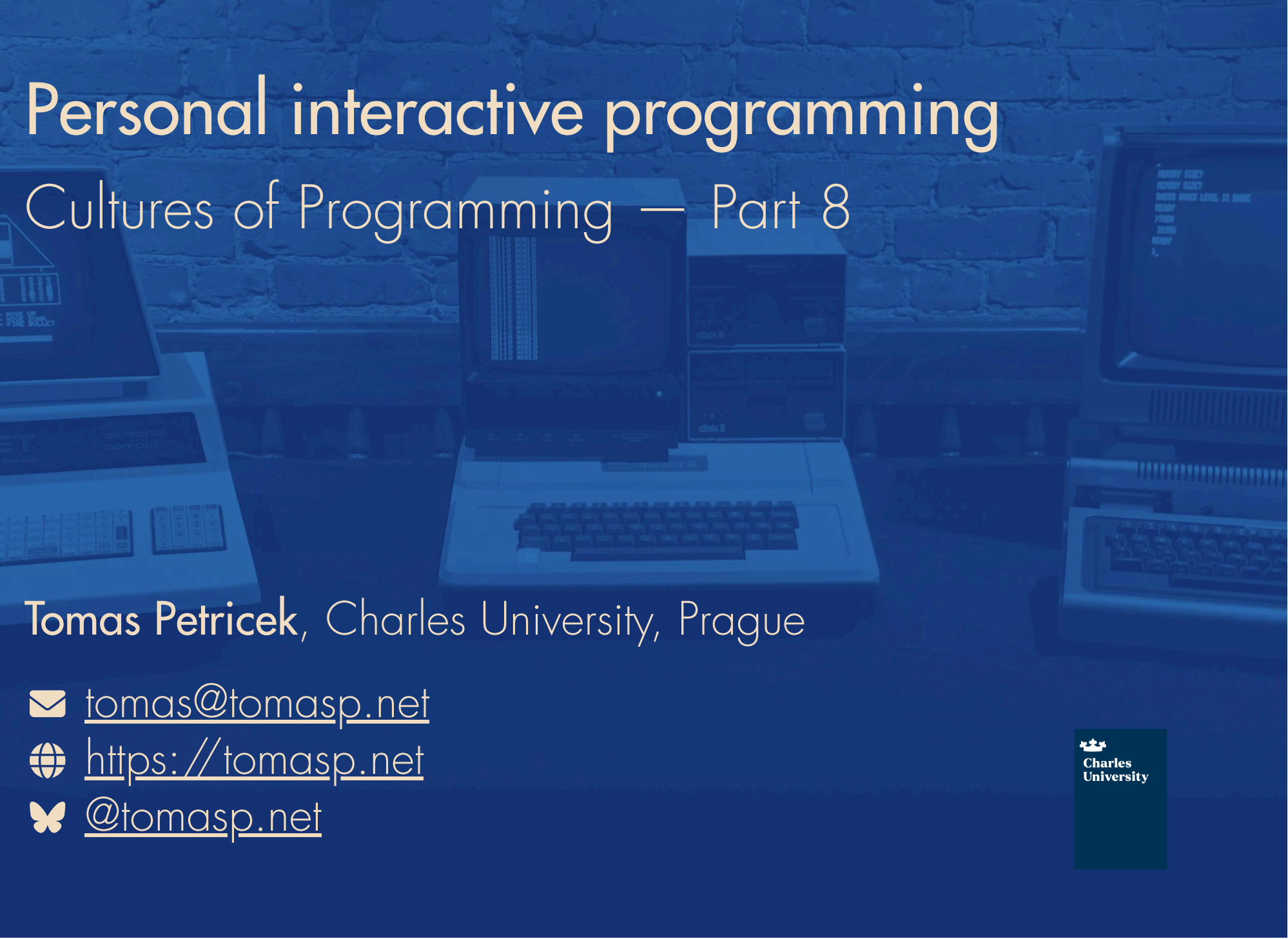

Personal interactive programming

Cultures of Programming — Part 8

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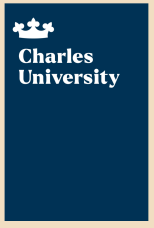
Xerox

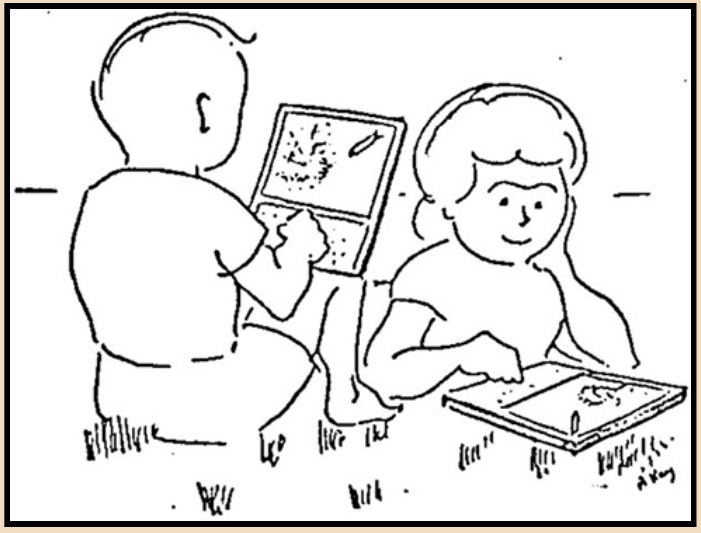
Personal Dynamic Media



Personal computer for children of all ages

Alan Kay

- Member of the ARPA community
- Cites many humanistic influences
- Dynabook project at Xerox PARC



Humanistic vision

- Using a computer also means programming
- Looks like iPad but that's not it…
- Smalltalk as the medium for it

