I WISH THAT EVERY DAY WAS MY RED AND WHITE BIRTHDAY PARTY"
400  PRINT "     I WISH ALL THE STORES WERE FREE RED BLUE"
410  PRINT LIN(1);"GET IT?  NOW YOU TYPE IN A WISH.  MAKE IT LESS THAN"
420  PRINT "ONE LINE LONG, OK, WHAT DO YOU WISH?"
430  INPUT A$
440  IF  END #1 THEN 630
450  PRINT "FAR OUT!  TRY ANOTHER ONE.  REMEMBER, IT CAN BE CRAZY"
460  PRINT "OR FREAKY IF YOU WANT IT TO."
470  PRINT #1;A$
480  INPUT A$
490  PRINT "ALLRIGHT!  WOULD YOU LIKE TO MAKE UP MORE";
500  PRINT #1;A$
510  INPUT A$
520  IF A$[1,1]="N" THEN 660
530  IF A$[1,1]="Y" THEN 560
540  PRINT "PLEASE ANSWER YES OR NO"
550  GOTO 490
560  PRINT "OK GIVE ME AS MANY MORE WISHES AS YOU WANT TO.  JUST"
570  PRINT "TYPE 'STOP' WHEN YOU RUN OUT OF WISHES.  NOW"
580  PRINT "GIVE ME YOUR NEXT WISH PLEASE..."
590  INPUT A$
600  IF A$[1,4]="STOP" THEN 660
610  PRINT #1;A$
620  GOTO 580
630  PRINT "WOW! MY STORAGE AREA IS FULL.  LET'S QUIT FOR NOW."
640  PRINT "IF YOU WANT TO DO MORE WISHING, YOU CAN RUN THIS"
650  PRINT "PROGRAM AGAIN."
660  PRINT
670  IF  END #1 THEN 740
680  READ #1,1
690  PRINT "NOW I'LL SHOW YOU A NEW WISH POEM.";LIN(2)
700  FOR I=1 TO 1000
710  READ #1;A$
720  PRINT A$
730  NEXT I
740  PRINT
750  PRINT "THAT'S A PRETTY SLICK WISH POEM YOU WROTE!!  CATCH YOU LATER."
760  END
```

LOVE

by David H. Ahl

This program is designed to reproduce Robert Indiana's great work "Love" with a message of your choice up to 60 characters long.

The program was written in BASIC-PLUS for DEC's RSTS-11 family. You will probably have to change portions of it for your machine. Multiple statements on one line are separated by a backslash. The message is inputted as A$ in Statement 60. Statements 65-67 set the output device; eliminate them if the device is always a terminal. Statements 100-130 repeat the message A$ if it is less than 60 characters long and insert it in T$. Statements 210-400 actually print the design. The data statements are an alternating count of the numbers of characters printed and the number of blanks which form the design.

```
LOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVE
L            OVELOVELOVELOVELOVELOVELOV         LOVELOVELOVE
LOV        ELOVELOVELOVELOVELOVELOV                 LOVELOVE
LOVE      VELOVELOVELOVELOVELOVEL                     VELOVE
LOVE      VELOVELOVELOVELOVELOVE            LOVEL      ELOVE
LOVE      VELOVELOVELOVELOVELOV           VELOVELO      LOVE
LOVE      VELOVELOVELOVELOVELOV          OVELOVELOV     LOVE
LOVE      VELOVELOVELOVELOVELOV         LOVELOVELOV     LOVE
LOVE      VELOVELOVELOVELOVELOV        ELOVELOVELO      LOVE
LOVE      VELOVELOVELOVELOVELOV       VELOVELOVEL       LOVE
LOVE      VELOVELOVELOVELOVELOV      OVELOVELOVE        LOVE
LOVE      VELOVELOVELOVELOVEL V     LOVELOVELOV         LOVE
LOVE      VELOVELOVELOVELOVEL V     LOVELOVELO          LOVE
LOVE      VELOVELOVELOVELOVE  V      OVELOVEL           LOVE
LOVE      VELOVELOVELOVELOV   V       VELOV             LOVE
LOVE      VELOVELOVELOVEL     VE                       ELOVE
L                             VELOV                 LOVELOVE
L                             VELOVELOV         LOVELOVELOVE
L             VELOV                                        E
L             VELOV                                        E
LOVE      VELOVELOVELOV   VELOVELOVE      VELOVELOVELO     E
LOVEL      ELOVELOVELO   OVELOVELOVE      VELOVELOVELOVE   E
LOVEL      ELOVELOVELO   OVELOVELOVE      VELOVELOVELOVEL  E
LOVELO      LOVELOVEL   LOVELOVELOVE      VELOVELOVELOVELO E
LOVELO      LOVELOVEL   LOVELOVELOVE      VELOVEL VELOVELOVE
LOVELOV      OVELOVE   ELOVELOVELOVE      VELOVE  VELOVELOVE
LOVELOV      OVELOVE   ELOVELOVELOVE              VELOVELOVE
LOVELOVE      VELOV   VELOVELOVELOVE      VELOVE  VELOVELOVE
LOVELOVE      VELOV   VELOVELOVELOVE      VELOVEL VELOVELOVE
LOVELOVEL      ELO   OVELOVELOVELOVE      VELOVELOVELOVELO E
LOVELOVEL      ELO   OVELOVELOVELOVE      VELOVELOVELOVEL  E
LOVELOVELO      L   LOVELOVELOVELOVE      VELOVELOVELOVE   E
LOVELOVELO          LOVELOVELOVELOVE      VELOVELOVELO     E
LOVELOVELOV        ELOVELOVELOVE                           E
LOVELOVELOV        ELOVELOVELOVE                           E
LOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVELOVE
```

```
10 REMARKABLE PROGRAM BY DAVE AHL
20 PRINT "A TRIBUTE TO THE GREAT AMERICAN ARTIST, ROBERT INDIANA.
30 PRINT "HIS GREATEST WORK WILL BE REPRODUCED WITH A MESSAGE OF
40 PRINT "YOUR CHOICE UP TO 60 CHARACTERS.  IF YOU CAN'T THINK OF
50 PRINT "A MESSAGE, SIMPLY TYPE THE WORD 'LOVE'" \ PRINT
60 INPUT "YOUR MESSAGE PLEASE"A$ \ L=LEN(A$)
65 INPUT "OUTPUT DEVICE (LP: OR KB:)";B$
66 IF B$="LP:" OR B$="KB:" THEN 67 ELSE PRINT "AGAIN" \ GOTO 65
67 OPEN B$ FOR OUTPUT AS FILE 1
70 DIM T$(120) \ PRINT #1 FOR I=1 TO 10
100 FOR J=0 TO INT(60/L)
110 FOR I=1 TO L
120 T$(J*L+I)=MID(A$,I,1)
130 NEXT I \ NEXT J
140 C=0
200 A1=1 \ P=1 \ C=C+1 \ IF C=37 THEN 999
205 PRINT #1
210 READ A \ A1=A1+A \ IF P=1 THEN 300
240 PRINT #1," "; FOR I=1 TO A \ P=1 \ GOTO 400
300 PRINT #1,T$(I); FOR I=A1-A TO A1-1 \ P=0
400 IF A1>60 THEN 200 ELSE 210
600 DATA 60,1,12,26,9,12,3,8,24,17,8,4,6,23,21,6,4,6,22,12,5,6,5
610 DATA 4,6,21,11,8,6,4,4,6,21,10,10,5,4,4,6,21,9,11,5,4
620 DATA 4,6,21,8,11,6,4,4,6,21,7,11,7,4,4,6,21,6,11,8,4
630 DATA 4,6,19,1,1,5,11,9,4,4,6,19,1,1,5,10,10,4,4,6,18,2,1,6,8,11,4
640 DATA 4,6,17,3,1,7,5,13,4,4,6,15,5,2,23,5,1,29,5,17,8
650 DATA 1,29,9,9,12,1,13,5,40,1,1,13,5,40,1,4,6,13,3,10,6,12,5,1
660 DATA 5,6,11,3,11,6,14,3,1,5,6,11,3,11,6,15,2,1
670 DATA 6,6,9,3,12,6,16,1,1,6,6,9,3,12,6,7,1,10
680 DATA 7,6,7,3,13,6,6,2,10,7,6,7,3,13,14,10,8,6,5,3,14,6,6,2,10
690 DATA 8,6,5,3,14,6,7,1,10,9,6,3,3,15,6,16,1,1
700 DATA 9,6,3,3,15,6,15,2,1,10,6,1,3,16,6,14,3,1,10,10,16,6,12,5,1
710 DATA 11,8,13,27,1,11,8,13,27,1,60
999 PRINT #1 FOR I=1 TO 10 \ CLOSE 1 \ END
```

Contest!

CONTEST RULES

All programs submitted must run in Dartmouth BASIC or FORTRAN IV. Programs running outside these bounds may be submitted, but a fair evaluation cannot be assured. Please submit your entries on paper tape, if written in BASIC; tape or punch cards, if written in FORTRAN. All entries become the property of Creative Computing. They cannot be returned.

The first two or three lines of the listing *and* the output, must contain your name, the name and address of your school, and both your home and school phone number and name and home phone of your teacher.

The winner will head a committee composed of himself, a fellow student and his teacher. Decisions of this committee will be final. The committee will be responsible for establishing the criteria upon which their judgment will be made. Possible criteria are usage of computer technique, uniqueness of the program, form of the program and output, length and running time. Limitations of your system will be considered.

The winner will receive a two-year subscription (or extension) to Creative Computing. Second and third place winners will receive a one-year subscription (or extension).

HERE'S THE PROBLEM . . .

78 multiplied by 345 produces 26910. Notice that these three numbers have between them all of the digits 0 to 9 occurring just once.

You can probably find other such examples containing all ten digits and with the three numbers having two, three, and five digits respectively. However, there is just one set of three numbers which has the additional peculiarity that the second number is a multiple of the first number. Can you write a computer program to find this combination?

Entries must be postmarked by February 20, 1975.

CONTEST, NOTONE and SQUARESVILLE Results

The results of the three competitive features, Contest, Notone, and Squaresville which appeared in the first issue of *Creative Computing* will be printed in the third issue. Because of printing and mailing delays, we will continue to have a 2-issue lag in publishing reader responses to contests and features.

BACK ISSUE

A *very* limited number of copies of Vol. 1, No. 1 (November-December '74 issue) of Creative Computing are available. If you want a copy of this issue (destined to become a classic!), send us $1.50 and your issue will be on its way.

Computer-Generated Super-8 Movies

During the summer of 1973, twenty college teachers produced Super 8 movies and sequences of 35mm slides during a six week NSF College Teacher Institute at Carleton College on Computer Graphics and the Production of Computer-Generated Materials for Teaching Mathematics. Of the dozen movies and forty slide projects, eight movies are being made available at this time. Each has proved to be effective in classroom use.

The ideas were conceived of, programmed, and photographed by the participants. A movie camera or 35mm camera was mounted in front of a Tektronix storage scope driven by a minicomputer. Film images are black and white, the negative of the scope face. Some parts were filmed "real time", other parts were manually or automatically single-framed for an animated effect.

The following movies produced during the 1973 Institute are available at $12.50 per Super 8 Technicolor Magicartridge loop or $125.00 for the entire set of 11 loops. It is expected that other materials from the 1973 Institute, and materials from the 1974 Workshop will also become available at minimal cost.

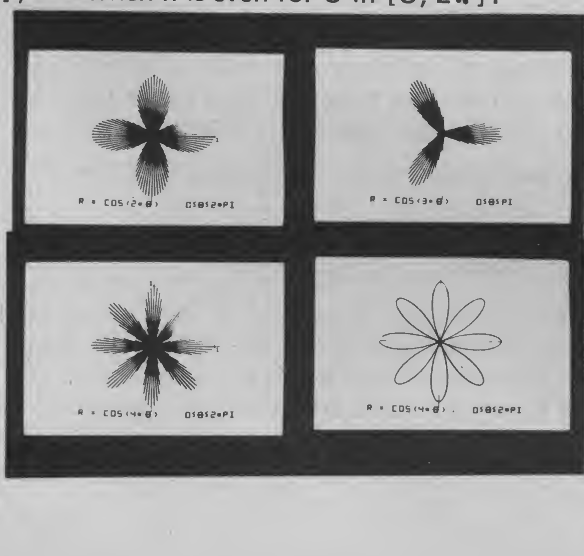
For ordering, or to obtain notice of other projects as they become available, write Roger B. Kirchner, Department of Mathematics, Carleton College, Northfield, Minnesota 55057.

Description of some of the Super 8 movies produced during the 1973 NSF Summer Institute at Carleton College on Computer Graphics and the Production of Computer-generated materials for teaching mathematics.

Non-calculus:

Professor Colpac's Roses, by Harold Mick, Linda and Charles Moulton

Partly animated, partly real time. "Colpac" refers to the graphics language used to write the computer programs. The roses are polar graphs of $r = \cos(n\Theta)$. The interesting point is made that the full graph is obtained when n is odd for Θ in $[0, \pi]$, and when n is even for Θ in $[0, 2\pi]$.



Sine (2 loops), by Jerry Caldwell

The graph of $t = \sin(s)$ is plotted for $s = (\pi/6)k$, $k = 1, 2, \ldots, 12$. The graph is then traced out continuously for s in $[0, 2\pi]$. Values are calculated by wrapping segments of length s around the unit circle. The animation is clever, but the pace is slow even for those who are just learning. The two loops take about 8 minutes. A threat of having to see the film twice engraves the idea of the sine fuction indelibly in the memory.

Calculus:

Numerical Integration I, II (2 loops), Linda and Charles Moulton

The integral of a particular quartic is estimated using various numerical techniques. Part I includes the more standard techniques such as the rectangle rule, the trapezoidal rule, and Simpson's rule. Part II includes Gauss-Legendre, spline, and Monte Carlo techniques. The animated portions were filmed real-time. The numerical results are difficult to read, but values are supplied on a supplementary sheet.

