

SIGHT talk
(slides)



RAISE YOUR HAND
IF YOU CAN SEE THIS

OPENING

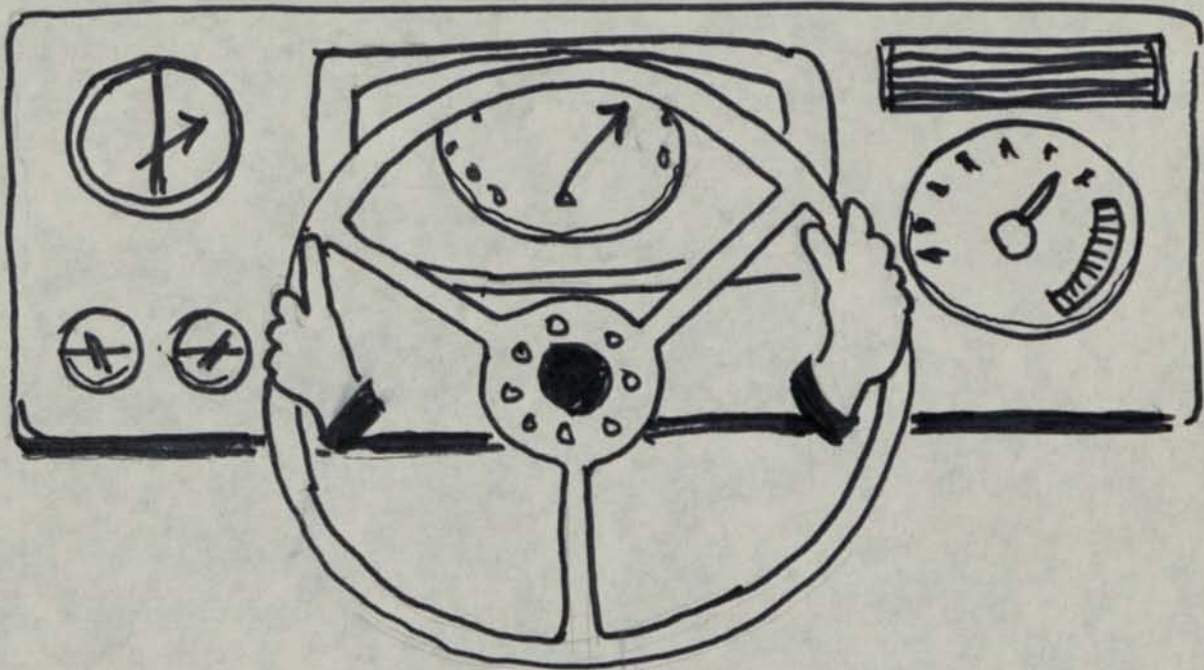
THE INTERFACE PROBLEM
ITS CONSTRAINTS

SOME SOLUTION PRINCIPLES
CRITERIA FOR SUCCESS

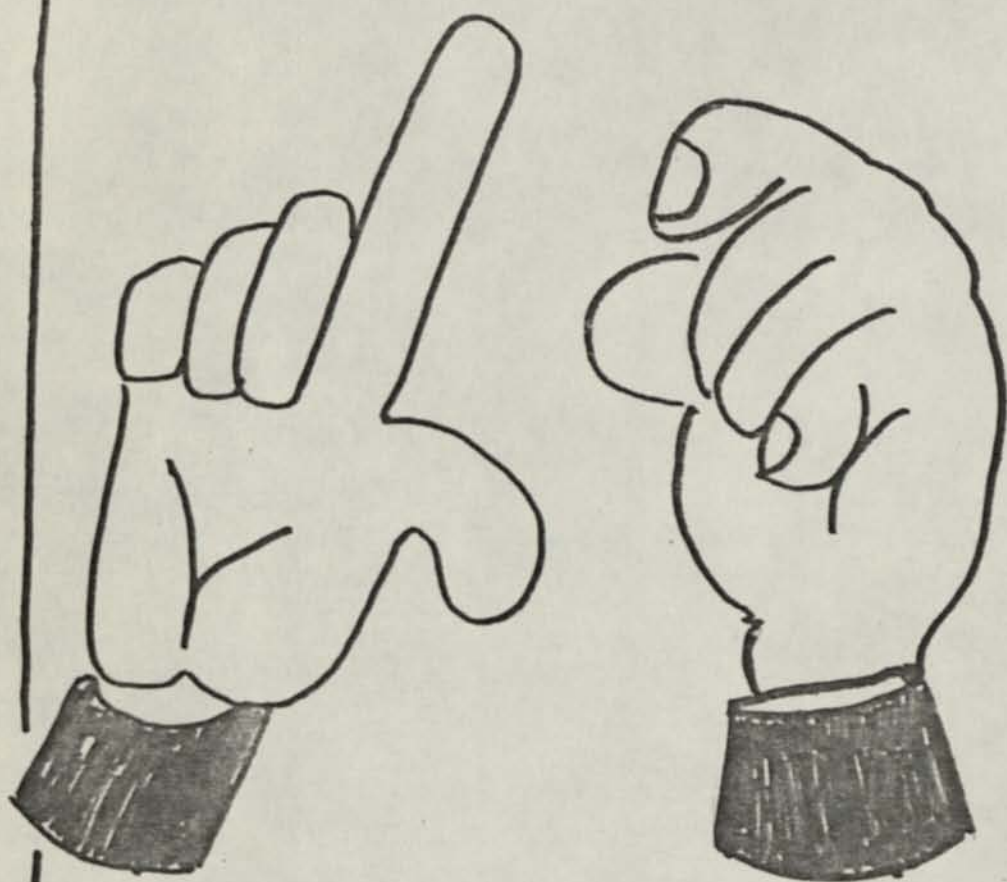
EXPLORATIONS
A VIDEOTAPE

CLOSING

"GOOD" POINTS OF
CONTACT FOR