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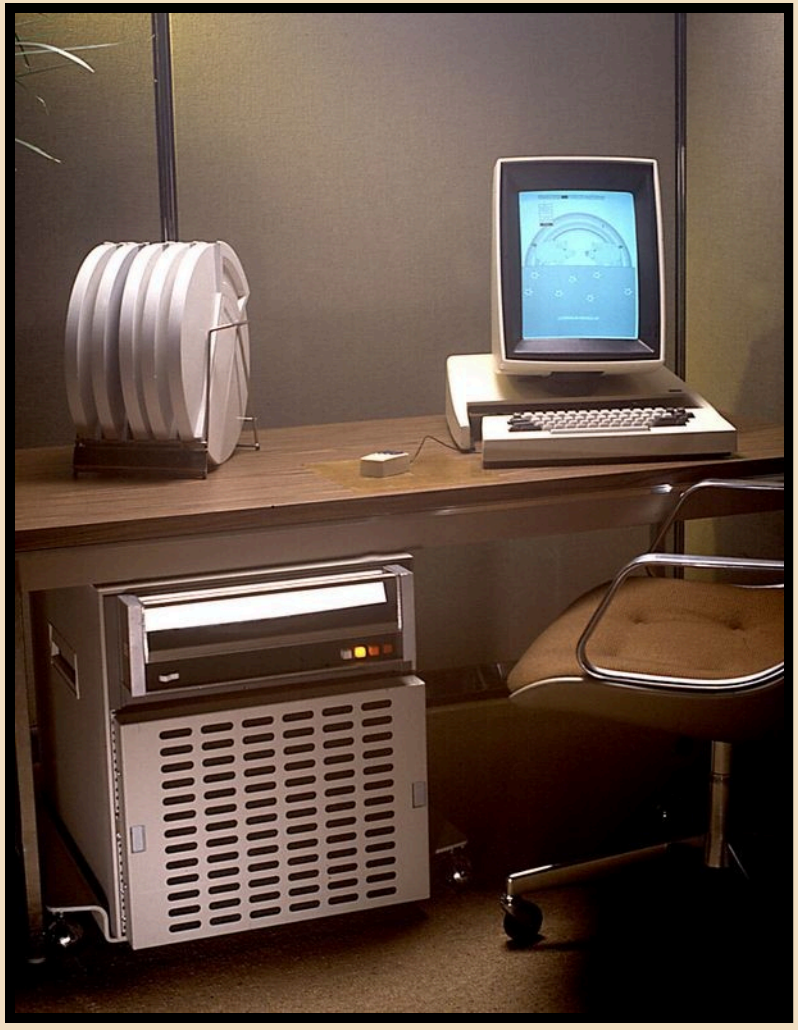

Xerox Alto

(aka Interim Dynabook)

Xerox blocked proposal
to buy PDP-10 for PARC

We'll build our own

Kay's vision meets Butler
Lampson and Charles Thacker

Microcoded architecture
No central processing unit

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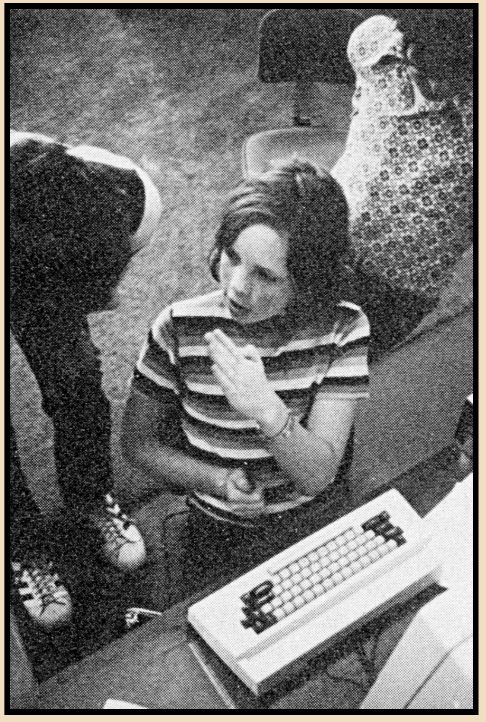
Personal Dynamic Media

Kay and Goldberg (1977)

- Kids use water colors, color TV, etc.
- "Medium is the message"
- Smalltalk as mode of interaction
- Adaptable meta-medium



Meta-medium for communication

- Simulation system for a decision theorists
- Electronic circuit designer for a student
- Drawing & animation system for a child

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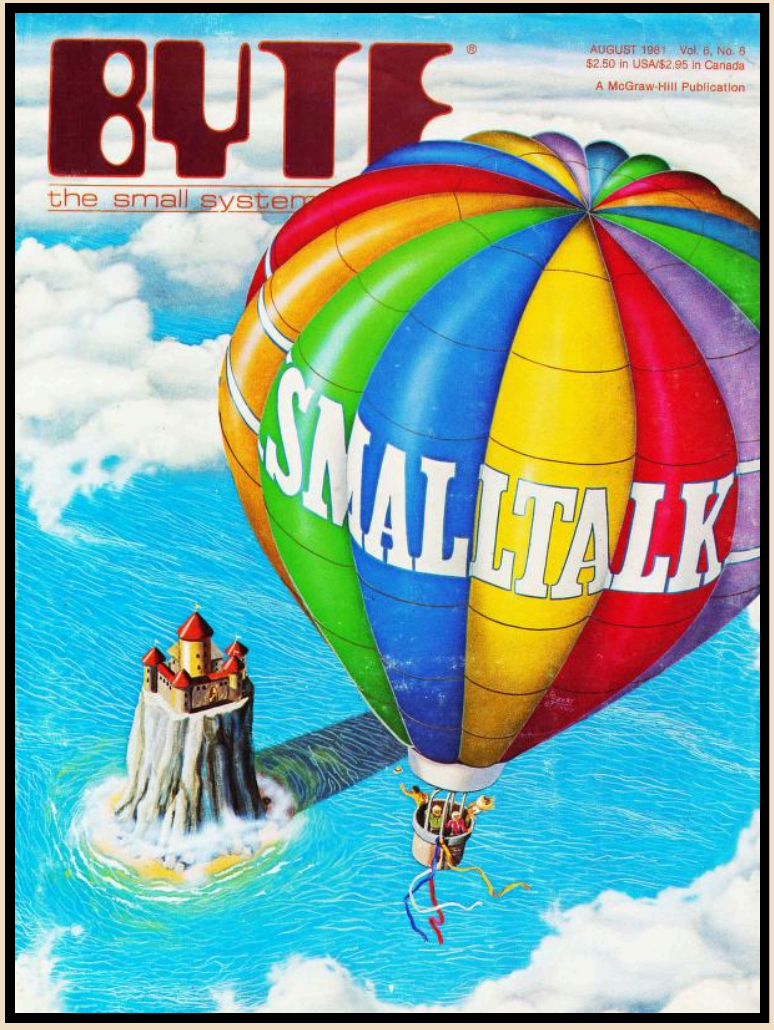

BYTE (1981)

Releasing Smalltalk to the wider public

Conceptual shift

- Smalltalk design principles
- Object-oriented system
- Progress from end user to system developer

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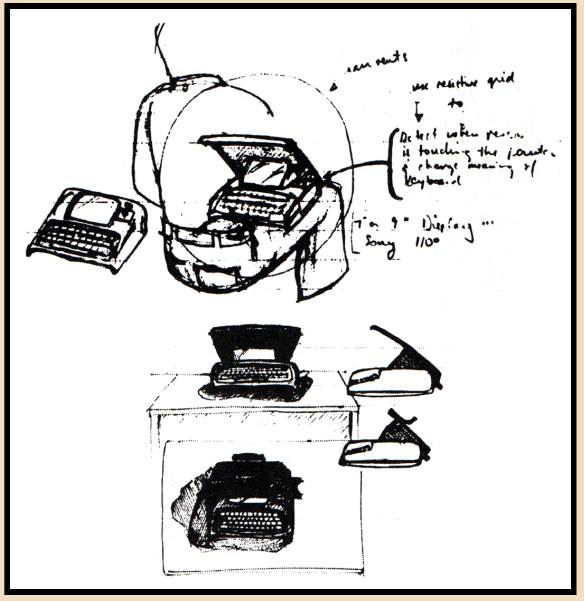
Let's burn our disk packs...

