

The Wall Street Journal and HP Calculators

A Bit of HP Calculator History



The Wall Street Journal and HP Calculators

Richard J. Nelson

In the spring of 1981 The Wall Street Journal started a project that may be described as a successful experiment that failed. The thinking was that the readers of the Wall Street Journal would want to read a magazine that was called the Wall Street Journal Magazine. A business plan was prepared, a publication staff was assembled, and the first issue was printed in what I assume was a limited quantity. They used Down Jones editors and free lance editors to write the articles. This was a very professional high powered project. One of the two major sections of the proposed magazine was a *Living* section.

The first issue was published with a June 1981 date. Consumer electronics was starting to blossom and HP was inspiring the market with leading edge products. Their users were well organized and it was unusual to write an article on the normally dry subject of scientific calculators in a publication of this type. To write this article they went to the late Hugh Kenner, a very well know writer who had a special ability to see the whole picture of a complex subject.

Hugh was a member of the HP Calculator User's Group called PPC so he knew what was happening with one of HP's most successful calculator products, the HP-41. This machine was unusual because it had four expansion ports and HP envisioned the HP-41 as part of a complete "personal computer" system. A system has to be connected, and HP engineered a brilliant way of connecting components together called the Hewlett-Packard Interface Loop or HP-IL. Because the HP-41 was a full alphanumeric calculator its use went far beyond normal number crunching.

It was not the HP-41 that Hugh wrote about; it was the unusually creative uses that HP's customers were finding for the HP-41 system that he brilliantly described. Hugh knew this topic very well because of his PPC membership and the sharing of cutting edge applications that were being published in the Club's news letter, the PPC Journal.

Here are some article facts on this excellent historical description of HP calculator users titled, *Calculus*. This bit of history is important because this exceptional article was never read by its intended audience.

1. People mentioned in the article: Hugh Kenner*, Bill Wickes, Ron Knapp, Richard Nelson, Paz Nelson, Duke Castle (HP), John Rausch, Hal Brown, James J. Davidson*, Gary M. Tenzer, Dean Lampman*, Emmett Ingram, Henry Horn* (HP), Joseph Weizenbaun, John McGechie*, Jack Kahoun & Valentin Albillo.
2. HP calculators mentioned: HP-25, 33C, 35, 41C, 45, & 65.
3. The slick colored magazine article was a full seven pages starting on page 52 in the "living" section.
4. Article photos: Full page width Bill Wickes with HP-41 system, p52; HP-41 backwards flying goose, p53; HP-41 System, p54; HP-41 Alpha display, p55; HP-41 Display of John Rausch's Hang man game, p56.
5. Separate Box's with special topics: A Slice of Pi, Ron Knapp's HP-41 print out of the calculation of 1,000 digits of Pi printed on the HP-41 IL printer, p54; A Smear Campaign describes Valentin Albillo's HP-41 Othello Program; What You Do When You Program describes programming, shows an HP-41 magnetic card and a bar code. I don't remember if I "sneaked" in the barcode without them knowing what it said. It said "JOIN PPC." Thanks to Jake Schwartz for preparing the bar code.
6. The article says the introduction date of the HP-65 was January 17, 1974. Hugh described this as Day 1 and that the club, which had 15,000 members world wide pass through its ranks, started on day 120.

Enjoy reading a bit of calculator history in the article that was published 25 years ago and is reproduced on the pages that follow.

* indicates that these people are no longer with us, including the author.

THE WALL STREET JOURNAL

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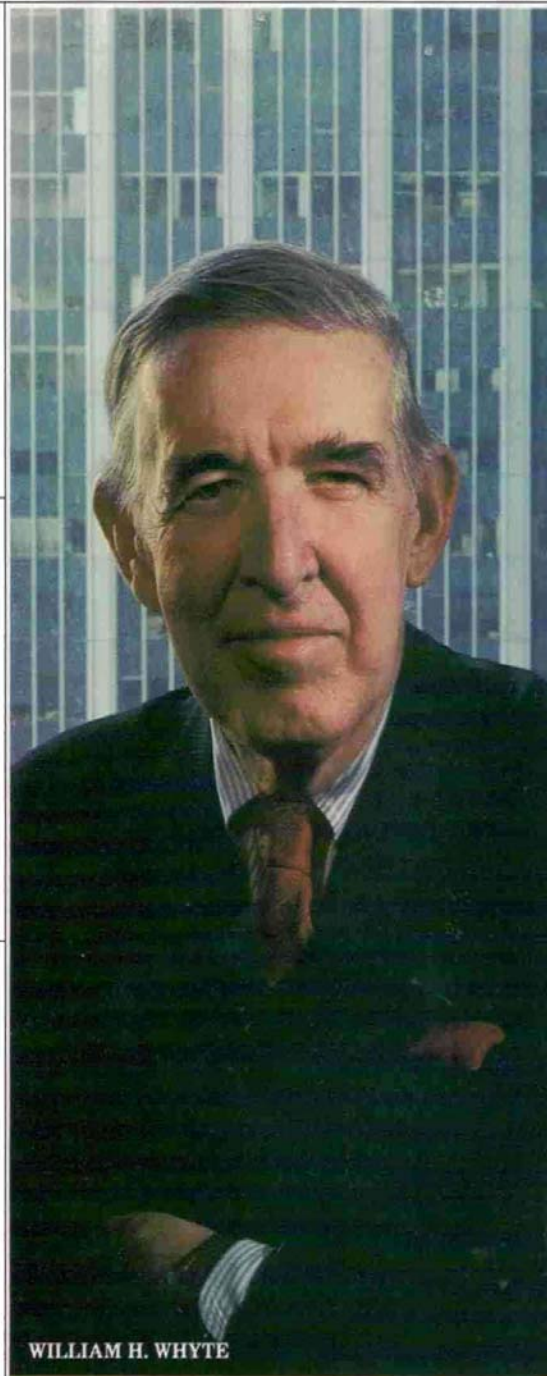
MAGAZINE

JUNE 1981

Silicon Valley Days
Company Loyalty
Doesn't Exist in
the Booming
Microprocessor
Industry. And
the Job Hoppers
Are Doing Very
Well, Thank You.