Advanced Calculus:

Nonuniform Convergence (2 loops), by George Abdo and Jerry Caldwell

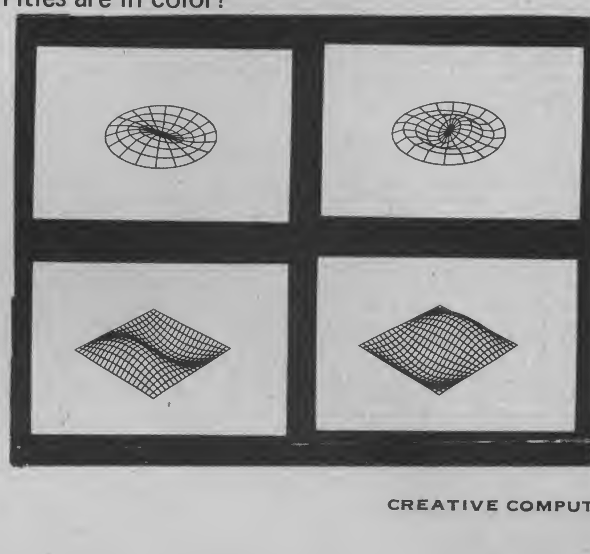
Several sequences of functions which converge pointwise but not uniformly are shown. Pointwise convergence is made clear by considering $f_n(x)$ at a particular x.

The first four sequences are fairly standard. The last two are interesting in a visual sense. They converge nonuniformly on every subinterval! The first examples are well paced. The last two may be criticized as developing too slowly but are well worth seeing.

Applied Mathematics:

Vibrating Membrance, by Stuart Goldenberg

Shows fundamental modes of vibration for membranes with square and circular boundaries. Solutions are those obtained using the separation of variables technique. This film is an incredible value because of the wear and tear on the graphics scope and the computer time used in producing it. Titles are in color!



Vibrating String, by George Abdo and Jerry Caldwell

Shows graphs of the traveling waves $y = f(x + ct)$ and $y = f(x - ct)$ together with the graph of the solution $y = (f(x + ct))/2$ to the vibrating string equation $y_{tt} = c^2 y_{xx}$. Several initial displacements are considered.

Heat in a Bar, by George Abdo and Jerry Caldwell

Shows the temperature distribution in a bar over time with a particular initial distribution and several endpoint conditions. Solutions are those obtained by the separation of variable technique.

Complex Variables:

w = exp(z), by Michael Collins

Studies of the image of circles $|z| = R$ under the complex exponential map for $0 \leqslant R \leqslant 25$. There is a spectacular zoom on the origin in the case $R = 8$. A must for complex variables courses. This film is remarkable in that it was produced on one roll of film and was not edited.

CCUC/5

To be held at Texas Christian University, Fort Worth, TX, June 16-18, 1975.

CONFERENCE HIGHLIGHTS

- Status of use of computers in education
- Terminal and systems available for use by authors of papers and attendees
- Mini-paper sessions
- CAI or CMI tutorial
- Users meetings
- Vendor displays (terminals and computer-based instructional materials)
- Attendees will have "follow-up" sessions with speakers
- Birds-of-a-feather sessions

FOR FURTHER INFORMATION:

A. A. J. Hoffman
Department of Mathematics
Texas Christian University
Fort Worth, Texas 76129
(817) 926-2461 ext. 541

> "Over the past fifty years, educational offerings in both secondary schools and colleges have changed very little and are essentially geared to the goals and methods developed during the industrial revolution. Our system glorifies and promotes the rat race."
> W. W. Turnbull, "Relevance in Testing," *Science*, 1968, *160*, 1424-1428.

AEDS Programming Contest

The Twelfth Annual AEDS (Association for Educational Data Systems) Computer Programming Contest for students in grades 7 through 12, providing recognition and awards to those who develop outstanding projects, is now underway.

Three classes of awards will be given: a Grand Prize, a First Prize in each of the seven judging categories, and possible Honorable Mentions. A prize of $25 in U. S. Savings Bonds will be awarded to each First Prize winner in the areas of:

1. Business
2. Biological Science
3. Computer Science
4. Games
5. Humanities
6. Mathematics
7. Physical Science

The Grand Prize winner, who will be selected from the winners of the individual categories, will receive $100 in U. S. Savings Bonds, plus an all expenses paid trip for both the student and his or her sponsor to the 1975 AEDS Convention to be held in Virginia Beach, Va., April 29 - May 2, 1975.

All entries must be received by March 1, 1975. Entry blanks may be obtained from:

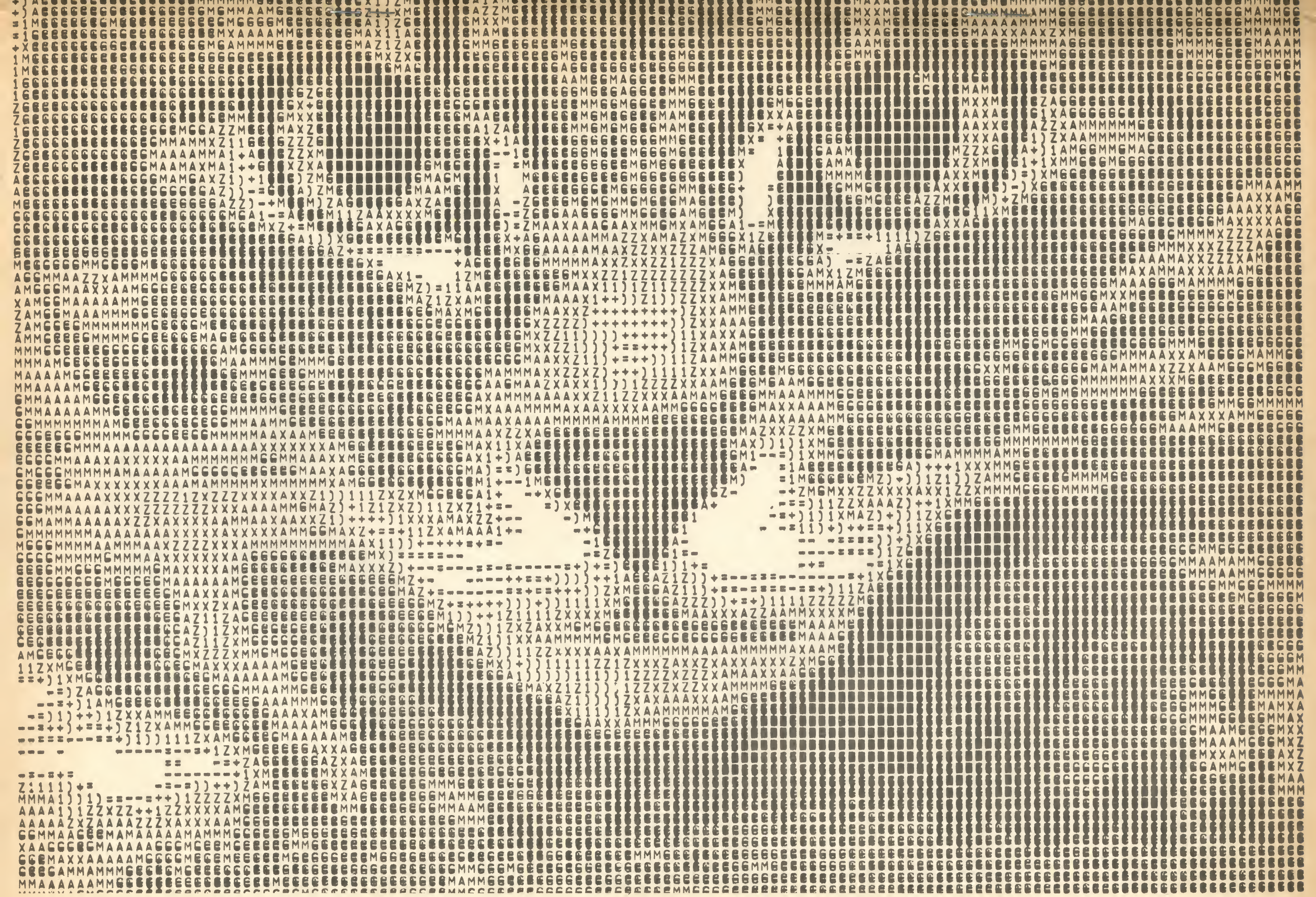
AEDS Programming Contest
Dr. Gary G. Bitter
College of Education
Arizona State University
Tempe, Arizona 85281

Poster

Sorry to say we have virtually no details about our centerfold poster. Apparently it was produced by a systems programmer at DEC on a PDP-10 using overprinting on the line printer. There appear to be about 30 shading gradations from white to black. If any readers can shed more light on this type of "computer art" please write.

creative computing

a non-profit magazine of educational and recreational computing



Creative Computing
P.O. Box 789-M
Morristown, N. J. 07960

TICCIT System Progress Report on Field Testing

by Eric McWilliams
National Science Foundation

Approximately two-and-one-half years ago, The MITRE Corporation at McLean, Virginia committed itself to preparing for and conducting a field-test of the TICCIT system of Computer-Assisted Instruction (CAI). Specifically, MITRE committed to

- developing and integrating the hardware and software required to provide CAI services to 128 consoles simultaneously using minicomputer and television technology;
- intalling and maintaining a 128-terminal TICCIT (Time-shared, Interactive, Computer-Controlled, Information Television) system in each of two community colleges; and
- developing and administering CAI lessons (courseware) and educational programs (including teacher-training, consultation, and courseware improvement) for community college English and mathematics.

The National Science Foundation committed $4 M to these activities, in order to obtain a field-test of several promising features of the TICCIT design, including

- relatively low capital and operating cost, through the use of increasingly powerful and inexpensive minicomputers and television sets as student consoles; and
- an approach to courseware development based upon mastery learning and a division of authoring labor made possible by a consistent separation of instructional content from instructional logic (the manner in which a student is able to access the content).*

An independent evaluation contract was awarded to the Princeton Educational Testing Service (ETS), to provide educational decision-makers with documented insight into the processes and outcomes of using TICCIT in community college instruction.

Much has been accomplished toward meeting these objectives.

- A dual-processor minicomputer-based system has been constructed which provides the following features, at a cost of about $450,000 per system:
  - 128 color television consoles, capable of displaying 17 lines of 43 (completely programmable) characters in any of seven colors, with automatic refresh of each TV picture accomplished by solid-state electronic memory;
  - provision for on-line entering and editing of the courseware content;
  - on-line access to textual and graphic courseware for four full-semester courses (roughly 20% of a community college course-load);
  - delivery of color videotape images to any 20 consoles simultaneously (through the use of 20 computer-switchable videotape players);
  - on-line random access to over five hours of pre-recorded audio messages, which can be delivered to any 20 consoles simultaneously; and
  - automatic digitalization (read-in) of color graphics such as drawings or still-frame cartoons, through the use of a scanning TV camera. (After being read in, any graphic can be edited on-line.)
- A system of "learner-controlled" CAI has been developed which allows each student to exercise the courseware content in the order that suits him. (He may be forced to listen to and look at advice from the system if he seems to be going astray, but he is never forced to look at material that he does not select.)
- Phoenix College, a campus of the Maricopa County Community College District, and the Alexandria Campus of the Northern Virginia Community College were selected as field-test sites, and an extensive implementation plan was adopted by the colleges, MITRE and Brigham Young University.
- Courseware has been designed and specified for community college courses in algebra, elementary functions, and English grammar and composition. Roughly half of the mathematics and a quarter of the English courseware is now in machine-readable form.

*Faculty and staff at Brigham Young University, who are responsible for the courseware, seek to develop the process of courseware production to a level more comparable to that practiced in the engineering professions, and in the process provide the student with powerful yet simple and consistent control over the instructional process. [See *An Overview of the TICCIT Program M 74-1*, January 1974.]

> NOTE
>
> The evaluative articles on PLATO and TICCIT were prepared in June 1974 and do not reflect developments in either project since that time.

A 32-terminal TICCIT system has been installed at BYU. The Phoenix system has been constructed and tested, and is ready for shipment and installation during the month of June. The Alexandria system is being wired and tested presently.

There have been other, related developments as well. For example, even at this very early stage, the Department of Defense has purchased a complete TICCIT system for use in training pilots for the U. S. Navy, and will probably purchase and install quite a number of systems later. Several colleges and universities have expressed interest in purchasing TICCIT systems for their own use, and several computer manufacturers have discussed with MITRE and the National Science Foundation the possibility of marketing the system. The modified TV console produces an extremely clear and stable display, and MITRE has adopted it as their standard computer terminal for use within their own organization. There is every indication that the TICCIT system will support a full 128 terminals simultaneously, which would reduce the per-console capital cost of CAI to about $3500, a significant contribution in itself.

There have of course been problems and delays, as well as progress, which have resulted in a significant increase in the cost to develop the system and the courseware, and have forced a seven-month postponement of the field-tests. Hardware has not contributed significantly to this delay, although some time and effort were invested investigating a mechanical/analog audio device, which was rejected in favor of digitally-stored audio. The major problems have occurred during the design and development of the software and courseware. At least one substantial false-start was made with each of these subsystems, and software and courseware development is still underway. As a result, only the mathematics courseware will be running in the colleges this September; the English courseware won't be ready until several months later.

The delays and increase in cost are disappointing in themselves, especially to the colleges, who have had to change their plans significantly. Equally important, however, the first classroom use of TICCIT will be considerably less of an application of "mainline" (complete, self-contained) CAI than originally planned, due to the need to compress the schedule. Since none of the courseware will be tested upon students until the summer of 1974, it will be necessary to continue to debug and improve the system and courseware through the fall, while serving the first small group of about 100 community college students. Such a start may make it difficult to operate and evaluate the TICCIT system in the fully mainline mode for which it was originally designed, and which carried attractive promises of reductions in the cost of instruction.

These delays have also complicated somewhat the evaluation of the TICCIT system being planned and conducted by ETS. A full field-test of both English and math cannot begin until the middle of the 74/75 academic year, since the first half-year will be required to let the system and courseware "settle in" at the colleges. This will reduce the amount of data that can be collected, and make interpretation of both baseline and other data more difficult.

The National Science Foundation has considered these factors, including the 25% increase in the cost for the TICCIT field-test. Although the problems (noted above) are significant and unfortunate, they do not obscure the promise of the TICCIT system and courseware approach. The problems that have occurred have been addressed in a promising manner. Although evaluation will be somewhat more difficult as a result of the delays and changes, a field-test of the TICCIT system seems even more important now than it was perceived to be three years ago. The Foundation has therefore approved of the proposed changes, and MITRE, BYU, and the colleges are proceeding with the field test of TICCIT, commencing in September of 1974, seven months later than originally planned.

wizard

To some people a computer seems to be a wizard, able to perform black magic at the request of a computer operator. The picture given below was "drawn" by a plotter located in the Oregon State University Computing Center. Actually, the picture was orginally created by the Tektronix Software Group; one can think of it as a "connect the numbered dots" picture, much like kids like to play with. A computer can rapidly connect the numbered dots either on a plotter or on a CRT display screen. An appropriately written computer program can scale the picture to any desired size.

