

# The Road to One-to-One: A Forty-Year Journey

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Ruben R. Puentedura, Ph.D.

Origins



**monday afternoon**

**december 9**

**3:45 p.m. / arena**

*Chairman:*

**DR. D. C. ENGELBART**

*Stanford Research Institute*

*Menlo Park, California*

## **a research center for augmenting human intellect**

This session is entirely devoted to a presentation by Dr. Engelbart on a computer-based, interactive, multiconsole display system which is being developed at Stanford Research Institute under the sponsorship of ARPA, NASA and RADC. The system is being used as an experimental laboratory for investigating principles by which interactive computer aids can augment intellectual capability. The techniques which are being described will, themselves, be used to augment the presentation.

The session will use an on-line, closed circuit television hook-up to the SRI computing system in Menlo Park.

Following the presentation remote terminals to the system, in operation, may be viewed during the remainder of the conference in a special room set aside for that purpose.



ON MAKING A THEOREM FOR A CHILD

Seymour Papert  
MIT

Part I: RHETORIC

I shall tell you about some theorems made for children. This does not mean that they are bad for adults--any more than Winnie-the-Pooh. The point is that most theorems (including the ones in the school books) are effectively X-rated. By this I mean that children can't get at them.

Before talking about my theorems I want to say something about what makes theorems good or bad. The most important factor is power. The best theorems have given men the power to think and do what no man could think or do before. But though all kids know how to rate cars by horsepower, they have never imagined there is such a thing as MATHPOWER. And it's not surprising: the stuff they call math at school gets you nowhere in doing or thinking anything. All you can do with long division is long divide...if that.

So good theorems for children should have a power punch. And the reason why I'm saying this to members of the Association for Computing Machinery is that you have the intellectual and material means to create contexts in which mathematics with a punch can be developed for use by children.

I do not mean by this merely that computers are powerful mathematical instruments and can make mathematics real for action-oriented kids. True enough; but you are scarcely scratching the surface when you use computers to teach, motivate or liven up the same old math. The concept of computation is beginning to spawn new mathe-

ple with a talent for research and a desire to contribute to the lives of children.

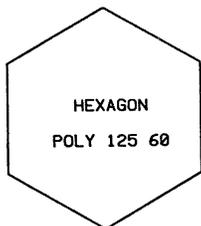
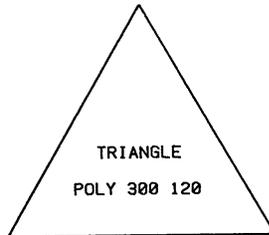
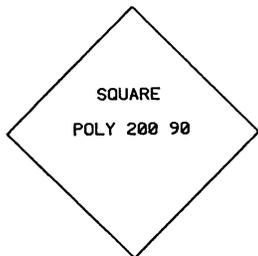
Part II: MATH

Computational geometry is an embryonic but growing branch of geometry concerned with the kinds of computation needed to generate, recognize or otherwise manipulate geometric figures. Turtle geometry is a piece of computational geometry. It is about the generation of line figures by programs which direct the motion of an abstract or real entity called a turtle. Basic turtle commands are FORWARD, which causes the turtle to move in a certain direction known as its HEADING; and RIGHT, which changes the turtle's heading by causing a clockwise rotation without change of position. Thus the STATE of a turtle is a heading and a position; the command FORWARD changes the position component, the command RIGHT changes the heading component. To indicate how much change is produced we write these commands as operators with a numerical input, measured (say) in millimeters for FORWARD and degrees for RIGHT. Thus the following program generates a square:

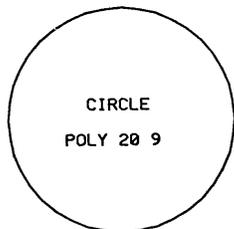
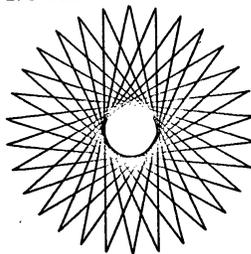
- 1 FORWARD 100
- 2 RIGHT 90
- 3 GO TO LINE 1

What input should RIGHT have in order to generate an equilateral triangle? Think before reading on! There is a fifty percent chance that you thought "RIGHT 60" before you corrected it to RIGHT 120". In

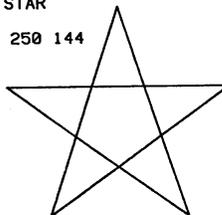
POLY PICTURES



POLY 275 156



STAR  
POLY 250 144



A Personal Computer for Children of All Ages

Alan C. Kay  
Xerox Palo Alto Research Center

Abstract

This note speculates about the emergence of personal, portable information manipulators and their effects when used by both children and adults. Although it should be read as science fiction, current trends in miniaturization and price reduction almost guarantee that many of the notions discussed will actually happen in the near future.