The Calculator Nuts
With Their
Electronic,
Alphanumeric,
Programmable
Machines, These
Guys Do Many
Useless Things.

Vintage Points
Is It True What
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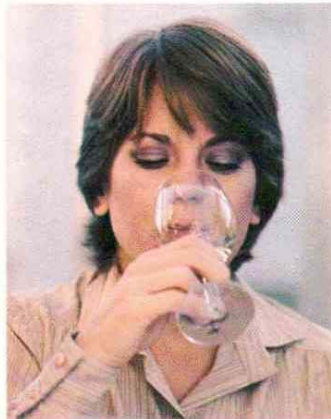
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JUNE 1981



26



84



100

5 From the Editors

7 **Unwinding: His Heart Attack** by David Sanford

9 **Fringe Benefits: Purloined Letters** by Ed Zuckerman

Working

15 **Silicon Valley Days** by Wayne Biddle

Company loyalty in California's semiconductor industry

26 **The Organization Man Today** by Edward Engberg

William H. Whyte and the perils of conformity

31 **Turning the Tide** by William H. Whyte

Why corporations are coming back to the city

37 **Who Isn't Who Anymore** by Reed Whittemore

The eighty-year effort to define success in America

44 **Out to Pasture** by Bernard Wysocki, Jr.

The mixed blessings of executive retirement

Living

52 **Calcutnuts** by Hugh Kenner

These guys can do things that are next to impossible.

64 **A Professional Gym at Home** by Peter Meyer

For the healthy wealthy, a Nautilus system at \$40,000

74 **New Routes to the Orient** by Ann-Byrd Platt

Fifty-odd China tours

84 **Vintage Points** by Roger Rapoport

Everyone has his own opinion about wine, and everyone is right.

93 **Special Project: The Sports Business**

edited by Michael Roberts

95 **The Owners** by Shirley Povich

Buy a franchise and reap the rewards, if any.

97 **The Mogul** by Thomas Petzinger, Jr.

Edward J. DeBartolo's empire owes a great deal to money and muscle.

100 **The Promoter** by Bill Brubaker

Don King says he's the greatest. There's merit in the boast.

108 **The Go-Betweens** by Paul Kaplan

Player representatives don't all play by the same rules.

Spending

112 **Family Sports Cars** by Barth David Schwartz

Four-door Maseratis, four-seat Ferraris

118 **Six Practical Cars** by Timothy Ehlen

You might like something better, but these will do.

124 **Investing in Photographs** by Frank Lipsius

Bhupendra Karia hopes to stabilize the market with his computer.

129 **God and Mammon** by William Martin

Investing in the Here and Now

136 **Crossword Puzzle** edited by Charles Preston

By the Numbers by William Lutwiniak

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From the Editors

This is the first issue of The Wall Street Journal Magazine, a prospective monthly publication from Dow Jones for readers of The Journal. We hope you enjoy it.

Our purpose is to complement the daily newspaper in a separate publication that emphasizes *life after work*—the time spent at home, on vacation, with avocations; the time spent enjoying the fruits of labor; the time spent contemplating life and job from outside the office.

The Journal's business audience has characteristics we are thinking about as we put together this new magazine. We intend the scope of our interests to be every bit as diverse as our readers are. We will be concerned with what concerns you.

We will deal in our columns, departments, and articles with leisure, with spending, and with both work- and nonwork-related personal issues. The *Spending* section will explore fascinating ways to dispose of disposable income. The *Living* section will be devoted to time off, free time, your own time (whatever you choose to call the hours away from professional responsibilities). In *Working*, we will look at how people approach their jobs and, also, in the second sense of the word, with "working out" the difficulties that affect all of us personally in the 1980s.

We hope the magazine will expand the coverage and the perspective of The Wall Street Journal, speaking with the same authority to the same very special, specialized audience.

