DYNABOOK: dy-na-MITE! 2

We've been hearing about the Dynabook fantasy for a long time. Below are some excerpts from the recently published report on the Dynabook project, entitled "Personal Dynamic Media" by the Learning Research Group, Xerox Palo Alto Research Center. Inquiries about this project may be addressed to Adele Goldberg, Learning Reasearch Group, Xerox Palo Alto Research Center, 3333 Coyote Hill Road, Palo Alto, CA. 94304.

I. Introduction

The Xerox Learning Research group (LRG) is concerned with all aspects of the communication and manipulation of knowledge. We design, build, and use dynamic media which can be made accessible to human beings of all ages. Several years ago, we crystallized our dreams into a design idea for a personal dynamic medium the size of a notebook (the *Dynabook*) which can be owned by everyone and has the power to handle virtually all of its owner's information-related needs. Towards this goal we have designed and built a communications system: the Smalltalk language, implemented on small computers we refer to as interim Dynabooks. We are exploring the use of this system for programming and problem solving; as an interactive memory for the storage and manipulation of data; as a text editor; and as a medium for expression through drawing, painting, animating pictures, and composing and generating music.

We have used our experimental experiences with our interim Dynabooks to guide the design of learning activities and examples for children in different age groups: preschool, primary, intermediate, and high school. Since children differ as to interest and intellectual development, each activity explores the potential of this new medium for these various groups. Our work with adults includes those in fields other than the computer sciences, especially those who are professionally involved with handling knowledge, such as secretaries and librarians.

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Suppose it had enough power to outrace your senses of sight and hearing, enough capacity to store for later retrieval thousands of page-equivalents of reference material, poems, letters, recipes, records, drawings, animations, musical scores, waveforms, dynamic simulations, and anything else you would like to remember and change.

We envision a device as small and portable as possible which could both take in and give out information in quantities approaching that of human sensory systems. Visual output should be, at the least, of higher quality than what can be obtained from newsprint. Audio output should adhere to similar high fidelity standards.

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Our design strategy, then, divides the problem. The burden of system design and specification is transferred to the user (who will generally not be a computer scientist). This approach will only work if we do a very careful and comprehensive job of providing a general medium of communication which will allow ordinary users to casually and easily describe their desires for a specific tool. We must also provide enough already-written general tools so that a user need not start from scratch for most things he or she may wish to do.

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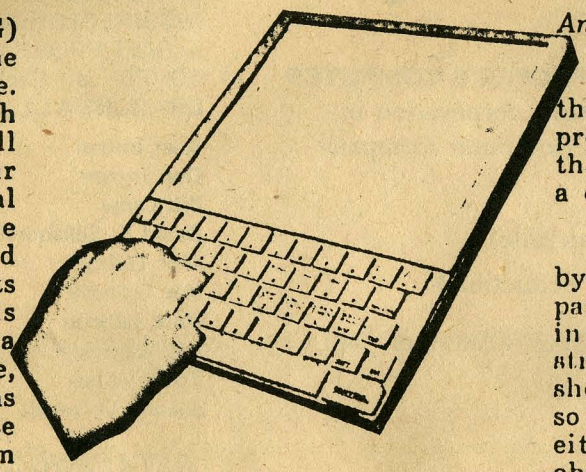
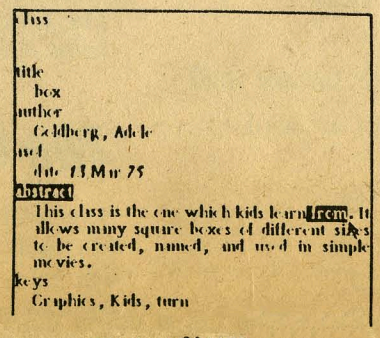
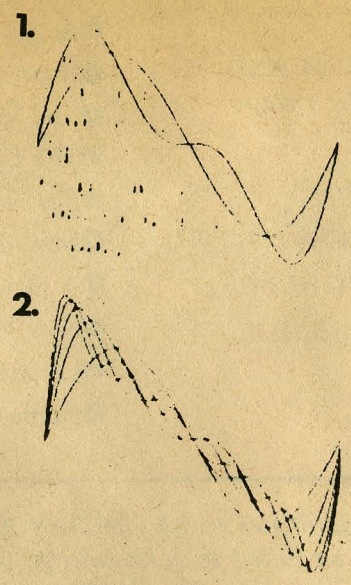
If such a machine is designed in a way that *any* owner can mold and channel its power to his own needs, then a new kind of medium will have been created: a metamedium, whose content is a wide range of already-existing and not-yet-invented media.

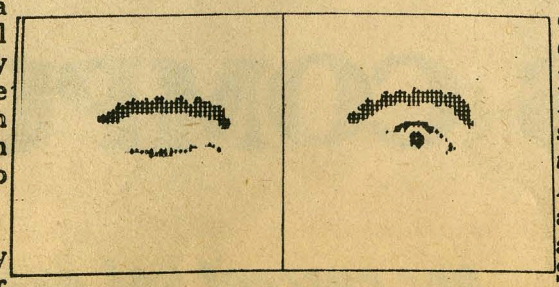




text editor



generation of a timbre



blinking pairs--
two frame movies

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Animation and Music

Animation, music, and programming can be thought of as different *sensory views* of dynamic processes. The structural similarities among them are apparent in Smalltalk, which provides a common framework for expressing these ideas.

All of the systems are equally controllable by hand or by program. Thus, drawing and painting can be done using a pointing device or in conjunction with programs which draw straight lines or curves, fill in areas with tone, show perspectives of 3-dimensional models, and so on. Any graphic expression can be animated, either reflecting a simulation (such as bouncing objects in free space) or by example (giving an "animator" program a sample trace or a route to follow).

Music is controlled in a completely analogous manner. The Dynabook can act as a "super synthesizer" getting direction either from a keyboard or from a "score" (a sequence of actions over time). The keystrokes can be captured, edited and played back. Children can both learn to play (coordinating their minds and bodies) and compose at the same time because they do not have to spend several years becoming good enough technically to play their own compositions.

Timbres are the "fonts" of musical expression as they contain the quality and mood which different instruments bring to an orchestration. They may be captured, edited and used dynamically.

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Much of the design of SHAZAM is an automation of the media with which animators are familiar: *movies* consisting of sequences of *frames* which are a composition of transparent *cels* containing foreground and background drawings. Besides retaining these basic concepts of conventional animation, SHAZAM incorporates some creative supplementary capabilities.

Animators know that the main action of animation is due not to an individual frame, but to the change from one frame to the next. It is therefore much easier to plan an animation if it can be seen moving as it is being created. SHAZAM allows any cel of any frame in an animation to be edited while the animation is in progress. A library of already created cels is maintained. The animation can be single-stepped; individual cels can be repositioned, reframed, and redrawn; newframes can be inserted; and a frame sequence can be created at any time by attaching the cel to the pointing device, then "showing" the system what kind of movement is desired. The cels can be stacked for background parallax; *holes* and *windows* are made with *transparent* paint. Animation objects can be painted by programs as well as by hand. The control of the animation can also be easily done from a Smalltalk simulation. For example, an animation of objects bouncing in a room is most easily accomplished by a few lines of Smalltalk which expresses the class of bouncing objects in physical terms.