electronic cocktail napkin
back of an envelope
~ 1994 - 2000

goal:

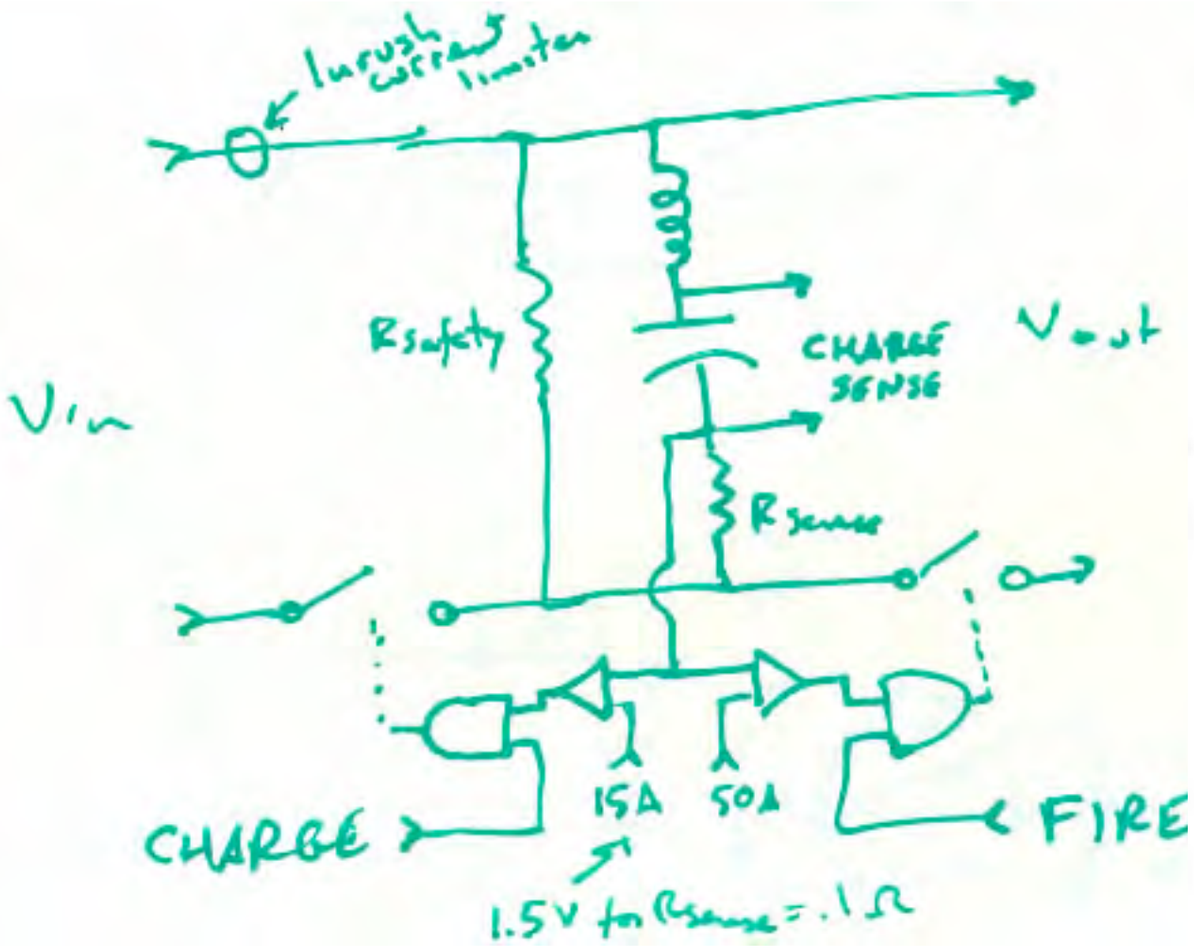
general purpose platform for diagram recognition

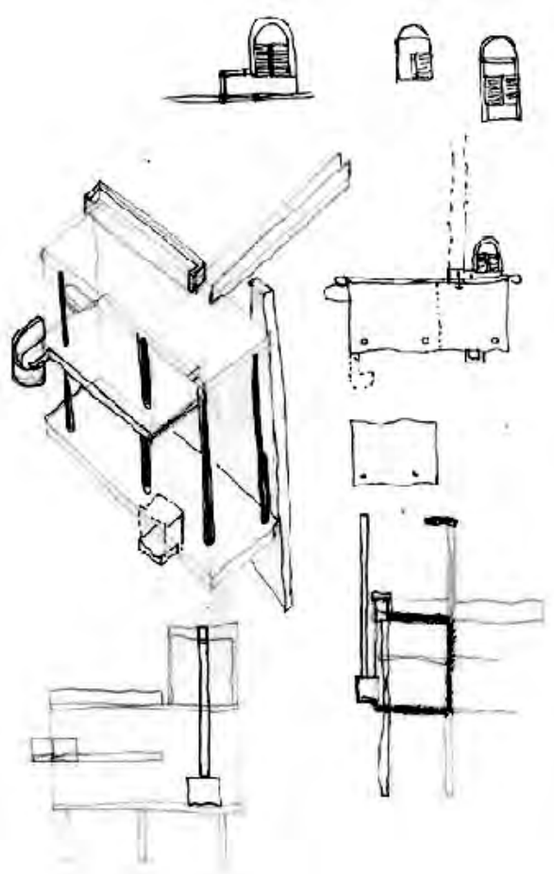
goal:

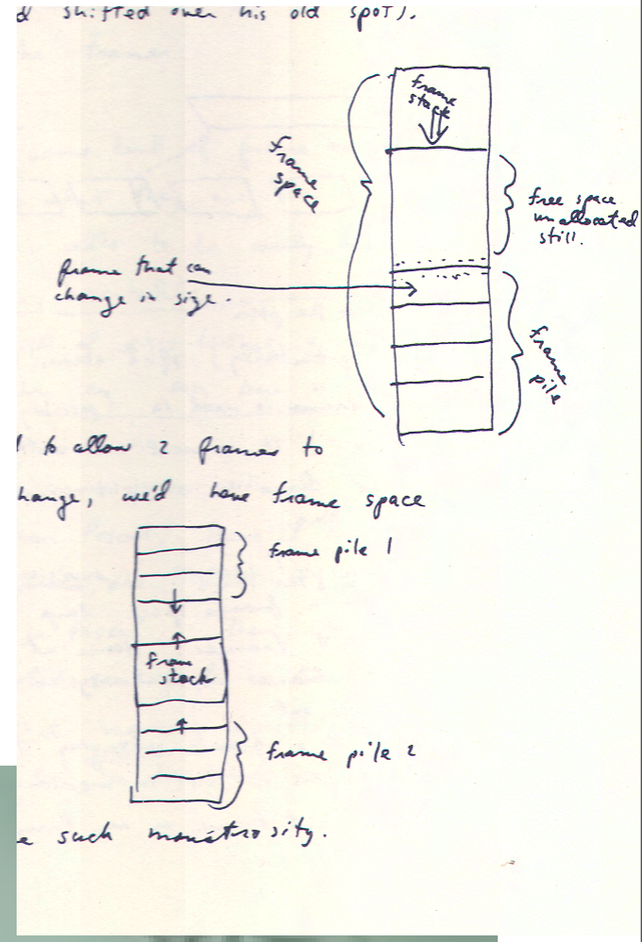
end-user trainable, on the fly

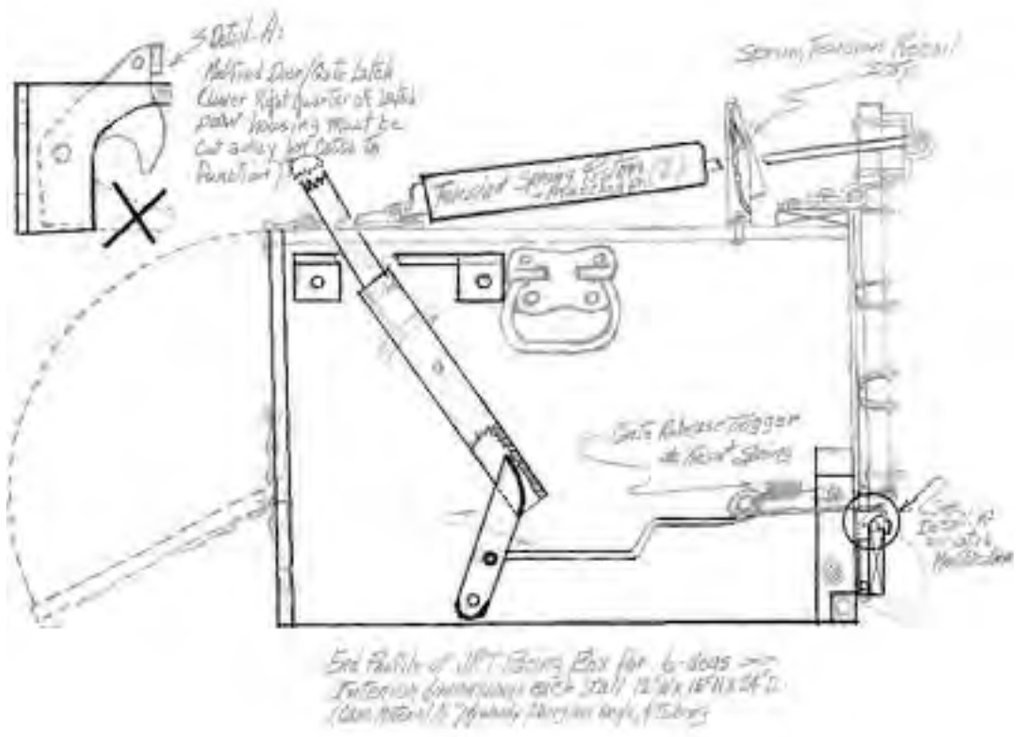
drawing as interface to (almost) everything