"To know the world one must construct it."

-Pavese

For many years it has been a tradition to attempt to cure our society's ills through technology: "You have slums? Let's build low-cost housing!" "You can't afford that TV? We'll build a cheaper one and you can buy it on time, even though it will break before you've finished paying for it!" "Your kids aren't learning and education is too expensive? We'll build you a teaching machine for less which will guarantee your kids will pass tests!"

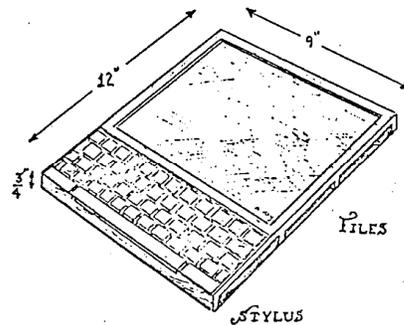
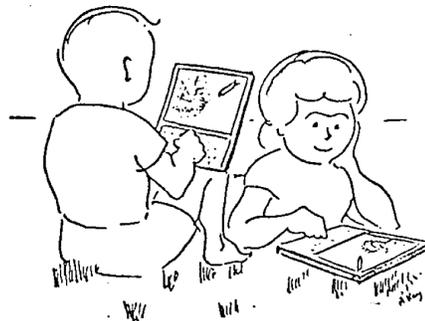
Unfortunately, most of these "cures" are no more than paint over rust; the sources of the initial problems still remain. Educational goals are even more obscured by the diverse models of the "end product" which exist: the society wants more members of the society (cultural genetics), the parents may want success, conformity, fame, or don't care; the kid is not asked (he may just want to plant beans and watch them come up).

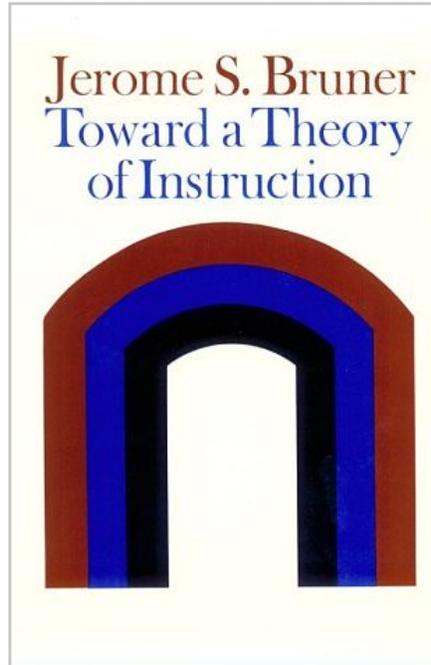
teacher? Maybe. But first, it must decide that it is a necessary and desirable goal to do so.

What we would like to do in this brief note is to discuss some aspects of the learning process which we feel can be augmented through technological media. Most of the notions have at their root a number of theories about the child that lie much closer to Piaget than to Skinner. We feel that a child is a "verb" rather than a "noun", an actor rather than an object; he is not a scaled-up pigeon or rat; he is trying to acquire a model of his surrounding environment in order to deal with it; his theories are "practical" notions of how to get from idea A to idea B rather than "consistent" branches of formal logic, etc. We would like to hook into his current modes of thought in order to influence him rather than just trying to replace his model with one of our own.

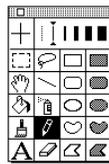
We do not feel that technology is a necessary constituent for this process any more than is the book. It may, however, provide us with a better "book", one which is active (like the child) rather than passive. It may be something with the attention grabbing powers of TV, but controllable by the child rather than the networks. It can be like a piano: (a product of technology, yes), but one which can be a tool, a toy, a medium of expression, a source of unending pleasure and delight...and, as with most gadgets in unenlightened hands, a terrible drudge!!

This new medium will not "save the world" from

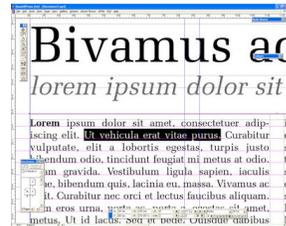




Enactive



Iconic



Symbolic

*"Doing with Images makes Symbols"*

## Implementation

1990:  
Methodist Ladies' College (Melbourne, Australia)

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Photo Credit: The Herald & Weekly Times Ltd.