Group meeting in 1976

- "Dynabook for children" losing
- No organism can live in its own waste
- Vision needs a fresh start!



Two eras of Smalltalk

- Humanistic culture prior to 1976
- Engineering and hacker post 1976
- Kay continues working on Note Taker

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Xerox

Research and business

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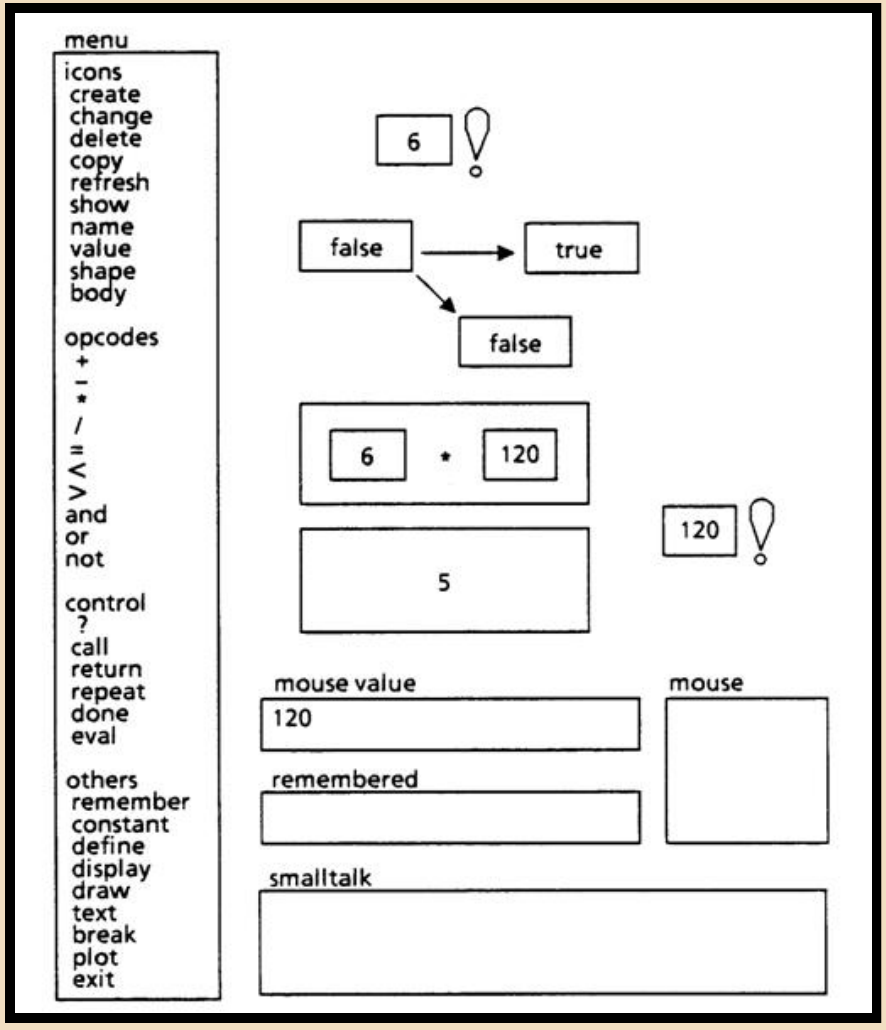

Pygmalion

(David C. Smith, 1975)

Largest Smalltalk-72 program ever written

Pioneered icons and programming by demonstration

Thesis with humanistic links
Art theory, cognitive science

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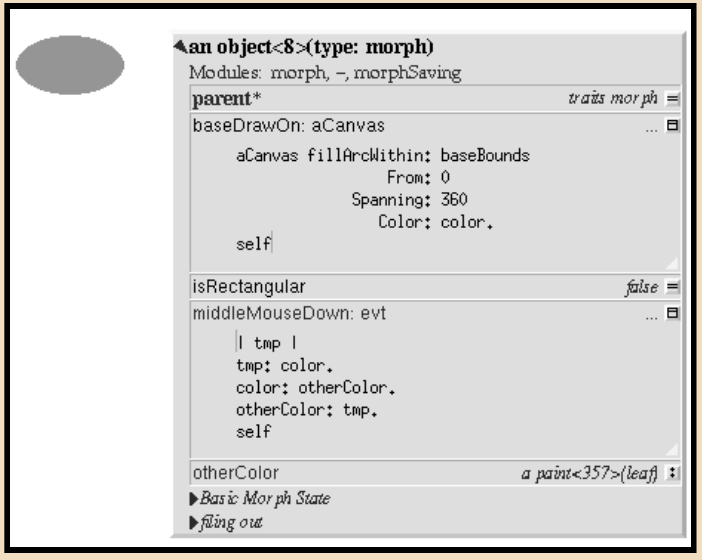
Self programming system (1987)

Pure evolution of Smalltalk

- Simple prototype-based OO
- Unify fields and variables
- Objects exist in space



Legacy of Self

- Mostly engineering results!
- Optimizing virtual machine
- Ideas adopted by V8 (in Chrome)