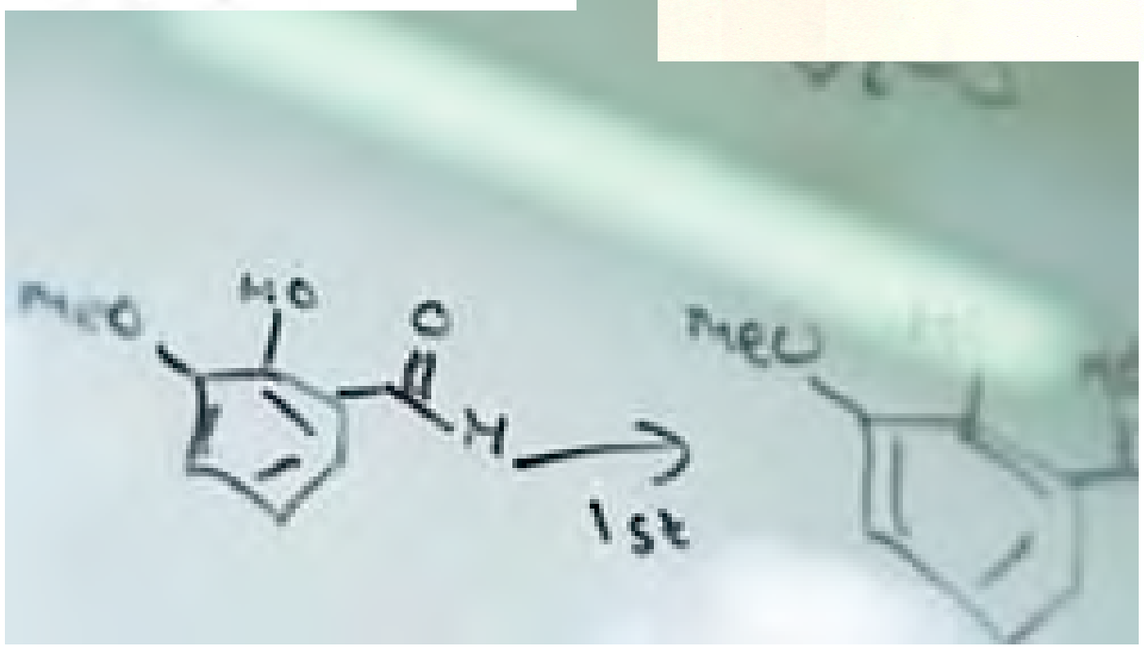
diagram = symbols + spatial relationships


Inrush current limiter
Rsafety
CHARGE SENSE
Vout
Vin
Rsense
ISA
SOA
CHARGE
FIRE
1.5V for Rsense = .1Ω



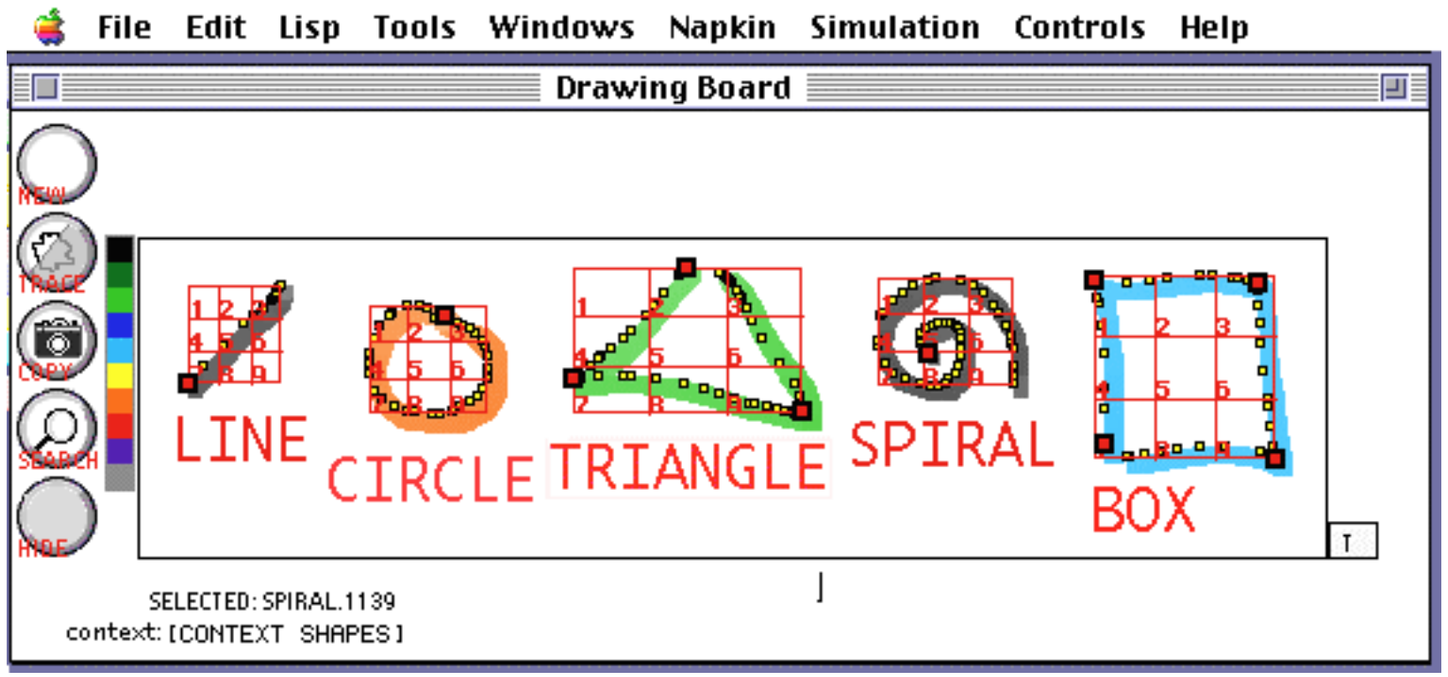

d shifted over his old spot).
frame stack
frame space
free space unallocated still.
frame that can change in size.
frame pile
I to allow 2 frames to
hange, we'd have frame space
frame pile 1
frame stack
frame pile 2
e such monstrosity.


Detail A:
Modified Door/Gate Latch
Lower right quarter of latch plate housing must be cut away for cable to pass thru


MeO
HO
O
H
1st
MeO

low-level (multi-stroke) symbol recognizer

ledeen recognizer



- path
- # strokes
- # corners
- corner locations
- size
- aspect ratio
- rotations & rotations

segmentation
corner-finding
inexact matching
2D transforms

symbol template libraries (contexts)