INFORMATION EXCHANGE

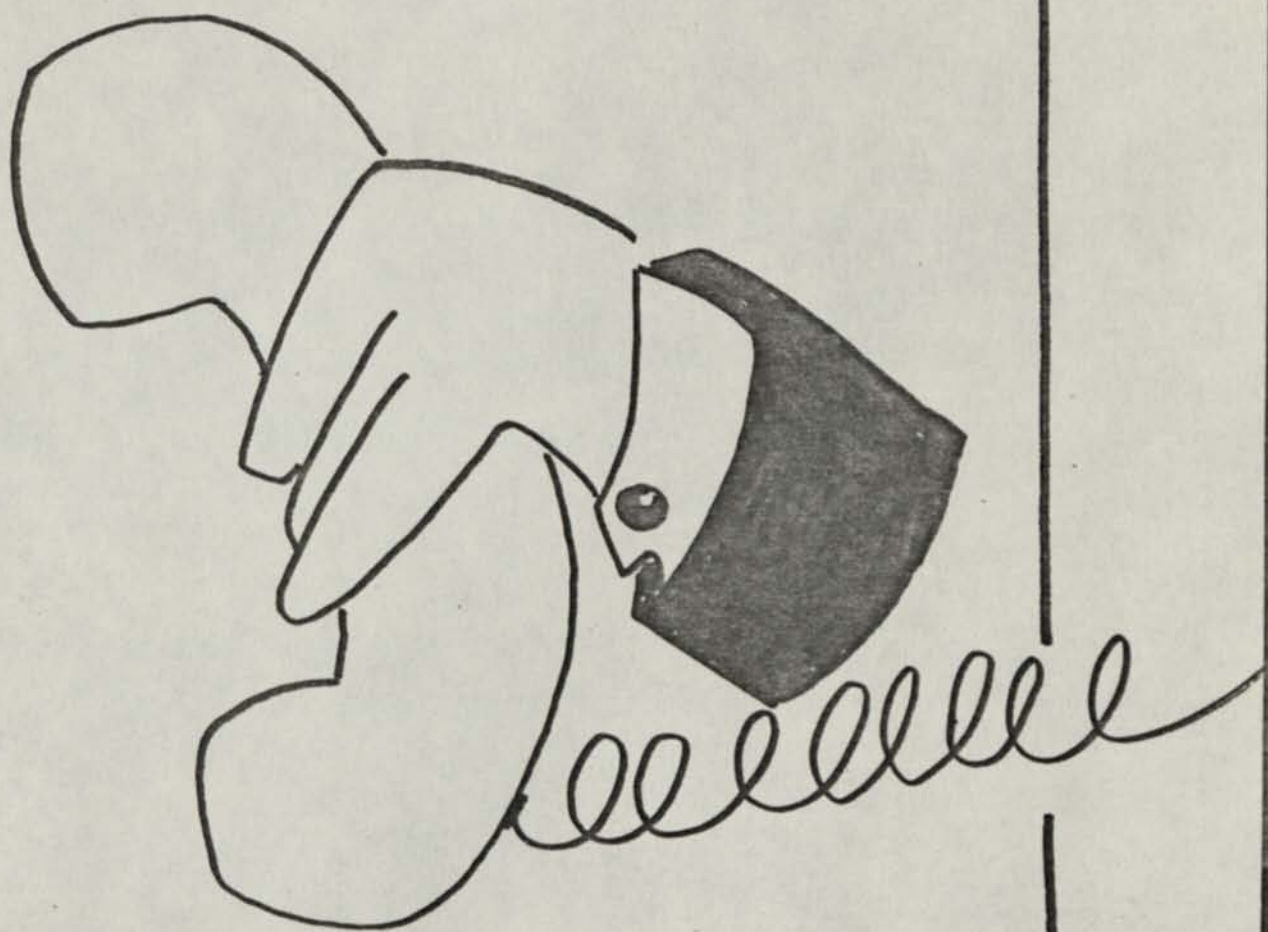


A SMALLTALK GAP



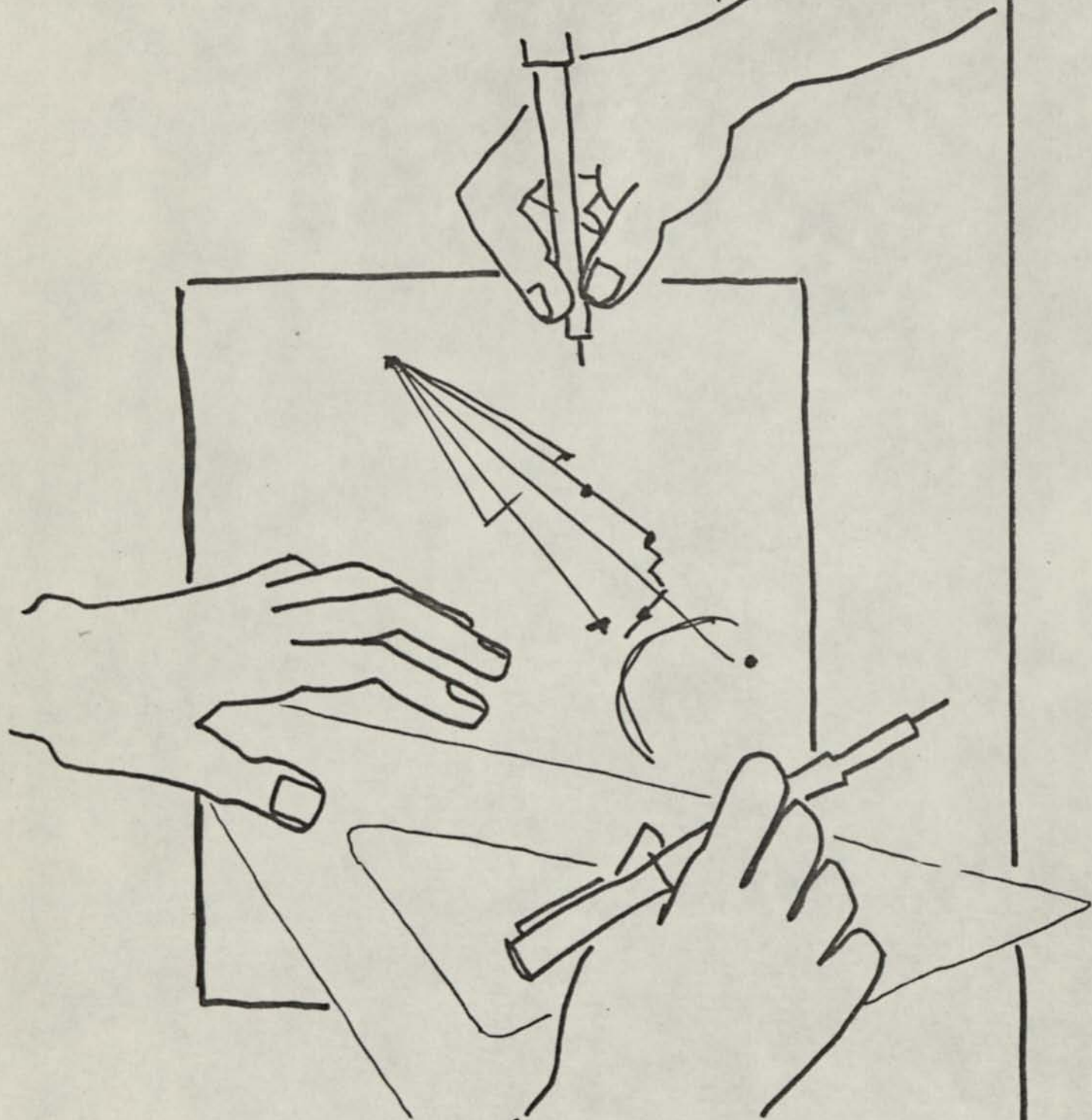
CAN'T EXPRESS WHAT
THE USER CAN EXPRESS

A SMALLTALK GAP



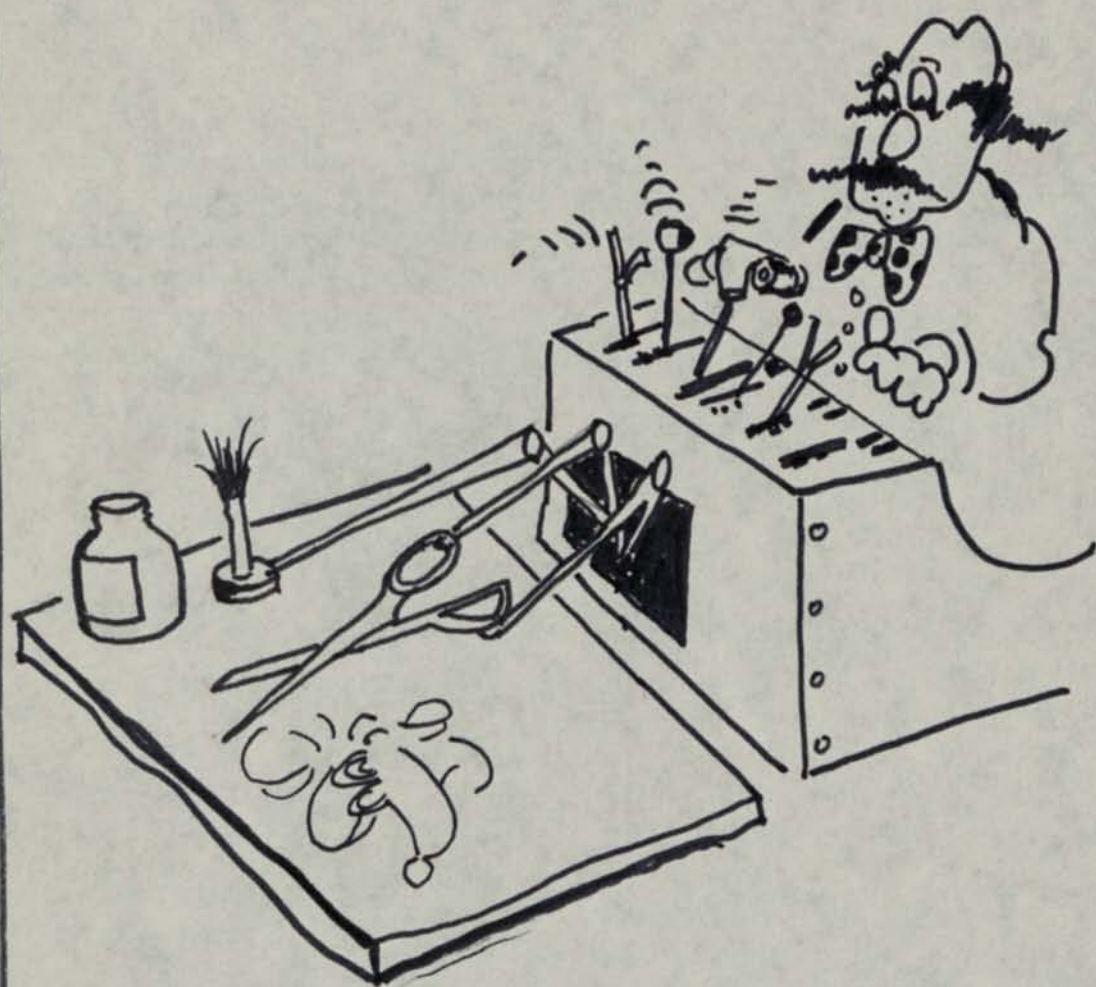
LACKS INTEGRATION WITH
A SHARED OBJECT-ORIENTED
INFORMATION SERVICE.