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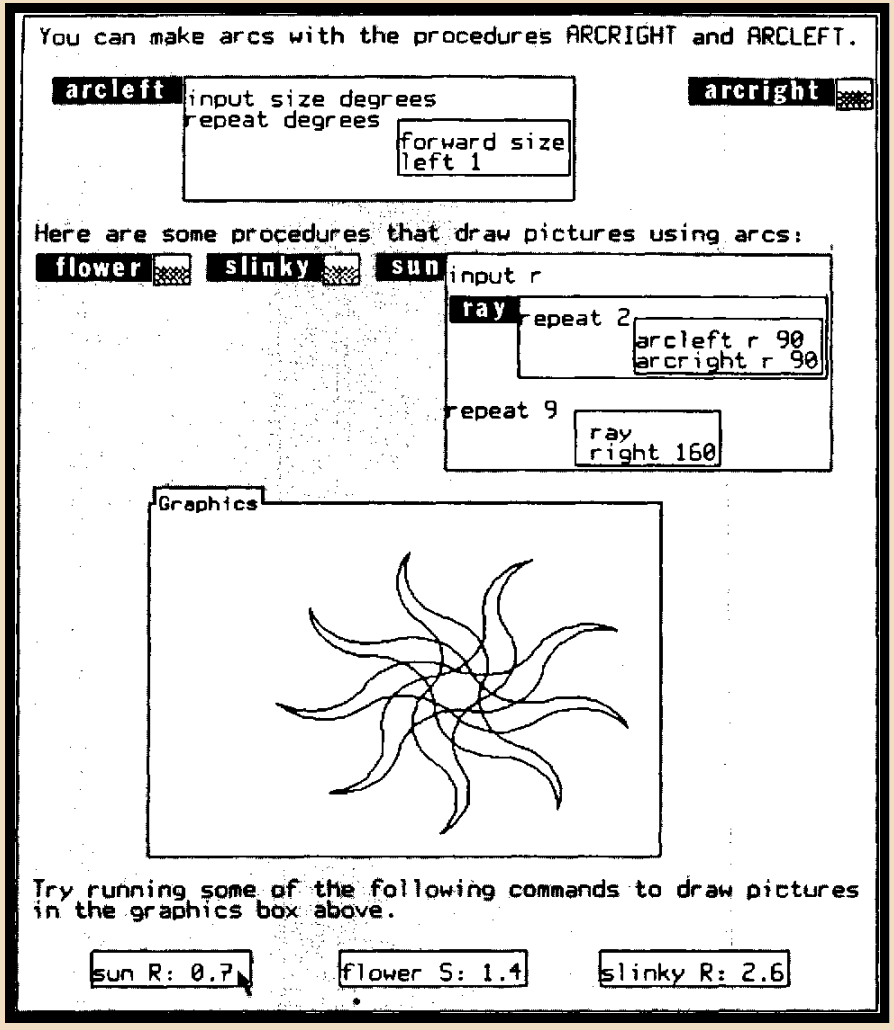


Boxer (diSessa, 1985)

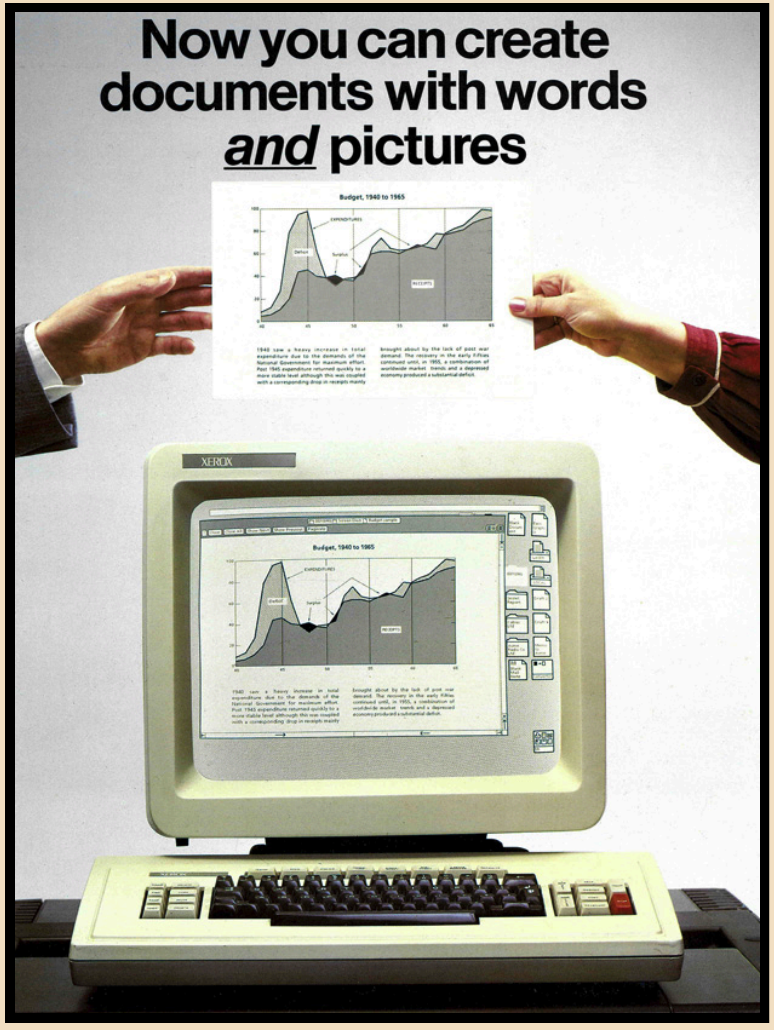
Integrated computational environment for naive and inexperienced users

Interactive physics textbooks

Two design principles

- Spatial metaphor
- Naive realism

Educational humanistic focus



Xerox Star

Commercialising Xerox PARC "office of the future" vision

- Graphical interface of Smalltalk
- Icons of Pygmalion
- Documents rather than apps!

Commercial failure

Too expensive and too late?

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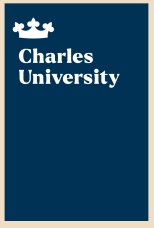
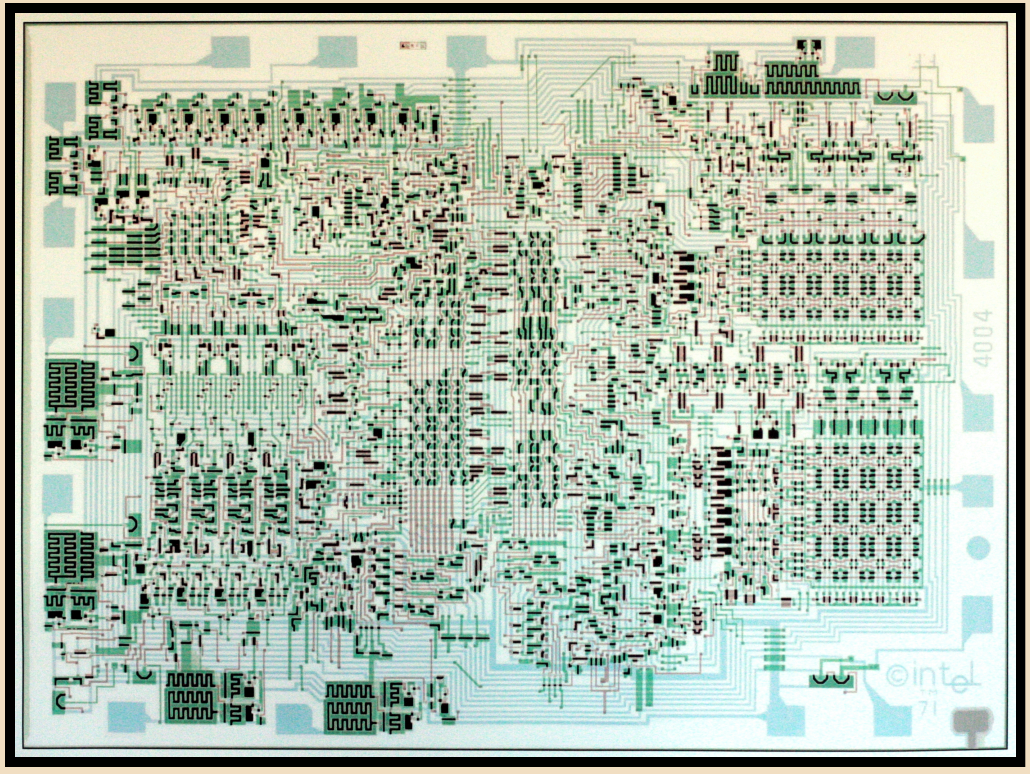
Microcomputers

Programming for everyone





Intel 4004 (1971)

First microprocessor "computer on a chip"

"Calculator" compared with Xerox Alto!