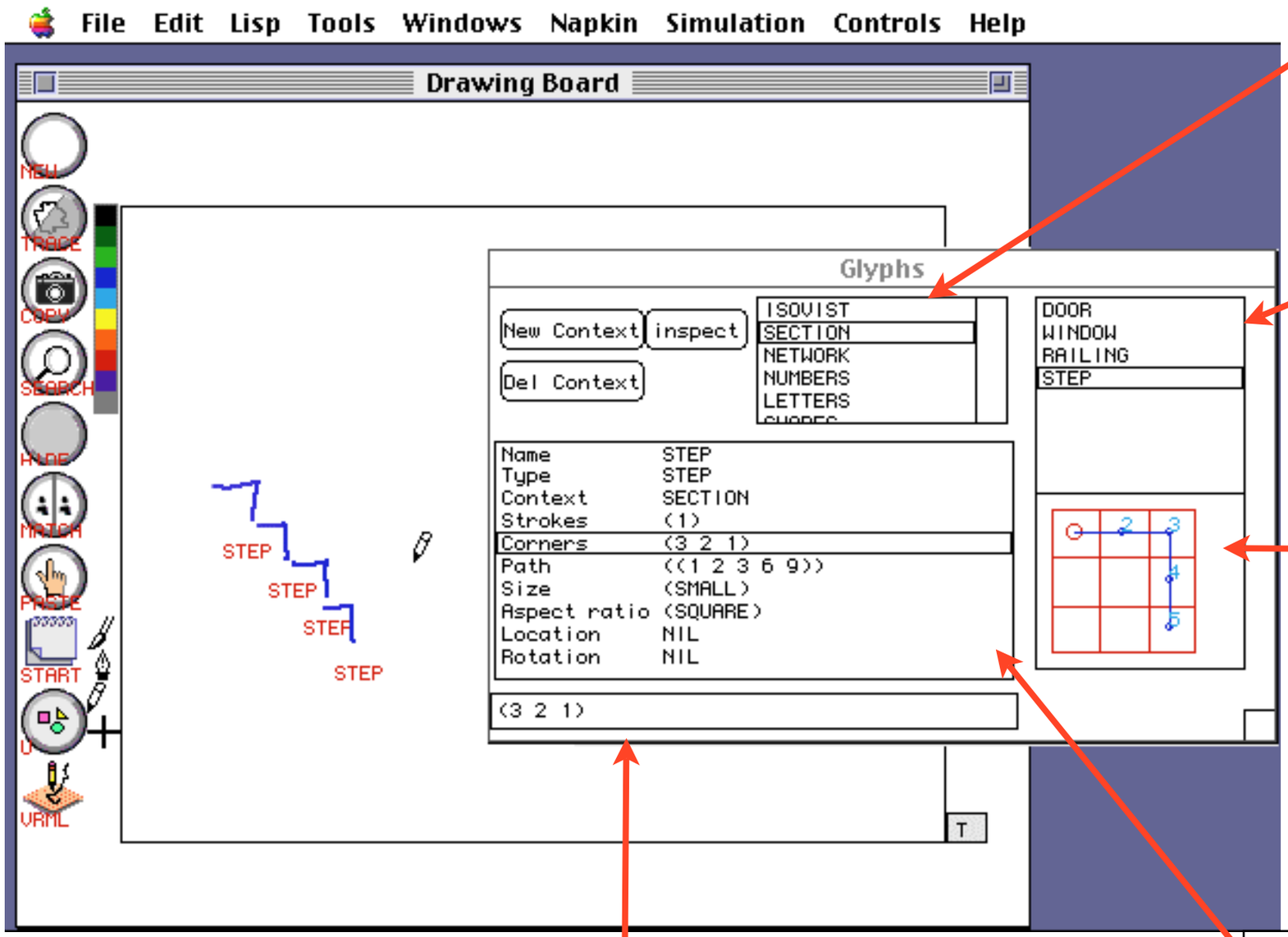
SHAPES
LETTERS
NUMBERS
MUSIC
CIRCUITS
etc....

lazy recognition

carry multiple recognition “hits”
allow symbols to remain unrecognized

perhaps we can figure it out later ...

training a symbol



context

symbols in context

path diagram

edit type-in

template values

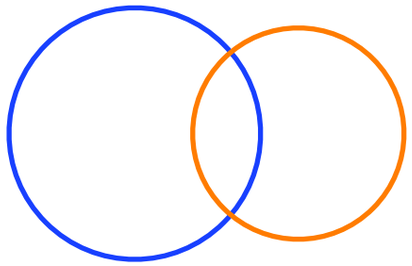
(typed) Binary Spatial Relations

left-of <any glyph> <any glyph>
above
below
right-of

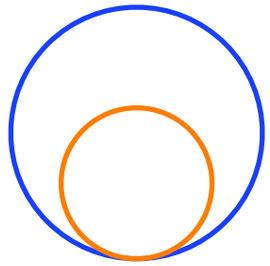
contains <shape> <any glyph>
connects <line> <line>
tees <line> <line>
intersects <line> <any glyph>

spatial relations

hierarchy of spatial relationships

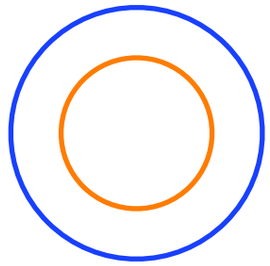


A overlaps B



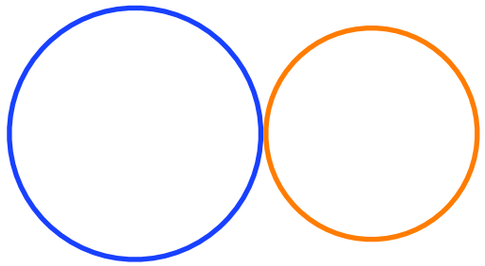
A contains B

A concentric B



A adjacent B

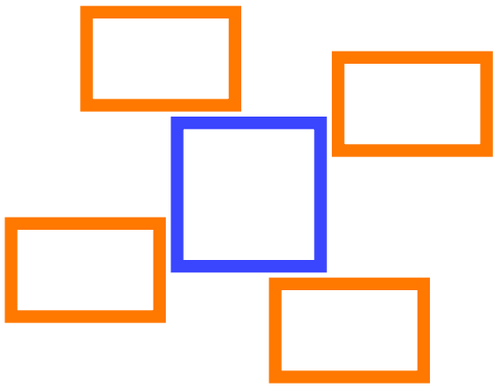
A overlaps B



A right-of B

?

hierarchy of spatial relationships

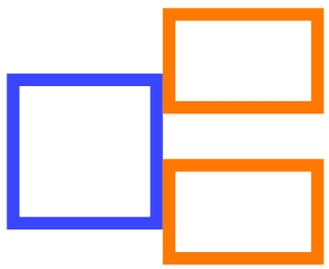


A adjacent B

A below B

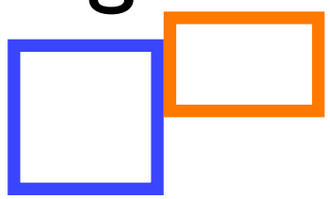
A immediately-below B

A right-of B



A above B

A immediately-right-of B



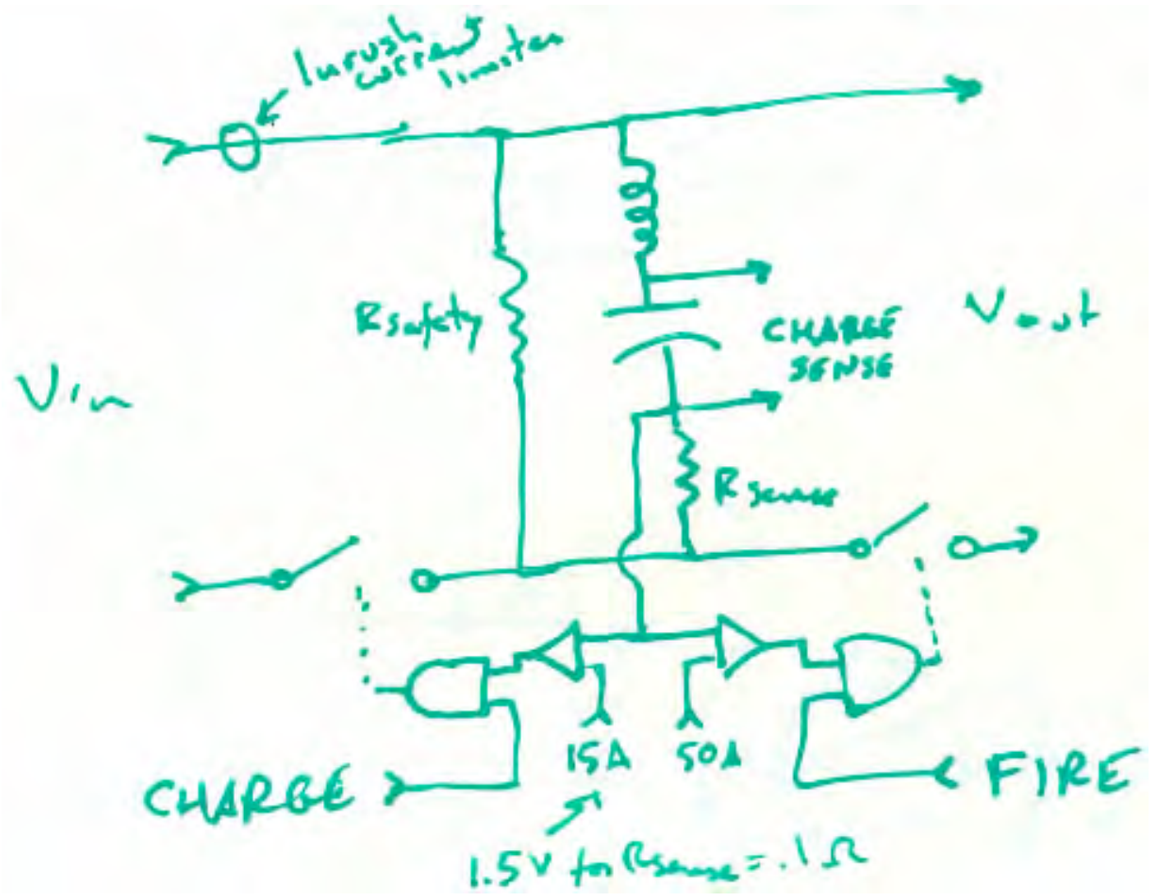
A immediately-above B

configuration (higher level) recognizers

config := {(e_1 $type_1$) (e_2 $type_2$) ... (e_n $type_n$)
(r_1 e_1 e_2)
(r_2 e_1 e_3)
...
(r_n e_i e_j) }

house := (e_1 box) (e_2 triangle)
(immediately-above e_2 e_1)
(approx-same-size e_1 e_2)