Hard Core CAI

PLATO IV System Progress Report on Field Testing

by Eric McWilliams
National Science Foundation

Approximately two-and-one-half years ago, the Computer-based Education Research Laboratory (CERL) at the University of Illinois at Champaign/Urbana committed itself to preparing for and conducting a large-scale field-test of the PLATO system of computer-assisted instruction (CAI). Specifically, CERL committed to

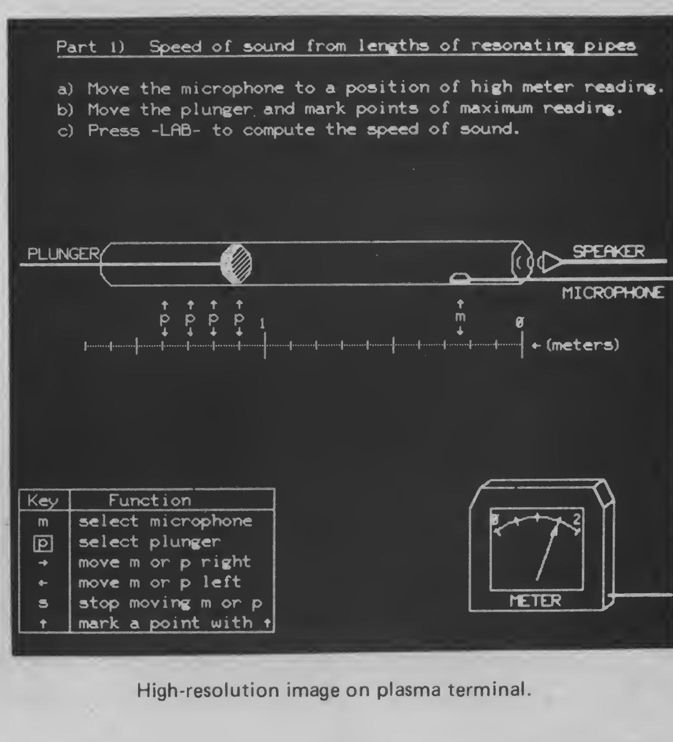
- developing and integrating the hardware and software required to support roughly 1,000 plasma panel consoles;
- installing, operating, and maintaining a network of at least 500 plasma panel consoles, in university, community college, and elementary classrooms; and
- developing and operating CAI lessons (courseware) and educational programs (including teacher training, consultation, evaluative services, etc.) for instruction in elementary reading and mathematics, community college accountancy, biology, chemistry, English, and mathematics, and university physics, chemistry, and foreign languages.

The National Science Foundation committed $5 M to these activities; the University of Illinois committed an equivalent amount, to pay for university lesson development and use on at least 200 of the promised 500 consoles. The field-test, originally scheduled to begin in September of 1973, will be evaluated by an independent third party (The Princeton Educational Testing Service), in order to provide data concerning the processes, costs, and effects of developing and operating the PLATO system and courseware.

Much has been accomplished toward meeting these objectives.

- A sophisticated system of hardware and software (PLATO IV) has been implemented and operated to serve several hundred CAI consoles simultaneously. Performance data indicates that this system will be capable of serving about 1,000 operating CAI consoles.
- A plasma panel console capable of providing extremely clear graphical displays using ordinary telephone lines has been perfected and placed into production. A network of roughly 450 such consoles has been installed and tested.
- Lesson designers, programmers, and other CAI specialists have been organized into teams responsible for producing the courseware for the elementary and community college field-test, and many university faculty members are developing lessons for use in their own courses.
- Plans and commitments have been made to field-test the PLATO system in elementary schools and Parkland Community College in Champaign/Urbana, and in several campuses of the Chicago City Colleges.
- A device for touch-input and a device for random access audio message output have been developed and perfected. Each will be available for the field-test, and for subsequent commercial use.

There have been other, related developments of some importance as well. For example, even at this very early stage, almost a dozen major universities have procured and are operating PLATO consoles, and an equal number want consoles as soon as possible. Eight military training centers are presently developing courseware and plans for their own field-test of the PLATO system. More than a dozen major U. S. (and several foreign) corporations are preparing to develop and market devices or systems based upon the PLATO technology. Several organizations are presently implementing or planning to install PLATO-based CAI systems in the rather near future. The system has been demonstrated upon request to hundreds of groups in more than 50 U. S. cities and more than eight foreign countries, including live demonstrations before the U. S. Congress, and before government



High-resolution image on plasma terminal.

officials and others in the U. S. S. R., in Moscow.

Additional evidence of PLATO's impact can be drawn from the fact that more than 500 authors (ranging in age and experience from school children to full professors) have produced more than 2000 hours of lesson material for PLATO, in more than 80 different disciplines. Although access to PLATO consoles and lessons is still quite limited, more than 20,000 student-contact-hours were logged under PLATO during the fall 1973 term. Furthermore, preliminary results from a survey of 42 instructors and about 500 students who used the system revealed that three-fourths of the instructors and two-thirds of the students felt rather positively toward PLATO CAI after one semester's use, in spite of limited access and occasional interruptions in service.

There have of course been problems and dealys, as well as progress, which have resulted in a substantial increase in the cost for the elementary and community college activities and a year's postponement in the start of the field-tests. Some of this delay is attributable to problems with the hardware and software itself. Although the system reached a moderate level of performance relatively quickly, there have been interruptions in service, especially during those periods when major hardware had to be added to the system.* These interruptions were especially troublesome at the (now more than 70) remote sites, since the terminals themselves have frequently accounted for the majority of the system down-time, and many remote sites have only a single terminal.

It must also be reported that the original configuration proved inadequate to serve the relatively large number of lesson authors committed to developing courseware. The initial configuration assumed that the majority of PLATO use would accrue to students enrolled in scheduled classes, who could therefore share PLATO lessons and memory space. Authors of course usually require distinct PLATO lessons and memory space, and a shortage of extended-core storage quickly developed. It therefore proved necessary to double the amount of extended-core storage for lesson swapping.

There have also been substantial delays in obtaining consoles and telecommunication equipment and service. Difficulties in obtaining educational television (ETV) service from the common carrier for service between Urbana and Chicago made it necessary for CERL to develop special (and more expensive) modulator/demodulator equipment capable of multiplexing up to four consoles on each voice-grade telephone line. This equipment should be adequate for the field-tests, but the change introduced delays which still persist, and it is unfortunate not to be able to field-test PLATO using ETV service at this time.

*Recent reports from CERL show that PLATO is available approximately 96% of the prime time (8 a.m. to 10 p.m., Monday through Friday), with roughly 7 hours between failures, each averaging 6 minutes in duration. The probability of a class (with scheduled access to consoles) being interrupted by a system failure is therefore about .1.

These system problems have had their effect upon project cost and schedule, not to mention staff effort at CERL. They have also tried the patience of a number of remote PLATO users, who understandably expected the service to be commensurate with the cost (presently estimated to be roughly $10,000 of capital investment per console). These system problems, however, seem to be of a transient nature, inherent in any new system. Furthermore, some of the solutions to these problems are clear improvements in the PLATO design.**

One problem, however, could prove to be more lasting, and therefore of greater significance in the long run. The problem referred to is the difficulty in preparing high quality courseware. It is hoped that a good deal of the delay thus far is developmental, due to the need to recruit and train a staff, and to discover how to use PLATO's features to good advantage. If this theory proves optimistic, and if improved training, authoring aids, techniques, and standards don't increase productivity substantially, we may discover that the original estimate of about 40 man-hours of effort per student-contact-hour of courseware is off by a large factor, at least for authoring teams developing courseware specifically for use by other classes and faculty.

The unexpected increase in the cost to develop courseware, together with the system problems summarized above, have increased the cost of the project by roughly 50%, and have forced a full year's delay in the commencement of the field-tests. Use of PLATO this fall will be limited to fewer students and classes, and less courseware than planned even six months ago. Furthermore, the task of evaluation, already complicated by a wide range of content and grade levels at widely scattered locations, is made even more difficult by the delays and changes in plans. For example, the interpretation of the baseline and other evaluation data will be less straightforward, and less data will be available concerning PLATO use, owing to the delay.

The National Science Foundation has reviewed the PLATO project and plans during the past 9 months. Although the problems noted above are not insignificant, they do not obscure the promise of this system, nor the accomplishments toward mounting a major field-test of it. The problems that have occurred, especially those requiring engineering solutions, have been addressed by CERL in a promising manner. A field-test of PLATO seems even more important than it appeared to be when planned three years ago. The Foundation has therefore agreed to share with the University of Illinois the additional support required. CERL is proceeding with plans to begin a two-year field-test in September of 1974, one year later than originally scheduled.

**For example, CERL has designed and built an electronic (fast access) memory subsystem, that can be added to PLATO in such small quantities and at such a low cost as to provide every console with immediate access to its own lesson, thereby eliminating the dependence upon scheduled classes.

The JOURNALISM Programs: Help for the Weary Writer

by Robert L. Bishop

("Help for the Weary Writer" was adapted by Diann Bradarich from a lengthier description of JCAI available from the Center for Research on Learning and Teaching, 109 East Madison, Ann Arbor, Michigan 48104.)

In 1955 the reading public was scandalized by Rudolph Flesch's popular book, "Why Johnny Can't Read." Many a disgruntled teacher will add that Johnny can't write either. At every level of education, the complaint is universal: students cannot communicate effectively through the written word. Students themselves can offer testimony enough to the abhorrence with which they attack the inevitable term paper. The literature detailing the reasons is extensive, but the question of fault is really irrelevant. Rather, the emphasis must be on developing alternative methods of building composition skills.

The Department of Journalism at the University of Michigan has made significant progress in alleviating the painful process of learning to write well. A tireless teaching aid has been discovered – the computer. Computer programs edit text by standard readability formulas, check for stylistic characteristics such as clarity and cliches, and examine conformity to style rules such as punctuation and correct spelling. The easy analysis of both style and content of the natural language text partially fulfills instructional requirements for technical and business-report writing, English composition courses, foreign language instruction, and journalism exercises. Sample stories and critiques are included as an appendix to this article.

The Structure of JOURNALISM

JOURNALISM is composed of four general categories of computer programs; specific exercises, a general stylistic analysis program, a spelling check, and a housekeeping routine which continually stores measures of performance.

Specific exercises. A general program called JCAI (Journalism Computer Assisted Instruction) allows a teacher to introduce an entirely new exercise into the system easily; previous experience with programming is unnecessary. The instructor merely indicates key words he wants to check and accompanying comments dependent on the order, presence or absence of the words. Sampe Story *B* is an example of an exercise written and programmed in six hours by Dr. Nadean Bishop who had no previous experience with computers.

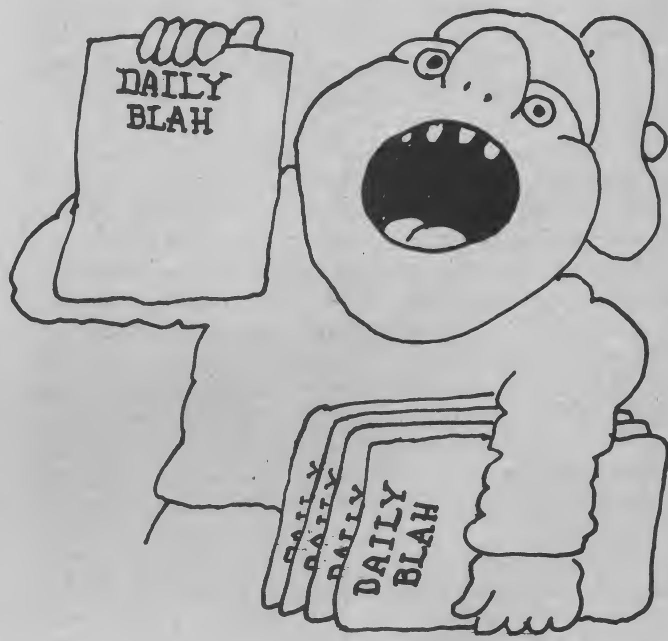
Stylistic Analysis. JOURNALISM'S second routine is a general stylistic analysis. In addition to clarity, readability and the mechanics of style, the routine analyzes variety in sentence length and structure, and the overuse of articles, passive verbs, adjectives or adverbs. Since the program is not dependent on content, any bit of prose can be analyzed. Thus, the teacher is freed from the limitation of "canned" assignments. Thy program may be run separately or in conjunction with JCAI.

Spelling. The third routine, a spelling check, compares each word in a given article to a dictionary of some 17,000 entries andprints out each word for which it does not find an entry. The dictionary may be supplemented with a list of specific words for a given exercise – proper names and technical terms, for example.

Housekeeping Aid. JOURNALISM'S fourth routine is a clerical or housekeeping aid which automatically stores all the statistics generated by the JCAI program, the stylistic analysis, and the spelling check. It also records types of errors such as failure to use reference sources, errors in news judgment, or potentially libelous comments. Each student then has an up-to-date record of progress in avoiding spelling errors, eliminating mechanical problems, reducing sentence length (or increasing sentence length, if desirable), and increasing sentence variety.

JOURNALISM in the Classroom

JOURNALISM has been used since 1969 in the beginning news writing course in the Department of Journalism at the University of Michigan. Four elements constitute the core of the course: a programmed instruction book, video tapes and discussions about writing, computerized



writing exercises, and at least three individual conferences with each student. The programmed book is a self-instructional guide to basic news writing, news values, condensation, speech reporting, copy editing, and descriptive writing; it replaces most of the usual lectures. The Department of Journalism offers seven video tapes for use at the instructor's option. These include four short tapes on writing intended to stimulate class discussion and three on specialized subjects: interviewing, reporting public opinion polls, and laws of libel.

Computerized exercises range from simple rewrite assignments to genuine challenges such as reporting a national study of public schools or handling a revenue-sharing proposal made by Nelson Rockefeller. The raw material for the story may be gathered from a film, a tape or the programmed text which furnishes simulated news releases. The idea of diversified sources hinges, of course, on the assumption that using realistic sources of information is valuable practice for the student.

When the student has written a story, it is fed into the computer by one of two methods: (a) batch, running a deck of computer cards punched with the story through a card reader, or (b) interactive, by typing the story into a computer terminal.

The JOURNALISM program first analyzes the story by scanning for key words or phrases. In this way, an article with an undesirable slant can be corrected by altering a few heavily connotative words. The same routine can be used for checking accuracy, and in some cases libel. All exercises have a check on key names, titles, and addresses.