Building a computer easier and cheaper

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Altair 8800

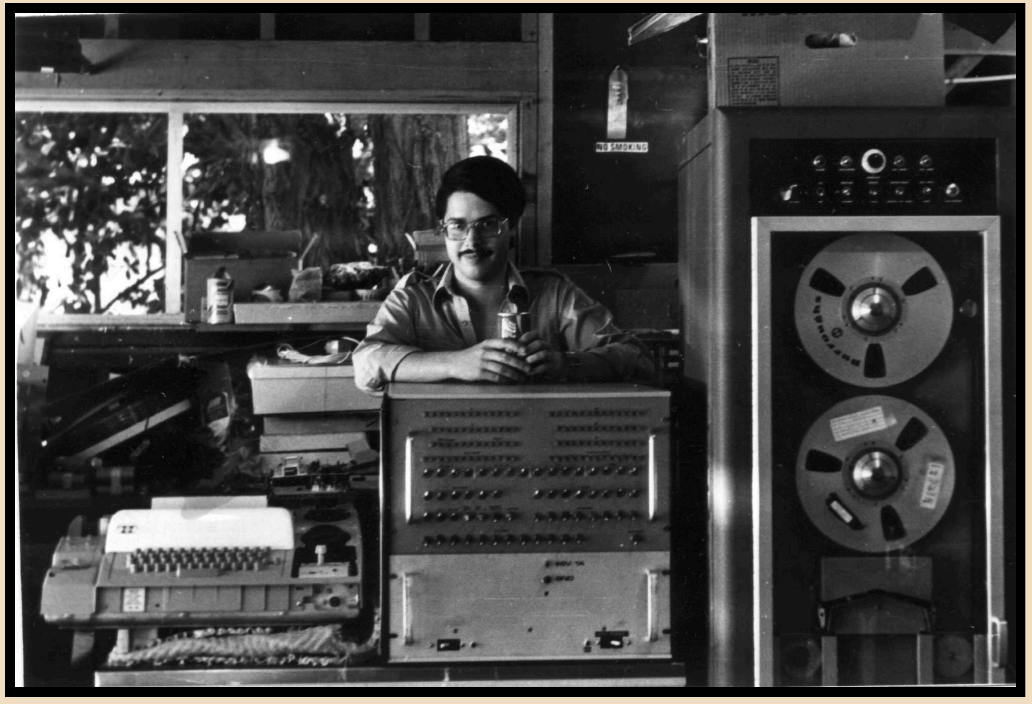
Computer for tinkerers

- Kit with 8-bit Intel 8008 CPU
- Available for $397 (~2k now)

Altair capabilities

- More like TX-0 than Alto!
- Switches to set memory values
- Extensible architecture for more!
- Affordable enough for fun





Homebrew Computer Club

(Menlo Park, 1975)

Do it yourself culture
Kids with toys to Xerox

Hacker culture without direct links to MIT

Wozniak and Jobs found Apple Computers

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Microcomputer "Trinity of 1977"



Make computers cheaply available to millions

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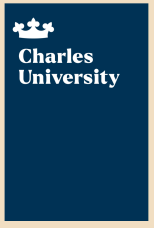
Homebrew

The rise of BASIC



Beginner's All-purpose Symbolic Instruction Code

Dartmouth time-sharing

- Every student should use it!
- Writing numerical programs
- Easier to use than FORTRAN

$$A_1X_1 + A_2X_2 = B_1$$

$$A_3X_1 + A_4X_2 = B_2$$

$$X_1 = \frac{(B_1A_4 - B_2A_2)}{(A_1A_4 - A_3A_2)}$$

$$X_2 = \frac{(A_1B_2 - A_3B_1)}{(A_1A_4 - A_3A_2)}$$

```
10  READ A1, A2, A3, A4
15  LET D = A1 * A4 - A3 * A2
20  IF D = 0 THEN 65
30  READ B1, B2
37  LET X1 = (B1*A4 - B2 * A2 ) / D
42  LET X2 = ( A1 * B2 - A3 * B1)/D
55  PRINT X1, X2
60  GØ TØ 30
65  PRINT "NØ UNIQUE SØLUTIØN"
70  DATA 1, 2, 4
80  DATA 2, -7, 5
85  DATA 1, 3, 4, -7
90  END
```

BASIC on microcomputers

- Micro-Soft BASIC for Altair 8800
- Later **PEEK**, **POKE** and **SYS** makes it more powerful
- More than a language…

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BASIC as a language

Dijkstra (1975)

It is practically impossible to teach good programming to students that have had a prior exposure to BASIC: as potential programmers they are mentally mutilated beyond hope of regeneration.