2002:  
Maine Learning Technology Initiative

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2009:  
Proyecto Ceibal (Uruguay)

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Photo Credit: Fernando da Rosa

## Context

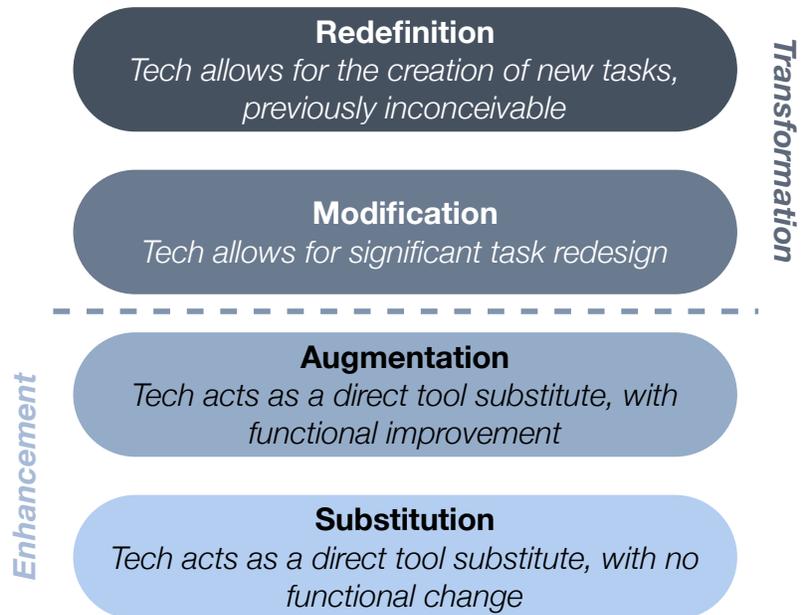
## The MLTI: Basic Facts

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- What institutions participate?
  - All middle schools
  - Over half of all high schools
- Who gets a laptop?
  - All middle school and high school teachers
  - All middle school students
  - All high school students in participating schools (approx. 23,000)
- How many laptops are currently in use?
  - 2009 Deployment: approx. 67,000
  - Some additional laptops from earlier years have been bought by schools for use in K-6 classrooms

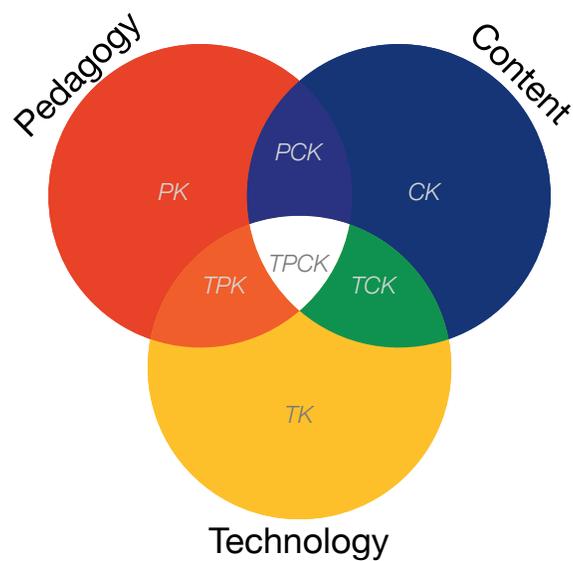
## SAMR (Puentedura)