In the second stage of stylistic analysis, the system checks sentence and paragraph length, the percentage of sentences containing verbs of being or passive verbs, the percentage of descriptive adverbs, indirect or wordy sentences, and points of newspaper-style rules. The computer advises the student which sentences need to be revised, and how many of them must be changed in order to erase the negative comment. The computer analysis of sample story *B* prints out the sentence which seems to have the most unnecessary words (that, those, these, of, because, etc.), blanking out the barred words so that the student can judge which ones are really unnecessary.

The computer retypes the story, numbers each sentence, and prints out a series of comments and queries specific to the student's work. Since there are infinite possibilities for expressing any idea, the student treats the critique as suggestions rather than as commands; the article remains ungraded.

At this point, the student decides which comments to use and rewrites the story to do the best of his ability. The new version is compared to sample stories written by other students.

Throughout the semester the student has a series of conferences with the instructor in which they can discuss the finer points of journalistic writing and any disagreements with the writing style suggested by the JOURNALISM programs.

Evaluation of JOURNALISM

The most important advantage of the JOURNALISM programs is that they give the student fast, tireless, and accurate responses, far more responses to a paper than any teacher has time to write. Most stories are checked for 15 different factual points in addition to general comments on sentence and paragraph length, conformity to the stylebook, and readability. Obviously, the student receives far more guidance on each story than an overworked instructor can offer.

JOURNALISM results in a substantial saving of time for both student and teacher. Because of the computer exercises and the programmed workbook, students spend less than three hours in class per week (for a course with four hours of credit). Teachers must correct only 33 to 50 percent of the papers in a normal load and can use the extra time for clinical sessions with individual students.

The results have been more than satisfactory. University of Michigan journalism classes now cover in 14 weeks what used to take 20 or 25 weeks. Students are well into feature writing in their first semester, rather than approaching this level halfway through the second writing course. And they express more satisfaction with the course than with conventional courses, both in terms of regular evaluation forms and in the percentage of those electing the second course. Despite some fears that students would strongly resist the computer, data from student opinion forms show that students would elect both JCAI and conventional sections if given the choice with slightly more elections for JCAI sections.

As one might expect, student satisfaction directly correlates with student performance. JCAI students score significantly better in the CAI course and in the following writing course than do students from conventional courses. Preliminary results of a study conducted during the 1973-74 academic year support this existing data. Students from JCAI sections who elected the second course received an average of a half a grade higher on a complex assignment reviewed by outside judges than did their non-JCAI counterparts.

Though many are skeptical about the threat of "mechanized teaching" destroying individuality in writing style, the success of JCAI clearly dispels such fears. The very structure of the programs is designed to provide more individual attention; the student works on an individual basis with the computer which, in turn, relieves the instructor of some of the drudgery of paper grading and frees him for work with students on individuality and creativity.

Sample Runs of JOURNALISM Programs

SAMPLE STORY A ENTERED INTO THE COMPUTER

1 THE DESTROYERS USS AMMAN AND USS COLLETT COLLIDED THIS MORNING
2 THREE MILES OFF THE CALIFORNIA COAST AT NEWPORT BEACH. ELEVEN MEN
WERE REPORTED KILLED WITH AT LEAST SIX OTHERS INJURED.
3 THE COLLISION OCCURED IN A FOG THAT LIMITED VISIBILITY TO LESS
4 THAN A QUARTER OF A MILE. THE FOG HAS ALSO HAMPERED RESCUE EFFORTS
BY HELICOPTERS.
5 A SEAMAN OF THE AMMAN CLAIMED, "THE COLLETT HIT US AMIDSHIPS
AND RIPPED THE SIDE OPEN, JUST LIKE IT HAD BEEN DONE WITH A GIANT
6 CAN OPENER. I WAS BELOW IN THE ENGINE ROOM AND THERE WAS NO
7 WARNING. THE WATER CAME POURING IN."
8 ONE NAVY SOURCE IN LOS ANGELES SAID THAT THE AMMAN'S REAR
ENGINE ROOM WAS FLOODED WITH WATER POURING IN THROUGH A HOLE ON THE
9 PORT SIDE. THE BOW OF THE COLLETT IS REPORTED TO BE DAMAGED.
10 EFFORTS ARE BEING MADE TO TOW THE HEAVILY LISTING AMMAN TO
11 LONG BEACH. A FIRE THAT BROKE OUT AFTER THE COLLISION WAS QUICKLY
BROUGHT UNDER CONTROL.
12 SMALL CRAFT FROM NEWPORT BEACH SPED TO THE SCENE AND BROUGHT
INJURED AND DEAD ASHORE.
13 THE AMMAN WAS HEADED FOR SAN DIEGO AND DEACTIVATION WHEN IT
WAS STRUCK.
14 THE COLLETT WAS CONDUCTING SEA TRIALS AFTER AN OVERHAUL AT
THE LONG BEACH SHIP YARD.
15,16 THE INJURED HAVE BEEN TAKEN TO HOAGUE MEMORIAL HOSPITAL. THEIR
IDENTITIES AND THOSE OF THE DEAD ARE BEING WITHHELD.

COMPUTER ANALYSIS OF SAMPLE STORY A

IDENTIFY THE DESTROYERS BY BASE AND FLOTILLA NUMBER AND REPORT ANY DAMAGES EARLY IN THE STORY UNLESS YOU HAVE VERY GOOD REASONS FOR NOT DOING SO.

FINE. I SEE THAT YOU HAVE MENTIONED WHAT THE DESTROYERS WERE DOING BEFORE THE COLLISION.

I DO NOT FIND WILLIAM WILBERS' NAME. DID YOU LEAVE IT OUT OR MISSPELL IT? USE AS FULL AN IDENTIFIER AS IS AVAILABLE.

GOOD. YOU HAVE MENTIONED THE HOSPITAL WHERE THE INJURED WERE TAKEN. THIS IS AN IMPORTANT DETAIL FOR READERS WITH RELATIVES WHO MAY HAVE BEEN INJURED IN THE COLLISION.

WHY DID YOU OMIT THE SIZE OF THE SHIPS AND THE NUMBER OF CREWMEN? THESE DETAILS, AFTER THE OTHER FACTS ARE GIVEN, INDICATE SOMETHING ABOUT THE MAGNITUDE OF THE ACCIDENT AND DAMAGES.

YOU MAKE YOUR WRITING MORE DIFFICULT BY USING TOO MANY PASSIVE VERBS.
TRY CHANGING THESE TO ACTIVE VOICE, PRESENT TENSE. CHANGE 4 OR MORE
TO ACTIVE VOICE.
CHECK SENTENCES 2, 8, 9, 10, 11, 13, 15

YOU MAY NEED TO VARY THE LENGTH AND STRUCTURE OF YOUR SENTENCES MORE.
FOR EXAMPLE, SEE SENTENCES
10 - 11 - 12
12 - 13 - 14

SENTENCES CONTAINING VERBS OF BEING, 20.0%
SENTENCES CONTAINING PASSIVE VERBS, 46.7%
DESCRIPTIVE ADVERBS IN TOTAL WORDS, 0.9%
INDIRECT OR WORDY SENTENCES, 7.7%
SENTENCE SIMILARITY MEASURE, 13.3%

YOUR AVERAGE SENTENCE LENGTH IS 14.1 WORDS.

SOME OF YOUR SENTENCES APPROACH THE MAXIMUM DESIRED LENGTH. CHECK THEM TO SEE IF THEY CAN BE CONDENSED. IF THEY CANNOT, YOU MAY WISH TO BREAK THEM INTO TWO SENTENCES.
CHECK SENTENCES 5, 8

THIS CONCLUDES THE ANALYSIS OF YOUR STORY. THE COMPUTER MAY HAVE MISSED SOME IMPORTANT ELEMENTS, OR MAY NOT HAVE RECOGNIZED SOME OF THE KEY PHRASES WHICH YOU USED. CORRECT THE STORY ACCORDING TO THE COMMENTS AND YOUR OWN BEST JUDGEMENT, AND THEN COMPARE YOUR VERSION WITH THE MIMEOGRAPHED STORIES DONE BY OTHER STUDENTS.

SAMPLE STORY B ENTERED INTO THE COMPUTER

(from an English Composition Class)

1 ONE OF THE LEAST PROTESTED ORDEALS THAT THE AMERICAN PUBLIC
HAS BEEN SUBJECTED TO HAS BEEN THE PROCEDURE OF FUNERAL ARRANGEMENTS
2 AND BURIAL. THE REASONS FOR THE LACK OF VOLATILE CRITICISM ARE MANY,
THUS GIVING THE COALITION OF FUNERAL DIRECTORS IN AMERICA THE UPPER
HAND IN DEALING WITH THESE MATTERS.
3 FUNERAL PREPARATIONS CAN BE AN ORDEAL AND TO THE MAJORITY OF
4 THE PUBLIC IT IS DEFINITELY ONE. ALTHOUGH THE AMERICAN PUBLIC MAY FEEL
THAT THEIR CUSTOMS AND TRADITIONS CONCERNING THE BURIAL OF THEIR LOVED
ONES TO BE THEIRS ALONE, THEY WOULD BE SURPRISED TO FIND THAT THESE
CUSTOMS AND TRADITIONS HAVE BEEN DICTATED BY FUNERAL DIRECTORS FOR
5 THEIR COMMERICAL BENEFIT. SELDOM IS THE INDIVIDUAL'S IDEA OF THE
6 PERFECT BURIAL HIS OWN. FOR YEARS FUNERAL DIRECTORS HAVE CAPITALIZED
7 ON THE UNPREPAREDNESS OF THE BEREAVED. UNLESS HAVING PREVIOUSLY
EXPERIENCED A DEATH IN THE FAMILY, THE AVERAGE CITIZEN IS TOTALLY
8 IGNORANT OF THE HIGH COST INVOLVED IN A FUNERAL. JESSICA MITFORD IN
HER BOOK, "FROM THE AMERICAN WAY OF DEATH", QUOTES THE AVERAGE UNDER-
9 TAKER'S BILL AS IN THE NEIGHBORHOOD OF $1,450. SHE GOES ON TO SAY
THE AVERAGE CITIZEN IS FORCED TO MAKE A QUICK DECISION ALTHOUGH HE
IS TOTALLY UNPREPARED FOR SUCH, AND RELIES ON THE ADVICE OF THE WORST
10 PERSON POSSIBLE--THE FUNERAL DIRECTOR. UNDER A BARRAGE OF APPEALS
TO "AMERICAN TRADITION", KEEPING UP WITH THE JONESES, AND SENTIMENTAL
AFFECTION FOR THE LOVED ONE, THE UNFORTUNATE CONSUMER CONSENTS TO
A SERVICE FAR EXCEEDING HIS WANTS OR NEEDS, BOTH PRACTICALLY AND
FINANCIALLY.
11 HOW HAS THE BOOMING BUSINESS REMAINED ABOVE PUBLIC CRITICISM?
12 LORD ESSEX SAYS THAT THE AVERAGE UNPROTECTED CITIZEN HAS NEITHER
THE MORAL COURAGE TO SPEAK AGAINST OR ACT IN DEFIANCE OF THESE
13 PSUEDO AMERICAN CUSTOMS AND TRADITIONS. ALSO, THESE PEOPLE ARE
CONFRONTED WITH THIS ORDEAL USUALLY JUST ONCE, AND ARE UNWILLING TO
MOUNT AN OFFENSIVE AGAINST SUCH A DISTANT PROBLEM.
14 TO COMBAT THIS GROWING INJUSTICE IN AMERICA THE PUBLIC SHOULD
15 BECOME AWARE OF THE SITUATION. EACH PERSON SHOULD DECIDE WITH HIS
FAMILY THE PROCEDURE THEY WILL TAKE SO THAT WHEN THE TIME COMES THEY
CAN BETTER COPE WITH PROBLEMS OF BURIAL.

COMPUTER ANALYSIS OF SAMPLE STORY B

THIS WAS A DIFFICULT ASSIGNMENT. YOU WERE ASKED TO GIVE A COMPRESSION OF THE EVIDENCE IN JESSICA MITFORD'S BOOK THE AMERICAN WAY OF DEATH AS PART OF A PERSUASIVE EDITORIAL TO CONVINCE YOUR READERS THAT FUNERAL PRACTICES SHOULD BE CHANGED. THE COMPUTER HAS BEEN PROGRAMMED TO CATCH ERRORS AND OMISSIONS AND SUGGEST WAYS YOU CAN REVISE YOUR EDITORIAL; USE THE COMMENTS YOU FIND USEFUL.

IT WAS GOOD THAT YOU REFUTED THE TENET THAT ELABORATE FUNERALS ARE IN THE "AMERICAN TRADITION."

THE CASE OF MR. AUGUST CRELINI WAS USED BY JESSICA MITFORD TO PROVIDE HUMAN INTEREST AND BUILD PERSONALIZED OUTRAGE AT THE LIES AND OTHER DECEPTIONS USED TO BILK BEREAVED RELATIVES. IF YOU DID NOT REFER TO THIS CASE STUDY, DID YOU PROVIDE SOME OTHER EVIDENCE TO ACHIEVE THIS SAME RESULT?

YOU WERE ASKED TO AROUSE PUBLIC SENTIMENT FOR REFORM. IF YOU DID NOT MENTION "FUNERAL SOCIETIES" OR "MEMORIAL ASSOCIATIONS" WHICH ARRANGE FOR PRE-PLANNED "DIGNIFIED FUNERALS AT REASONABLE COST," DID YOU RECOMMEND SOME OTHER SOLUTIONS TO THE PROBLEM?

BOOK TITLES ARE ALWAYS UNDERSCORED, SO THE REFERENCE TO MISS MITFORD'S BOOK SHOULD BE TO THE AMERICAN WAY OF DEATH, UNDERSCORED. OUR TEXT GAVE THE EXCERPT THE CHAPTER HEADING "FROM THE AMERICAN WAY OF DEATH," BUT YOUR CITATION SHOULD BE TO THE BOOK ITSELF.

CURRENT TYPOGRAPHY REQUIRES THAT PERIODS AND COMMAS ALWAYS COME WITHIN THE CLOSING QUOTATION MARKS.

THE CLICHE "KEEPING UP WITH THE JONESES" USES THE PLURAL FORM OF THE NAME JONES.

EDITORIALS USUALLY ARE GIVEN TITLES, SO IF YOU DIDN'T HAVE TIME TO THINK OF ONE TRY TO DESIGN SOME SHORT AND EYE-CATCHING TITLE FOR THE REVISED ESSAY.

REPLACE SOME OF YOUR "TO BE" VERBS FORMS, "IS," "WAS," "AM," "ARE," "BEEN," ETC., WITH VERBS SHOWING MORE ACTION.
REPLACE 1 OR MORE WITH ACTIVE VERBS.