Basic as a programming system

- Great fit for machines it ran on
- Enabled active learning culture

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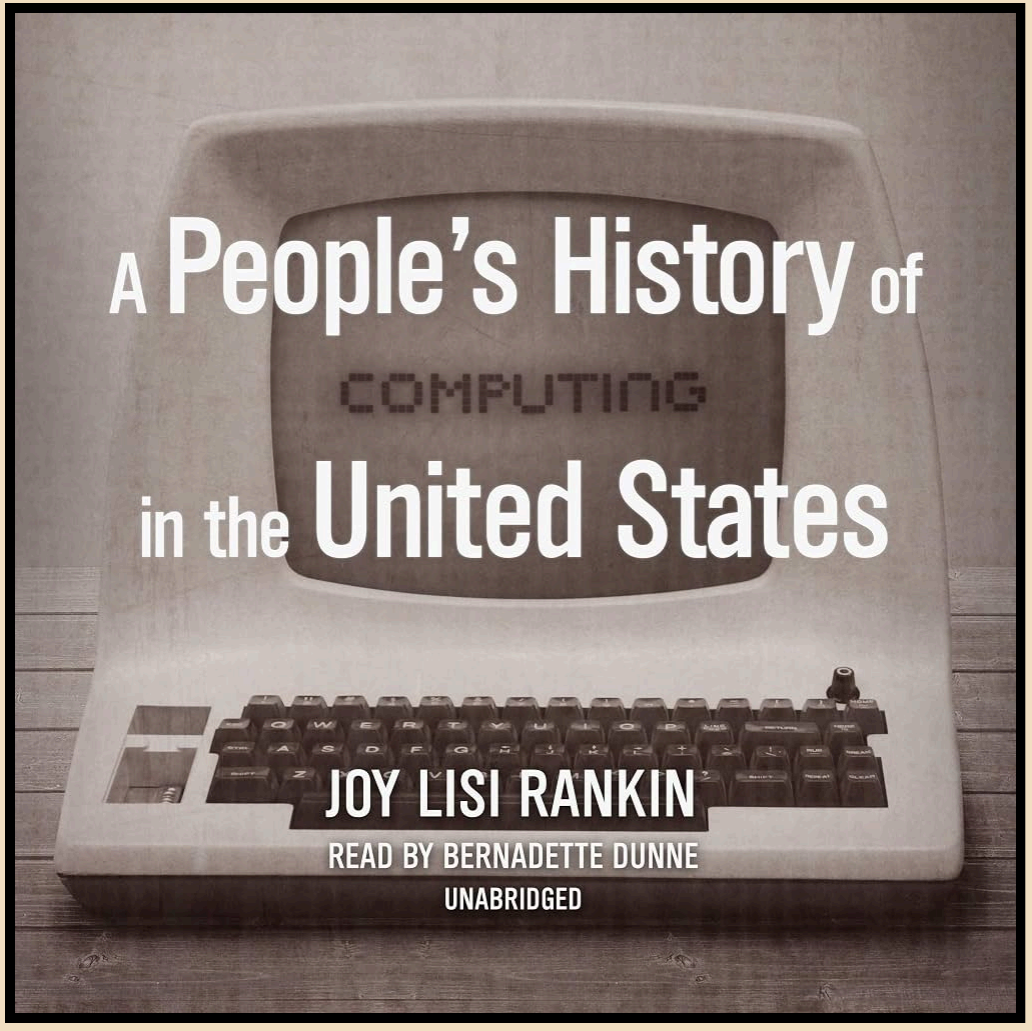

Timesharing BASIC

New Hampshire, Minnesota & Illinois

Dispersed diverse communities around education & games

Humanistic culture distinct from the Silicon Valley hackers

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Hobbyist computing magazines



C 64

Wie musikalisch der C 64 sein kann, ist den meisten bekannt, wie man die Musik macht, aber den wenigsten. Dieses Programm, als Anwendung des Monats, zeigt die Fähigkeiten Ihres Computers.

JAZZ

Klassik

Elf verschiedene Instrumente sind in diesem Programm schon verwirklicht. Sie können zwischen Piano, Röhrengong, Metallophon, Xylophon, Glocke, Glasorgel, Violine, Flöte, Panflöte, Klarinette und Harfe auswählen. Das Programm läßt sich jedoch noch erweitern. Ihrer Phantasie sind keine Grenzen gesetzt.

Empfehlenswert ist ein Verstärker oder eine Stereoanlage. Das Programmlisting ist weitgehend selbstdokumentierend, daher nur einige Hinweise zur Bedienung:

Oben rechts wird eine Klaviatur dargestellt, die der augenblicklichen Tastenbelegung entspricht. Gespielt wird durch Drücken der jeweiligen Taste.

Die Instrumente werden durch geshiftete Buchstaben gewählt.

Besondere Funktionen:

— Halleffekt:
Alle drei Tongeneratoren werden abwechselnd benutzt, so daß immer zwei Töne nachklingen. Symbol: ((())) ganz unten.

— Oktavenwahl:
Oktaven wählbar von Subcontraoktave (SCO) bis dreigestrichene Oktave (0''). Die Subcontraoktave ist nur durch Einzeltonverschiebung zu erreichen. Das Pfundzeichen setzt Instrumente in die Grundoktave zurück und die Einzeltonverschiebung 0. Symbol: unter der Klaviatur.

— Einzeltonverschiebung:
Die Tastaturbelegung kann in Einzeltonschritten über den gesamten Tonbereich verschoben werden. Symbol: Klaviatur.

— Akkorde:
Zweiklang, wählbar bis Note. Apostroph setzt Akkorde auf 0. Symbol: >?< links neben Halleffekt.

— Lautstärke:
wählbar von 0 bis 15.
Symbol: 0000000000...unten.

Von der Bildschirmaufteilung her kann noch ein Instrument zusätzlich entworfen werden. Dazu muß man die Variable IZ in 150 gleich 11 setzen. Nun kann man ab Zeile 620 das neue Instrument entwerfen.

Format:

Name, Wellenform, Anschlag-Abschwellen, Halten-Ausklingen, Tastverhältnis low, Tastverhältnis high, Hall (3 = ja, 1 = nein), Grundoktave (Contraoktave = 0), Bild (10 x 7).

Soll mehr als ein neues Instrument entworfen werden, muß man die Bildschirmgestaltung ändern.

(Christian Gebauer/rg)

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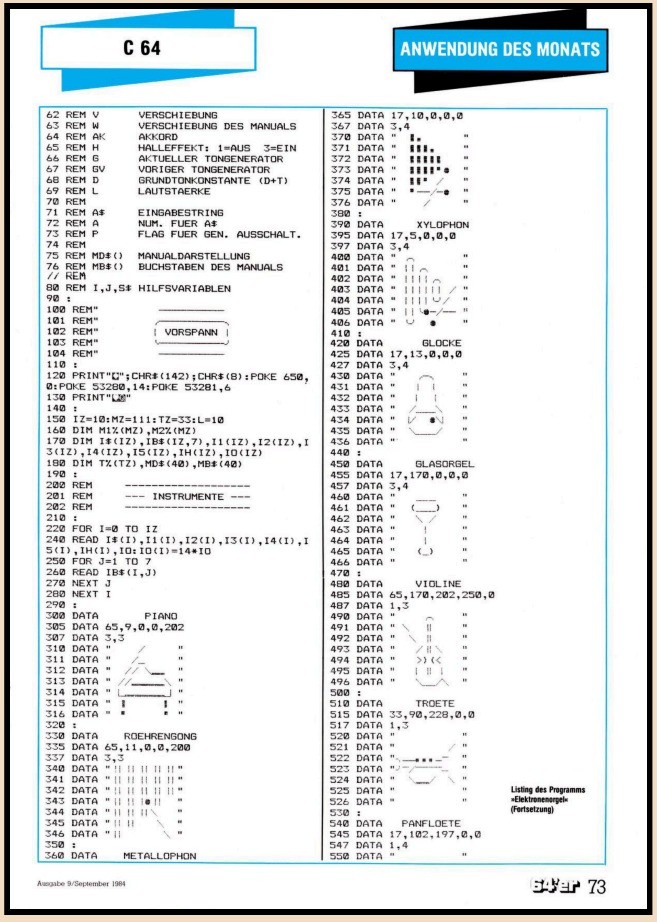