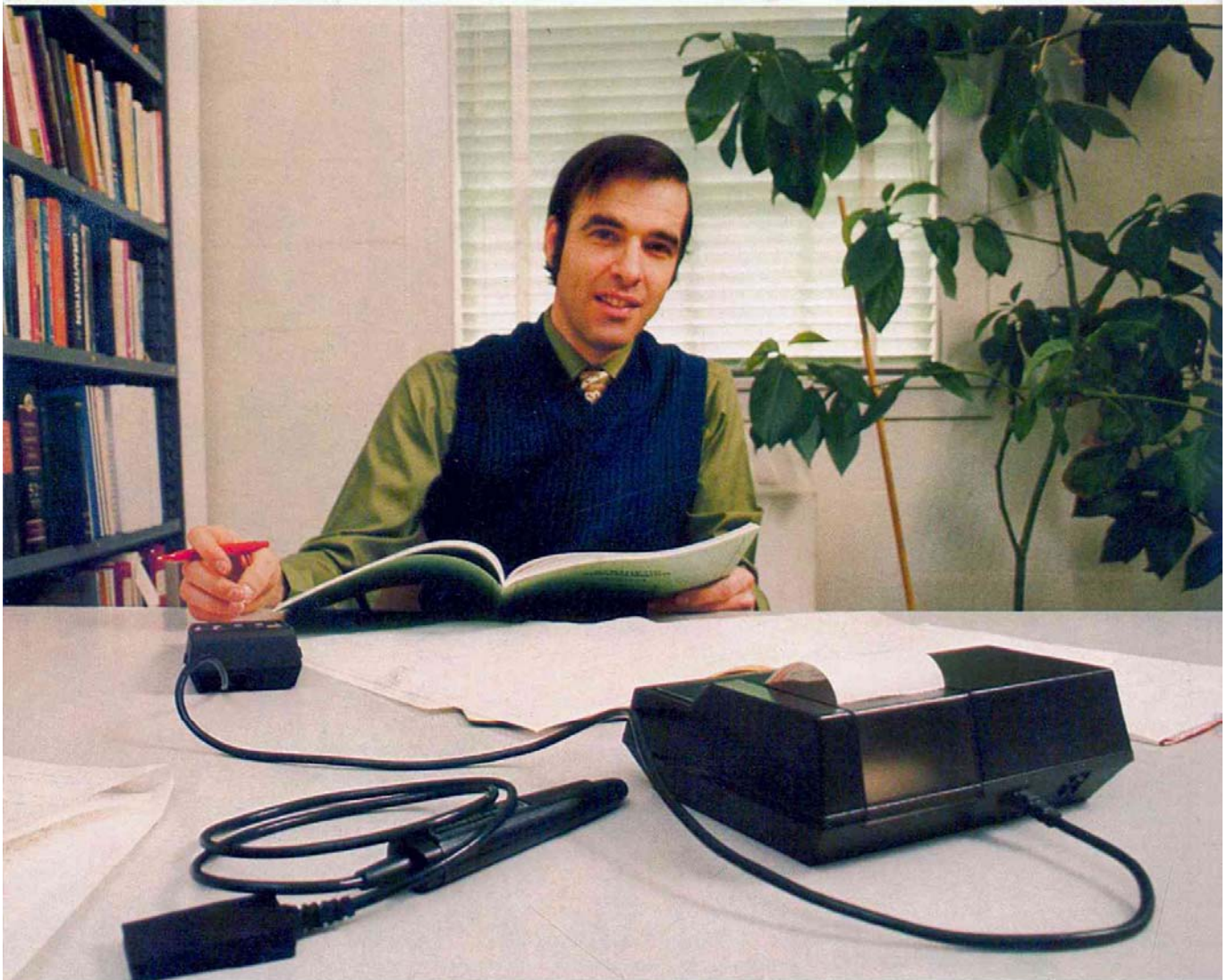
We have some serious intentions, but we don't intend to be somber about them. Hence: cartoons, first-rate photographs and color graphics, humor, special projects (such as the one in this issue on *The Sports Business*), and a regular crossword puzzle.

We asked many fine writers—both Journal reporters and free-lancers—to contribute articles to this premiere issue of the magazine, and they responded with some of their best work. We are proud of their contributions and we hope that you will want to spend some of your own good time with The Wall Street Journal Magazine.

Living

Calcunuts

With their seven-ounce, hand-held, battery-operated, programmable calculators, these guys can do things that are next to impossible
by Hugh Kenner



The Dalai Lama of Calcunuts. Astrophysicist William C. Wickes among the playthings of the Calculator People.

Climbers find nothing exceptional atop Everest save cold and horrible wind, spelunkers nothing in earth's deepest caves save darkness, runners in the Boston Marathon nothing ahead of them save exhaustion and Boston. Overcoming the challenge suffices.

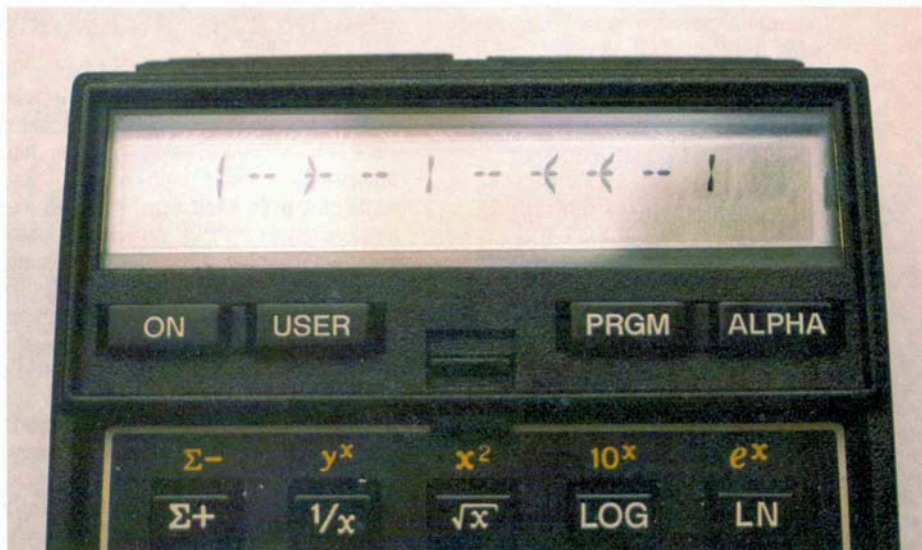
And Ron Knapp of Bellflower, California, transcribing innumerable digits by hand on a strip of adding-machine paper laid sidewise, does not suppose that the huge number he copies will benefit him or mankind. Ah, but how he arrived at it!

The number is pi, that ancient nagging sphinx, the number that tells you how many times a circle's breadth will divide into its perimeter. Most of us were taught to call it $3\frac{1}{7}$, or 3.14. More finicky teachers insisted on 3.1416. A better value is 3.14159, and a better one still is 3.1415926536. Rightward from the decimal point the digits run on forever, each contributing one-tenth the accuracy its predecessor did. Nine digits will give you the circumference of an earth-sized sphere to a third of an inch. Two more reduce the error to the thickness of a sheet of Bible paper. It's hard to think of a use for more than eleven. And no one has been out to the end of the sequence—there is no end.