CHECK SENTENCES 1, 3, 4, 7

YOU USE A FEW TOO MANY PASSIVE VERBS.
CHANGE 3 OR MORE TO ACTIVE VOICE.
CHECK SENTENCES 1, 4, 9, 13

YOU MAY BE USING TOO MANY ADVERBS AND ADJECTIVES INSTEAD OF FINDING THE VERB OR NOUN WHICH SAYS EXACTLY WHAT YOU MEAN. EXAMINE YOUR STORY TO SEE IF ADVERBIAL OR ADJECTIVAL PHRASES CAN BE ELIMINATED.

WORDS LIKE "CAUSE," "OF," "THERE," "WHICH," "THAT," "THESE" AND "THOSE" OFTEN INDICATE WORDY, INDIRECT SENTENCES. ELIMINATE 4 OR MORE OF THEM IN YOUR STORY. SEE IF YOU CAN IMPROVE THE SENTENCE:
ALTHOUGH THE AMERICAN PUBLIC MAY FEEL THEIR
CUSTOMS AND TRADITIONS CONCERNING THE BURIAL
THEIR LOVED ONES TO BE THEIRS ALONE, THEY WOULD BE
SURPRISED TO FIND CUSTOMS AND TRADITIONS
HAVE BEEN DICTATED BY FUNERAL DIRECTORS FOR THEIR
COMMERCIAL BENEFIT.

NEWSPAPER STYLE GENERALLY ELIMINATES THE COMMA BEFORE "AND" AND "OR," ESPECIALLY IF CONNECTING ITEMS IN A SERIES.
CHECK SENTENCES 9, 10, 13

SENTENCES CONTAINING VERBS OF BEING, 33.3%
SENTENCES CONTAINING PASSIVE VERBS, 40.0%
DESCRIPTIVE ADVERBS IN TOTAL WORDS, 1.7%
INDIRECT OR WORDY SENTENCES, 38.5%
SENTENCE SIMILARITY MEASURE, 0.0%

YOUR AVERAGE SENTENCE LENGTH IS 23.4 WORDS.

SOME OF YOUR SENTENCES APPROACH THE MAXIMUM DESIRED LENGTH. CHECK THEM TO SEE IF THEY CAN BE CONDENSED. IF THEY CANNOT, YOU MAY WISH TO BREAK THEM INTO TWO SENTENCES.
CHECK SENTENCES 4, 9, 10

SOME OF YOUR PARAGRAPHS ARE DEFINITELY TOO LONG. BREAK THEM INTO TWO OR MORE PARAGRAPHS IF YOU ARE SURE YOU CAN NOT CONDENSE THEM.
CHECK PARAGRAPH 2

THIS CONCLUDES THE ANALYSIS OF YOUR STORY. THE COMPUTER MAY HAVE MISSED SOME IMPORTANT ELEMENTS OR MAY NOT HAVE RECOGNIZED SOME OF THE KEY PHRASES WHICH YOU USED. CORRECT THE STORY ACCORDING TO THE COMMENTS AND YOUR OWN BEST JUDGEMENT, AND THEN COMPARE YOUR VERSION WITH THE MIMEOGRAPHED STORIES DONE BY OTHER STUDENTS.

Control console for Computer Image Corporation's automated animation system. According to Lee Harrison III, president of the company and developer of the system, "Great pains were taken to make the system operation invisible to the user -- to give him the feeling he's merely wielding an electronic paintbrush."

"Electronic Paintbrush" Adds New Dimension To The Graphic Arts

The group of young Indians crowding around the TV screen whoop in anticipation as the smart-alecky coyote, ignoring the admonition of the wise old lizard, slides down the sand dune riding atop a large, flat rock—only to lose his balance and get overtaken and flattened in the process. "That's perfect," says the Navaho elder with a smile, "tape it." The console operator pushes a button and the luckless coyote again slides down the slope—this time so that his every action can be captured on color videotape.

It's the kind of cartoon your kids might see on any Saturday morning TV show, except for two things—the dialogue in this particular sequence is all in Navaho, and the film itself was produced entirely by computer, in an interactive system that permits sequences to be repeated and refined so as to reflect the subtle details of Indian experiences and Indian legend.

Computer animation has made enormous strides during the past two or three years. Combining a hybrid analog-digital computer with television components, systems such as the one at Computer Image Corporation of Denver, Colorado can now produce character animation approaching the quality achieved through conventional animation methods. Perhaps even more significant, such systems can do in one day what a conventional animator working with standard equipment might take as much as two or three weeks to produce. That's why commercial filmmakers are following developments in computer graphics with growing attention.

To produce a basic bit of animation by the old method—for example, the sequence in which the coyote picks up the rock and begins to run with it—would require between 25 and 50 separate drawings, each painstakingly hand-drawn by an artist. With a computer-controlled system, the artist first makes some basic drawings to show the computer what the subject looks like. In the example of the coyote, he would make separate drawings of the rock and the head, body, paws, and tail—a drawing of each of the moving parts of the subject. These few black-and-white drawings on transparent sheets, or "Kodaliths," are the equivalent of dozens, or even hundreds, of conventional "cels"—the individual drawings that form the basis of a manually-created animation sequence. When various parts of the image are to have different colors, the corresponding transparent areas of the Kodalith are masked with variable densities of gray scale so that each area transmits a different amount of light.

The Kodalith is then placed on a light box and scanned by a special TV camera which converts the images into electrical signals and feeds them into the computer. The restructured images next appear on a high-resolution X-Y display where they are again scanned by a TV camera and transmitted to the control CRT on the operator's console.

In Computer Image Corporation's systems, analog techniques allow the operator to manipulate the basic shapes and set up the animation sequence; a Honeywell 316 digital computer with 12K of memory is used for control, storage, and timing of the total animation. This arrangement gives the operator real-time control of the images on the screen—and at least as much flexibility as he would have working with a pencil or paintbrush.

In looking up at the control CRT, for example, our animator would first see his picture of the rock and the jumbled parts of the coyote—he can have as many as eight individually controlled elements on the screen at one time. By manipulating his analog controls, he assembles the coyote and positions the rock where he wants it. He also adjusts the size of the images and the intensity. Next, he moves the image of the coyote to the position on the screen where he wants it to be at the end of the animation sequence. After making similar adjustments for the initial starting position, he sets the length of the sequence from a few tenths of a second to several seconds for that scene. The operator then presses the control that triggers the animation cycle and the coyote moves from the initial to the final position, executing whatever action has been programmed to occur between the two terminal locations. Since the entire sequence has been stored in the computer memory, it can be repeated as often as desired with the simple press of a button. Or selected parts of the sequence may be changed until the entire episode meets the operator's approval.

An "overlap" feature built into the system blanks out portions of a character that are located behind other elements and keeps them from showing through. This permits an arm to pass in front of a character's face, for example, and obscure the face in a realistic fashion without producing what would otherwise appear to be a multiple exposure.

As a rule, color is added to a scene after the animation has been worked out. The colorizer portion of the computer identifies five levels of light intensity and assigns a different color to each level. (This is why elements of the image that are to be the same color must be coded with identical gray tones on the original artwork.) By adjusting the setting of five red-blue-green mixing controls, the operator can paint each area of the image any color he wishes—and even change the colors during a scene. There may be as many as four different colors on a character plus one other color for the background of the scene. The background color is supplied by a color television viewing a separate piece of color artwork. When both animation and color are judged to be optimum, the sequence is recorded on videotape.

But computer-controlled systems do more than simply translate ideas into pictures; they let the artist explore a whole new electronic world of interacting colors and shapes. He can start with a simple image—perhaps a name or company logo—and by varying the waveform, frequency, phase, and amplitude of the shaping function generator, create an endless variety of shapes and colors. The original image explodes, shrinks, grows, undulates, and rearranges its component parts in ways the artist could not possibly have imagined.

As important as these exciting visual effects may be to the individual artist, it's the cost advantage that prompts hard-headed businessmen to buy computer animation systems. An enormous amount of expensive time is saved when an animator can input a minimum amount of initial drawings, set up a few key frames, specify the desired colors, and let a computer "draw" all the intervening frames. If any of the parameters have to be changed, it's merely a matter of adjusting a few controls. And the finished sequence can be viewed immediately—before it's committed to videotape. By contrast, any change in manually executed animations requires the complete redrawing of perhaps hundreds of cels—and there's no assurance that the sequence is satisfactory until the new film or tape can be viewed.

Or, putting it another way, conventional animation is 5% creative and 95% production. With a computer-controlled system that ratio is reversed. As one filmmaker, Hatfield Davis, observes, the goal of computer animation systems is to produce the kind of animation we saw in "Snow White." "But to produce those 83 minutes of "Snow White" took 750 artists working three years to complete 1,000,000 cels.

Digital Calculators - Then and Now

The electronic digital computer first appeared in the middle 1940s. Then, it was a specialized calculating tool of mathematicians and scientists. Today, it is helping to solve information problems in almost every area of human activity.

The computer now can be used to print bank statements, as well as calculate astronomical tables. It can be used to compare the writing styles of two poets, as well as compare the performances of two chemical processes. It helps creative artists, as well as builders of bridges or buildings.

This revolution in computer use parallels to some extent an earlier evolution from simple manual counting tools to mechanized data processing machines. Some of the basic principles embodied in early mechanized calculators, as well as the problems they were designed to solve, help to explain the significance of the modern digital computer and the recent rocket-like rise in its use as a general problem-solving tool.

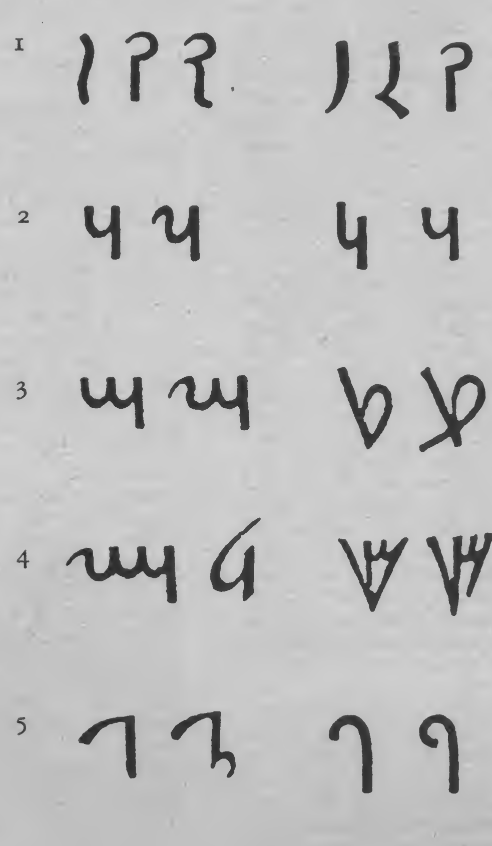
In the beginning

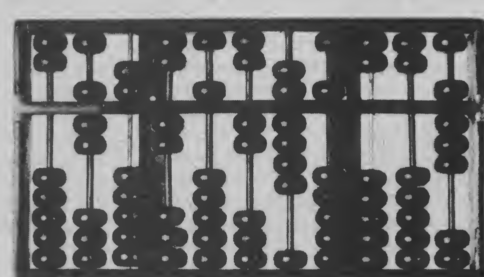
It's usually assumed that man developed the concept of number and counting before he developed an effective written language of words. His first records were primitive accounting and inventory records of grain, animals and possessions, recorded with sticks, pebbles or scratches on cave walls.

But his need for information and communications gradually outstripped the capability of these simple tools. So he invented new and better tools: first the abacus and, later, faster mechanical and electrical counting and information-handling aids. These were the forerunners of today's electronic digital computers.

The Abacus

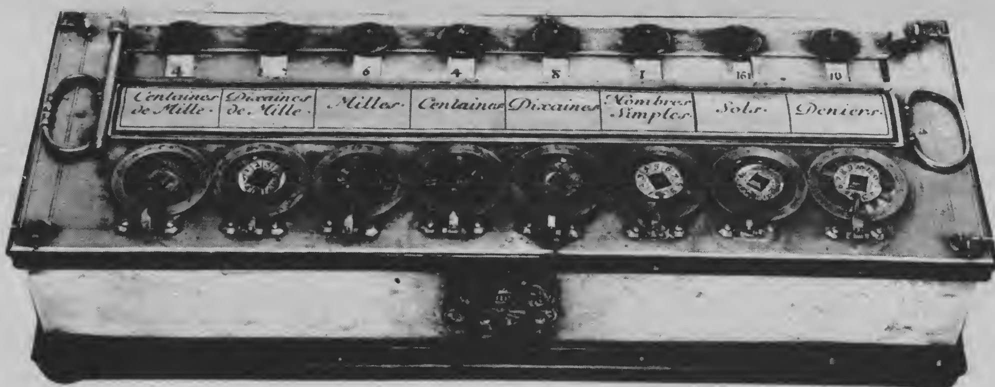
The first digital calculator, the abacus, is really a mechanized form of pebble-counting. Beads, sliding on wires, substitute for the pebbles. Five beads below a wooden bar are units; each bead above is worth five. Numbers are represented by pushing beads against the bar. The wires or columns, starting at the right, represent place value: units, tens, hundreds, etc., just as our decimal arithmetic columns do. The abacus first appeared in the Near East and China about 2,000 years ago and it is still being used in parts of Asia.





Left, early Egyptian numerical symbols.
Above, an abacus similar to those used for rapid calculation in the Orient since the thirteenth century.

Facing page, top, French mathematician Blaise Pascal's Arithmetic Machine, invented in 1642. *Below,* a nineteenth-century Jacquard loom, controlled with punched cards.



Pascal's Arithmetic Machine

Blaise Pascal–French mathematician, philosopher and writer–devised a calculating machine in 1642, at the age of nineteen. This machine demonstrated the practicability of mechanized calculation.

Pascal's machine was operated by dialing a series of wheels bearing the numbers zero to nine around their circumferences. To "carry" a number to the next column when a sum was greater than nine, Pascal devised an ingenious ratchet mechanism that would advance a wheel one digit when the wheel to its right made a complete revolution. Answers appeared on indicators above the dials.

Leibniz' Calculating Machine

Gottfried Wilhelm Leibniz took the next great step forward in calculating machines. He wanted to mechanize the calculation of trigonometric and astronomical tables and free scientists for more fruitful work. "It is unworthy of excellent men," wrote Leibniz, "to lose hours like slaves in the labor of calculation..." In 1671, he started development of the first machine to multiply and divide directly. A version of this machine was built in 1694.