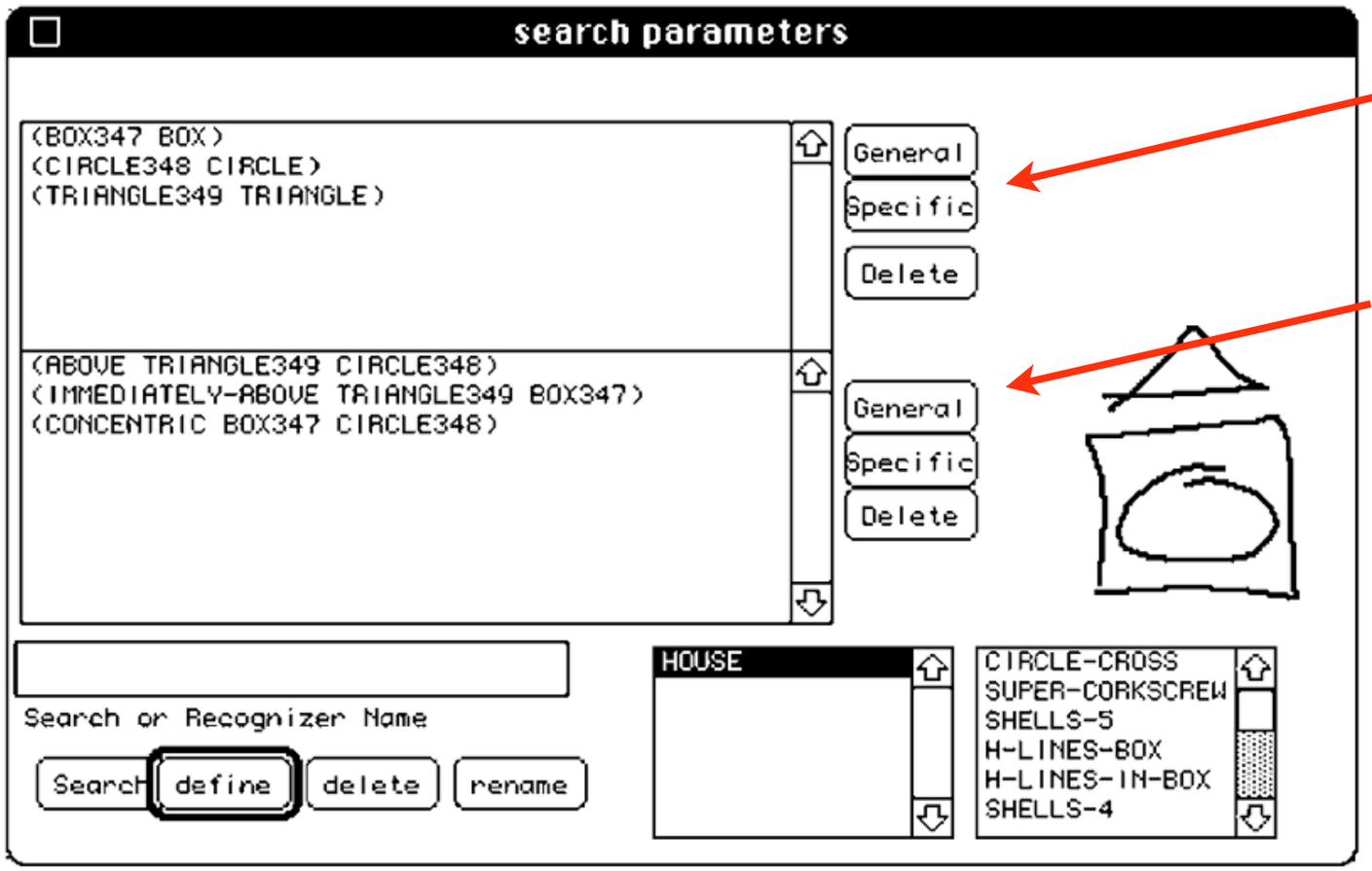
Problem:
which relationships are salient?
which are incidental?



a well-formed VL may answer this... but ...

configurations (elements and relations)

2 ANALYZE SPATIAL RELATIONS



element control

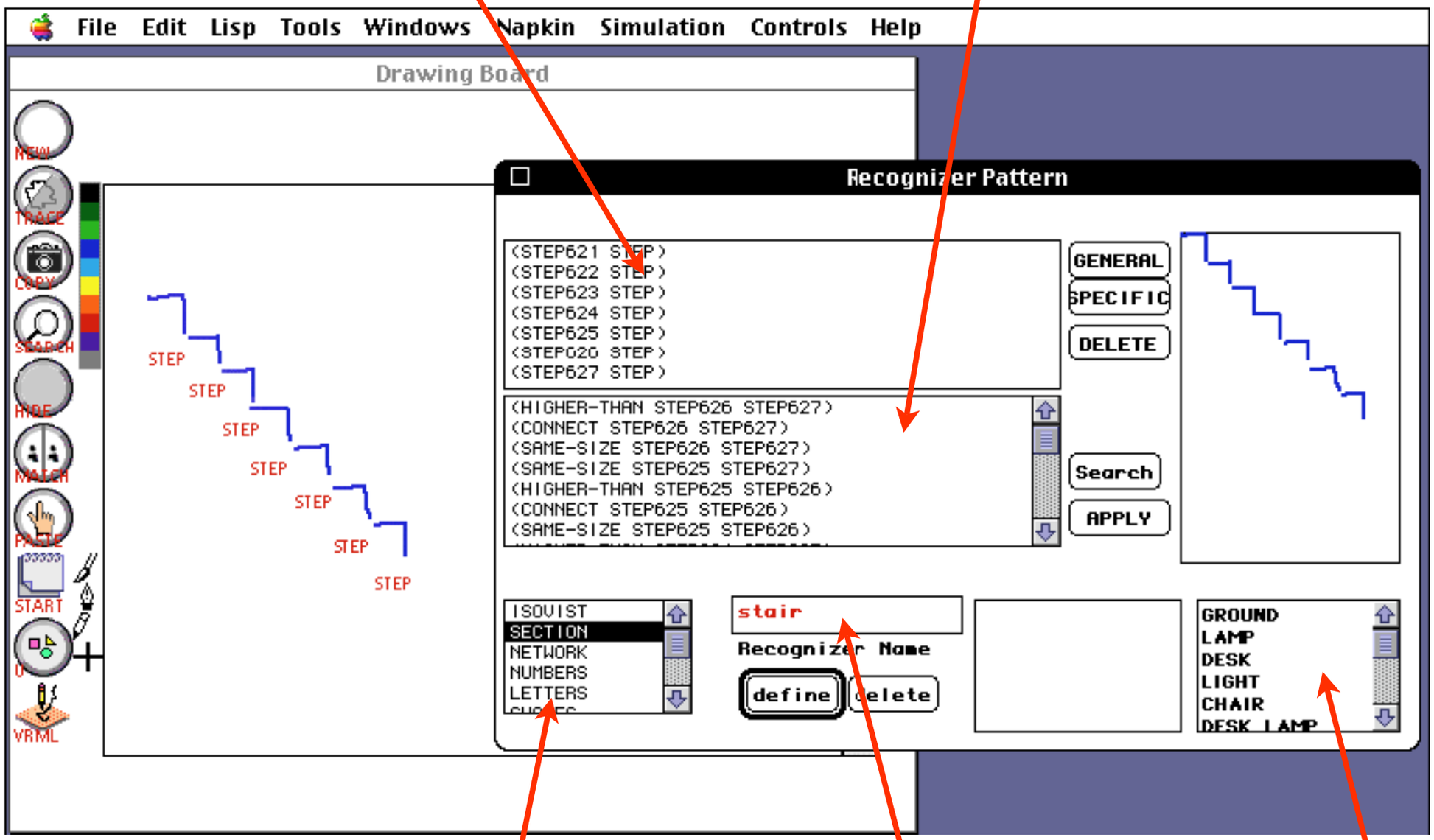
relation control

(BOX347 BOX)
(CIRCLE348 CIRCLE)
(TRIANGLE349 TRIANGLE)