A SMALL TALK GAP



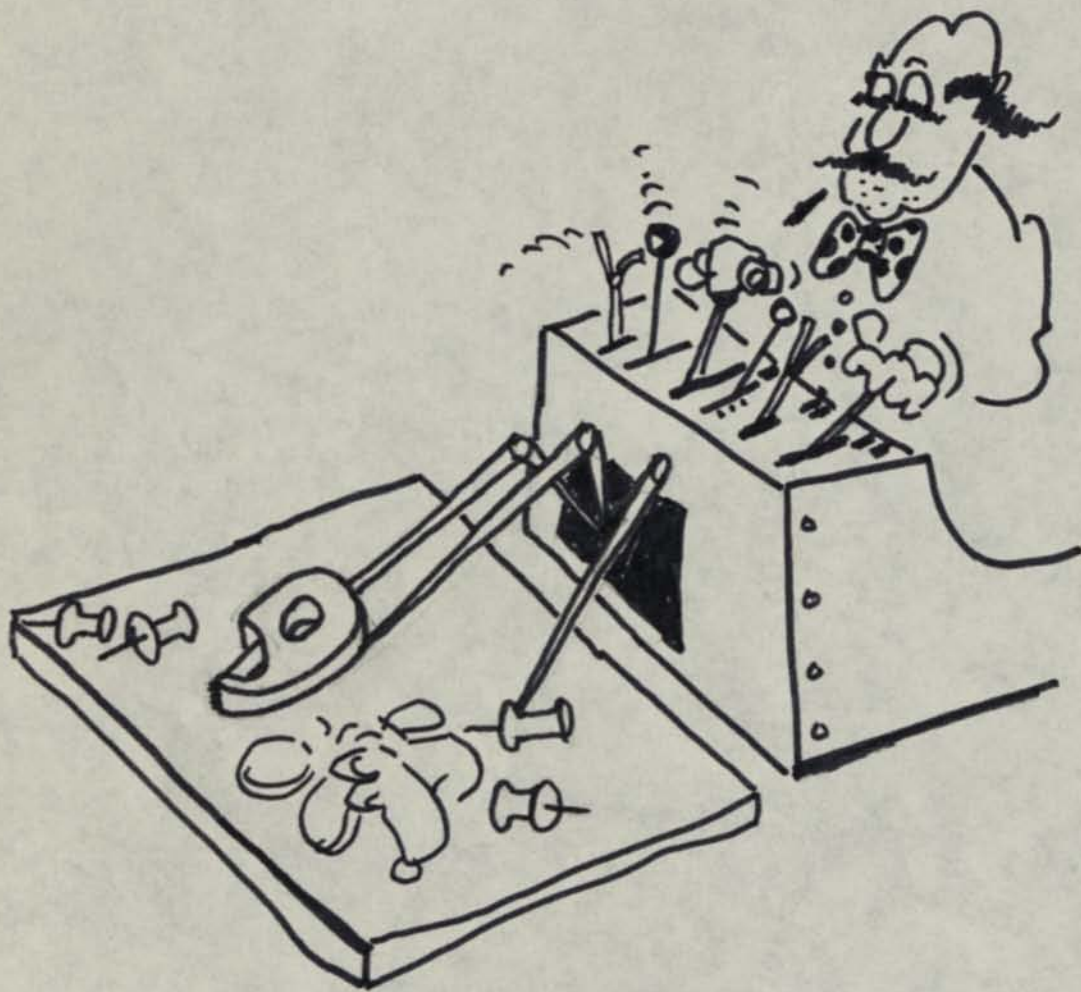
LACKS GENERAL ASSISTANCE
FOR STORING INFORMATION

CUT 'N PASTE PROJECT DESKTOP



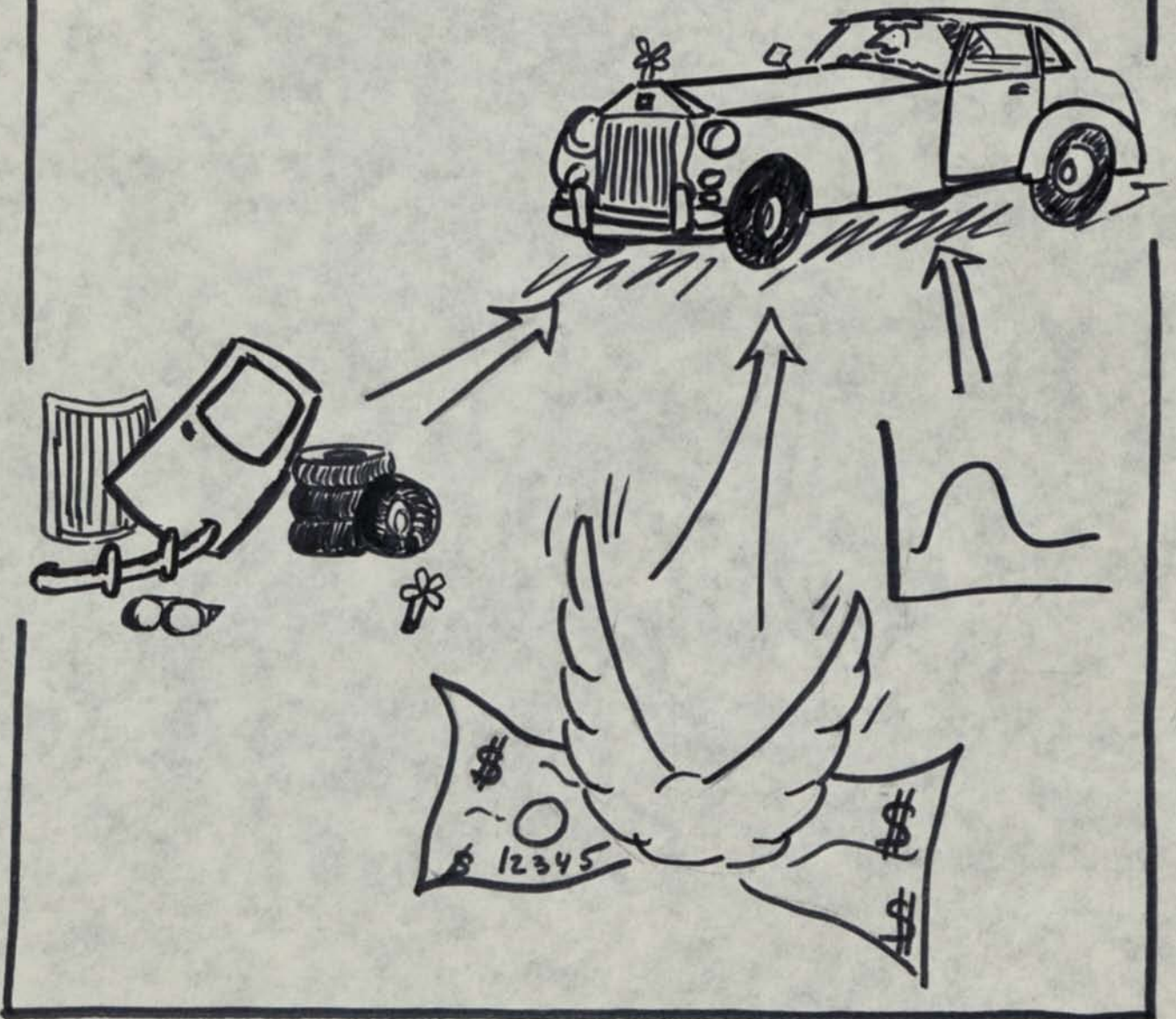
SUPPORTS SEARCH 'N EDIT

ATTACH AND DO IT

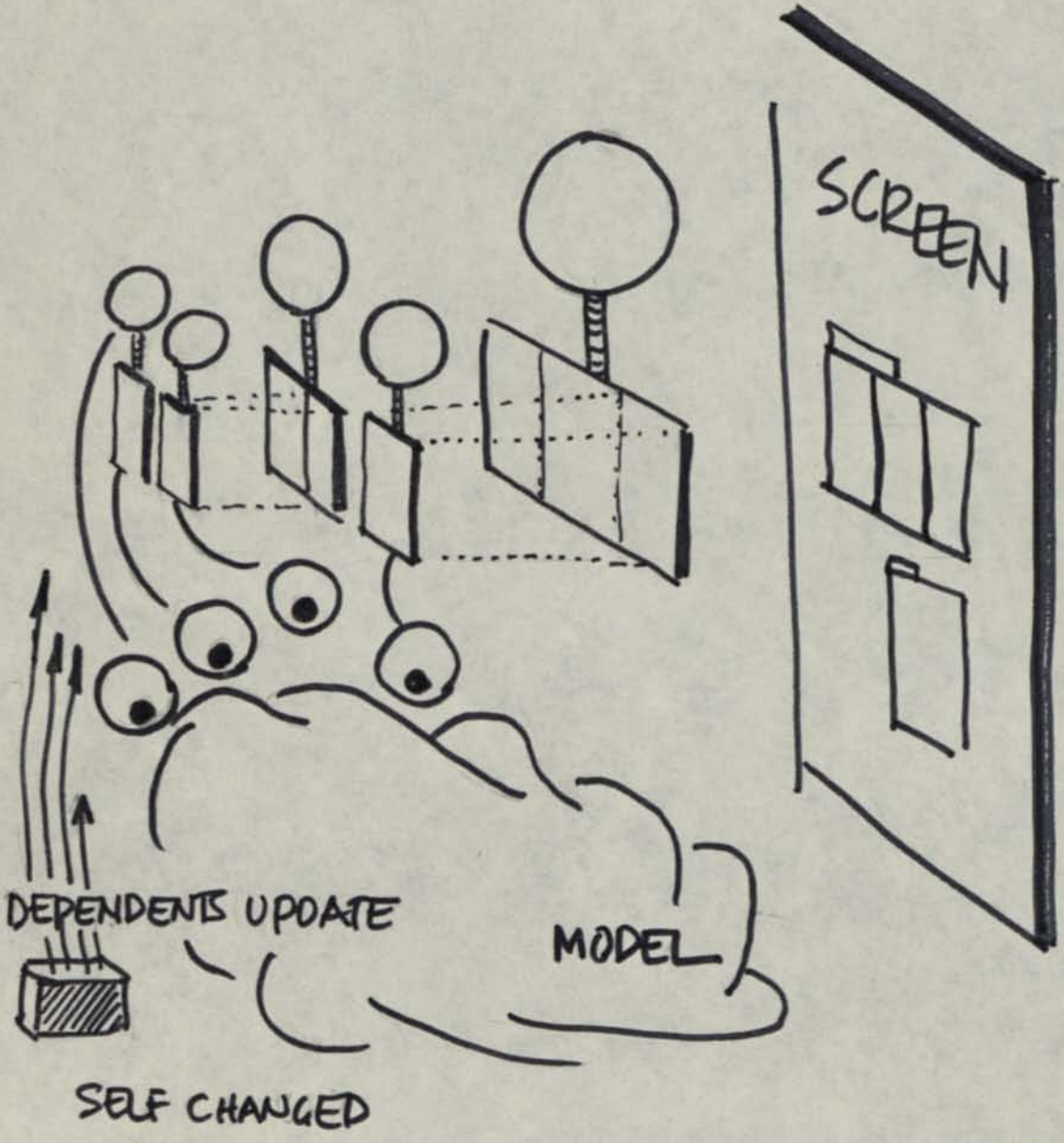


SUPPORTS CONNECT 'N EDIT

SEPARABLE?