Punched Card Looms

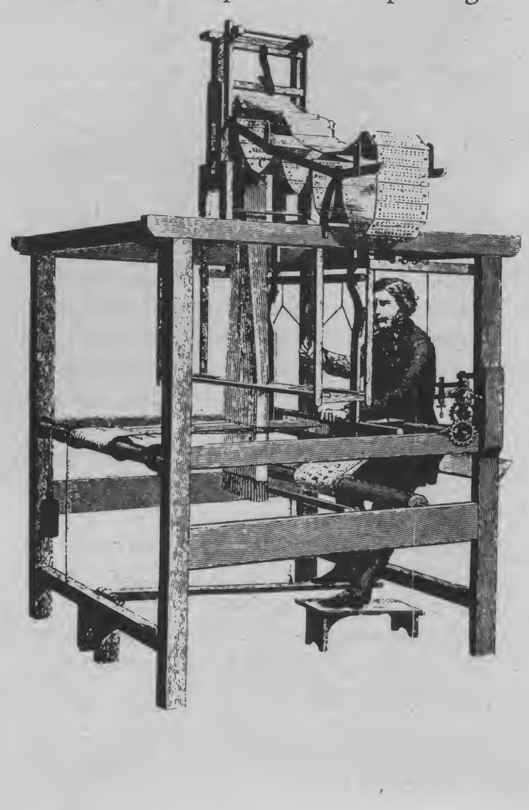
Weaving looms in France were the first machines to be controlled automatically from coded information punched into paper cards. First proposed in the first half of the eighteenth century, the idea of using holes punched in paper to control the operation of a loom was perfected by Joseph Marie Jacquard in 1804. He controlled the operation of a loom with a series of connected punched cards. The same basic technique is still in use in the textile industry.

Babbage's Calculating Engines

Over a century ago, an English mathematician named Charles Babbage was designing a machine based on the same basic principles as today's electronic computers.

His first machine was a Difference Engine with which he hoped to mechanize the calculation of logarithmic and astronomical tables. Babbage built his first Difference Engine in 1822 (for which he won the first Gold Medal of the Royal Astronomical Society). It was a relatively simple machine that could generate tables to an accuracy of six decimal places. Then, he immediately began work on a bigger engine capable of twenty-place accuracy. Only part of it was ever constructed.

After his work on the Difference Engine, Babbage developed new ideas for a really powerful tool to handle any sort of mathematical computation automatically. Powered by steam, this machine would have worked from a planned program of operating instructions stored on punched cards. It would have included, as modern computers now do, a memory or data storage section, an arithmetic unit, a section for entry of data and instructions, and an output section for printing



results. It would also perform decision-making functions. He called it an Analytical Engine. These concepts were not incorporated in a workable automatic calculator until the twentieth century.

Punched Card Counting

Dr. Herman Hollerith, of the U.S. Census Office, was the first person to use electrical tabulating equipment to analyze statistical data. For the U.S. Census of 1890, he devised a way to represent a person's name, age, sex, address, and other vital statistics in the form of holes punched in paper cards. This coded data then was counted electrically. During the 1890 Census, his ideas enabled the government to tabulate the census data more than twice as fast as it had handled the 1880 Census, even though the population had increased 25 per cent during that decade. Without some such mechanized tabulation, the census data would have become obsolete before it could have been completely analyzed.

Hollerith's pantograph punch was one of the first devices used to punch coded census data into cards. A blank card was placed on a plate at the back of the machine. At the front of the machine, a large replica of the card showed the coded meaning of each of the squares on the card. To record an item of data, the operator moved the punching mechanism over the appropriate hole in the replica and pressed the handle to punch a corresponding hole in the card.

Hollerith's first electrical tabulator used a clock-like counting device. The operator placed a punched card in a card reader and then pulled down a lever which caused a set of spring-loaded pins to be pushed against the card. Wherever there was a hole punched in the card, the pin passed through into a cup of mercury and completed an electrical circuit. This caused a pointer on a dial counter to advance one unit.

Cards were sorted semi-automatically. When a card was counted in the tabulator, a cover on a preselected compartment in a separate sorter box opened automatically. The operator placed the card in the compartment and closed the cover manually. In this way, cards were quickly sorted according to any desired characteristics such as place of birth, age, sex, citizenship.

During the first third of the twentieth century, punched-card machines based on Hollerith's ideas were modified, improved, speeded up. New and faster machines were developed to handle payroll, accounting, billing, sales analysis and other problems.

Below, an early twentieth-century, key-driven card punch.

In the 1930s, punched-card equipment made it possible to handle a mountain of data which suddenly had to be recorded when the Social Security Act was passed. The same kinds of machines also were used to develop statistical tables, calculate the orbit of the moon more accurately than ever before and speed calculations for a variety of scientific problems.

However, scientists and mathematicians kept collecting new data and they needed even faster calculators to handle it. As a result, new kinds of machines were developed and old ones were adapted to handle calculation at greater speed.

Mark I: The First Large Scale Automatic Digital Calculator

In 1937, a Harvard University Ph.D. physics candidate, Howard H. Aiken, outlined plans for a machine that could be made to solve differential equations automatically. The plans were so interesting that IBM agreed to help him develop and build the Automatic Sequence Controlled Calculator, or Mark I, as the machine was later called. It was completed in 1944 and presented by IBM to Harvard University.

Mark I was a 5-ton machine, consisting of a complex of 78 devices linked by 500 miles of wiring. It contained 3,304 electromechanical relays and was controlled by a sequence of instructions prepared by a programmer and then punched into a roll of paper tape. Once the Mark I was started on the first instruction in a program, no further human direction was needed until a new problem was put in the machine.

The Mark I could perform 23-digit additions and subtractions in three tenths of a second and could multiply two 23-digit numbers in about six seconds. Under automatic control of the paper-tape program, it could produce intermediate and final answers to a problem on punched cards or electric typewriters.

Mark I was retired in 1959, after fifteen years of continuous, useful work. Parts of the original machine are on display at the Smithsonian Institution and at Harvard University.

ENIAC:

The need for ever faster computations kept mounting, especially during World War II. This pursuit of speed led to the first electronic computer, ENIAC (Electronic Numerical Integrator and Calculator).

Completed in 1946, ENIAC was developed for the U.S. Army at the University of Pennsylvania's Moore School of Electrical Engineering by graduate student J. Presper Eckert and physicist Dr. John W. Mauchly. They eliminated the need for mechanically moving parts, such as electrically controlled counter wheels, to represent digits and numbers. Instead, they adapted electronic flip-flop circuits and used electronic pulses to flip vacuum tubes on and off like switches, with the "on" and "off" states representing numbers.

Since electronic pulses could move thousands of times faster than electromechanical devices, the concept behind ENIAC was a real breakthrough in the development of fast calculators.

The Stored Program Concept

It took another great idea to complete the concept of today's stored program computer. It was developed in the 1940s by Dr. John von Neumann. He suggested, in 1945, that operating instructions (the program), as well as data, be stored inside the computer memory and that the computer be made to modify these instructions under program control.

During the late forties, several electronic computers based on the ideas of Von Neumann were under development in the U.S. and Great Britain. The first such machine in Great Britain, called EDSAC, started operating at the University of Cambridge in 1949. Several computers were completed in the U.S. from 1949 to 1952. Among them were the EDVAC at Aberdeen Proving Grounds, Whirlwind I at the Massachusetts Institute of Technology, UNIVAC I for the Census Bureau and an Institute for Advanced Studies machine at Princeton University.

Below, Herman H. Goldstine and J. Presper Eckert, Jr. holding a unit from an accumulator used in ENIAC, the first electronic digital calculator. (Photo courtesy of Science Museum, London.)

Today

Since the days of Aiken, Eckert and Mauchly, it has been a battle, even for computer specialists, to keep up with computer progress. Faster, miniaturized circuits and storage devices have been developed, as well as techniques that enable many people in locations remote from a computer to share time on the same system. New programming languages and terminals make the machines easier to use.

As a result, computers today can be used by more people on more problems at less cost per computation. Computers no longer must be high-cost, room-size systems. Even small, desk-size units can work faster on large problems than some of the biggest of yesterday's systems. And results of computation now can be presented as pictures, graphs or spoken words as well as printed forms. Continuing improvement in both equipment and programming can be expected to further extend the use of digital computers.

Doomsday, Says MIT Computer, May Be Just 100 Years Away

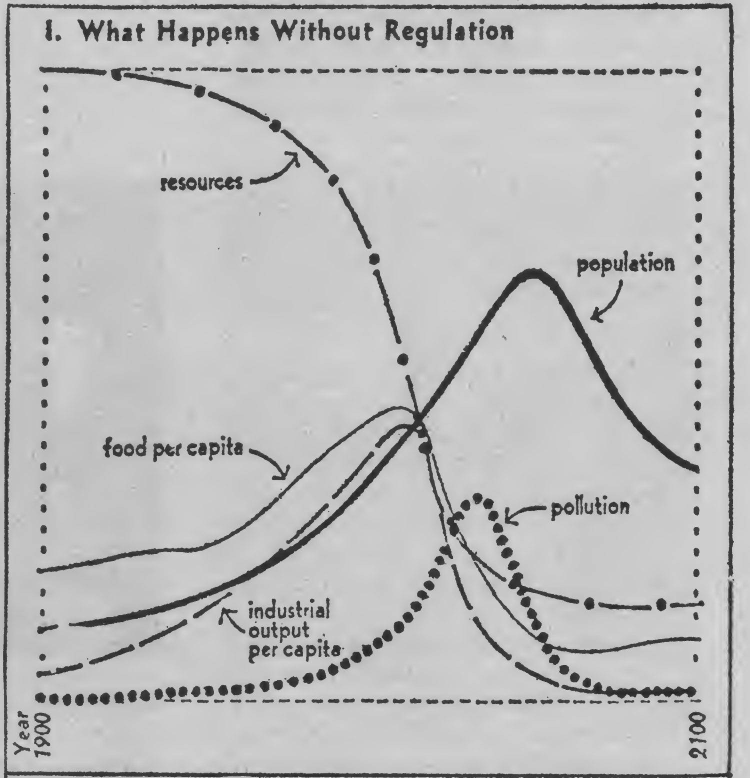
By Robert Reinhold

CAMBRIDGE, Mass. (NYT).— A major computer study of world trends has concluded, as many have feared, that mankind probably faces an uncontrollable and disastrous collapse of its society within 100 years unless it moves speedily to establish a "global equilibrium" in which the growth of population and of industrial output are halted.

Such is the urgency of the situation, the study's sponsors say, that the slowing of growth constitutes the "primary task facing humanity" and will demand international cooperation "on a scale and scope without precedent." They concede that such a task will require "a Copernican revolution of the mind."

The study, which is being sharply challenged by other experts, was an attempt to peer into the future by building a mathematical model of the world system, examining the highly complex interrelations among population, food supply, natural resources, pollution and industrial production.

The conclusions are rekindling an intellectual debate over a question that is at least as old as the early economists, Thomas Malthus and John Stuart Mill: Will. human population ultimately grow so large that the earth's finite resources will be totally consumed and, if so, how near is the day of doom?



The New York Times.

This computer "run" by MIT group, using five key growth factors to the year 2100, shows rapidly diminishing resources eventually slowing growth, assuming no major change in physical, economic or social relationships. Time lags in decline of population and pollution are attributed to natural delays in the system Population rise is finally halted by an increase in the death rate.

Club of Rome

The study was conducted at the Massachusetts Institute of Technology under the auspices of the Club of Rome. In the findings, to be published Thursday by the Potomac Associates under the title "The Limits to Growth," the MIT group argues that the limits are very near—unless the "will" is generated to begin a "controlled, orderly transition from growth to global equilibrium."

The study would seem to bolster some of the warnings of environmentalists. In Britain, for example, a group of 33 leading scientists issued a "blueprint for survival" in January, calling on the nation to halve its population and heavily tax the use of raw materials and power.

But others, particularly economists, are skeptical.

"It's just utter nonsense," remarked one leading economist, who asked that he not be identified. He added that he felt there was little evidence that the MIT computer model represented reality or that it was based on scientific data that could be tested.

Another economist, Simon S. Kuznets of Harvard, a Nobel Prize-winning authority on the economic growth of nations, said he had not examined the MIT work first hand, but he expressed doubt about the wisdom of stopping growth.

"It's a simplistic kind of conclusion—you have problems, and you solve them by stopping all sources of change," he said.

Others, like Henry C. Wallich of Yale, say a no-growth economy is nard to imagine, much less achieve, and might serve to lock poor cultures into their poverty.

"I get some solace from the fact that these scares have happened many times before—this is Malthus again," he said.

Malthus, the 19th-century British economist, theorized somewhat prematurely that population growth at rates that could be graphically represented as a rising curve would soon outstrip available food supply. He did not foresee the Industrial Revolution.

Prof. Dennis L. Meadows, a management specialist who directed the MIT study—which is the first phase of the Club of Rome's "Project on the Predicament of Mankind"—conceded that the model was "imperfect," but said that it was based on much "real world" data and was better than any previous similar attempt.

The report contends that the world "cannot wait for perfect models and total understanding." To this Dr. Meadows added in an interview: "Our view is that we don't have any alternative—it's not as though we can choose to keep growing or not. We are certainly going to stop growing. The question is, do we do it in a way that is most consistent with our goals or do we just let nature take its course."

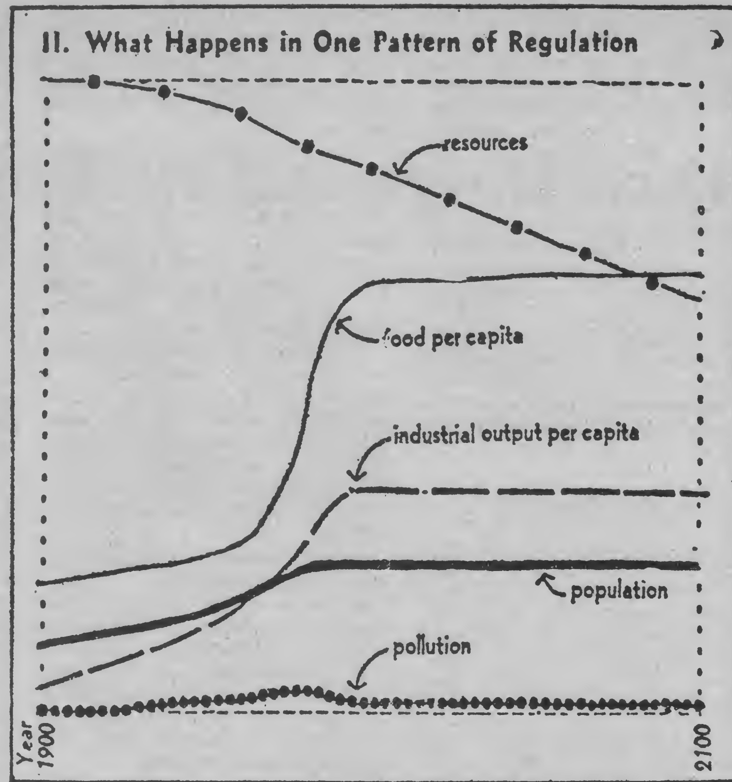
Letting nature take its course, the MIT group says, will probably mean a precipitous drop in population before the year 2100, presumably through disease and starvation. The computer indicates that the following would happen:

- With growing population, industrial capacity rises, along with its demand for oil, metals and other resources.
