

Communication & Learning?

- Communication vs Mimetic Technology
- Communication technology is not unalloyed good
 - power
 - fascination and pleasure
 - deception

Communication

Information ≠ Knowledge

- Reflection vs Discourse ...

Learning as Research Activity

- **Learning by doing: Make your own**
 - tools, to encapsulate knowledge (theorems)
 - Cabrera Physics
 - Tversky Psychology
 - models, to learn how to abstract, analyze
 - views, to learn how to communicate
- **Research Environment = Learning Environment**
 - research -- understand something known to few
 - study -- understand something known to many
 - experts and novices share “language,” -- different registers, dexterity

Scholarly Gestures

- **Create and interpret models**
 - algebraic, geometric
 - relational
 - numerical, statistical
 - logical
- **Create and interpret narratives**
 - text
 - cinema
 - music
- **Annotate anything with anything**
- **Create and use functions**

What's Fundamental? What's Artifact?

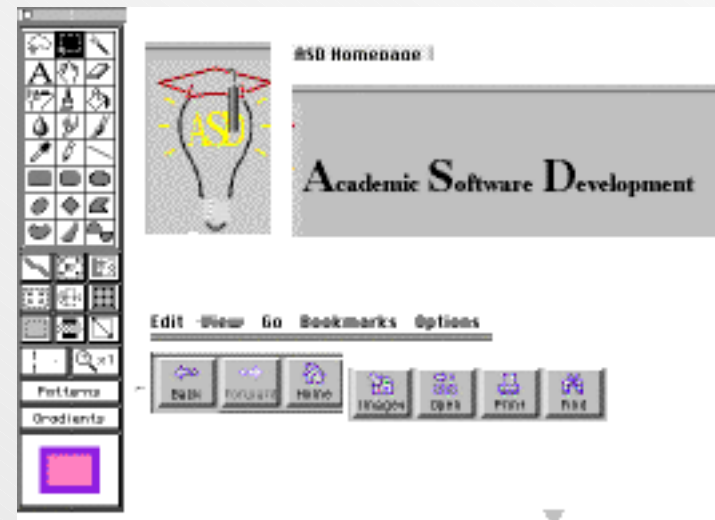
- **Network is artifact. Latency becomes**
 - object inertia
 - metric on places
- **Multimedia is an artifact.**
- **Expressivity is fundamental.**

Trends: "Computing Technology"



Monolithic, OS-bound apps ->
-> distributed tools
-> pure document

Transmit data ->
-> remote process
-> transmit objects



Trends: "Writing Technologies"

expressive

Video, film

Music, Theater

Natural (written)
language

Mathematica

Diagrams, Drawings

Structure programming
languages

Procedural programming
languages

inexpressive

hard to write

easy

Old Dualities

- Natural language narratives, analog art

17.2.11. Now define the continuous map $f_4: M \rightarrow \mathbb{R}^n$ in the following way

$$f_4(x) = \begin{cases} f_3(x) & \text{for } x \in M_i - M_i^0, \\ (1-t)f_3(x) + tpf_3(x) & \text{for } x = (b,t) \in B_i^0 \times [0,1] = T_i, \\ \tilde{f}_i(x) & \text{for } x \in M_i^0 - T_i, \end{cases}$$

where p is the projection on Γ_i , while $\tilde{f}_i: (M_i^0 - T_i) \rightarrow \Gamma_i$ is the smooth C_{n-1} -operimetric map spanning $\tilde{g}_i: B_i^0 \rightarrow \Gamma_i$, $\tilde{g}_i = pf_3$, which exists according to the induction hypothesis.

```
int main(int argc, char* argv[])
{
#ifdef DEBUG
    syslog(LOG_WARNING, "mddSession: created
mddResMgr and sessionMgr\n");
    fprintf(stderr, "mddSession: created
mddResMgr and sessionMgr\n");
    fflush(stderr);
#endif

#ifdef DEBUGREAL
    {
        char *p;
        char **argPtr;
        register int i;
        FILE *fd;

        argPtr = argv;
        i = 0;
        while (i < argc)
        {
```



Programming language, application

Performable Writing

- + Readable by human
- + Interpretable by computer

Example

Differential Equations - student projects:

Written narrative

Interpretable (math) functions

Structures amplify conversation

between teacher and student

Math 130 Term Projects Incorporated Presents:

Predator Prey, the Equations

excellent work.

This curve represents a family of solutions for the equation. Each solution is defined by x_0 and y_0 , which together define the specific elevation, or value for z . For example if we choose $z = .2$ (or conversly, we choose values for x_0 and y_0 and get a z), we can slice the curve above at $z = .2$ to get the two-dimensional curve for that value:

```
Plot3D[z, {x, 0, 6}, {y, 0, 4}, PlotRange -> {0, .2}, PlotPoints -> 4, ClipFill -> None]
```

lovely plots... would be nice to ask (the "state" of the "dy" an orbit.

Another natural que...

lovely plots, but they don't seem to match your definition for z, there must be typo

where the border of the plateau represents the two-dimensional curve for that value of z . Looking at both of these graphics in a different way, we can use ContourPlot to represent the above curves from overhead:

```
ContourPlot[z, {x, 0, 6}, {y, 0, 4}, Contours -> 40]
```


Performable Writing

Example: Quantum Mechanics Simulations

Combine symbolic with numeric functions

Combine mathematics with English narrative

Produce video in place

Schrödinger's Equation (2-dimensional version)

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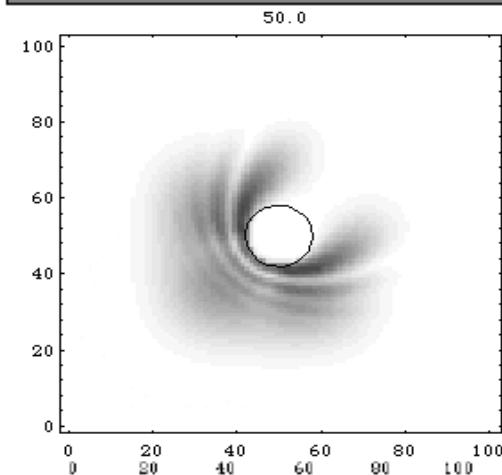
■ Experiment 1: Scattering

$$\frac{\partial \Psi}{\partial t} = \Delta \Psi + v \Psi + \lambda \Psi$$

■ Animation

```
schroed2d[0, $PSI->psi0, $T->0, $VFUNC->potential];
```

```
Do[Do[schroed2d[dt],{5}]; plotit[], {15}]
```



Problems

- **Modalities**

- Sound, Music and Speech
- Haptic
- Embed computational artifacts into physical media

- **Representations**

- Structured media: text, databases, scorefiles, Mathematica
- Opaque media: human, realia, bitmap, digital video, aiff sound

- **New writing technologies (languages) for**

- Action and interaction
- Multi-modality
- Performable literature