MVC



EXPLORATIONS?

- LANGUAGE INTEGRATION
- INCLUSION OF SHARED INFORMATION
- FULL ILLUSION OF COOPERATIVE PARTNERSHIP
- NEW STYLES OF USE AND CONSTRUCTION FOR COMMUNICATION

WHAT DO WE KNOW?



READABLE ?

USER INTERFACE LAYER

1. How do I invoke response?

FUNCTIONALITY LAYER

2. What specifically can I do?
3. What is needed to do a specific function?

STRUCTURE LAYER

4. What is that?
5. Where is it?
6. Does any part of the system do this?
7. What part of the system knows about that?
8. How did I get here?
9. How can I get back?

LANGUAGE LAYER

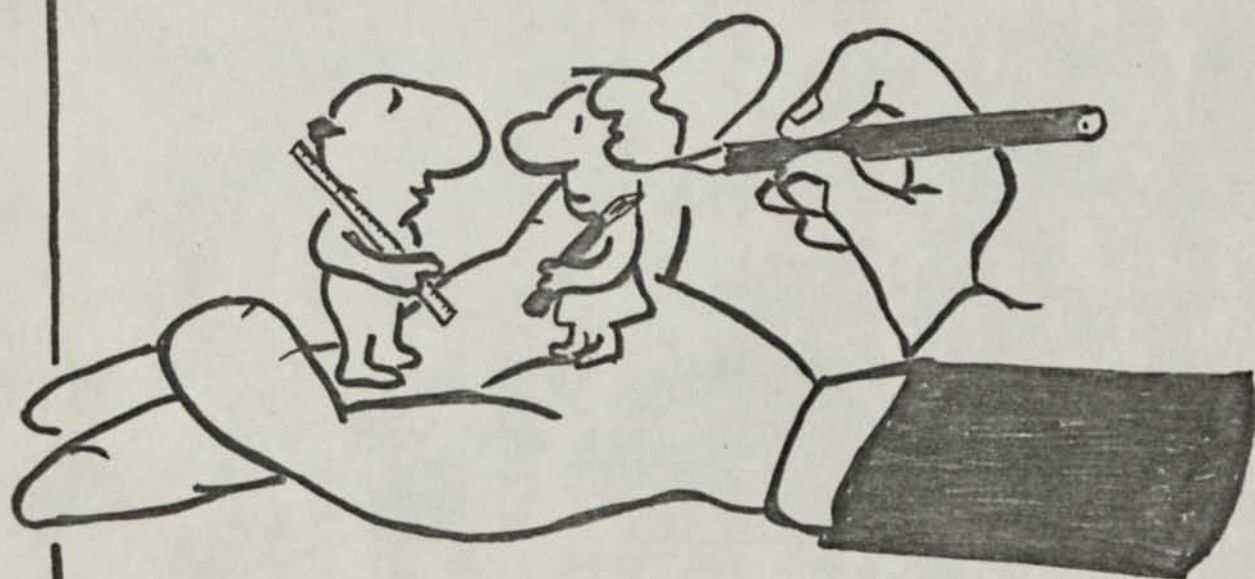
10. What is the current state of the system?
11. Why did that happen?
12. Why didn't that happen?

