Introducing the Smalltalk-80 System

Adele Goldberg
Manager, Learning Research Group
Xerox Palo Alto Research Center
3333 Coyote Hill Rd
Palo Alto CA 94304

It is rare when one can indulge in one's prejudices with relative impunity, poking a bit of good humored fun to make a point.

With this statement, Carl Helmers opened his remarks in the "About the Cover" section of the August 1978 issue of BYTE. The issue was a special on the language Pascal, so Helmers took the opportunity to present Pascal’s triangle as drawn by artist Robert Tinney. The primary allegory of the cover was the inversion of the Bermuda Triangle myth to show smooth waters within the area labeled “Pascal’s Triangle.” In explaining the allegory, Helmers guided the traveler through the FORTRAN Ocean, the BASIC Sea, around the Isle of BAL, and up to the Land of Smalltalk.

Traveling upward (in the picture) through heavy seas we come to the pinnacle, a snow white island rising like an ivory tower out of the surrounding shark infested waters. Here we find the fantastic kingdom of Smalltalk, where great and magical things happen. But alas . . . the craggy aloofness of the kingdom of Smalltalk keeps it out of the mainstream of things.

It is rare when one can indulge in one's fantasies to respond to so pointed a remark as that provided by the then editor of BYTE. This month's cover design presents just such an opportunity. It depicts the clouds clearing from around the kingdom of Smalltalk, and, with banners streaming, the Smalltalk system is taking flight into the mainstream of the computer programming community. This cover was also executed by Robert Tinney, to the delight of the Learning Research Group (LRG) of the Xerox Palo Alto Research Center. LRG is the group that has designed, implemented, and evaluated several generations of Smalltalk over the past ten years.

The balloon on the cover symbolizes the Smalltalk-80 system that is being released this year for more general access. The release is in the form of publications and a file containing the Smalltalk-80 programming system. Twelve articles describing the system appear in this issue of BYTE. Through such publication, LRG’s research will become generally accessible, dispelling the clouds.

Smalltalk is the name LRG assigned to the software
part of Alan Kay's personal computing vision, the Dynabook. The vision is a hand-held, high-performance computer with a high-resolution display, input and output devices supporting visual and audio communication paths, and network connections to shared information resources. LRG's goal is to support an individual's ability to use the Dynabook creatively. This requires an understanding of the interactions among language, knowledge, and communication. To this end, LRG does research on the design and implementation of programming languages, programming systems, data bases, virtual memories, and user interfaces.

The ivory tower on the island of Smalltalk is an exciting, creative place in which to work on these ideas. A sense of LRG's long-range goals is aptly portrayed in the illustrations designed by Ted Kaehler.

In figure 1, we see a view of the conventional software development environment: a wizard sitting on his own computational cloud creating his notion of a Taj Mahal in which programmers can indulge in building applications for nonprogramming users. The Taj Mahal represents a complete programming environment, which includes the tools for developing programs as well as the language in which the programs are written. The users must walk whatever bridge the programmer builds.

A goal in the design of the Smalltalk system was to create the Taj Mahal so that programmers can modify it by building application kits, which are specialized exten-
sections and/or subsets of the system whose parts can be used by a nonprogrammer to build a customized version of the application. Applications that can be created from a kit are related in a fundamental way: the programmer may, for example, create it for building bridges, but it is the user who pieces together the parts to create a customized bridge (see figure 2).

One of LRG's current research goals is to provide system parts to aid the programmer in creating kits. Although Smalltalk itself is conceptually sufficient for this task, it needs better support to help the programmer piece together the graphical display and the control for an interactive user interface. This is the "kit maker," as shown in figure 3.
TAKE A STEP TOWARD TOMORROW

At MSI our small company environment encourages big ideas. If you've been thinking about a high technology career in micro-computers that offers high visibility, then why not think about MSI, the leader in Hand-Held Source Data Entry Systems. For Software Professionals, the following positions are now available.

PROJECT GROUP LEADERS

Needed to direct a small team of technical professionals in:

High Level Languages
Background in HLL, i.e., PASCAL, ALGOL, etc., needed for development of Automatic Program Generator Systems using BASIC compiler and other languages. Assembly language required.

Operating Systems
Assembly language and/or interpreter experience required. Hardware interface experience desirable. Must have strong documentation and design skills. Knowledge of FORTH and PASCAL preferred.

SENIOR ENGINEERING PROGRAMMERS

Test and Integration
Background in test planning and evaluation. Will be responsible for forming new group of specialists to develop test programs, implement test procedures and integrate software products.

Communications Development
Requires extensive experience in systems and programming. Knowledge of BSC protocols desirable and Hardware interface background in assembly language required. Familiarity with FORTH or PASCAL preferred.

Operating Systems Development
Senior and Intermediate Engineering Programmers. Assembly language programming experience on micro and mini-computers needed to create application solution systems for our new Route Accounting, Program Management Group. Experience in HIGH LEVEL LANGUAGE and FORTH would be a plus.