(ABOVE TRIANGLE349 CIRCLE348)
(IMMEDIATELY-ABOVE TRIANGLE349 BOX 347)
(CONCENTRIC BOX347 CIRCLE348)

elements

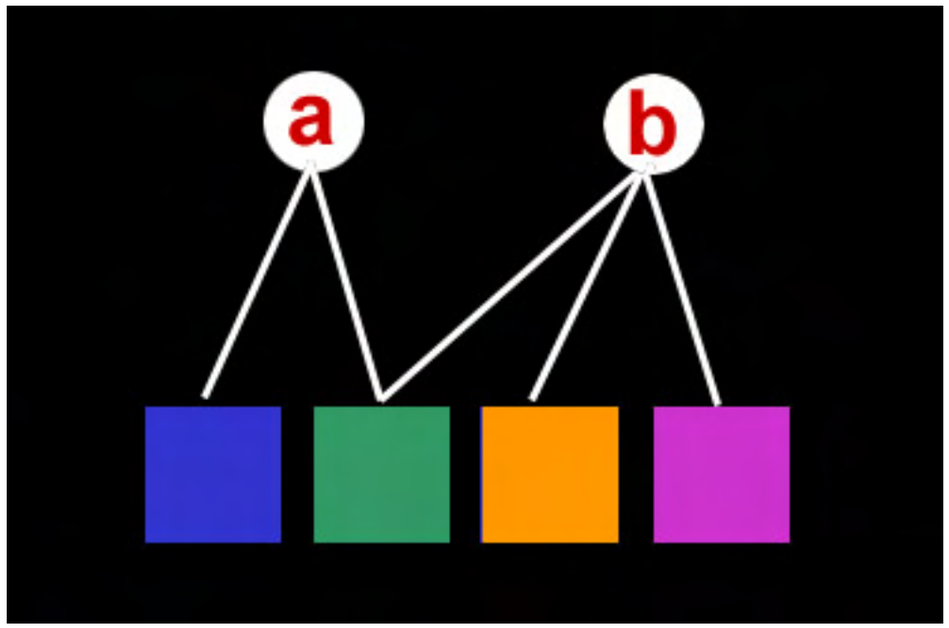
relations

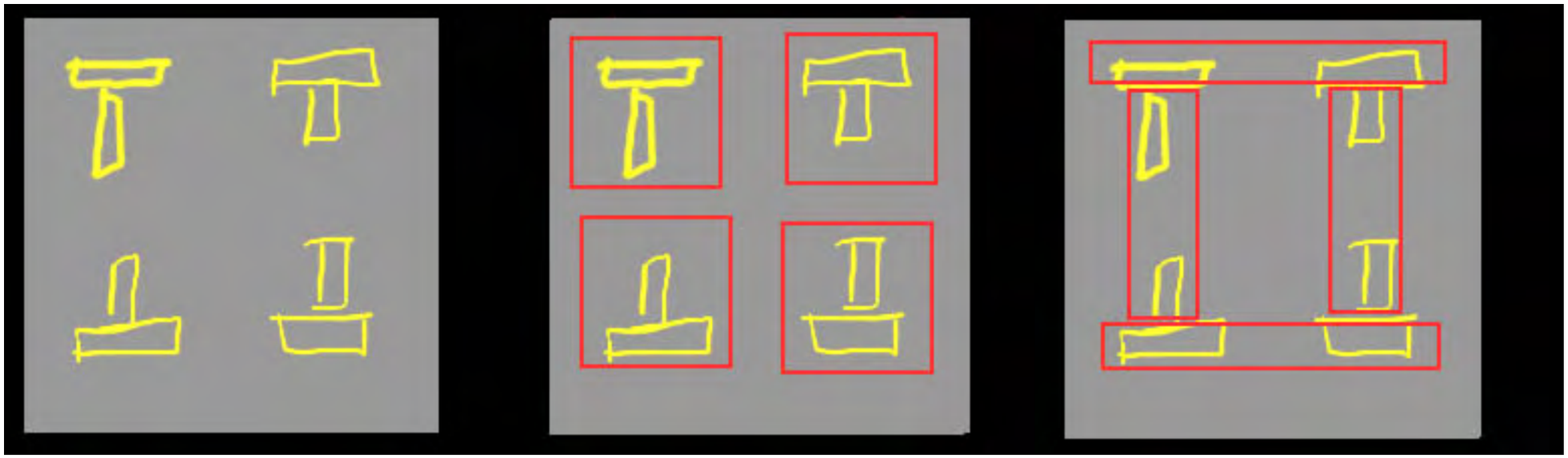


context

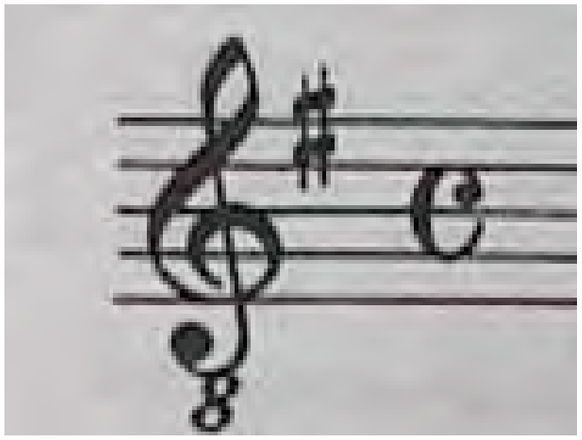
config name

other configs in context

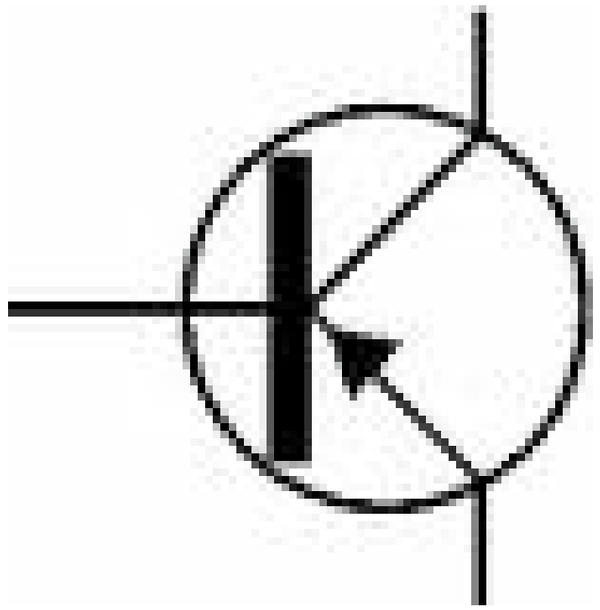




multiple parses are okay ....