5

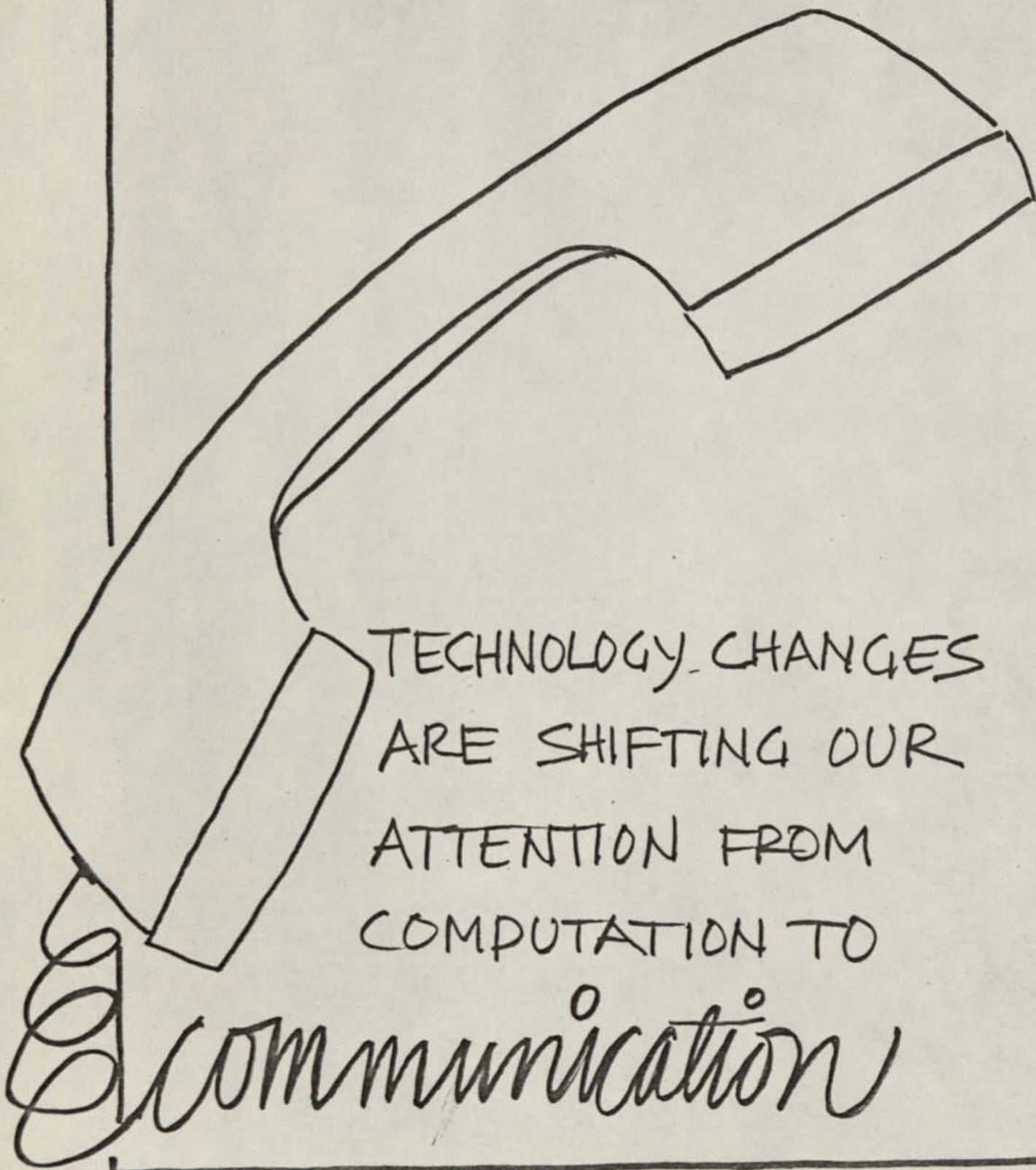
KITS AND KIT MAKERS



A SMALLTALK GAP



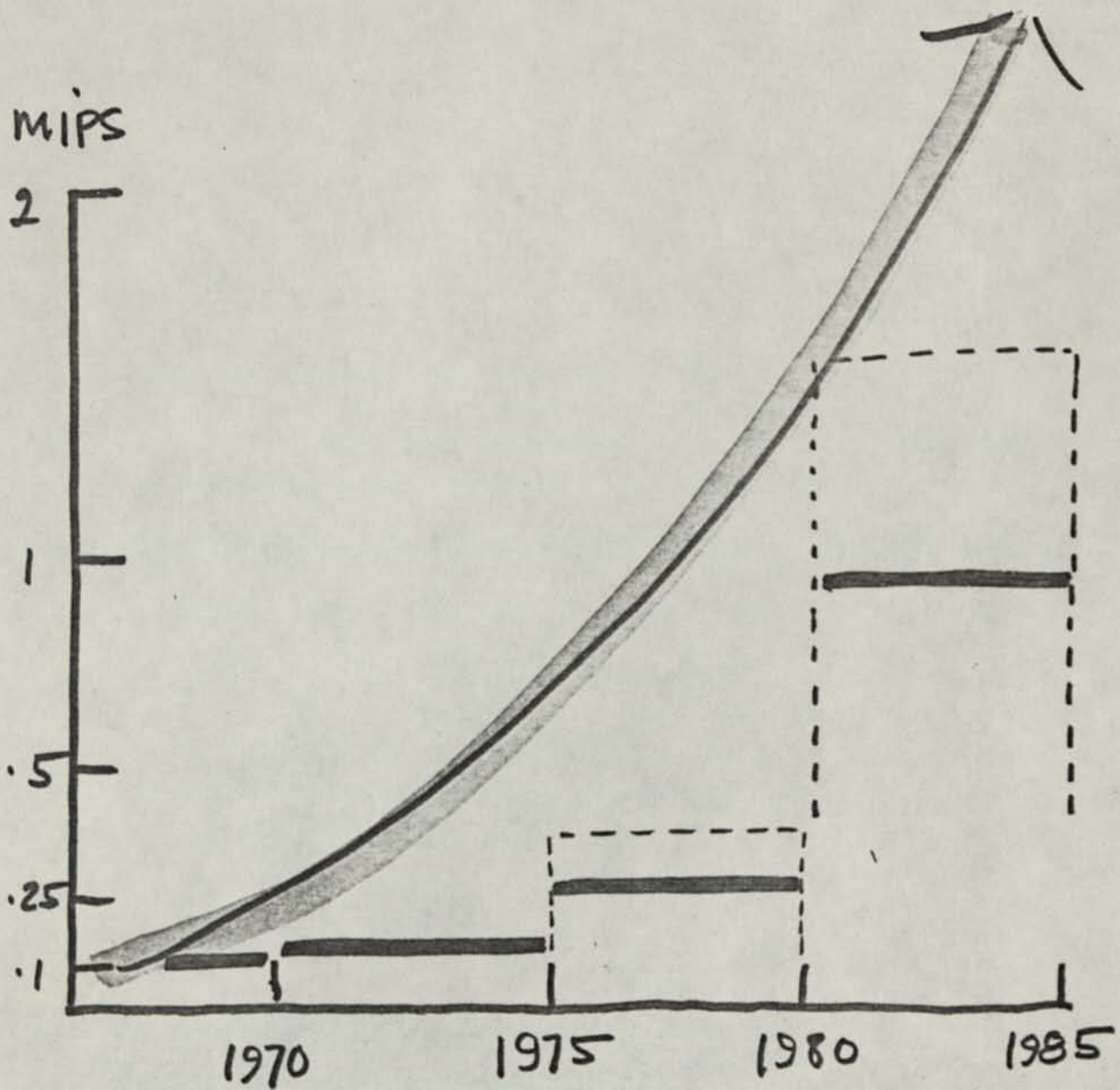
A LIBRARY OF
COMPUTATIONAL CREATURES



TECHNOLOGY CHANGES
ARE SHIFTING OUR
ATTENTION FROM
COMPUTATION TO

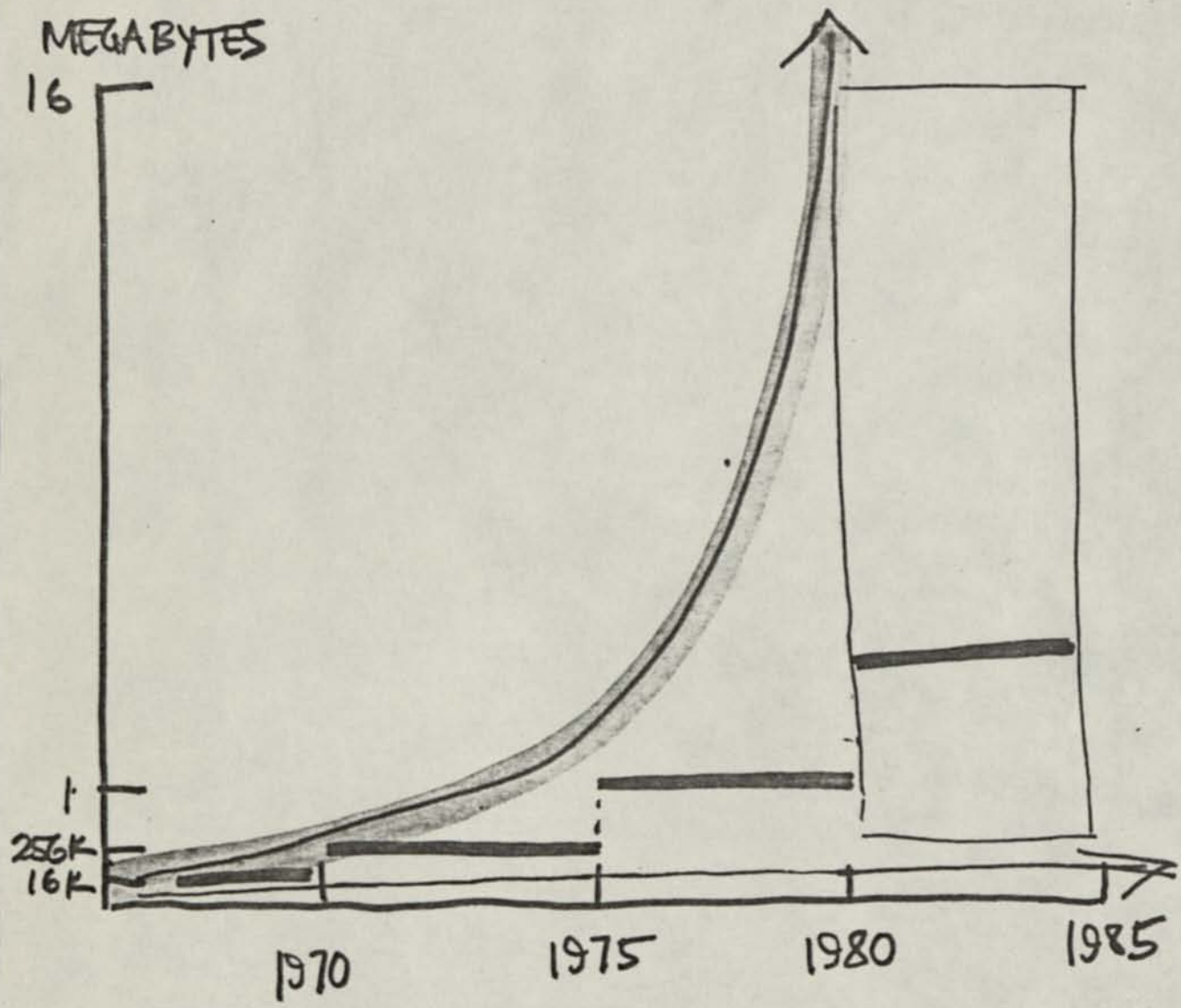
communication

CHANGE IN COMPUTING POWER



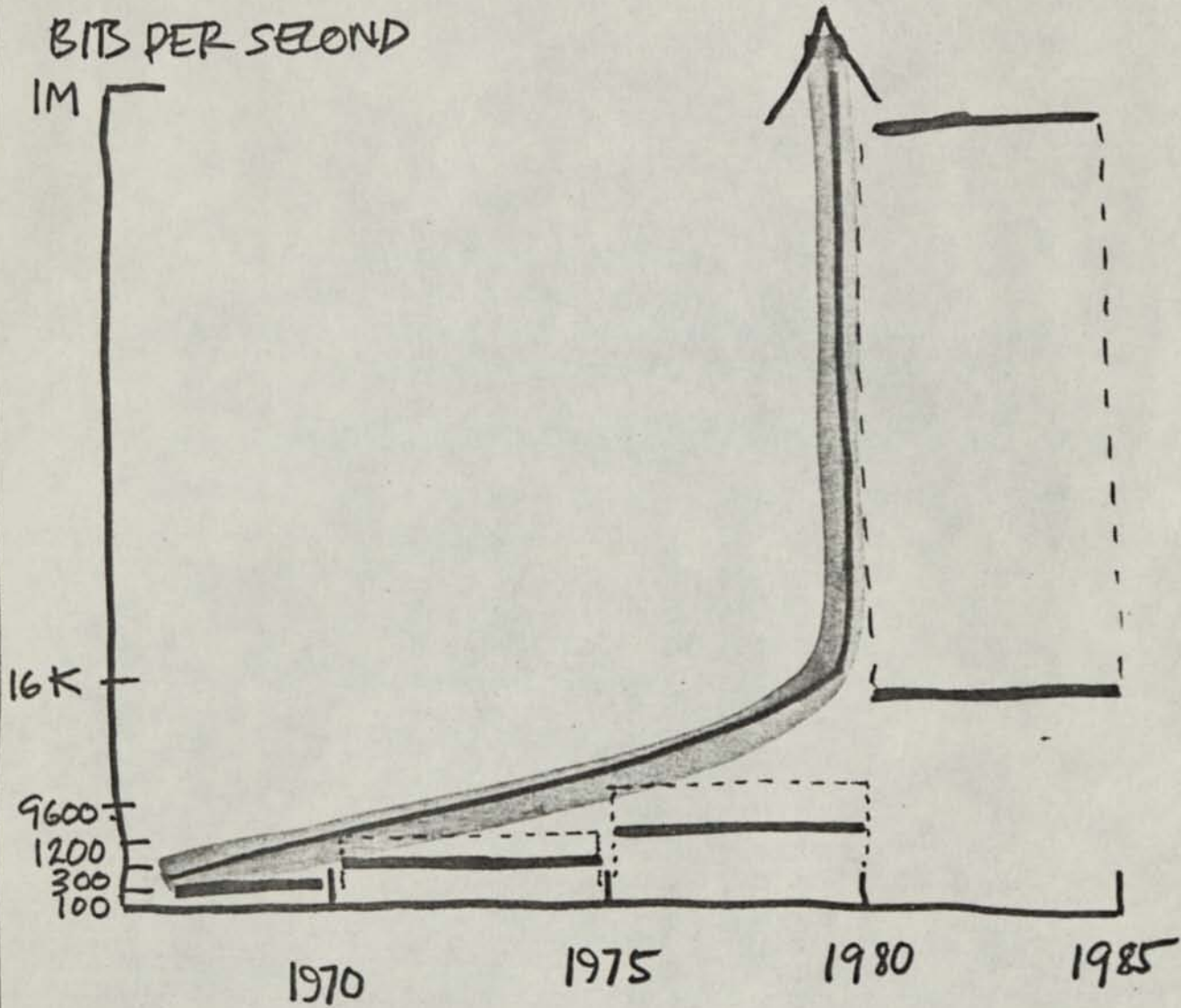
WHAT CAN I ASK THE
COMPUTER TO DO?