Last year Ron Knapp wrote down the opening "3." and continued with 1,000 further digits. Though neither Archimedes nor Isaac Newton had ever beheld so generous a piece of pi, the result in itself added nothing to human knowledge. The thousand-digit barrier was broken in 1939, when the \$480,000 room-sized ENIAC burned 50,000 watts steadily for 70 hours in the course of achieving pi to 2,037 places. Computer runs of a half-million digits have since grown commonplace. It's one way to test the computer.

Knapp's triumph lay in harpooning Moby Dick with a peashooter. He coaxed his 1,001 digits out of a palm-sized, seven-ounce, off-the-shelf programmable calculator, the \$250

HUGH KENNER is chairman of the English department at Johns Hopkins University. He is a longtime mathematical hobbyist, and one of the earliest members (No. 103) of the oldest fan club devoted to programmable calculators.



Neither plane nor Superman: Electronic "geese" in flight across the display window of Hewlett-Packard's 41C calculator. HP said it couldn't be done.

Hewlett-Packard HP-41C, which can run for some 2,000 hours of intermittent use, drawing 0.036 watts from four little batteries. Guided by 377 instruction "lines" of Knapp's devising, the 41C pondered silently by itself for eleven and one-half hours, storing the digits of the huge result in orderly blocks of ten, and beeped a four-note tune when it was finished. If no one came by in the next ten minutes, it thriftily turned itself off, a trickle of current through its "Continuous Memory" ensuring that on being awakened it would have forgotten nothing. A user who (unlike Knapp) would rather have spent \$385 than copy by hand can now plug in a printer.

Irwin Ronald Knapp is neither a mathematician, an engineer, nor any type akin whose work is shot through with number. He has no demonstrable use for such a machine. A sixty-seven-year-old retired letter carrier who has "always liked puzzles" and whose math education peaked with a junior-college course ten years ago, he belongs to the growing subculture of Calcunuts, the programmable-calculator fanatics whose joy is the use of the machine itself and whose special delight is to drive it to lengths its designers never imagined. For the true Calcunut, a top-of-the-line programmable, which at this

writing means the HP-41C, is life's one indispensable toy.

The Early Enthusiasts

An elite subgroup of the Calcunuts will boast of having "been there from Day One," a plausible claim even from people still in their thirties. Day One dawned as recently as January 17, 1974, when Hewlett-Packard, a California-based firm noted for advanced instrumentation, put an end to months of rumors by announcing the first pocket programmable, the HP-65. "Programmable" meant that whereas on its predecessors, the HP-35 and -45, jobs like solving a triangle without trig tables meant keeping your fingers busy without mistakes, the new machine could remember those keystrokes in sequences of 100 or more for automatic execution, and could even record them for re-use on a magnetic card half the width of a stick of gum.

By Day Two Richard Nelson of Santa Ana, California, then a thirty-three-year-old applications engineer with a manufacturer of low-frequency crystals called Statek, had placed his personal order. "I didn't have the \$800, but I ordered it anyway." Soon Nelson was pestering H-P's Customer Support division for answers they were unhappy to put their minds to, and flushing

A Slice of Pi

Ron Knapp's program ran eleven and a half hours in the HP-41C. Printing the digits, neatly grouped by fives, took another six minutes.

The result is of no earthly use to anyone, but sharp eyes may be arrested by a string of six consecutive 9s.

PI: THE FIRST 1,001 DIGITS

PI = 3.
 14159 26535 89793 23846
 26433 83279 50289 41971
 69399 37510 58209 74944
 59230 78164 06286 20899
 86280 34825 34211 70679
 82148 08651 32823 06647
 09384 46095 50582 23172
 53594 08128 48111 74502
 84102 70193 85211 05559
 64462 29489 54930 38196
 44288 10975 66593 34461
 28475 64823 37867 83165
 27120 19091 45648 56692
 34603 48610 45432 66482
 13393 60726 02491 41273
 72458 70066 06315 58817
 48815 20920 96202 92540
 91715 36436 78925 90360
 01133 05305 48820 46652
 13841 46951 94151 16094
 33857 27036 57595 91953
 09218 61173 81932 61179
 31051 18548 07446 23799
 62749 56735 18857 52724
 89122 79381 83011 94912
 98336 73362 44065 66430
 86021 39494 63952 24737
 19070 21798 60943 70277
 05392 17176 29317 67523
 84674 81846 76694 05132
 00056 81271 45263 56082
 77857 71342 75778 96091
 73637 17872 14684 40901
 22495 34301 46549 58537
 10507 92279 68925 89235
 42019 95611 21290 21960
 86403 44181 59813 62977
 47713 09960 51870 72113
 49999 99837 29780 49951
 05973 17320 16096 31859
 50244 59455 34690 83026
 42522 30825 33446 85035
 26193 11881 71010 00313
 78387 52886 58753 32083
 81420 61717 76691 47303
 59825 34904 28755 46873
 11595 62863 88235 37875
 93751 95778 18577 80532
 17122 68066 13001 92787
 66111 95909 21642 01989

other users of the machine who already knew things its designers apparently didn't. Those users were eager to share what they knew.

By about Day 120 Nelson had paid \$4 to print 100 copies of a two-page newsletter. By Day 350, in December, 1974, his ten-page seventh issue had ninety-seven paid subscribers, and what now calls itself the PPC Club had been formed.* "PPC" stands for nothing in particular, though Programmable Personal Calculators will fit. Six years later, with more than 3,000 members in forty-five countries, PPC is the forum and rallying place of the world's H-P Calcunuts, with an especially active chapter in Australia. (Texas Instruments fans have their own TI Users' Club. Machine architecture differs so radically that no club can efficiently support more than one manufacturer.)

