Education Letter

Published by the Harvard Graduate School of Education in association with Harvard University Press

Volume VI, Number 2 March/April 1990

Video Screens: Are They Changing the Way Children Learn?

By Patricia Marks Greenfield

The video screen has become omnipresent in our society. Along with television, action video games are now a mass medium. In a recent survey of children in southern California, conducted by Sarah Rushbrook, 94 percent said they had played video games either at home or in an arcade (and many in both places). While national statistics are not available, we do know that as of December 1988 the sale of Nintendo game sets numbered 14 million.

When parents and educators worry about the amount of time children spend in front of video screens, they usually focus on the content of particular programs or games. My concern, however, is with the effects of media per se, the formal features that are used to transmit a broad range of specific content. What difference does the video screen make in the way children and adults process information? More generally, what difference does experience with moving visual imagery make in the way learners learn?

Traditionally, the term "literacy" has been defined as the ability to read and write. Formal education itself grew up around the technology of print. As a consequence, instead of thinking of print as just one of many technologies of communication, we have equated it with education. The video screen, however, is helping children develop a new kind of literacy—visual literacy—that they will need to thrive in a technological world.

Mental Mapping

In television or film, the viewer must mentally integrate diverse camera shots of a scene to construct an image of the whole. This is an element of visual literacy: an understanding of the code by which to interpret linkages between shots or views.

Castle Wolfenstein is an example of an action video game that calls upon the same ability to construct space. In this game, players (using a joystick to control the character shown at the bottom right-hand corner of the top maze in Figure 1) must escape from a series of mazes, which they encounter one at a time on the screen. The individual mazes are

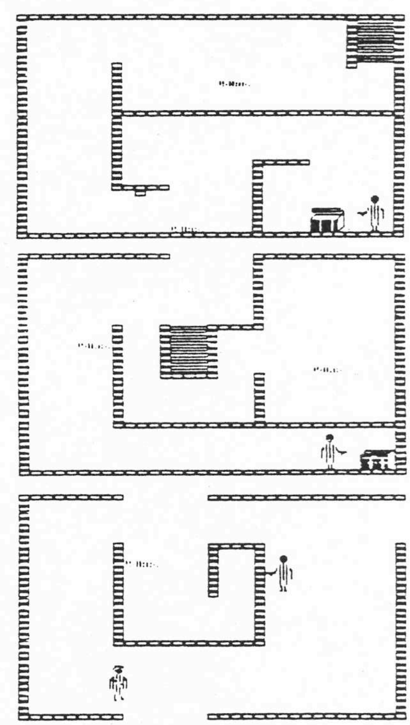

Figure 1. Three screens from Castle Wolfenstein.

linked to make up a castle. Links are depicted either as stairways (at top right of the top maze; in the middle of the middle maze), or as doorways (breaks in the walls of the middle and lower mazes). In order to become skilled at escaping from the castle, players must put the individual mazes together in their minds to form a map of its layout.

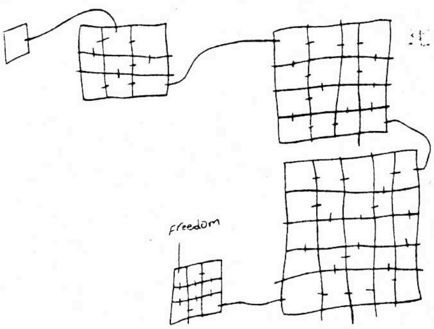

Figure 2. An expert player's mental map of Castle Wolfenstein. Long wavy lines represent the "stairways"; cross-hatches represent the "doorways."

A conversation with my son, Matthew, provided my first indication that this was a visual convention taken for granted by expert video game players—but not by novices like me. In playing Castle Wolfenstein for the first time, I had no idea that the mazes were spatially linked but assumed, instead, that they were randomly ordered.

The type of model that video game experts construct from the fragments of individual game screens is shown in Figure 2—a quick sketch of Castle Wolfenstein made for me by a 15-year-old, Paul Riskin, when he learned that I was interested in the spatial aspects of the game. Each square represents one maze or screen; the wavy lines represent the stairways shown in Figure 1; the cross-hatches represent the doorways.

Paul's map is not completely accurate. But the point is that he had a map of the whole castle in his head while he was playing the game. Players of video games, like television and film viewers, are learning part of a code—an iconic (that is, pictorial) code rather than a symbolic print code. In this particular case, they are learning to interpret fragments as connected space; and the code, once again, originates in the technology itself.

Indeed, the technology in question here is computer technology. Every computer program is organized like Castle Wolfenstein in an important sense: you cannot move to all locations in the program from any given location. You have to know the pathway that links Point X with Point Y, and this requires a mental model of the program. In a book, in contrast, you do not need a map, but can move freely from one page to any other page.