C 64

ANWENDUNG DES MONATS

```
62 REM V       VERSCHIEBUNG
63 REM W       VERSCHIEBUNG DES MANUALS
64 REM AK      AKKORD
65 REM H       HALLEFFEKT: 1=AUS  3=EIN
66 REM G       AKTUELLER TONGENERATOR
67 REM GV      VORIGER TONGENERATOR
68 REM D       GRUNDTONKONSTANTE (D+T)
69 REM L       LAUTSTAERKE
70 REM
71 REM A$      EINGABESTRING
72 REM A       NUM. FUER A$
73 REM P       FLAG FUER GEN. AUSSCHALT.
74 REM
75 REM MD$()   MANUALDARSTELLUNG
76 REM MB$()   BUCHSTABEN DES MANUALS
77 REM
80 REM I,J,S$ HILFSVARIABLEN
90 :
100 REM"
101 REM"
102 REM"       | VORSPANN |
103 REM"
104 REM"
110 :
120 PRINT"{CLR}";CHR$(142);CHR$(8):POKE 650,
0:POKE 53280,14:POKE 53281,6
130 PRINT"{DOWN}"
140 :
150 IZ=10:MZ=111:TZ=33:L=10
160 DIM M1%(MZ),M2%(MZ)
170 DIM I$(IZ),IB$(IZ,7),I1(IZ),I2(IZ),I
3(IZ),I4(IZ),I5(IZ),IH(IZ),IO(IZ)
180 DIM T%(TZ),MD$(40),MB$(40)
190 :
200 REM     ---------------------
201 REM     --- INSTRUMENTE ---
202 REM     ---------------------
210 :
220 FOR I=0 TO IZ
240 READ I$(I),I1(I),I2(I),I3(I),I4(I),I
5(I),IH(I),IO:IO(I)=14*IO
250 FOR J=1 TO 7
260 READ IB$(I,J)
270 NEXT J
280 NEXT I
290 :
300 DATA       PIAND
305 DATA 65,9,0,0,202
307 DATA 3,3
310 DATA "
311 DATA "
312 DATA "
313 DATA "
314 DATA "
315 DATA "  !     ! "
316 DATA "  *     * "
320 :
330 DATA     ROEHRENGONG
335 DATA 65,11,0,0,200
337 DATA 3,3
340 DATA "!! !! !! !! !! "
341 DATA "!! !! !! !! !! "
342 DATA "!! !! !! !! !! "
343 DATA "!! !! !! !! !! "
344 DATA "!! !! !! !! !! "
345 DATA "!! !!    !! !! "
346 DATA "!!        !! !! "
350 :
360 DATA     METALLOPHON
365 DATA 17,10,0,0,0
367 DATA 3,4
370 DATA "  !.          "
371 DATA "  !!!.        "
372 DATA "  !!!!!       "
373 DATA "  !!!!'*      "
374 DATA "  !!'  /      "
375 DATA "  *--/--*     "
376 DATA "     /        "
380 :
390 DATA       XYLOPHON
395 DATA 17,5,0,0,0
397 DATA 3,4
400 DATA "    ,-.       "
401 DATA "   ( ( )      "
402 DATA "    | |       "
403 DATA "    | |  /    "
404 DATA "    | | (/    "
405 DATA "    |  *--/   "
406 DATA "    \_/  *    "
410 :
420 DATA         GLOCKE
425 DATA 17,13,0,0,0
427 DATA 3,4
430 DATA "     ,-.       "
431 DATA "    ( ( )      "
432 DATA "     | |       "
433 DATA "    /---\      "
434 DATA "   (  *  )     "
435 DATA "    \___/      "
436 DATA "               "
440 :
450 DATA      GLASORGEL
455 DATA 17,170,0,0,0
457 DATA 3,4
460 DATA "    ____       "
461 DATA "   (____)      "
462 DATA "    \  /       "
463 DATA "     ||        "
464 DATA "     ||        "
465 DATA "    (__)       "
466 DATA "               "
470 :
480 DATA       VIOLINE
485 DATA 65,170,202,250,0
487 DATA 1,3
490 DATA "       ,-.     "
491 DATA "      (  )     "
492 DATA "       ||      "
493 DATA "       ||      "
494 DATA "      )) ((    "
495 DATA "      ( || )   "
496 DATA "       \  /    "
500 :
510 DATA       TROETE
515 DATA 33,90,228,0,0
517 DATA 1,3
520 DATA "             ,-"
521 DATA "          ,-'  "
522 DATA "       ,-'*--- "
523 DATA "     ,'        "
524 DATA "    (          "
525 DATA "     `.        "
526 DATA "       `-.     "
530 :
540 DATA     PANFLOETE
545 DATA 17,102,197,0,0
547 DATA 1,4
550 DATA "             "
```

Listing des Programms »Elektronenorgel« (Fortsetzung)

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Microcomputers

Fulfilling the Dynabook dream

- Microcomputers boot into BASIC terminal
- Engagement with code encourages curiosity
- Simple language with escape hatches
- Progress from user to programmer