CHANGE IN MAIN MEMORY AND MASS STORAGE



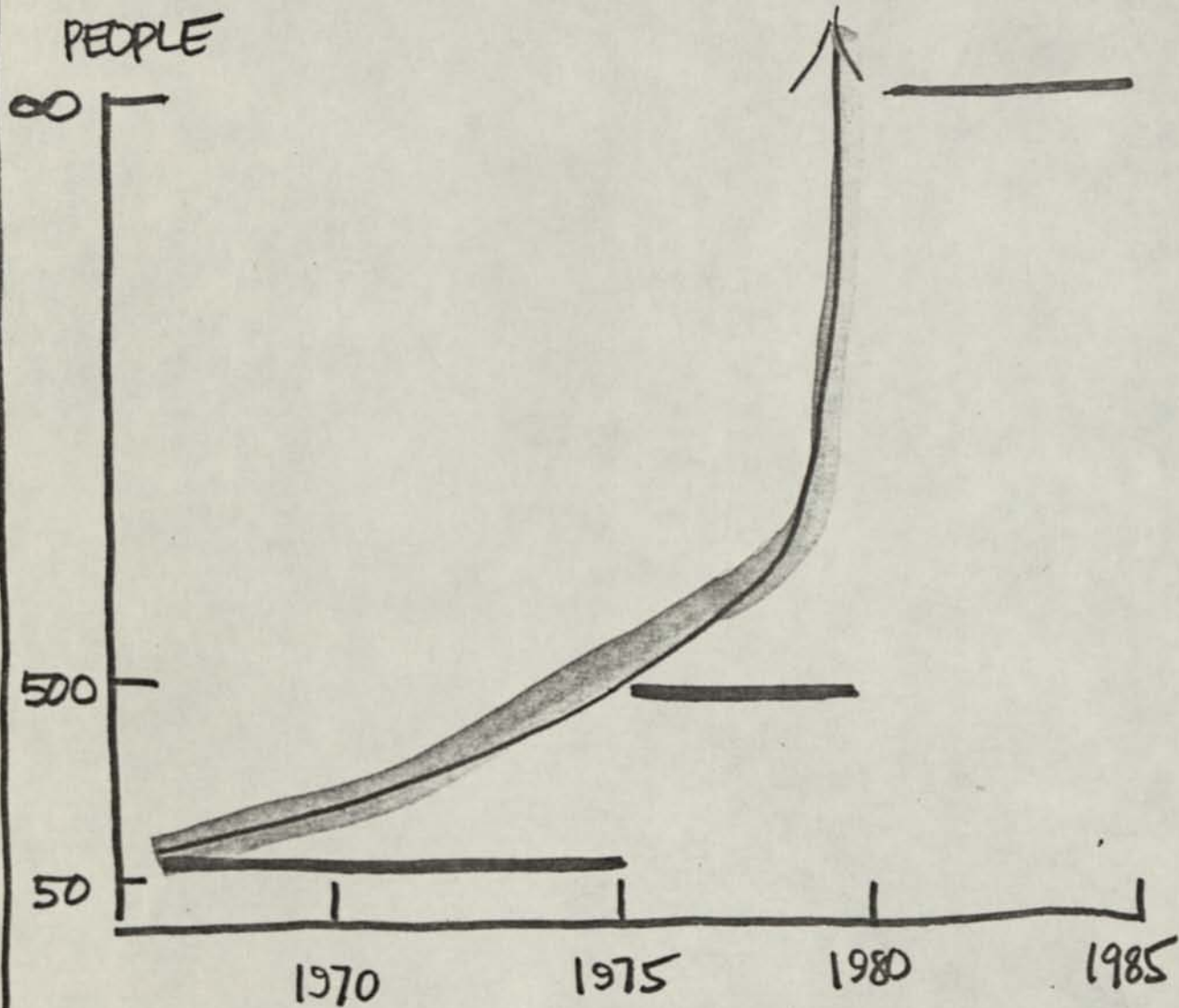
HOW MUCH FUNCTIONALITY IS AVAILABLE AT ONCE?

CHANGE IN OUTPUT TECHNOLOGY



WHAT IS THE BANDWIDTH FROM
THE COMPUTER TO ME?

CHANGE IN COMMUNICATIONS



HOW MANY PEOPLE CAN
I REACH?

LIBYA - INTERFACE

LAUNCH CONF OF HOPE FOR
PEACE

<make sure lights are on, slides & video off>

☐ Good morning

FOR THE LAST COUPLE OF YEARS, I HAVE FOUND MYSELF PRIMARILY IN AN ADMINISTRATIVE ROLE, FOCUSED ON SETTING UP VARIOUS FORMS OF HUMAN-TO-HUMAN INTERFACES-- BOTH IN ACM AND AT XEROX -- SO IT IS ESPECIALLY NICE TO HAVE THE CHANCE TO GET A SOMEWHAT MORE TECHNICAL HAT BACK ON -- ALTHOUGH THE TOPIC IS STILL THE HUMAN-TO-HUMAN INTERFACE.

IT OPENS WITH A SPECIAL THANKS TO SOME PEOPLE WHO HELPED PRODUCE THIS MORNING'S PLAYFUL LOOK AT DESIGN ISSUES -- BOB FLEGAL, RANDY SMITH, STEVE HARRISON, CHRIS HIBBERT, ^{RANJIT} MAKKUNI, STEVE PUTZ, ^{GEORGE GOODMAN} AMONG THE CAST IN THE SYSTEM CONCEPTS LAB AT PARC; AND JOHN MASHEY, OF MIPS COMPUTER SYSTEMS, A LONG TIME UNIX DEVELOPER BUT STILL A FRIEND DESPITE my PERSISTENT DIATRIBES AGAINST THE SYSTEM.

JOHN ENCOURAGED ME TO CHECK OUT

THE TECHNOLOGY BEFORE DIVING TOO DEEP INTO THE PRESENTATION. I'LL START WITH HIS PREFERRED TEST:

COULD THOSE OF YOU TOWARDS THE BACK OF THE ROOM RAISE YOUR HANDS IF YOU'VE BEEN HEARING ME CLEARLY.

<wait>

<raise my hand>

<fix if necessary>

^{YOUR} THE RESPONSE TIME SEEMED SLOW BUT THE ^{SYSTEM} VISUAL <HAND> AND AUDIO INTERFACES, SO FAR, SEEM TO WORK. YOUR RAISED HANDS WERE MORE APPROPRIATE THAN VOICE RESPONSE SO I COULDN'T BE FOOLED BY VOICES FROM UP FRONT.

NOW LETS SET THE NEXT VISUAL INTERFACE

* <FIRST SLIDE - LIGHTS STAY ON>

I WOULD LIKE TO LEAVE THE LIGHTS ON IF POSSIBLE, SO WE CAN HAVE

any hands?
up front?

2/
EFFECTIVELY A DIALOGUE — I'LL
USE SLIDES & VIDEOTAPE & MY VOICE —
YOU'LL GET TO TALK BACK WITH
BODY LANGUAGE. WE WILL TURN OFF
THE LIGHTS FOR THE TV MONITORS LATER.

* <SLIDE>

ONE LAST PART TO THIS INTERFACE
QUIZ --

HOW MANY OF YOU VIEW YOURSELF
PRIMARY AS A DESIGNER ?
--- AS AN ANALYZER ?

<report result>

EACH OF COURSE TAKES RESPONSIBILITY
FOR EFFECTIVE COMMUNICATION.
KNOWING THE PERSPECTIVE FROM
WHICH WE CARRY OUT OUR DIALOGUE,
HOWEVER, SHOULD ENHANCE OUR
ABILITY TO LISTEN TO ONE ANOTHER.

~~* <SLIDE>~~

I VIEW MYSELF PRIMARY AS DESIGNER —
I'VE NOT THE DISCIPLINE, I SUSPECT,
NOR RESTRAINT FOR CAREFUL ANALYSIS —

4/

* <SLIDE>

I'm FROM THE SCHOOL THAT VIEWS THE DESIGNER AS ARTIST, ^{THUS} MODELLING THE DESIGNER AS SOMEONE WHO ATTEMPTS TO EXPRESS IDEAS THROUGH THE CREATION OF A TANGIBLE ARTIFACT. IF I WERE BEING TRULY HONEST I'D FURTHER CONFESS THAT I SHARE, WITH THE BALINESE, THE BELIEF THAT ART IS ANYTHING YOU CAN GET AWAY WITH - AND THUS OOW TO THE RIGHT OF MY UNIX FRIENDS TO RAISE THEIR HANDS AS DESIGNERS.