The map of Castle Wolfenstein is therefore analogous to a mapping of the links in any computer program. A video game of this type provides informal education that is relevant to the world of computers.

The Media Message

In an experiment at the University of Rome, Luigia Camaioni, Paola Ercolani, Paola Perucchini, and I tested the effect of prior experience with video games on students' ability to understand scientific or technical material presented on a computer screen. Animated video displays simulated the logic of computer circuitry.

Students took a pretest and a posttest assessing their comprehension of the simulation. In between the two tests, one group played a video game called Evolution for several hours. Another group played a concentration-type memory game on the computer for the same amount of time. A third group played the same memory game but in a different medium: they mechanically opened windows on a board to reveal symbols underneath. A fourth group simply took the pretest and posttest.

Both the action video game and the computer memory game—but not the mechanical memory game—led to significantly improved performance on the posttest. That is, two different contents presented in the same (computer) medium produced similar improvements in students' comprehension of the simulation, whereas the same content (a memory task) presented in two different media did not. The medium—not the content—carried the cognitive message.

What the video game, the computer memory game, and the animated simulation of computer circuitry have in common is the necessity to decode and interpret dynamic computer graphics. Increasingly, scientific and technical problem-solving requires this type of visual literacy skill.

Seeing versus Hearing

In another experiment, Jessica Beagles-Roos and I compared children's responses to stories presented on television and on radio. The major advantage of television was that the combination of image and word led to better overall *memory for information* than did word alone. In addition, television led to better *memory for action information* in particular. This finding should be no surprise when we consider the great success of action sports on TV. It is hard to imagine listening to the Olympics on the radio!

On the negative side, television—with its visual images—was less stimulating to the *imagination*. After watching an incomplete story on TV, children were less likely to add new or original material than after listening to a similar story on the radio.

THE HARVARD EDUCATION LETTER (ISSN 8775-3716) is published bimonthly for $24.00 per year by the Harvard Graduate School of Education, Longfellow Hall, Appian Way, Cambridge, MA 02138-3752, in association with Harvard University Press. Second class postage paid at Boston, Massachusetts. POSTMASTER: Send address change to The Harvard Education Letter, 79 Garden Street, Cambridge, MA 02138-1423.

Articles in THE HARVARD EDUCATION LETTER represent the views of the editor in consultation with the editorial board. Signed articles represent the views of the authors.

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In addition, the television version resulted in significantly less *memory of dialogue*, even though both versions had exactly the same soundtrack. It seems as though unrelated visual imagery distracts attention from purely verbal information, a finding of potential social importance. For example, judgments about a presidential debate—in principle a verbal duel—are greatly affected and, according to my analysis, potentially distorted by attention to visual images.

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In our study, television also led to more *vague references*. In retelling a story to someone who had not seen it, children were more likely than they were in retelling a radio story to say "he" or "the man" without specifying the character in question. Apparently, the children in the TV group were unconsciously referring to visual images in their heads, even though these images were not shared by their listeners.

Finally, we found that children exerted less mental effort after watching TV than after listening to the radio. Each child was exposed to one story on radio and one on TV, with about a week elapsing in between. When the TV story came first, overall performance on measures of imagination and recall was diminished in both sessions, compared with the opposite order of radio first. The lower level of mental effort induced by the TV story appeared to affect response to the radio stimulus a week later.

School Strategies

In sum, the dynamic visual imagery shared by film and all of the video media produces a number of cognitive benefits: (1) an array of visual literacy skills, (2) better acquisition of information in general, and (3) better acquisition of action information in particular. On the negative side, dynamic visual imagery leads to (1) decreased stimulation of imagination, (2) a decrease in mental effort, and (3) a decrease in attention to purely verbal information.

Among educators today, the general philosophy is that we should compensate for the large quantities of television and video games children are exposed to outside of school by relying exclusively on other media—notably print—in school. This compensation strategy certainly has some validity, but it must be expanded.

First, this strategy has been too narrowly interpreted. It must also include compensation for possible *inequalities* in media experience that children receive outside of school. In other words, the planning of formal education needs to take into account children's informal educational experiences.

If visual literacy skills constitute an important element of preparation for the world of computers, then there is a problem that has not been mentioned up to now: a gender gap. Boys play video and computer games more than girls, partly because, as Thomas Malone has shown, they are attracted to the violent themes that are all too frequent in the games.

Parents can selectively purchase nonviolent games for their home machines. Nevertheless, schools may need to understand the gender inequality in informal education, and to compensate for it by giving girls extra experience with computer literacy. Such experiences could include computer graphics, word processing, programming, and educational games.