- As wells and mines are exhausted, prices go up, leaving less money for reinvestment in future growth.
- Finally, when investment falls below depreciation of manufacturing facilities, the industrial base collapses, along with services and agriculture.
- Later, population plunges from lack of food and medical services.

All this grows out of an adaptation of a sophisticated method of coming to grips with complexity called "systems analysis." In it, a complex system is broken into components and the relationships between them reduced to mathematical equations to give an approximation, or model, of reality.

Then a computer is used to manipulate the elements to simulate how the system will change with time. It can show how a given policy change might affect all other factors.

If human behavior is considered a system, then birth and death rates, food and industrial



The New York Times.

Another computer "run" by the MIT group projects a relatively stable future on the assumption that "technology policies" are combined with other growth-regulating mechanisms. The study says policies would include resources recycling, pollution control devices, increased lifetimes of all forms of capital, and methods to restore and renew eroded and infertile soil.

production, pollution and use of natural resources are all part of a great interlocking web in which a change in any one factor will have some impact on the others.

For example, industrial output influences food production, which in turn affects human mortality. This ultimately controls population level, which returns to affect industrial output, completing what is known as an "automatic feedback loop."

Drawing on the work of Prof. Jay W. Forrester of MIT, who has pioneered in computer simulation, the MIT team built dozens of loops that they believe describe the interactions in the world system.

They then attempted to assign equations to each of the 100 or so "causal links" between the variables in the loops, taking into account such things as psychological factors in fertility and the

The Limits to Growth report, which this article is about, originally appeared in March 1972. This "Doomsday . . ." article is the original New York Times news release. Since that time, various reports from the Club of Rome, but particularly *The Limits to Growth* have spurred much spirited debate and controversy. The computer model used is most certainly one of the most sophisticated ever devised. But is it correct? Does it take into account man's phenomenal adaptability and ingenuity?

In future issues, these pages will be available for your serious discussion about *The Limits to Growth* and related computer simulations.

biological effects of pollutants.

Critics say this is perhaps the weakest part of the study because the equations are based in large part on opinion rather than proved fact, unavailable in most cases. Dr. Meadows counters that the numbers are good because the model fits the actual trends from 1900 to 1970.

The model was used to test the impact of various alternative future policies designed to ward off the world collapse envisioned if no action is taken.

For example, it is often argued that continuing technological advances, such as nuclear power, will keep pushing back the limits of economic and population growth.

Little Benefit

To test this argument, the MIT team assumed that resources were doubled and that recycling reduced demand for them to one-fourth. The computer run found little benefit in this since pollution became overwhelming and caused collapse.

Adding pollution control to the assumptions was no better; food production dropped. Even assuming "unlimited" resources, pollution control, better agricultural productivity and effective birth control, the world system eventually grinds to a halt with rise in pollution, falling food output and falling population.

"Our attempts to use even the most optimistic estimates of the benefits of technology," the report said, "did not in any case postpone the collapse beyond the year 2100."

Skeptics argue that there is no way to imagine what kind of spectacular new technologies are over the horizon.

"If we were building and making cars the way we did 30 years ago we would have run out of steel before now, I imagine, but you get substitution of materials," said Robert M. Solow, an MIT economist not connected with the Club of Rome project.

At any rate, the MIT group went on to test the impact of other approaches, such as stabilizing population and industrial capacity.

Zero population growth alone did very little, since industrial output continued to grow, it was found. If both population and industrial growth are stabilized by 1985, then world stability is achieved for a time, but sooner or later resource shortages develop, the study said.

Ultimately, by testing different variations, the team came up with a system that they believe capable of satisfying the basic material requirements of mankind yet sustainable without sudden collapse. They said such a world would require the following:

- Stabilization of population and industrial capacity.
- Sharp reduction in pollution and in resource consumption per unit of industrial output.
- Introduction of efficient technological methods—recycling of resources, pollution control, restoration of eroded land and prolonged use of capital.
- Shift in emphasis away from factory-produced goods toward food and nonmaterial services, such as education and health.

The report is vague about how all this is to be achieved in a world in which leaders often disagree even over the shape of a conference table.

Even so, critics are not sanguine about what kind of a world it would be. Dr. Meadows agrees it would not be a Utopia, but nevertheless does not foresee stagnation.

"A society released from struggling with the many problems caused by growth may have more energy and ingenuity available for solving other problems," he says, citing such pursuits as education, arts, music and religion.

Many economists doubt that a no-growth world is possible. Given human motivations and diversity, they say, there will always be instability.

"The only way to make it stable is to assume that people will become very routine-minded, with no independent thought and very little freedom, each generation doing exactly what the last did," says Dr. Wallich. "I can't say I'm enamored with that vision."

What of Africa?

"Can you expect billions of Asians and Africans to live forever at roughly their standard of living while we go on forever at ours?" asked Dr. Solow.

Dr. Wallich terms no-growth "an upper-income baby," adding: "They've got enough money, and now they want a world fit for them to travel in and look at the poor."

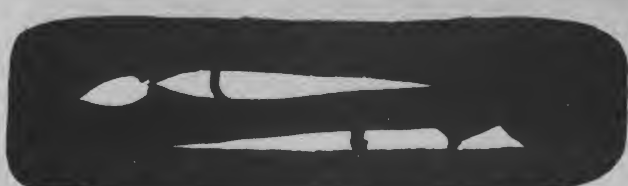
The MIT team agrees that there is no assurance that "humanity's moral resources would be sufficient to solve the problem of income distribution." But, it contends, "there is even less assurance that such social problems will be solved in the present state of growth, which is straining both the moral and physical resources of the world's people."

The report ends hopefully, stating that man has what is physically needed to create a lasting society.

"The two missing ingredients are a realistic long-term goal that can guide mankind to the equilibrium society and the human will to achieve that goal," it observes.

Collaborating with Dr. Meadows in writing "The Limits to Growth," were his wife, Donella, a biophysicist; Jorgen Randers, a physicist, and William W. Behrens 3d, an engineer. They were part of a 17-member international team working with more than $200,000 in grants from the Volkswagen Foundation in Germany.

Growth for the sake of growth is the ideology of the cancer cell
- Ed Abbey



All animals, except man adapt according to their environment. Man changes his environment, making it adapt to him
- R. Buckminster Fuller

NSF Awards

Back in April 1974 when *Creative Computing* was just a germ of an idea, I had several conversations with people in the National Science Foundation. It seemed to me that *Creative Computing* would be an excellent communication vehicle between leading edge computer projects, most of which are sponsored by the NSF, and the rest of the world. Several NSF people agreed, a proposal was written and submitted. And then nothing. Finally six months later a polite refusal of funding.

In any event, we still think the world would like to know where NSF dollars are going these days and what the current hot button is of the folks in Washington. Most of the dollars for computer projects come from the Technological Innovation in Education Section, so we're listing just those projects. If you want more information, a 19-page booklet, "1974 Awards", is available containing an abstract of each project. To get your free copy, write:

Erik D. McWilliams
Technological Innovation in Education
National Science Foundation
Washington, D. C. 20550

ERRATA

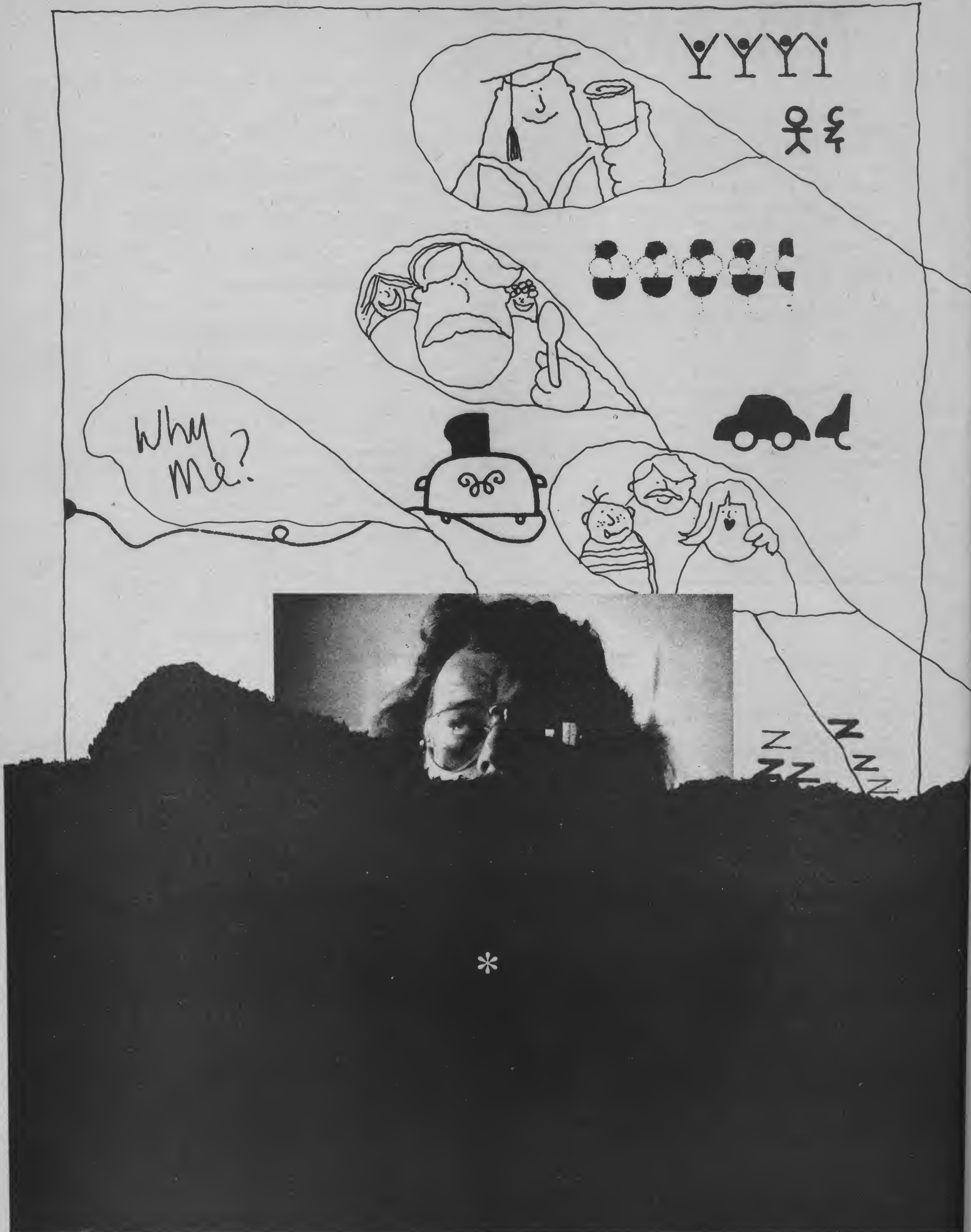
While one purpose of *Creative Computing* is to bring you the best in puzzles and games, one unintentional puzzle crept into the November-December 1974 issue despite eagle-eyed proofreading. In particular, in John Nevison's article, "The Parable of the Horse" on page 34, the six lines at the bottom of column one ("appears in unfamiliar" . . .) should have come at the bottom of column two (following "sometimes it"). Sorry about that!

60,000,000 PAGES OF SCIENTIFIC AND TECHNICAL MATERIAL IS PUBLISHED EACH YEAR

THE U.S. APPROPRIATED $16,400,000,000 IN 1972 FOR SCIENTIFIC RESEARCH

List of Projects

Hard-Core CAI	
PLATO IV	$2,164,000
PLATO Software	116,000
TICCIT	1,400,000
Evaluation of PLATO and TICCIT	235,922
PLANIT	15,700
Audio and Natural Language in CAI	330,000
Biofeedback in CAI Reading Instruction	50,000
CAI for Indian Students	31,500
Translation of a German Study of CAI Languages	5,500
Subtotal	$4,348,622
Transportability and Networks	
CONDUIT	$ 493,300
Central Mississippi Regional Computer Network	195,800
Florida Regional Computer Cooperative	9,100
Subtotal	$ 698,200
Elementary and Secondary School Projects	
A Strategy to Introduce Computers in Secondary Schools	$ 530,926
LOGO and New Learning Environments	350,000
Computer-Based High School Math Laboratory	163,600
Study of Computing Activities in Secondary Education	105,300
Subtotal	$1,149,826
Guidance	
SIGI Development and Field Test	$ 133,300
Subtotal	$ 133,300
Conferences	
Computer Technology Forecast Conference	$ 107,800
Subconference on Computer Communication Networks	22,000
Conference on Cable Communication and the University	20,900
Conference on Computers in the Undergraduate Curricula	16,400
Subtotal	$ 167,100
Miscellaneous	
MITS Interactive Television System	$ 246,700
Digital Systems Engineering Course	256,400
Computer Graphics in Learning	213,100
Improvement of Science Education via Technology	100,000
Evaluation of Communication Device for Severely Handicapped Students	88,000
Study of Computer Literacy Courses and Materials	17,300
Instructional Variables in Computer Programming	5,000
Subtotal	$ 926,500


Why me?

FRACTIONATED PEOPLE

by David Henderson

We are rapidly becoming a nation of statistics. Someone feeds information into a half-million dollar computer and discovers the average Harvard graduate has one and two-thirds children. This information is flashed across the country. Reaction is mixed:

Yale: "We always thought those Harvards were queer."

Dartmouth: "Like father like son."

University of Miami: "When we get 'em that size we throw 'em back."

Stanford: "No wonder they have such a lousy football team."

M.I.T.: "We question the accuracy of the feed-in figures."

Columbia U. (pre-med): "Keep him in the incubator on a reinforced liquid diet and he may pull through."

A random sampling in the street:

Man: "Must be a peculiar-looking kid."