CONTEXTS

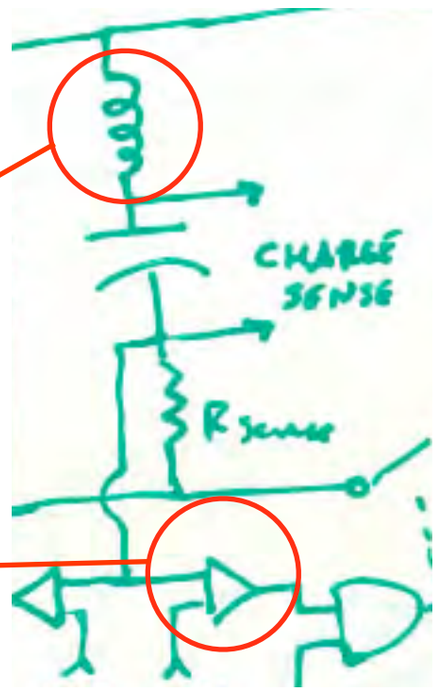


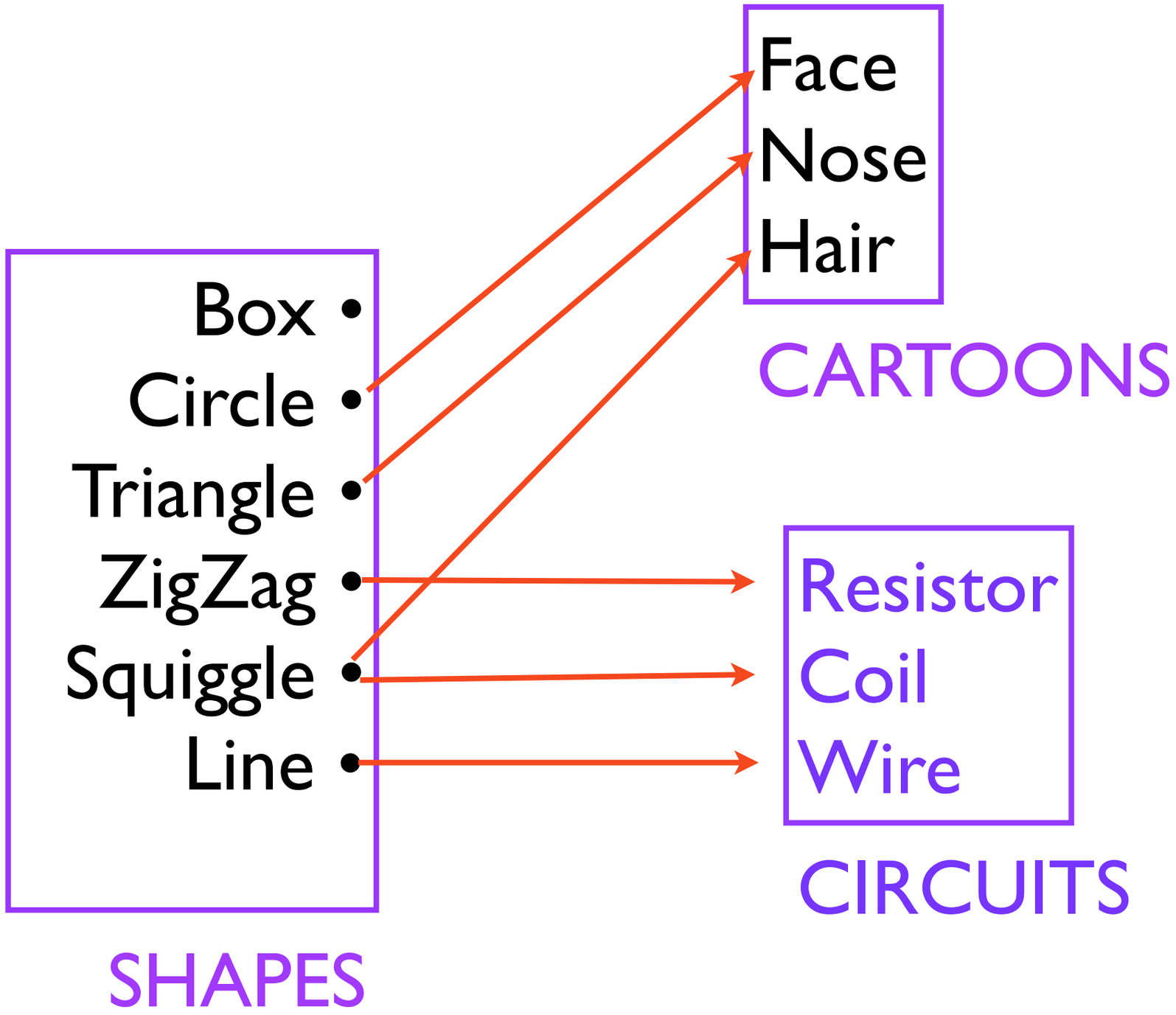
a unique glyph triggers context recognition

context guides recognition

spring? coil?

op-amp? inverter?

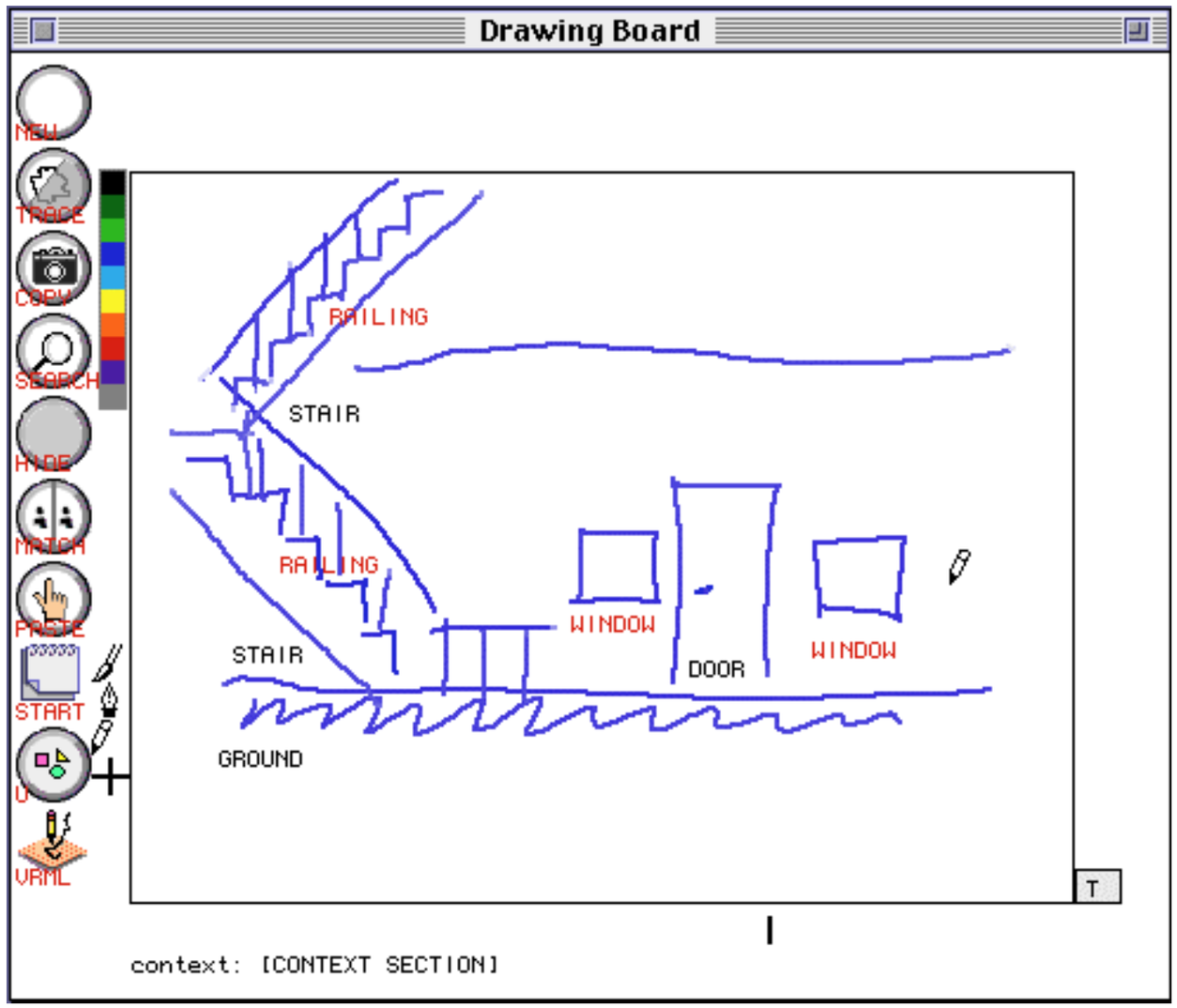




Contexts map glyphs

"current context chain" - (C_1 C_2 ... C_n)

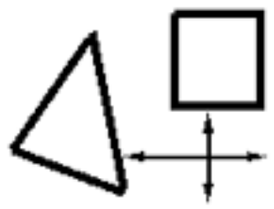
in context “SECTION”, Box ==> Window

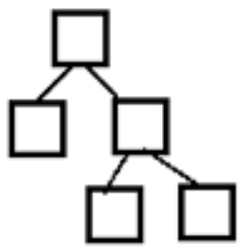


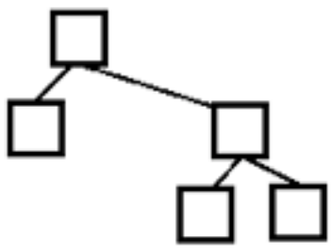
Context affects higher-level configuration recognition too...

in “circuits” context, “parallel resistors” configuration defined by “resistor”, not by “zigzag”

1  RECOGNIZE GLYPHS

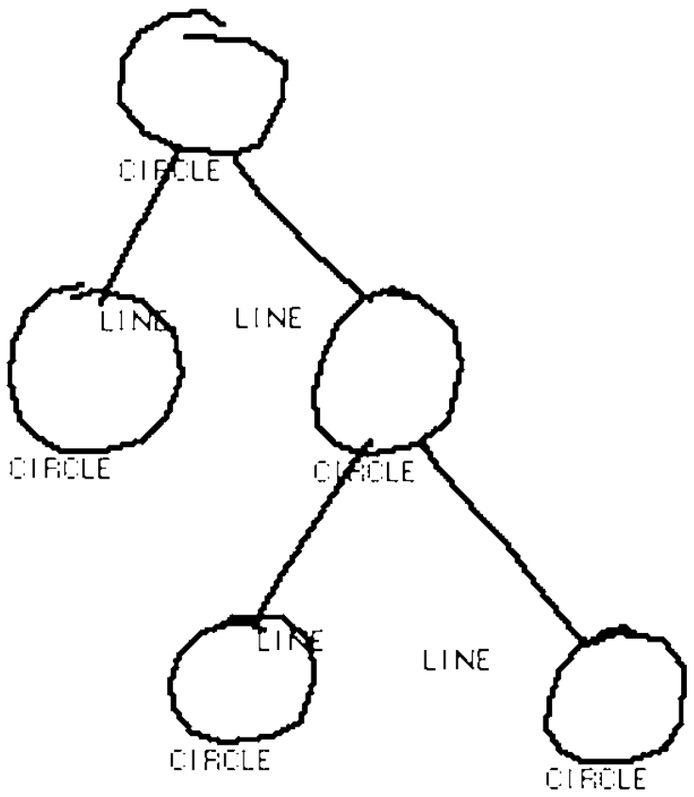
2  ANALYZE SPATIAL RELATIONS

3  MATCH CONFIGURATIONS

4  MAINTAIN CONSTRAINTS

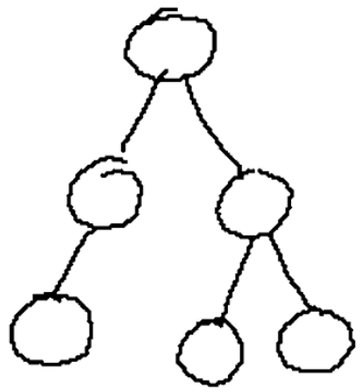
stretch-a-sketch (constraints + sketching)