We must also move beyond the compensation strategy to at least two others:

1. *The stimulation strategy:* This strategy has to do with teaching about television in school. The goal is to get children to watch TV more critically, to understand the nature of the code and the conventions and techniques by which effects are produced. This is the way schools deal with literature. We assign selected books and teach literary analysis, so that when people read for pleasure outside of school they will choose more challenging reading and understand it on a deeper level.

If reading instruction did not go this far, but stopped at the decoding level, we might all still be reading comic books for pleasure. That is exactly what happens with television: it is not taught in school, so children try to watch the TV equivalent of comic books when they go home. Rosemary Lehman's research indicates that, when television analysis is taught in elementary school, children become more analytic in *how* they watch and more discerning in *what* they watch.

No medium—not even print—is perfect for education. Each medium should be used to do what it does best.

In the traditional print medium, we learn to write as well as to read. The fact that we generally consume television but do not produce it may be one factor that causes us to be less mentally active with the medium. Now that video equipment has become so affordable, light, and simple to use, schools could provide opportunities for children to produce television as well as to consume it.

Because computers are intrinsically interactive, there is a productive aspect to all computer uses, including video games. Computer programming takes production to its ultimate degree. For this reason, it is important that programming have a central role in computer education in the schools, and video games are often a favorite programming topic. Producing games should make children more critical of the games they interact with as consumers.

2. *The multimedia strategy.* It should be clear from the preceding discussion that each medium has its strengths and weaknesses. No medium—not even print—is perfect for education. The implication for education is that each medium

should be used to do what it does best. For example, since audio makes dialogue relatively salient, it is an excellent way to present dramatic literature; since television makes action relatively salient, it can be used for science demonstrations.

Combinations of media can bring out various facets of a topic and increase children's awareness of the qualities and conventions of each medium. While media should not be used as a substitute for direct experience, we live in a multimedia world, and schools need to learn how to use each medium to its best educational advantage.

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Collaborating to Write: An Interview with Eliot Wigginton

Since 1966, Eliot Wigginton's students at Rabun County High School in Georgia have published Foxfire, *a magazine featuring their own writings about local history, folklore, and crafts. Anthologized in a series of nine books,* Foxfire *has inspired many similar projects across the country. In his book* Sometimes a Shining Moment: The Foxfire Experience *(Doubleday, 1985), Wigginton described the philosophy behind his efforts. Recently, Wigginton became a MacArthur Prize Fellow in recognition of his outstanding contributions to education. In addition to teaching, he is involved in developing courses and support networks for teachers.*

HEL: What was the impetus for becoming involved in teacher education?

EW: When the first Foxfire book came out, teachers from all over the country wrote to us, asking how to make something similar happen in their own communities. We sent them information about how to help the kids conduct and transcribe interviews, how to build a darkroom, how to publish and copyright a magazine. In other words, we transferred the mechanics and ignored the fact that there was a philosophy at work that made the projects successful in Rabun County.

Consequently, teachers would decide that their class would produce a magazine, and teachers would decide on the contents, negotiate with the principal, find the money for it, choose the name, and assign the articles to students who in fact did not want to do that work. This, of course, misses the whole point, which is that a magazine is only one of thousands of things that can result from the pedagogy that Foxfire stands for.

HEL: How would you characterize your pedagogy?

EW: What I'm striving for is a classroom that functions as a learning laboratory, instead of a place where students get walked through the pages of a textbook; a classroom where every year all of us are involved in some new enterprises, and where all of us together are constantly evaluating where we are. "Is this working or not," or "How are we going to get the three students in the back of the room involved who haven't caught fire yet? How can we make sure that everybody crosses the finish line at the same time and that everybody is being stretched?"

Inside this room, we will not embarrass each other or compete. Inside this room, the kinds of things that students don't quite understand yet are the things that we celebrate. That's one of the beauties of these projects—kids constantly get baffled or stuck. As students watch how you treat their mistakes, they'll understand very quickly that the agenda here is not to isolate those who know from those who don't.

HEL: What if you have a group that can't come up with a project idea?

EW: Normally that happens only in situations where the teacher says, "What would you like to do?" and the kids don't know the options and don't have a clue as to what to suggest. What's required is a different kind of questioning process, which always starts with a set of givens. "OK, folks, what we are about in this room is writing, literature, and grammar. We can't get away with cooking pizzas for the rest of the year."

The questions flow from that agenda. You say something like: "Let's take a look at writing. List all the places where you see writing or the results of writing in the real world." Before you know it, you have a list of a hundred items; they might say trayliners at McDonald's, movies, soap operas, or magazines. And then the next question is, "Of all the items on that list, which do you think you might be interested in trying to do—pick one."

Take trayliners for an example. The next question is "what kinds of trayliners could we design—let's brainstorm a list of possibilities." Maybe you're in a town where there