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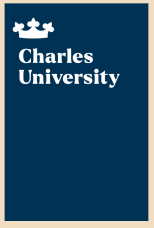
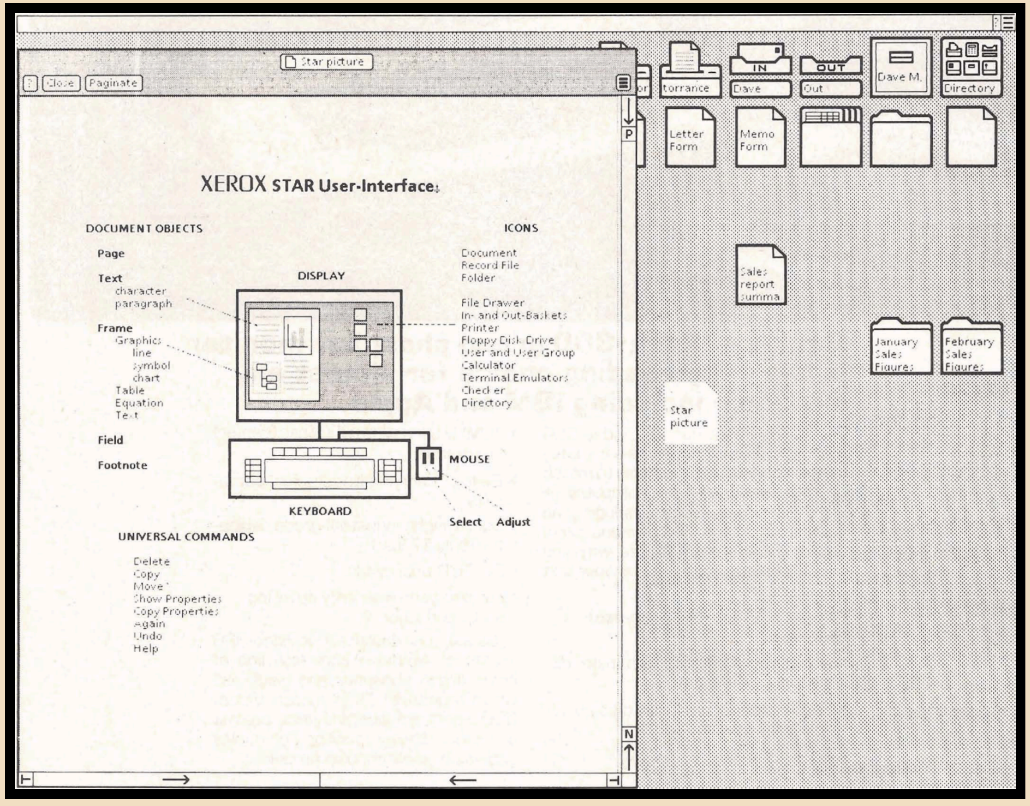
Struggle

Interactive programming





Commercialization of Xerox research

Interactive programming not desirable for office applications

Engineering and managerial culture

Too fragile, protecting intellectual property

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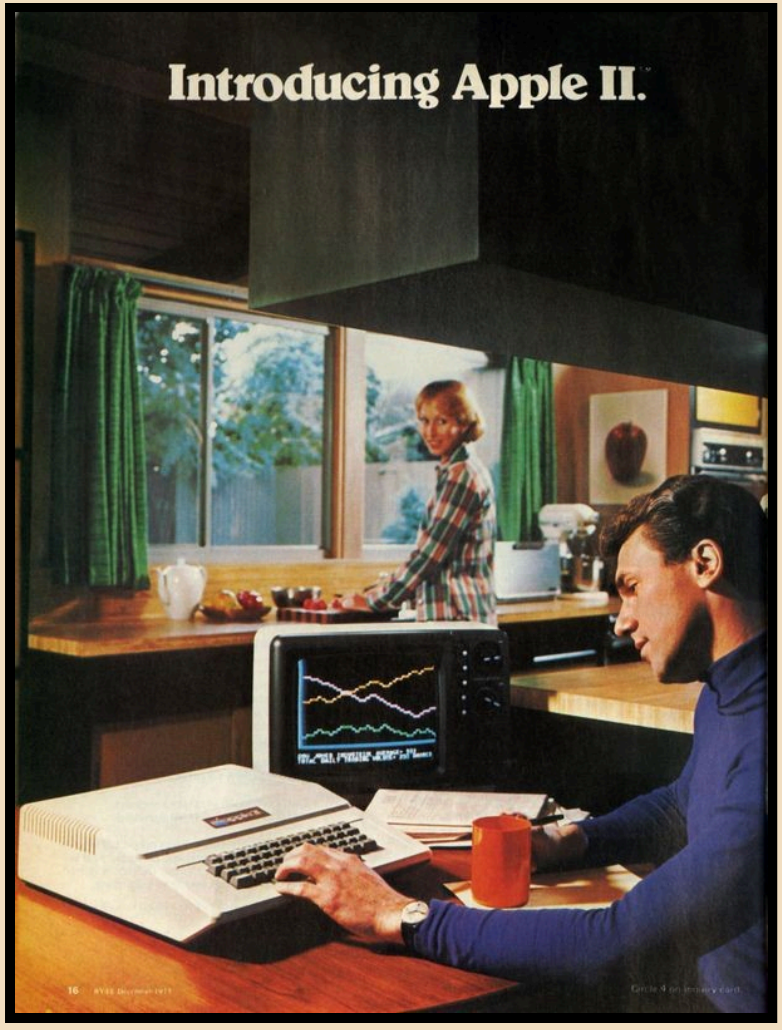

Commercialization of microcomputers

Apple II increasingly bought for running existing apps

Called the VisiCalc machine by Wall Street traders

VisiCalc and Hypercard still visionary, but more narrow

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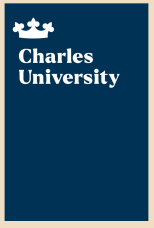
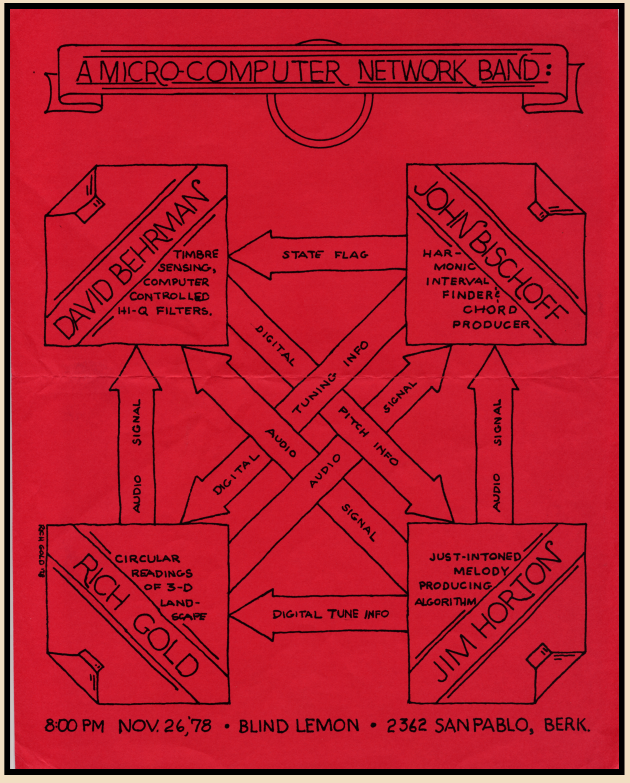
Struggle

Computer generated music



The League of Automatic Music Composers





Using KIM-1 microcomputer (1978)

Network of microcomputers to synthesize music

Composition through unexpected interactions

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Live coding - TOPLAP manifesto (2004)

"Obscurantism is dangerous. Show us your screens"

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Interactive programming

- **Innovation linked to new technologies**
  Interactive way of programming appears first
- **Humanistic and hacker reasons**
  Empowerment for education and technical reasons
- **Engineers and managers kill it?**
  Intellectual property, reliability, predictability
- **Reinvented across many disciplines**
  From TX-0 to microcomputers and live coding

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Cultures of Programming



Home → Continue to Part 9

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