Reflections

by Seymour Papert

Congratulations to *Logo Exchange* on entering its second decade! And one could almost say the same for Logo itself; if you count its birth from the time it was carried into the big world by the advent of little computers, the nineties will be Logo's second decade. But for me it will be the fourth: With a little playfully upbeat projection (appropriate for an anniversary celebration) I see Logo as conceived in the sixties, gestated in the seventies, toddling through the eighties, coming of age in the nineties, and reaching real maturity in the tenties.[1]

That's one way to look at it. But I long ago understood that unless you make three theories of everything, you start taking your ideas too seriously. So, in the hope of finding another, I cast around in my mind for metaphors that have served in related contexts, and after a while the following popped into my mind: The sixties is a "classical" period, the seventies a "romantic" one, the eighties is "reactionary," and the nineties will be the "pre-millenium." Hey!—I thought to myself—don't push it too hard (trying to make Logo decades and calendar decades line up exactly is bound to stretch historical literalness—perhaps the Logo decades lag by five years), but there's something right about that idea…it captures some of the "feel" of Logo history and maybe even relates it to other stuff going on at the same time in the larger computer culture and the still larger general culture.

I'll explain myself, but first let me warn you about the third theory: *you* will have to make it. I offer my two attempts in the spirit of Logo-like constructionism: they are not intended to be believed as such but to provoke you to invent your own.[2] The only Grand Truth I'd like you to take from me is the idea that making up predictions and strategies for the future of Logo is more fun (and more valid—the two do go together) if you look beyond the latest good idea for how to use Logo well (or the latest fad for using something else) and poke around for historical patterns.

The sense in which the early Logo work is "classical" is best brought out by contrast with the "romantic" period that followed. I see it in my own writing about Logo, which in the earliest period was focused on clearly structured issues. The very title of one of my early papers (written in 1969/70) on Logo supports the point: "Teaching Children to Be Mathematicians vs. Teaching Them About Mathematics." In the paper I present Logo as a classical formal system. I argue that Logo and turtle geometry allow children to do some-

thing more like traditional mathematics than school math. I describe some new ways to define a circle and to prove a theorem, but I stay within the framework of defining circles and proving theorems. None of this explicitly challenges the traditional concept either of Mathematics or of School.

Ten years later *Mindstorms* reflects my transition from a classical to a romantic period, and it begins to challenge both School and traditional philosophies of Mathematics (of the thing itself, not merely how it is taught). My use in the book of the Brazilian Samba School as a model learning environment is romantic in the obvious sense of the word, as is the pervasive image of children as epistemologists taking charge of their own intellectual lives. But there is also a deeper sense: Challenging the right of Mathematics to impose its "canonical" epistemology can be seen as a "romantic reaction" in the more sophisticated sense that historians of literature use when they classify Byron or Mary Shelley as participating in a romantic reaction against the neoclassical hegemony of Newtonian super-rationalism.[3]

The word "romantic" links *Mindstorms* also with the populist excitement about microcomputers, which manifested itself in the computer clubs and the proliferation of computer magazines of the late seventies. The same movement was expressing itself when visionary teachers brought the first microcomputers into their classrooms. Their intention was not a classical education goal of teaching math better (though they may have believed that would happen as well) but a more romantic goal of changing people's relationship to learning and to knowledge. The impression this made on me was dramatic. Even now I can close my eyes and see vividly a 1981 scene in a New York City public school. Two worlds seem to coexist in one room: at one end a teacher is giving a "lesson" at the blackboard; at the other end, a cluster of students are working on their own projects using a pair of TI 99/4s, the first small computers with Logo. The computer group gets into trouble and sends someone to "ask the teacher," who simply says "ask Bill" and continues her lesson without missing a beat, quite unperturbed by the fact that one more student (Bill) has joined those who aren't even pretending to listen to it. The image for me is a tiny foretaste of deep change in the relationships of learning.

By the middle eighties the typical picture was changing fast. For the "romantic" teacher the whole point was to make the computer part of the life of his or her class; to use it as a means to take one more step away from the limitations school imposes on the vocation of teaching. But when the centralized administration of a school system sets up computer labs on a city-wide scale, the motivation (surprise!, surprise!) is not to subvert the structure of school but to bolster it—and nine (or more) times out of ten this is what happens. Creating a separate place for the computer, with a special computer teacher and even a computer curriculum is calculated to thwart the goal of changing the mainstream life of the classroom. This new compartmentalization tends strongly (though, thank goodness, brave teachers, it doesn't always manage) to reaffirm School's balkanization of learning, by which I mean carving knowledge into "subjects," time into "periods," and the learning community into teachers who know and students who don't. Thus the computer, which promised to be the instrument of revolutionary change, is neutralized, and often even becomes a tool of the reactionary forces.

One's projection into the nineties depends on one's theory of the eighties. Were the earlier phases, the classical and the romantic, defeated or only driven underground? In a forthcoming book.[4] I argue that the period of reaction was an inevitable stage in the development of an educational computer culture and that the old forces are still there. Here I mention only the very simplest corner of the argument. Think of the school sociologically and ask yourself what would be the "natural" way for it to distribute computers. One answer is that it depends on numbers. When there were few computers and few teachers who felt comfortable with such machines, it was "natural" that the teachers who felt comfortable with them could get the machines to integrate into their work. As soon as there were 15 or 20 computers, the pressure to isolate the machines became extremely high. I don't believe that the drive to use computers to change learning subsided. I believe that the conservative forces were temporarily in a position where their viewpoint was hard to resist. But the question is reopened when there are 40 computers and when young new teachers coming into the system have used computers routinely at home and at school. This time we have a better chance to win. And where we don't win this time, we have yet another chance the time after. History is on our side.

And so have a happy anniversary, *Logo Exchange*, and...

Forward Twenty.

Notes:
1. ```
To Decades :number
  output word
  number - name :number
    "ties
  end
```

2. And remember to be recursive. When the fairy offers you three wishes you say: I'll have a white horse (or whatever) and a pile of gold...and three more wishes.

3. On the concept of romantic reaction in the history of computational thinking and on the social movements mentioned in the next paragraph, see Sherry Turkle, *The Second Self* (New York: Simon and Shuster, 1984). On the epistemological challenge, see Turkle and Papert, "Epistemological Pluralism," a paper that has been (or will be) published in somewhat different versions in *Signs: A Journal of Feminist Studies*, Winter, 1990; in *Constructionism*, Harel and Papert, eds. (New Jersey: Ablex, 1991); and in the *Journal of Mathematical Behavior*.

4. To be published by Basic Books in 1992.