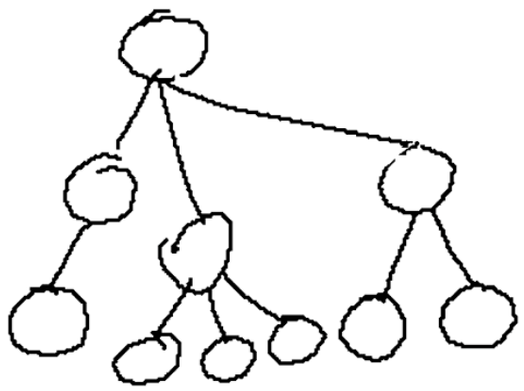
4 MAINTAIN CONSTRAINTS



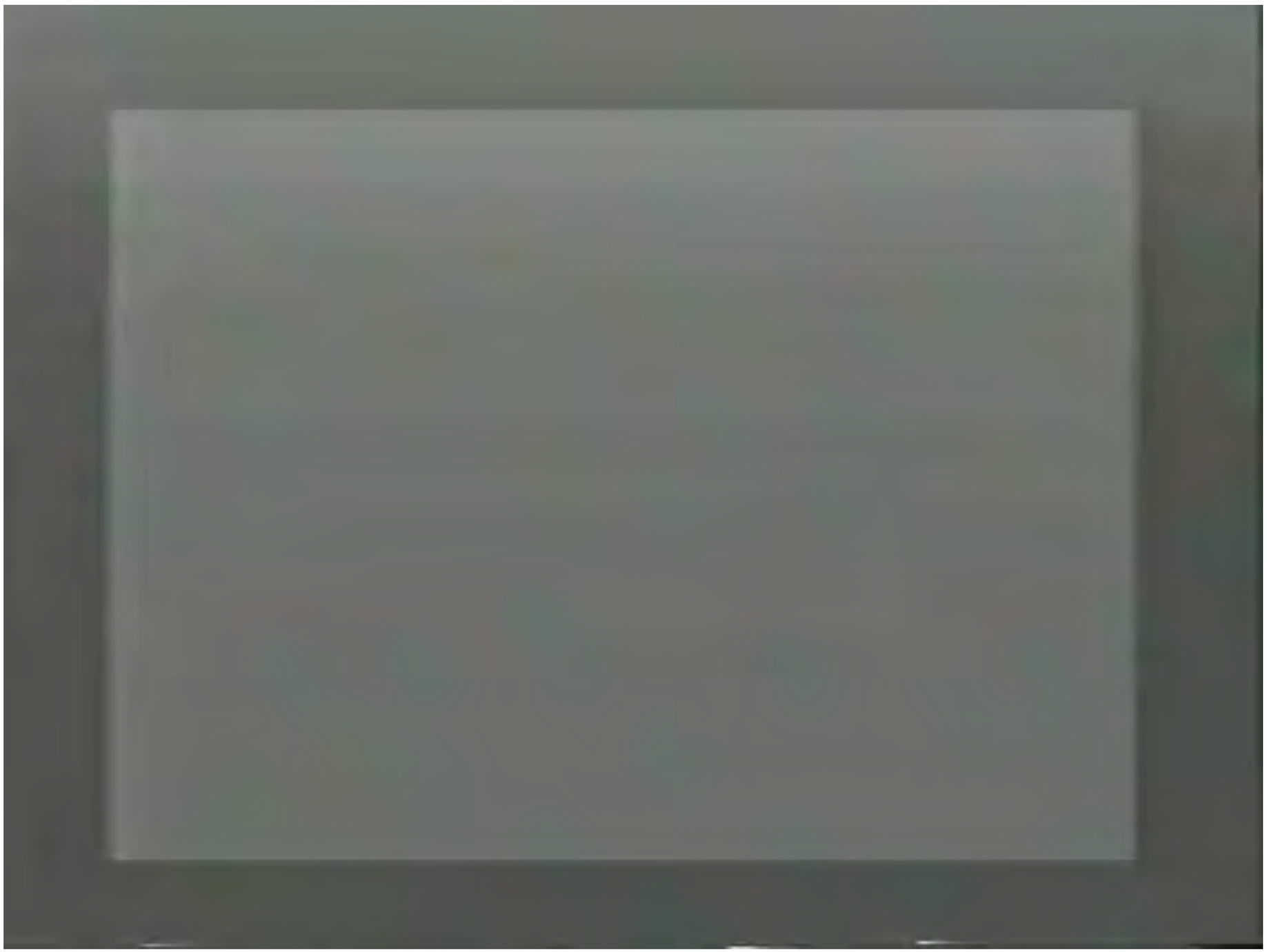
TREE

(CONNECTS LINE01 CIRCLE02)
(CONNECTS LINE01 CIRCLE03)
(ABOVE CIRCLE02 CIRCLE03)



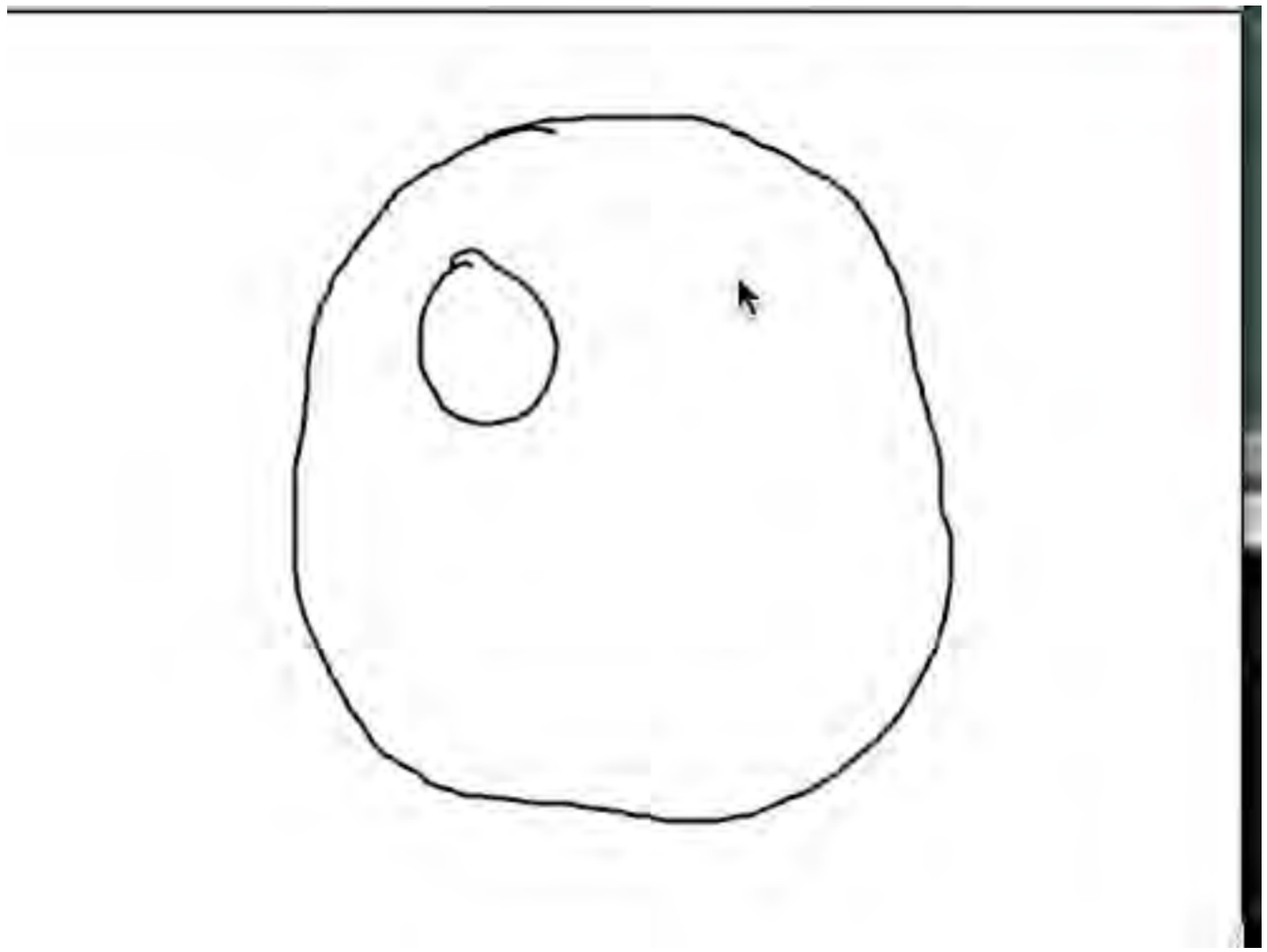


stretch-a-sketch ...