Woman: "Poor dear."

Taxi driver: "I get a lot of half-baked passengers, but never two-thirds baked."

Teenage girl: "I care?"

Teenage boy: "Sez who?"

Now there is nothing wrong with statistics, but reliance on figures like these is courting the danger of going down in history as a fractional race.

The average American family owns one and a quarter cars. Two and a third members of every family on the eastern seaboard watch "All In The Family" fifteen minutes every other week. Two and seven-eighths of every ten readers of *Time* magazine scan four and one-tenth issues during national campaigns. Statistical fractions could invade our language and become a way of life.

Here is how a typical family in the near future may behave:

It is Saturday night and they are headed for a movie. They miss the beginning of the feature because three-quarters of the family car is scheduled for recall and it doesn't run too well. Father steps up to the cashier. "Three and two-thirds tickets, please" he says, shoving part of a ten-dollar bill through the opening. They also miss the end of the film. This is the week one family views only nine-tenths of the picture.

On the way home they stop at a drive-in. Four and a third plates of ice cream are ordered. Father stares at his plate in disappointment. This week he gets only one-third of a scoop. When they prepare for bed, it's Mother's turn to be disappointed. She gets only one-fifth of the innerspring mattress to sleep on. However, it's Saturday night and they will sleep only two hours, seventeen minutes and four seconds. Their dog, Smedley, a medley of breeds that defies statistics, pays no attention to computer read-outs and is rarely on balance in the game plan. He gets his one and a tenth can of dog food anyway.

At breakfast Father says to Junior: "Eat your one-third egg."

"I'm waiting for my three-quarters of a piece of toast," Junior replies.

I'll drop the car off to be fixed on my way to the train," says Father. "I'll pick it up on the way home."

No one objects. This is the day the family is statistically grounded. With the exception of Smedley. Dogs average two and a fifth miles per month in cars. No one minds skipping this. Smedley throws up on one-third of the back seat before the car is four-fifths down the block.

At the garage the mechanic listens to the engine and considers how he will overcharge by one-third for his work. The work is marginally over the guarantee that covers the repairs he predicts will be necessary.

The train isn't crowded. This must be the Monday one-fifth of the workers have hangovers, three-tenths have colds and one-eighth are just goofing off.

Arriving at the office he is greeted by the receptionist: "J. B. wants to see you in his office."

J. B. looks up from his desk. "I think we should go over the Harper account. They're unhappy with one-fifth of the last campaign."

"They're nitpicking. Their sales are up one-eighteenth over last year."

"Well, keep an eye on it. We don't want to lose that one. It's five-sixths of your income, you know."

At lunch, the drab day turns pleasant, relaxed and conquerable. Everyone knows businessmen average three and a half dry martinis per lunch. It would be an even four but they spill half of the last one. The rest of the day is one-third inefficiency, one-third blur, and one-third thick tongue.

The club car on the evening train is a refueling station. One-tenth of commuters are club car fixtures. This night there is such a crush that Father consumes his own martini and a quarter of the drinks of those pressed against him. He arrives home one hundred percent smashed. He is one hundred percent unaware of what's being served for dinner and falls into bed one hundred percent fully clothed. He snores one-third more than one hundred percent loud. □

David Henderson is a Canadian humorist who is funny four-quarters of the time.

Illustration by Dagfinn Olsen. The artist was only able to provide three-quarters of an illustration for this article due to circumstances five-sixteenths beyond his control.

CREATIVE COMPUTING Reviews

II Cybernetic Frontiers, Stewart Brand. 96 pgs. $2.00. Random House, Inc., 201 East 40th Street, New York 10022. 1974.

Stewart Brand, editor of The Last Whole Earth Catalog, examines two cybernetic frontiers in this book. The first frontier examined is the means by which the human mind processes and acts upon information. Instead of a straightforward discussion of this topic, Brand recounts a rambling dialogue between himself and Gregory Bateson, who is an anthropologist specializing in South Pacific natives. In the course of their conversation, both men present many unsupported personal hypotheses as undeniable facts. At one point Bateson confesses to an anti-experimental bias, while both Brand and Bateson state their belief in mysticism and usage of LSD as valid approaches to consciousness expansion. Their conclusions remain unconvincing when these factors are taken into account.

Unlike the first frontier, the second frontier described in the book makes fascinating and engrossing reading. In it Brand tells the story of a specific group of programmers and their recreation. The programmers were at MIT in the early 60's; their recreation was designing a computer game named Spacewar.

Brand's description of Spacewar is quite vivid. It is played with computer generated spacecraft displayed on a television screen. Players can control movement of their spacecraft on the screen via hand controls, while the computer figures in effects of acceleration and gravitational fields. Unfortunately there are no hard programming details, but there are numerous illustrations and interesting comments.

The reader follows the MIT group as Spacewar becomes only a pastime at first, then grows into an obsession and finally becomes a way of life. Through Spacewar, the programmers soon realize what "computer power to the people" could mean if it were to ever become a reality. Eventually the group dissolves and the members go their separate ways, all carrying the dream of "computer power to the people" around in their minds.

That was in the 60's. Today that dream has sprouted into half a dozen concrete realities which Brand examines in an Epilogue to his second frontier. Several individuals describe their work since Spacewar, including such things as storefront computer centers, personal TV scratchpads and marketing of educational computers. Many useful addresses are listed.

Despite its poor opening, this book is recommended to anyone wishing insight into the motivations of top programmers. It provokes the reader to imagine what the widespread use of computers could mean, and provides valuable reference material as well.

Ricky James Roberson
Cleveland, TN

The Use and Misuse of Computers in Education, by Allan B. Ellis. 226 pages. $12.95. McGraw Hill, 1974.

In chapter 1, the author describes commonly-accepted definitions, attributes, and history of computers. He convincingly shows the short-comings of each of these. In chapter 2, he presents the best description of a Turing machine that I have read. He then defines a computer as a universal Turing machine. He ends Part I of the book discussing computing, iteration, semi-algorithms, algorithms, and heuristics, giving several interesting examples and analogies. This excellent presentation is marred by 2 gross errors in his iteration scheme for extracting square roots by Newton's method (square root of 1/4 is 17/16???). Regardless, these two chapters should be read by the computer novice, as well as by professionals teaching classes or writing books on computers.

The major premise of Part II is that education problems are the primary concern, and computerization is only of secondary importance (why computerize something that is educationally unsound?) In chapters 3 and 4, Ellis describes what has been done in education by Suppes at Stanford, Bitzer (PLATO) at Illinois, Papert (LOGO) at MIT, project LOCAL at Dartmouth, and other projects. He uses these projects to show potential dangers in computerizing education; but he does not accuse any of the projects as misusing the computer. Perhaps the word "Misuse" should not be in the title of the book. Anyone trying to computerize topics in teaching should read these two chapters.

Most of chapter 5 describes the history of the NESDEC-NEEDS project in Massachusetts. Most of the details seem irrelevant to the goals of this book.

Part III, starting with chapter 6, develops a case study of building a computer system, called ISVD, for providing guidance and counseling in schools. But the software developed could be used for other purposes, such as CAI (computer-assisted instruction), information retrieval, etc. Enroute, the author describes several computer programs for processing English words, phrases, and sentences, and programs for providing interaction with the time-share user, in English. I found this quite interesting. Anyone interested in CAI would find part III of interest to them. Chapter 8 presents a fictitious student using the system. ISVD really looks nice. But, as is typical of Ellis throughout the book, he ends the topic by showing ISVD's shortcomings.

The appendix introduces some hardware (some obsolete, probably because ISVD was implemented on the RCA Spectra 70/45 computer), as well as some brief theory on how the hardware works. Ellis makes several minor errors here, such as describing left-handed magnetic fields on page 209.

Over all, Ellis's book is a well-written thoroughly-documented criticism of current thought on computers and their use in education. But it is not an easy book to read. Rather, the book requires you to think skeptically as you read it, a reading technique most people are not used to.

James L. Boettler
Taladega, Alabama

BASIC in a Flash, by Earl Orf and Royce Helmbrecht. $1.50. The Math Group, Inc., 5625 Girard Ave. South, Minneapolis, MN 55419.

"This set of cards is designed to help students learn the meaning of symbols, commands, and statements used in the BASIC programming language. Terms are printed in red on one side and definitions in black on the other side. Many cards also contain examples showing how the term might be used. Blank cards are included to add your own terms. Could be used as flash cards or as a reference near the computer terminal." – Publisher's summary.

Survival Printout, edited by Total Effect, Vintage Books, New York. 232 pg. Paperback. $1.95.

The Introduction of this book describes a dialogue in SEMANT between the editors (three professors of English who call their group Total Effect) and a Burroughs Illiac 4. By means of this dialogue, they claim that the computer actually chose the sixteen selections of science fact and science fiction that comprise the book.

The selections are divided into four groups. The first is called "Evolution/Identity" and the four short stories by Eiseley, Ballard, Bester, and Zelazny are speculations on man qua man. The first three delve into deep fantasy and bring tto the surface thoughts that we probably have all had during times of deep depression or extreme loneliness. *For a Breath I Tarry* by Roger Zelazny, the last selection in this group is by far the best and describes the thought process of a robot/computer attempting to achieve manhood. Absolutely fascinating!

The second section is called "Earth Probabilities". Arthur Clarke leads off with a factual article on the *Social Consequences of Communications Satellites* written in 1945 but timely today as it was then. The next two stories in this section by Silverberg and Lafferty describe living conditions in an urban city of the future and the reemergence of the streetcar. The last story is Harlan Ellison's *I Have No Mouth and I Must Scream*. It describes what happens when the remaining giant computers on the earth after a nuclear war get together to keep five human survivors living forever. It has been reprinted several places; however, if you haven't read it yet, you must! It's superb.

The third section "Ecosystems – Cellular and Solar" starts with a factual selection by Nigel Calder on exploding stars, black holes, pulsars, and other cosmic phenomena. An excellent introduction to the fundamentals of the universe. The other three stories in this section by Leiber, Delany, and Simak are good solid entertainment with a liberal sprinkling of naked truth among the fun and humor.

The last section "Time Space Travel" is probably the most speculative, dealing from several points of view with relativistic travel to other stars, galaxies, or galaxy clusters. It seems fairly clear that relativistic spaceflight is the way to go assuming a way can be found to propel the craft (anti-matter?) and protect the occupants. Cosmic radiation near the speed of light would have an intensity 100,000 times greater than that of sunlight at the earth's surface. Naturally in the three fiction selections by Smith, Heinlein, and Blish these problems have been overcome and we are fascinated with the paradoxes of time travel and the like.

Survival Printout is recommended for an entertaining, yet highly informative diversion from your computer.

David H. Ahl
Morristown, N. J.

On-Sets (Game), by Layman E. Allen, Peter Kugel, and Martin F. Owens, $6.50, WFF'N PROOF, 1490 South Blvd., Ann Arbor, MI 48104.

Objectives:

After a student plays the game of ON-SETS he should know

1. what a set is.
2. the relationship between the names of a set and the number of things that are in the named set.
3. operations with sets such as union, intersection, complementation and difference.
4. what is meant by the universal set and the null set.

Evaluation:

There are many variations of the game; the simplest versions are for use in the primary grades. The game increases in complexity and should be suitable for use all the way up to the adult level. The instructions for the elementary versions are easy to follow, and this game can be used to effectively introduce concepts of set theory at an early age. The game is played by 2-3 children at any one time and should not take more than approximately 5-10 minutes to complete. It is, therefore, suitable for use in a classroom where a short time filler is needed to keep small groups of students occupied. This game is highly recommended for use at this level in the classroom.

The more advanced versions of this game are too complicated for general classroom use. It would be much simpler to explain set theory to the middle and high school student than the mechanics of this game. The rewards involved in playing the game do not warrant the time needed to explain the play of the game.

Ms. E. T. Rubin
Richmond, VA

Space Hop: A Game of the Planets by Helmut Wimmer. $12.95. Teaching Concepts, Inc., 230 Park Ave., New York, NY 10017.

"*Space Hop* is a valuable teaching tool in the form of a game which illustrates the scientific facts of our Solar System, its sun, moons, planets, comets and asteroids. One of a series of GAMES BY TEACHERS." (Publisher's description.)

This game is suggested as suitable for 9-to-adults, and that evaluation seems accurate. My two boys, 10 and 12, enjoy it thoroughly and like to show it off to their friends. The educational aspects are well planned and the competitive elements are just enough to make the game fun without introducing too many stress situations of the type likely to set siblings at each other's throats. In addition to coming away from the game with reinforced facts about the solar system (What was the first planet to be discovered by telescope? My mission is to go there . . .), they will subliminally pick up the concept of odd-even parity, and just may come away bemused by the peculiar topology of the "outer space" defined by the rules.

I recommend the game for any group of "kids" with a scientific bent.

Lynn D. Yarbrough
Lexington, Mass.

Computers in the Classroom. Ed. by Joseph B. Margolin and Marion R. Misch. 382 pp. $14.00. Hayden Book Co., 50 Essex Street, Rochelle Park, New Jersey 07662. 1970.

A group of scientists and educators were briefed on the current state of computer technology. They then embarked on a week-long tour of five computer-assisted instruction centers across the country. Following this each member of the seminar prepared an article stating his views of the problems and issues facing education arising from this new technology.

The result is a very readable book which should be important reading for both the layman interested in education and the educator interested in the impact of computer technology on current education practices.

The book is organized into three parts. Part I focuses on the pre-seminar briefing in which government, academic, and business representatives spoke to the group on the major issues as they saw them. Part II details the traveling seminar and includes the participants' articles. Questions raised by the seminar participants in their articles are relevant to all areas of education today. Part III gives an excellent summary of the major issues raised as well as the predictions and recommendations of the panel members.

An extensive, if somewhat dated, bibliography is given at the end of the book.

Allan L. Forsythe

Coming in Creative Computing

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WHAT IS CREATIVE COMPUTING?

CREATIVE COMPUTING is a lively new magazine for students and teachers using computers in colleges, junior colleges, secondary schools, and even the lower grades. It contains games, simulations, problems, exercises, curriculum materials, and ideas directly usable in the classroom.

CREATIVE COMPUTING deals with the use of computers and computer related devices in mathematics, science, social science, ecology, computer familiarization, computer science, and career education. The content of CREATIVE COMPUTING reflects the view that computers can make learning fun!

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CREATIVE COMPUTING is a forum for the discussion of the social impact of the computer with a focus on privacy, automation and jobs, leisure time, medical care, pollution control and the like.

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