It was round about Day 1,000, in the fall of 1976, that Nelson's overburdened mailbox tore loose from the wall of his house. His garage was preempted by newsletter production, membership was well past the 1,000 mark, and just coping with queries was becoming a full-time job. Two more years, and with the newsletter running 40,000 words plus programs per issue, Nelson was exhausted by the weekly collision between fifty hours of unpaid PPC work and his inflexible forty-hour work week. Rather than terminate PPC he reversed the priorities. Early in 1979 he left Statek to give the club his scheduled time and support a family of four as a free-lance writer-consultant on the side. Friends of this charter Calcunut marvel at his routine twenty-hour days, at his sensitivity ("He should have been a psychologist"), and at the forbearance of his wife Pastora ("Paz"), the charter calculator widow.

Ecce Homo Programmus

The imminence of calculator widows was apparent soon after Day One at Hewlett-Packard, where Customer Relations personnel, coping with less-focused queries than most of Nelson's, soon found themselves playing Ann Landers between *homo programmus* and

*Dues are now \$23 a year for a big, fat, sort-of-monthly mailing. Write 2541 W. Camden Pl., Santa Ana CA 92704, or better, call (714) 754-6226.



Still life for fanatics: All you need to become a full-fledged Calcunut

his silkily responsive machine. "Amazing letters," recalls Duncan Castle, a veteran of those times and now a calculator manager at the Corvallis, Oregon, division. "I wish we'd kept some of the early ones." Machines got pet names like Charley or Edna, had their virtues hymned in verse or torrential prose, came in for service swathed in owners' anxieties. A hospitalization of more than three days was apt to draw phone calls from the bereft partner.

What sort of man does the little black box seduce? "A romantic," says Richard Nelson; also, "someone who likes to do things his own way." The romantic imagines, often rightly, that a numerical Everest can be climbed, and by him; that any problem will yield to the right approach; even that by suitable nesting, 120 operations can be fitted into 100 lines of program space.

That last challenge would sound especially familiar to owners of the more modest programmables: H-P's 33C, for instance, which at \$90 has a mere forty-nine program lines, and compared with the 41C's several hundred would seem impossibly restricted. Not at all. To the true Calcunut nothing is quite impossible. Elegant technique is all, and the man who has tricked a forty-nine-line machine into yielding a Chebyshev Polynomial or the summation of a Taylor's Series is entitled to feel that the Bible will, *so*, fit onto a pinhead and that life has few further rewards.

There are people who have a use for such esoterica of higher math, and people who just like to program them. For the latter, the tighter the constraints the better, since all games maneuver amid systems of constraint. Hence

(apart from their lower price) the appeal of lower-down-the-line machines with limited memories. There are PPC purists who will complain that standards of the art began to slip with the availability of more memory and will sniff on moral grounds at Texas Instruments, whose competitive weapon is said to pack so much raw storage you can be as sloppy as you like.

As an art, programming has austere criteria. John Rausch of Cincinnati was famous in the early days for the ingenious word games he could insert at will into the mere 100 lines of the pioneer HP-65. The vastly extended capacities of the 41C, which allows you to display actual letters instead of substituting numerical coding, merely turned him off for a while. When he succumbed it wasn't to the machine but to the challenge of constructing a game of Hangman, and to play against his new program for that would conceivably offer solace in the condemned cell. You guess the hidden word letter by letter. When you guess right, your guesses are inserted into a pattern of blanks. When you guess wrong, one more element is added to a gallows.

It is somehow unsurprising that Rausch has no interest in *playing* his games. "I program them and that's it." Programming, he says, is no different from any other kind of puzzle, and he likes puzzles. He also grumbles about PPC members who never lose interest but never *do* anything either: hung up on equipment, he thinks.

At the opposite extreme would be Hal Brown of King of Prussia, Pennsylvania, who for twelve months conducted a *PPC Journal* column on what was then the cheapest and simplest programmable, the HP-25, without ever owning one. For him the equipment was simply a box of conventions, just as readily tackled on paper.

And by common consent the programmer's programmer was the late James J. Davidson of Overland Park, Kansas, who in issue after issue of the *PPC Journal* produced for an unpretentious forty-nine-line machine one virtuosic solution after another to impossibly complicated problems in higher math. Workers who feel over-endowed with later technology routinely scan Davidson programs for nuggets of principle,

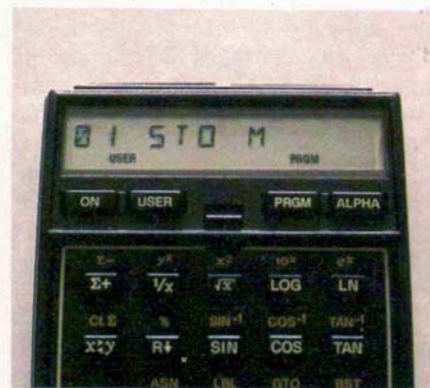
At one time, H-P marketing consultants were warning management against backing a toy.

not to say honesty. His affection for the little machine was aesthetic, as he'd not have said; but it was never concealed by his quickness to point out that as an electrical engineer he *used* its results.

If the Curve Fits

Meeting the machine on the job need be no bar to a self-sustaining romance. Six years ago Gary M. Tenzer, a mortgage broker in Los Angeles, where prices per square foot grow with spectacular implacability, saw that the PPC could put curve-fit forecasts at the disposal of his clients. The technique is a classroom stand-by. You have a sequence of recent data, a kit of standard curves (linear and exponential are two common ones), and a technique for deciding which curve fits the data best; that is the curve to hang an extrapolation from. Unfortunately, the mechanics of judging the fit are not simple, and sheer misery of computation has tended to keep curve-fitting in the classroom. A demo program that came with Tenzer's PPC made trial fits easy.

Unfortunately, each trial destroyed the data, so comparing a linear fit with an exponential meant starting twice from scratch. Might a self-regulating



The letter "M," another H-P "impossibility," displayed in Wickes's first synthetic program

program be devised to try four likely curves and select the best?