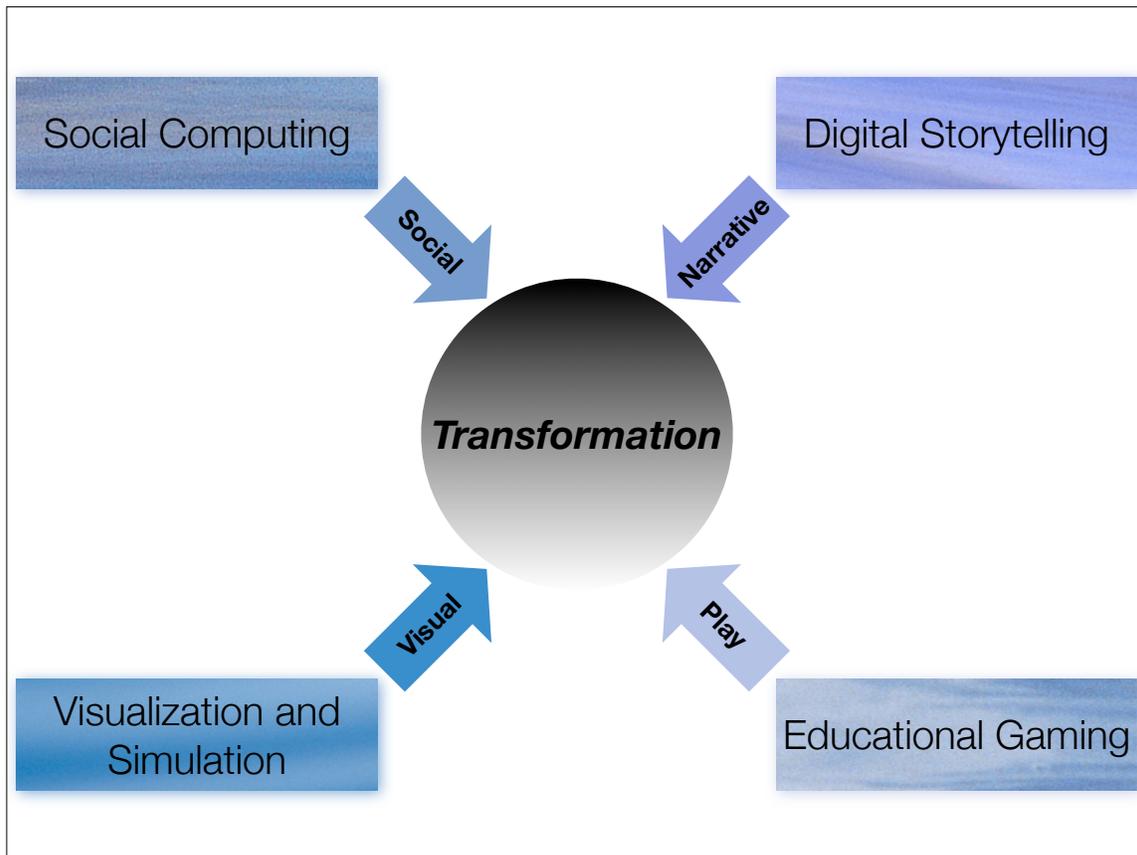
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## TPCK (Mishra & Koehler)

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**Redefinition**  
*Tech allows for the creation of new tasks, previously inconceivable*

**Modification**  
*Tech allows for significant task redesign*

**Augmentation**  
*Tech acts as a direct tool substitute, with functional improvement*

**Substitution**  
*Tech acts as a direct tool substitute, with no functional change*

The screenshot shows a digital notebook titled "English Drama 101" with a page on "Macbeth: Tragedy and Equivocation". It lists resources for Macbeth, categorized into "The Original Text", "Critical Commentary on Macbeth", "Shakespeare and his Stage", and "Classic Performances on Film". Below this is a "List of Scenes" for "The Tragedy of Macbeth", detailing Act 1 through Act 5 with specific scene descriptions.



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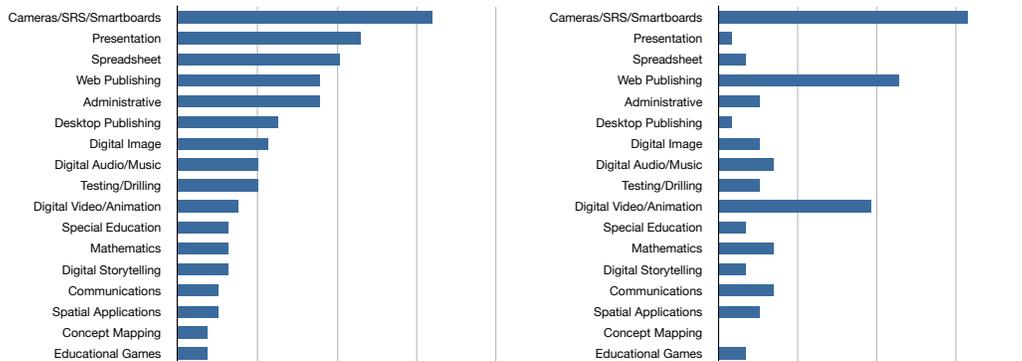
## The Key Technologies to Watch

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- One Year or Less:
  - Collaborative Environments
  - Online Communication Tools
- Two to Three Years:
  - Mobiles
  - Cloud Computing
- Four to Five Years:
  - Smart Objects
  - The Personal Web

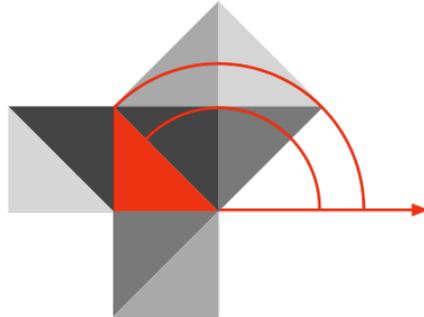
## CVEDC-ESA Survey Results Software Used/Software Wanted by Teachers

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# Hippasus

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