THE NOTION OF DESIGNER-AS-ARTIST ENCOURAGES US TO CONSIDER DESIGN AS PROCESS, NOT JUST PRODUCT, AND IMPLIES US TO LOOK AT THE METHODOLOGY OF DESIGN, THE NATURE OF LEARNING THROUGH DOING, THE IMPORTANCE OF CAPTURING AND RE-EXAMINING THE HISTORY OR AUDIT TRAIL OF PROCESS, IMPLEMENTS, AND OUTCOMES.

* <slide>

ANALYZER AS ART CRITIC, THEN, REMINDS THE DESIGNER OF HIS OR HER LIKELY RECEPTION — BUT CANNOT GUARANTEE SUCCESS OR FAILURE.

RAPPORT BETWEEN ARTIST AND ART CRITIC DEPENDS ON ACKNOWLEDGEMENT THAT THE ACT OF DESIGN AND THE ACT OF ANALYSIS EACH ATTEMPT TO COMMUNICATE HUMAN EMOTION, REACTION, AND FACT. THE ANALYZER TELLS US WHAT SEEMS TO WORK IN WHAT SETTING — AND PROVIDES SOME CONJECTURE AS TO WHY. THE USER-INTERFACE DESIGN ANALYZER IS PROBABLY, OR SOMEWHAT MORE OBJECTIVE THAN THE MOVIE CRITIC, BUT BOTH ^{ARE} TEMPERED BY THE STRENGTH OF PERFORMANCE IN THE CURRENT COMMERCIAL MARKETPLACE. I SAY CURRENT SINCE THE MASTER OF A NEW SCHOOL OF ART IS OFTEN NOT RECOGNIZED UNTIL A MULTIPLICITY OF STUDENTS BEGIN TO ADOPT AND ADAPT THE MASTER'S CONCEPTS. TAKE THE INCREASING INTEREST IN ENGLEBART'S NLS WORK, IN THE NEW TECHNOLOGY ^{COMMERCIAL} SETTING OF THE 1980'S, AS A CASE IN POINT.

AT THE END OF THIS TALK, I WILL INTRODUCE
A FAMOUS DESIGNER - AS ANALYZER THIS
TIME - COMMENTING ON THE IMPACT
COMMERCIALIZATION HAS ON DESIGN JUDGMENT.

* (SLIDE) (PRINCIPLES)

THE ANALYZER REQUIRES ^① A SENSE OF
PURPOSE OF THE DESIGN, ^② A STATEMENT OF
OBJECTIVES SET BY THE DESIGNER, AND ^③
ESPECIALLY A NOTION OF THE PRINCIPLES
OF THE DESIGN PROCESS THAT CAN SERVE
AS A MEASURE FOR SUCCESS. PRINCIPLES,
WHEN STATED ^{FOR} GENERAL ^{ACCEPTANCE}, READ LIKE A
RECIPE FOR MOTHERHOOD AND APPLE PIE.
FOR EXAMPLE - make aesthetic use of
space and time; aim for consistency
but provide contrast; seek good balance
of form and content, but infuse an
element of surprise.

THESE ARE ALL TARGETED TO MAKE
THE EXPERIENCE OF INVOLVEMENT WITH THE
DESIGN, AND ITS ARTIFACTS, FUN AS WELL
AS PRODUCTIVE.

☞ look at the whole for complete
design balance ←

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By TRADE, I AM CURRENTLY A ^{DESIGNER OF} PROGRAMMING LANGUAGES AND DEVELOPMENT ENVIRONMENTS, ~~DESIGNER~~, SO MY COMMENTS THIS MORNING ARE CLEARLY DERIVED FROM THOSE EXPERIENCES. MOREOVER, OUR RESEARCH PROGRAM ON THE SMALLTALK ^{SYSTEMS} HAS ONCE AGAIN COMPLETED A FULL CYCLE OF DESIGN-IMPLEMENT-TRYOUT - SO THIS IS A TIME FOR SELF CRITICISM, TO SEARCH FOR THE GAPS IN THE SMALLTACK RESEARCH. I WILL SHARE SOME THINKING ABOUT THESE GAPS AS I SUSPECT THEY APPLY MORE BROADLY AND THAT MANY OF YOU HAVE COME TO SIMILAR CONCLUSIONS.

ON THE SLIDE ARE LISTED 4 PRINCIPLES THAT ENTER INTO OUR DESIGN EFFORTS. THE FIRST TWO THREATEN TO BE CLICHES THAT SEEM TO POP INTO MUCH OF THE LITERATURE LATELY. UNDER THE LABEL ILLUSION I INCLUDE THREE REQUIREMENTS: COOPERATION, USER CONTROL, AND FEARLESSNESS.

8) GLOSS OVER FIRST 2 - DETAIL OF OTHER 2
ILLUSIONS

COOPERATION - AN ILLUSION OF A PARTNERSHIP WHEREBY COMPUTER & USER EXPLAIN TO ONE ANOTHER WHAT CAN & CAN NOT BE DONE

USER CONTROL - USER AS THINKER
NON PREEMPTIVENESS

FEARLESSNESS - BELIEVE CAN'T BE DESTRUCTIVE

TENSION - - DESIRE SMART COMPUTER

PREDICTABILITY

CONSISTENCY	reasonable / command language physical actions
DIRECTNESS	
GROWTH WITH USER	
RESPONSIVENESS	

TENSION - - BALANCE SURPRISE

9/

IARL

READABILITY - underlying structure
 & use/mixed of underlying structure
 comprehension assistance

SEPARABILITY
 - modularity, reusability
 known - - integration

* <slide>

So with that advanced look at the designer's pen, we should put up the title slide and remind ourselves that with each cycle of Smalltalk R&D we stop, examine today's technology and what is ahead, and try to decide what we know that can guide the next design effort.

So this is the title of the talk although not exactly what the talk is about. The talk is actually about what we do not know, or at best, what we think we do not know.

10/

* <side> The BASIC THEME IS //

We believe we know something about creating interesting situations in which an individual can be brought in close partnership with computation-centered technology. We have some experience with satisfying some personal information handling needs, including limited ways in which to link people together in a virtual work group. But we have little experience with the broad based implications of a technology in which the telephone rather than the calculator is the center of attention.

As we enter a new decade of research, many of the system design questions, especially the user interface ones, need to be reasked from a communications-centered point of view.

//
* <SLIDE> OUTLINE ...

* <SLIDE>

WHAT PROBLEM THEN ARE WE
ASKED TO SOLVE?

AGAIN, RECALL THAT I WILL DRIVE MY
COMMENTS FROM A PGM'G DEV. ENV
PT-OF-VIEW & ASK YOU TO
TRANSFER THEM TO THE APPLICATIONS
ARENA OF YOUR OWN EXPERIENCE.

2 WORDS OF INTEREST

INTER - AMONG PARTS OR LAYERS
NOT PERSON TO MACHINE
ALSO MACHINE TO MACHINE
"DOING CENTERS"

(OBJECTS) - CAR UNDER HOOD

FACE - PRESENTATION

CPTR → USER → - OPEN SAME ENGINE
DIFF IT FACE → DIRTY \$

ACTION - WAY ONE DOING CENTER
EXPRESSES ITS NEEDS,
REQUESTS DOING, OF ANOTHER
CENTER.

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* <SLIDE>

THE REQUIREMENT IS AN EFFECTIVE WAY TO CONDUCT INFORMATION AND REQUESTS FROM ONE DRIVING CENTER TO ANOTHER.

CAR EXAMPLE: NICE

CLEAR SEPARATION OF DRIVING CENTER (ENGINE, ETC) FROM PRESENTATION TO THE DRIVER.

PROBLEMS - MANY - CITE 3

1. NO EASY SEPARATION OF THE PARTS OF THE U.I. THAT LET'S THE DRIVER LEARN THE PARTS BEFORE HAVING TO DEAL WITH THEM AS A WHOLE.
2. CAN'T LEARN BY MAKING MISTAKES ACTIONS / REACTIONS ARE PREDICTABLE UNFORTUNATELY, THOSE OF OTHERS NOT PREDICTABLE
3. LIMITATIONS OR CONSTRAINTS ON USE ON THE ROAD HELP DECREASE FEAR OF DRIVING — NO CONSTRAINTS ON EXTERNAL INTERACTIONS

B/

COMMUNICATIONS-CENTRED TECHNOLOGY
IS MORE LIKE ALL THE ROADS AND
CARS COMBINED THAN ABOUT
AN INDIVIDUAL IN A CAR.

* (SLIDE)

PROBLEM IN PROG-SYSTEM IS TO CREATE
GOOD FACES FOR INFORMATION
INTERCHANGE AMONG MANY
POSSIBLY INDEPENDENT DOING CENTERS,
KEEPING IN MIND THAT THESE CENTERS
MAY ^{ALL} RESIDE IN ELECTRONIC FORMS.

A GAP FOR OUR SMALLTALK RESEARCH
IS THAT THE LANGUAGE OF DESCRIPTION
(PGM LANG) MUST BE CAPABLE OF
DESCRIBING WHAT THE HUMAN USER
CAN DO.