Tenzer's first try at an automated curve-fitter appeared in the *PPC Journal* for January, 1978, whereupon his phone started jumping and his mailbox bulging, and volunteer collaborators surfaced as far afield as Paris. Hardly any of them was interested in real estate or any other practical application; the curve-fit in itself had become a Holy Grail. By the time of his fourth revision, a 41C version of March, 1980, curve-fitter fans were an informal PPC subgroup, and American Management Associations, an agency based in New York, had Tenzer offering seminars round the country on financial decision making with the calculator. For \$890 registrants get the machine and three days of intensive instruction on how to think with it: "Not how to push buttons," says Tenzer, whose own machine is now "a part of my life." To think comfortably he wants it in his hand.

So does Dean Lampman of Cincinnati, a mechanical engineer and a veteran not only of Day One but of the still earlier time when the nonprogrammable HP-35, with its trig and log functions, was beginning to render the slide rule obsolete. The last American slide rule was manufactured not many months ago, a datum they affect to deplore in Russia, where scientists explain away the absence of sophisticated calculators by adducing the alleged ill effect of such gadgetry on the American high-school mind.

Smaller Than Six Refrigerators

Among American numbermen, opposition to calculators is more likely to ground itself on the statement that they aren't "real computers." At one time, H-P marketing consultants were warning management against backing a toy, and Lampman still meets computermen who share that attitude. "'You're such a pro,' they say to me. 'Why are you playing with the kids?' I tell them, 'The kids are playing with a higher level of technology than you are.'"

The skeptics have a point of sorts. Notwithstanding that it can assemble 1,001 digits of pi, beat most challengers in a game of Othello (a complex version of checkers), and with its full alphanu-



Calculated justice: John Rausch's game of Hangman, in progress on the 41C

meric capability flash messages in any Western language, the 41C does look undeniably toylike alongside something the size of six refrigerators, and if you like to pat sheet metal it can't gratify you. But a more important point is, it belongs to *you*.

"Personal," Lampman insists, is an overlooked part of the PPC definition. "The computer mainframe belongs to the boss. You take the job to it, get enmeshed in productivity reports, and leave both job and machine behind you at five." But take the same job to your PPC and you pluck a resonant string indeed—your pride of ownership.

Fewer every day are the numerical jobs you can't take to a PPC. Compared with a computer: being number-oriented, it won't maintain an address-list; and it cannot store thousands of discrete data items—at most a couple of hundred; and it's noticeably slower. That's about all. One reason for the slowness is low power consumption—size "N" batteries! Even so, the right program can solve a quadratic equation in one second, and even the minute or five some multi-loop programs require is short compared with a walk to the big machine in the hope that for once it's idle.

Nor can you poke inside the big machine. "The day I lay hands on a calculator I try to find out what makes it tick," says Emmett Ingram of Rolling Hills Estates, California, an unashamed Calcunut of the subspecies Hardware Buff. When H-P issued stamp-size plug-in memory modules, four of which can quintuple the 41C's data or program capacity, Ingram destroyed three of them getting the hang

of their innards. His relentlessness can be gauged from the information that the modules sold for \$45 each.

Today he fills time released by retirement from AT&T remedying on a piecework basis what he regards as a minor design flaw. The 41C has four sockets for plugging in its various peripherals—the card reader, the printer, the barcode-reading optical wand, the extra memory modules. But if you plug in the four modules it can handle you've filled the last socket and can't attach anything else. So in Ingram's shop, PPC members can, for \$32.50, have two modules sliced open and combined into one—a delicate piece of micro-work indeed if you consider that a hand's static electricity is enough to zap the micro-circuitry. Ingram gets a half-dozen a day from all over the world, regards the challenging surgery as a fine sport, and envies Dr. DeBailey nothing.

Of Bugs and Byte Jumpers

If Ingram seems a familiar American tinkerer, there are purists who are more like behavioral psychologists. The austere Calcunuts disdain hardware modifications, preferring the sheer elegance of outmaneuvering design engineers by selective disregard of the instruction manual and observation of undocumented machine behavior.

Here Dean Lampman pioneered in the far-off days of the HP-65, which he discovered would not only "branch," as advertised, two ways after a test ("If x is greater than y do this, otherwise do that"), but also three ways corresponding to a three-value test such as "greater than?," "equal to?," "less than?."

PPC members learned about three-way branching right away, and their programs grew more sophisticated. Users who depended on the factory never did learn about it, apparently in consequence of what Rich Nelson calls "the NIH syndrome." "NIH" means "Not Invented Here": If we didn't devise it we'll not mention it, especially if it represents a fissure in what we meant to devise. The Lampman Branch exploits the unintended fact that the HP-65 would under certain conditions accept half of a two-part instruction in separation from the other half. This it wasn't supposed to do. H-P, long accustomed to corporate equipment users

with requirements neatly specifiable, had now encountered the anarchic individual buyer who even welcomed controllable misbehavior, and the company passed for some time into a light cataract. Head in sand, that was the drill.

Meanwhile subsequent calculator models got more complicated and their behavior still less foreseeable, a genius being less predictable than a moron. "Bugs"—unintended flaws in logic—plagued early production runs, and Calcunuts leaped to exploit them. The current Dalai Lama of Calcunuts, William C. Wickes, a name mentioned whenever two of them get together, owes his status to his bug-enabled ability to roam inside the intricate 41C where most of its designers can't follow him.

A Princeton Ph.D. whose office door at the University of Maryland bears the sign WARNING: ASTROPHYSICIST: OF NO EARTHLY USE, Bill Wickes squeezed through the crack opened by a now-celebrated bug that somewhat confused the 41C's program and data spaces. This would happen under conditions so unlikely as to be undiscoverable by anyone save a Calcunut, but once discovered it enabled Wickes to poke unauthorized instructions into programs. Ignorant of H-P's manual, the machine would then blithely execute them. One could store data in places that weren't supposed to exist, print characters the printer didn't know, and greatly shorten ways of doing things that were meant to be done the long way.