SOFTWARE TECHNICAL WRITER

Responsible for development and design of software documentation manuals, including writing maintenance documents, operating instructions and design specifications. Degree plus 3 years' software documentation experience in Assembly and HIGH LEVEL LANGUAGE. Background in FORTH would be a plus.

We offer a complete benefits portfolio including paid medical, dental and life insurance, 100% tuition reimbursement, and retirement benefits.

Please contact or call collect:

Joan Ramstedt
MSI Data Corporation
340 Fischer Avenue, Costa Mesa, CA 92626
(714) 549-6125

An Equal Opportunity Employer M/F/H

As part of the Dynabook vision, the system should help the programmer build a personal computational cloud (see figure 4). Two research projects, ThingLab by Alan Borning and PIE by Ira Goldstein and Danny Bobrow, took advantage of Smalltalk's support for creating new metaphors.

We are often asked: "What makes Smalltalk different from other languages?" The articles in this issue attempt to answer that question. Look for an emphasis on interactive graphics, on modular development of programs, and on integrated approaches to accessing program development tools. Also, look for the distinction between a programming language and a programming system, and consider the difference in providing a system in which the user can feel individual mastery over complexity. Although each article can be read independently of the
others, knowledge of the Smalltalk-80 system and its design philosophy is a prerequisite to understanding many of them. The map in figure 5 is presented to help the reader find a course through this hitherto uncharted ivory tower.

You can begin at the drawbridge by reading Dave Robinson's introduction to object-oriented programming (page 74) and then proceed by reading the description of the Smalltalk-80 language (page 36). The two examples of control structures (page 230); the other, by Peter Deutsch, describes how to build control structures (page 322). Or, you can follow a hallway to the user interface window and read Larry Tesler's description of the Smalltalk programming environment (page 90). Trygve Reenskaug offers further perspectives on providing a programming interface to a Smalltalk system (page 147).

At any time, you can take the side stairs to read Dan Ingalls' presentation of the design principles behind Smalltalk (page 286). Those readers who are interested in implementation details can head for the cellar and read Glenn Krasner's article on the Smalltalk virtual machine (page 300), or Ted Kaehler's article on a Smalltalk virtual memory (page 378).

The walls of the tower are covered with visual images that will please any graphics enthusiast. Many were created by the ToolBox painting component of Smalltalk, as described in Bill Bowman and Bob Flegal's article (page 369). Greater detail about the Smalltalk graphics kernel is provided by Dan Ingalls (page 168).

Ivory towers are often associated with educational enterprises. So it is not surprising that field studies of the various versions of Smalltalk have been carried out mostly in educational settings; elementary, junior, and senior high school students as well as university students have helped us test our ideas. Joan Ross and I provide some of the history in an article exploring whether the Smalltalk-80 system is for children (page 348).

Many people have helped to build our ivory tower, to surround it with protective clouds, and then to blow some of the clouds away. All the people, past and present, of the Xerox Palo Alto Research Center contributed a brick or two. George Fike, vice president of Corporate Research, assembled the bricklayers. We especially herald the person who is responsible for laying the foundation, Alan Kay, and current members of LRG not named as article scribes: Peggy Asprey, Alan Borning, Laura Gould, Bruce Horn, Neil Jacobstein, Kim McCall, Diana Merry, Steve Putz, and Steve Weyer. Special thanks to Bert Sutherland who did the "preflight check."

BAR CODE FOR YOUR SMALL COMPUTER.

New in-depth report tells you how-at savings of up to $40,000.

"Contemporary Applications of Optical Bar Code Technology" is a new, comprehensive report from North American Technology that can save you thousands of dollars in research and development time when programming and equipping your small computer for bar code.

Written by the originators of Byte Magazine's experiments with publication of software in printed form, Walter Banks and Carl Helmers, this report is the only complete presentation of materials on keyless data entry using modern bar code technology. It will enable you to:

- Read HP-41C calculator formats into your Apple, or other suitable computer.
- Prepare and deliver machine readable printed software to your customers.
- Read a UPC code into your personal computer.
- Print Code 39 manufacturing inventory tags with your formed character or dot matrix printer.

Here, in clear, concise, understandable language is all you need to know about bar code history, software engineering requirements, complete machine independent Pascal software in source listing and machine-readable bar code forms. There is also description of software to generate and read all major formats from Code 39 to HP-41C, and UPC to the new NATI text software publication format. You get information you can use to program your small computer for bar code without detail processing by a human operator. This method speeds the operation, eliminates translation and entry errors and, where desirable, permits the use of unskilled personnel for the entry function. You save thousands of dollars as a result. The $500 purchase price of the report includes license for the commercial modification and use of all software contained therein.

For detailed information, send for our brochure. There is no cost or obligation.

Mail the coupon today.

NORTH AMERICAN TECHNOLOGY, INC.

Strand Building
174 Concord St.
Peterborough, NH 03458
(603) 924-6048

Please send me your FREE brochure on "Contemporary Applications of Optical Bar Code Technology"

NAME: __________________________
ADDRESS: _______________________
CITY: ___________________________
STATE: __________________________
ZIP: ____________________________

Circle 407 on inquiry card.