NEED GEN'L PURPOSE PGM LANG

UI POSSIBLE

DB ACCESS

↓ LANGUAGE INTEGRATION PROBLEM

ADVANTAGE - ABILITY TO CLEARLY
ARTICULATE INTERACTION
- ABILITY TO AGGREGATE
ACTIONS

* <SLIDE> WHAT ARE THE DESIGN CONSTRAINTS OF A COMM-CENTED INTERFACE?

USE WHAT THERE IS

MAKE BEST USE OF WHAT IS AVAILABLE

UNDERSTAND EVOLUTION TO PREDICT

FUTURE CAPABILITY & DESIGNS WITHOUT REGRESSION.

FUN TO EXAMINE TODAY'S ^{IND'L} CARS FROM PT-OF-VIEW OF PROGRESS OR THROWBACK

- ADD FUNCTION

▷ KEY REMOVE WITH BUTTON

▷ CRUISE CONTROL

▷ LOCK CONTROL

- REMOVE ACCESS TO FUNCTION (DUNK CENTER DOES IT BETTER)

▷ MANUAL CHOKE

- CHANGE PRESENTATION

▷ DIGITAL NOT ANALOG; ORANGE LIGHTS

▷ WINDSHIELD WIPER CONTROL IS ∞

CARS ARE IN A PRETEEN STAGE

TALK BUT DON'T LISTEN

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~~*SLIDE >~~

~~ARTISTIC LICENSE~~

~~PICASSO - ART IS THE LIE THAT
TELLS THE TRUTH~~

EVIL, PROGRESS

2 QUESTIONS:

WHAT CAN YOU GET TO?

WHAT BELONGS ONLY TO YOU?

NOTION OF OWNERSHIP IMPACTS U.I.

NOT JUST CHANGES IN WHAT PEOPLE

CAN ACCESS (P TO P) BUT

MACHINE TO MACHINE

COOPERATIVE WORK AMONG CARS

*SLIDE >

ARTISTIC LICENSE

PICASSO - ART IS THE LIE THAT
TELLS THE TRUTH

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COMPUTING POWER - WHAT CAN I ASK CPTL TO DO

60's	BATCH - MINI
early 70's	TIMESHARE - MINI
late 70's	SLICE OF TIMESHARE
80's	Departmental processors

more compute \Rightarrow WILLING TO TURN MORE
OVER TO THE COMPUTER

- TO DO MORE BACKGROUND
WORK

- TO CLEAN UP SCREEN
(WASH WINDOWS)

* <SLIDE>

MAIN MEMORY / STORAGE

LARGE INCREASE MEANS MORE

FUNCTIONALITY CAN BE READILY
AVAILABLE SO WE THINK MORE
ABOUT MULTI-TASKING

o INT EXCHANGE / INTERPLAY

\Rightarrow affects consistency &
predictability requirements
when can see not just
recall differences

& feel

* (SLIDE)

OUTPUT TECHNOLOGY

BANDWIDTH FROM CPU TO ME?

TO DISPLAY OR HARDWARE PRINTER

RESPONSE TIME & PRESENTATION EXPECTATIONS

HERE IS SIGNIFICANT REASON FOR

U.I. SHIFT —

BITMAP AS SIMULATION OF FLAT PANEL

* (SLIDE)

NOW, WHAT IS ON THE DESK IS A PATHWAY
TO IMMEDIATE FUNCTIONALITY &
PRESENTATION/ACTION

BUT A COMM-CRUEL QUESTION ASKS
HOW MANY PEOPLE CAN I REACH?
SHIFT FROM PEOPLE SHARING SAME
MACHINE (50), TO LAN'S (500), TO
MULTIPLE NETS (∞).

IMPACT: DEFERRED INTERACTION REQ'S

* * how
get
attention

u.i. has to handle
event-driven, not just
user-driven presentation

→ alert the user
→ wake the user aware of connections

18/

* (SLIDE)

SUMMARY -

INTERPERSONAL \Rightarrow POLITICAL

FILTERS

PERSPECTIVES

FORUMS

ACCESS PATHS

WAY STATIONS / SERVICES ON THE PATH

* (SLIDE)

OBVIOUS SMALL TALK GAP

SAY CURRENT STATUS

COMPUTATIONALLY - ACTIVE

COMPUTATIONALLY - PASSIVE

* (SLIDE)

PRINCIPLES REPRISÉ

WE'RE SEEKING SOLUTIONS THAT REQUIRE

INTEGRATION OF LANG OF DESC., OF INTERFACES,

OF INTERACTION w/ SHARED INF SPACE.

Readability & expandability (what's in the library)

19

* <SLIDE >

Readers & WRITERS PROBLEM

PC: SINGLE READER - SINGLE WRITER

↓

SINGLE READER - MULTIPLE WRITERS

LEARN FROM ONE SYSTEM EXPERIENCE

to use in ANOTHER

COMM-CTR: MULTIPLE READERS - MULTIPLE WRITERS

WHO DOES THE THINKING? | BOOKKEEPER?

SOCIAL CONTEXT

PERSPECTIVES - HOW REQUEST?

HOW BE REMINDED?

NOT MANAGEMENT OF TROUBLE

BUT MANAGEMENT OF POTENTIAL

LEARN TO WRITE - COMMUNICATE

By READING

* <SLIDE >

HENCE ASSISTANCE CRITERIA IS TO

PROVIDE COMPREHENSION ASSISTANCE

- LAYERS FOR SMALL TALK
- WHY DOES IT WORK? WHAT IS THERE?

90

* <SLIDE > GAP

- SMALL TALK U.C., ABOUT RETRIEVAL
- WRITE IN CONTEXT OF ORGANIZING FOR RETRIEVAL
- GENERALLY NEED TO BE ABLE TO STORE ~~IT~~ WITH ADVICE FOR READING, WHETHER USER ASKS OR NOT
- MONITORS STANDING ORDERS

* <SLIDE >

CURRENT APPROACH GIVEN CONTEXTS FOR RETRIEVAL \Rightarrow BROWSERS
STORAGE & SHARING
BY CUT 'N PASTE

SUPPORT FIND (NOT REALLY SEARCH)
& EDIT

eg IN VIDEO OF MAIL \rightarrow CALENDAR
 \rightarrow RESPOND

TO MUCH BOOKKEEPING BY USER
FORWARD GET CONTEXTS ONTO SCREEN, PHYSICALLY MOVE INTO CONTEXT
CUT 'N PASTE IS COMPUTATION-CENTERED

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* <SLIDE> HERE'S A SIMPLE ALTERNATIVE
DRIVEN FROM A COMMUNICATIONS
POINT OF VIEW

ATTACHMENT METAPHOR / ATTACH &
DU IT
GET MAIL - ADD POST IT
ATTRIBUTABLE OBJECTS

CONNECT INFORMATION TO ACCESS
ATTRIBUTES

EDIT THE INF & ACCESS REQUESTS

MORE LIKE OBJ-ORIENTED INTERFACE
& MSG TO OBJ

WELSH PUT OBJECT INSIDE FUNCTION

* <SLIDE> separability?
modularity - see parts of car to
re-use

- views of car

- use within other contexts

what can be put in the shared
information space

- ~~external~~ active objects
- related objects - kits
- attributes

* <SLIDE>

THINKING

22

~~SLIDE~~

HOW CAN THIS STORAGE BE CARRIED OUT SO THAT I CAN, ON MY DESK, MAKE USE OF A KIT CREATED ON YOUR DESK?

ATTACH TO DO IT IS A METAPHOR ABOUT

- LINKAGES OR THREADS
- TRAVERSAL AIDS

? [CONNECT 'N EDIT IS IMMEDIATE,
 WHEREAS SEARCH FIND 'N EDIT IS DEFERRED]

~~SLIDE~~

MVC →

PHILOSOPHY FOR SEPARATING THE

STRUCTURED INF (MODEL)

FACE (VIEW)

ACTION (CONTROLLER)

my implementation

VIEW STRUCTURE -
 to get + direct manipulation

SYSTEM PROVIDE AUTOMATIC

- LINK OF DEPENDENCIES
- UPDATE & CHANGE BROADCASTS

BIG RESEARCH AREA

* <SLIDE> GAP

NEED A LIBRARY OF PARTS TO ATTACH & TO ATTACH TO —

~~PSY~~

VIDEO

GOAL IS PLAYFUL

EXAMPLE OF ULTIMATE CONTEXT-SENSITIVE BROWSING

- MORE FRIVOLOUS, LESS STRICT STRUCTURE — DYNAMIC COMPOSITION LINKS

metj B

- FANCIFUL TEMPLE STUFF | Gesture TO IDENTITY AGGREGATES
- FLOW ~~NOT~~, ALIVE
- ART

* <SLIDE> SUMMARY OF RESEARCH VIDEO



DIRECTNESS. FOR MEETING SUPPORT

POINT, COPY, PLACE
AUTOMATE LINK

THINGLAB
AERIAL

}

CONSTRUCTION KITS
pickup & place
only

TEMPLE
DESIGN

}

getting not for directness
but for aesthetics
not to clutter
visual

ARK

}

separate domain from
control

VIDEO

}

INCORPORATING NEW MEDIA
TESTING BROWSING
TRANSFER

gesture



gestures are currency of interaction

- effective use of time, stroking to get to action

- interpretation of gesture to get info needed for the action

- gesture as way to identify aggregates as well as items

select token

select container ↺

now go into sequence of prompting
preemptive possible

shift of technology
cptr → Com

IFIP papers
E. H. Putz
version mgt
paper

db ⇒ psm by copying
multiplying subtypes ⇒