Not content to exploit an oddity, Wickes set out to understand it. This meant discarding the arrayed number-boxes the manual lets you envisage, and tracing instead eerie loopings in what Wickes describes as "a long string of bits like a machine-gun belt with a pattern of missing bullets."

A "bit" is the unit of information—yes or no, 1 or 0. A "byte" is eight bits, the machine's lexical unit, and a number or an instruction is a string of up to seven bytes. The keyboard combines bytes into authorized strings, but non-keyboard combinations, based on techniques made possible by the bug, opened the domain of "synthetic programming," a sort of gene-splicing to create new forms.

This pastime gathered devotees

Bugs Bunny should sponsor that anarchic goose. Nothing can have been further from the minds of the men at Corvallis.

worldwide. Soon staid readers of the *PPC Journal* were confronting dispatches from Colorado, from Australia, from Spain, ababble with "status registers," "black box routines," and "curtain control." They grumbled that a plague of jargon had struck. And what use any of it might be no one was taking time to say. Enough that the results were (a) reproducible and (b) unsanctioned at the factory in Corvallis, where trouble-shooters were closing in on the bug that had made it all possible.

It was a close race, but by the time H-P had exterminated the bug from its production runs Wickes had discovered the "byte jumper," a dodge that enables synthetic programming to proceed without bugs. Not so much as turning a screw or snipping a wire (abhorrent!), byte-jumpers evade the barrier between the part of memory users have access to and the part where the machine does its housekeeping (keeping track of where it's put things), and they modify its intimate codes to create synthetic instructions at will.

These can permit, for instance, alphabetizing words by turning them into numbers the number-oriented machine can easily sort. They can also do something no more useful than wipe out all memory, and synthetic programming, an untidy procedure by instruction-manual standards, was long something they didn't want to hear about in Corvallis—certainly something they weren't about to publicize.

Late in 1980, Wickes was about to publish a synthetic-programming manual. H-P was now compelled to decide whether to go on pretending the procedures didn't exist. In early October Corvallis agreed to let customers know that the book can be ordered from Lar-

ken Publishing Company, P.O. Box 987, College Park MD 20740, at \$10 including postage. H-P's Henry Horn draws a careful analogy with the car manufacturer's neutrality toward purchasers who soup up his product. The Wickes book likewise isn't something H-P is endorsing; but as a narrative of one user's experience they are glad (ahem!) to draw attention to it. In confirming diplomatic relations with the most uncontrollable sector of Calcunut culture, this marks a long distance traveled.

An Orderly Handheld World

And what agitates that culture, drives those fanatics?

Do not, to begin with, confuse them with the computer junkies, locked into addictive intercourse with a keyboard, who are as familiar at every computing center as the winos at bus terminals.

Of junkiedom, MIT's computer scientist Joseph Weizenbaum has noticed an interesting correlation with—hang on—motion sickness. For, he says, you do not get carsick when you are driving, only when someone else is driving. Motion sickness is an extreme reaction to your feeling that your environment controls you. In the computer junkie it finds an extreme compensation, virtuosity in an environment *he* can control. (The machine fights back? Never mind. The junkies *can* win. They get to be expert, if futile, programmers, endlessly elaborating on games like *Star Trek*.)

If no one represented in this article admitted to motion sickness, that would be because something you can hold in your hand, moreover something that belongs to you, is not an environment. It is at the least a tool, task-oriented however inconsequential the task. At most it is a magical concentration like Citizen Kane's glass ball, something in which what is seen, what satisfactions are derived, will vary with the variousness of mankind.

John McGeachie, who teaches philosophy at Monash University in Australia, is willing to reflect on why he spent uncountable hours helping develop synthetic programming. He wanted, he says, to see *at firsthand* what goes on in a joint intellectual enterprise. He also suspects that what drove many great literary figures was a similar compul-

A Smear Campaign

The Othello program, by Valentin Albillo of Madrid, in the last stages of trouncing an opponent. Machine plays white, and by the last frame has achieved 4:1 superiority.

Players alternate placing pieces, and must bracket opposing pieces that are then "flipped" to the player's color. The program's notation "11" means row 1, column 1. Successful strategy, well understood by the program, involves commanding corners and edges.

Cool and resourceful play will beat the program, but beginners and incautious players are sure to be smeared. A full game (sixty moves) lasts about an hour.

```

1 2 3 4 5 6 7 8
1 - ■■■■■■■■
2 ○ - ■■■■■■■■
3 ○ ○ ■■■■■■■■
4 ○ ■■■■■■■■
5 ○ ■■■■■■■■
6 ○ ○ ■■■■■■■■
7 ○ ■■■■■■■■
8 ○ ○ ■■■■■■■■

```

I PLAY 11
FLIP 6 PCES

```

1 2 3 4 5 6 7 8
1 ○ ○ ○ ○ ○ ○ ○ ○
2 ○ - ■■■■■■■■
3 ○ ○ ■■■■■■■■
4 ○ ■■■■■■■■
5 ○ ■■■■■■■■
6 ○ ○ ■■■■■■■■
7 ○ ■■■■■■■■
8 ○ ○ ○ ○ ○ ○ ○ ○

```

MOVE ? 22 RUN
YOU PLAY 22
FLIP 1 PCES

```

1 2 3 4 5 6 7 8
1 ○ ○ ○ ○ ○ ○ ○ ○
2 ○ ■■■■■■■■
3 ○ ■■■■■■■■
4 ○ ■■■■■■■■
5 ○ ■■■■■■■■
6 ○ ■■■■■■■■
7 ○ ○ ■■■■■■■■
8 ○ ○ ○ ○ ○ ○ ○ ○

```

I PLAY 28
FLIP 7 PCES

```

1 2 3 4 5 6 7 8
1 ○ ○ ○ ○ ○ ○ ○ ○
2 ○ ○ ○ ○ ○ ○ ○ ○
3 ○ ■■■■■■■■
4 ○ ■■■■■■■■
5 ○ ■■■■■■■■
6 ○ ■■■■■■■■
7 ○ ○ ■■■■■■■■
8 ○ ○ ○ ○ ○ ○ ○ ○

```

GAME IS OVER

HF: 51, YOU: 13

I WON

sion, and that good scientists are less rational than they pretend to be.

Jack Kahoun, a retired physician in San Mateo, California, who confesses to "a passion for calculators," invokes elegance and pride of authorship. For in that orderly little handheld world one can trim redundancies, eliminate waste motion, sweep and tidy a garden where (as in one Kahoun program) your latitude and longitude and the date will get you the times of sunrise and sunset to the minute. When I checked against today's paper it was the paper that turned out to be wrong (by forty-three minutes), sun and calculator shaking precise hands. The satisfaction of perfecting so well-behaved a program must be, Kahoun surmises, like writing good prose. A romantic indeed.

And there's perhaps unanalyzable fun. While deep in thought the 41C routinely lets you know it's alive by propelling a cartoon "goose" left to right across its display. Rumors spread some time ago that H-P had a free machine for anyone who could make the goose face backward. Bill Wickes perceived a job for synthetic programming, and after a bout of flu during which his mind byte-jumped still more freely than usual, he had achieved, yes, the backward-facing goose: so much ingenuity expended, he notes, to achieve a purely and perfectly useless end.

But it was just then his eyes commenced to dart fire. Soon the goose could not only face backward but also fly backward, also flap its wings, also stream by in flocks of up to nine, shed droppings, even collide head-on with its predecessor, the right-facing factory-hatched manual-engendered bird. The program that sequences all these happenings is reminiscent of a Warner Bros. cartoon of the 1940s. Bugs Bunny should sponsor that anarchic goose. Nothing can have been further from the minds of the men at Corvallis who thought they were designing a top-of-the-line programmable calculator to—oh, let's say to estimate the volume of water tanks.

And the free machine? Mere rumor. And it turned out that there wasn't a soul in Corvallis who could begin to guess what magic would make so much as one mere stationary backward-facing goose. □

What You Do When You Program

Machines are fast and patient and error-free, but they have no way of helping you with problems you'd not know how to attack without them. Writing a program entails: (1) finding an *algorithm*—a logical procedure guaranteed to produce the solution; (2) seeing how to implement it with the keys your machine makes available; and (3) specifying keystrokes in the proper sequence.

Algorithms are *definite*: they spell out procedures explicitly; and they are *terminating*: the machine has a clear-cut way to decide it's finished. Deciding this can mean nothing more than having gone once through all the steps, or it can mean recycling until some test value has grown as large or as small as the programmer specifies. Everybody remembers one simple algorithm, the formula πr^2 for the area of a circle, which terminates when you've moved through it once left to right.

Suppose we want to program this easy algorithm, to display a circle's area on being fed the diameter. We begin by noting that r , the circle's radius, is one half its diameter, and we know how to make our machine divide by 2. The machine has a π key and a squaring key, and of course it can multiply.

The user will key a diameter and run the program. The program will divide by 2, square, introduce π , multiply, and stop. We are now going to write it. Switching to "program" mode, we simply press the keys that will do those things in that order, as if we were solving the problem by hand. The instructions get stored in program memory as a series of "lines," shown on the HP-41C listing below. The "LBL" (label) records the program's name, for retrieval from among other programs stored in memory. The printer's shorthand includes / for "divide," $\times 12$ for " $\times 2$," and * for "multiply." "RTN" (Return) means thanks, you're finished, return control to the human.

```
01*LBL "AREA"
02 2
03 /
04 X12
05 P1
06 *
07 RTN
08 .END.
```

We now switch back from "program" to "run" and try it out. On the 41C our first step is assigning "AREA" to an unused key that will start it with a single keypress. We then enter a sample diameter—say 25—and press our new "AREA" key. The "Trace" print-

out below shows in detail what happens in the next half-second.

```
25.0000
XEQ "AREA"
01*LBL "AREA"
?
/
12.5000 ***
X12
156.2500 ***
P1
3.1416 ***
*
490.8739 ***
RTN
```

The "25.0000" is the diameter we supplied. "XEQ" means "execute" and marks the moment recourse to a program was triggered. By the next line the machine has located the "AREA" program in its memory. Remaining lines record the steps it executed in order, followed by their results, which are tagged *** for easy recognition. Dividing by 2 gave 12.5, squaring gave 156.25, multiplying by π gave the final answer, 490.8739, and this was what appeared in the machine's display window while the user's fingertip was still rising from the "AREA" key.

We'd not trouble ourselves writing a program just to do one such simple job; what we've gained is ease in doing any number of similar jobs. We can now get the areas of fifty circles as fast as we can key in their diameters.

More intricate programs, like Ron Knapp's thousand-digit "Pi," extend these simple principles—by parking interim results in "registers" for later fetching; executing a repeated procedure ("loop") a specified number of times; tagging frequently re-used sequences for recall as "subroutines"; and branching to one part of program memory or another at the bidding of such tests as $x = 0?$ or $x > y?$.

Long programs can be recorded on magnetic cards like the one below;



passing the card through a slot in a plug-in card-reader transfers its contents intact to memory. A more recent storage medium uses the plug-in optical "wand" (\$125) that reads supermarket-style barcodes. These can be published in manuals or photocopied; some skillful Calculators even draw them by hand. The following is a sample barcode.