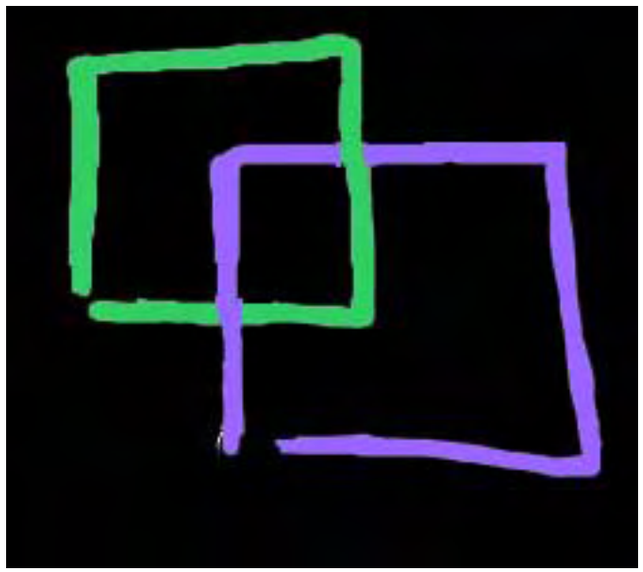
“ambiguous intentions” - UIST ‘96

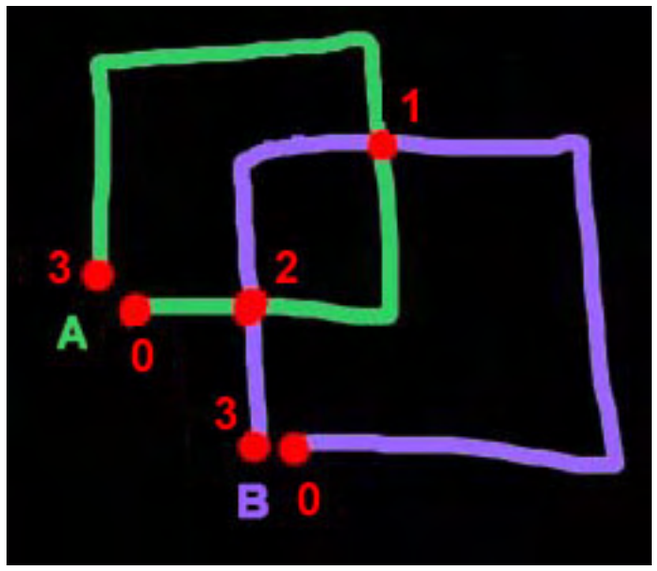
some more stuff ...

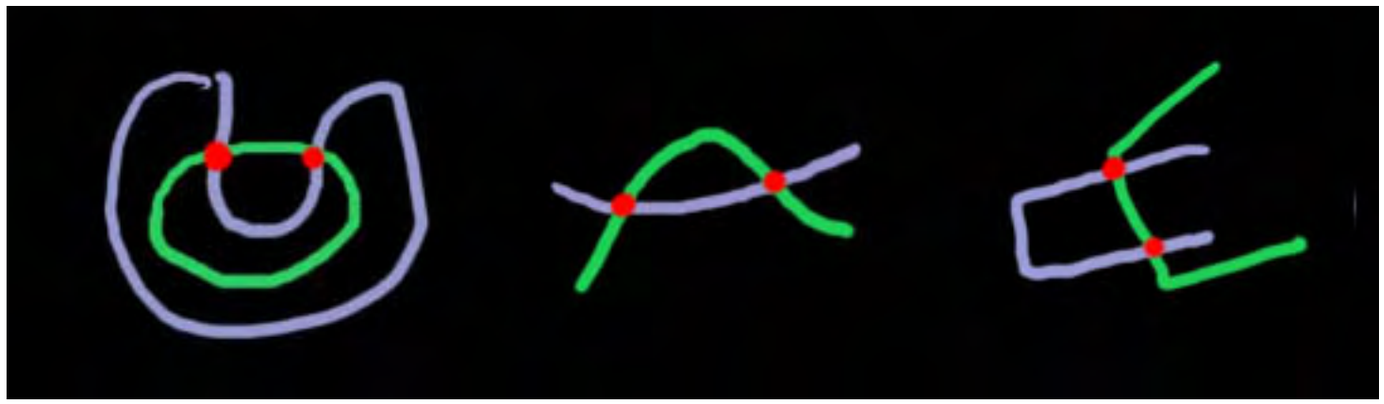


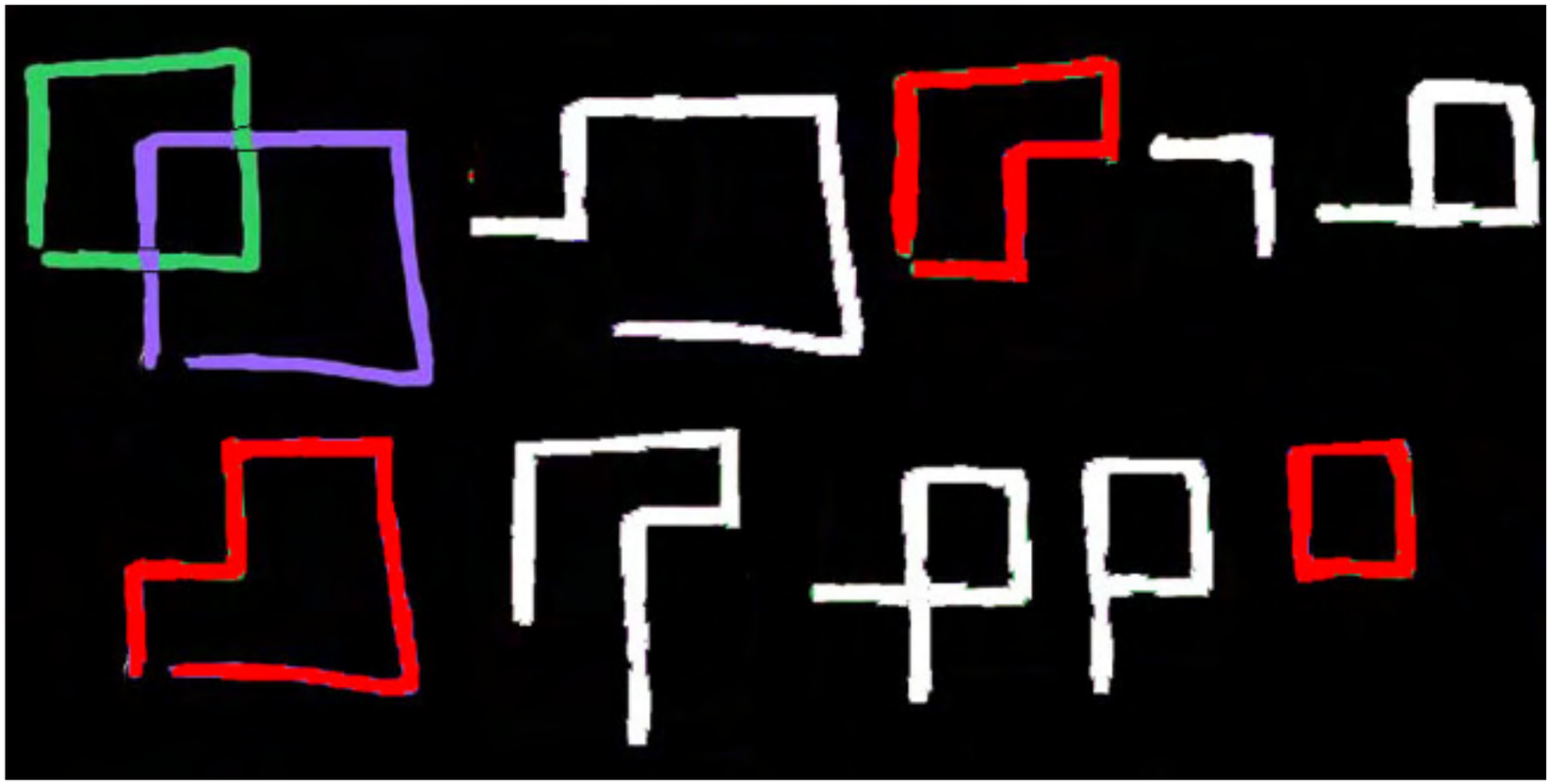
flow-select (gabe johnson: AVI 2004)

“emergent” shapes

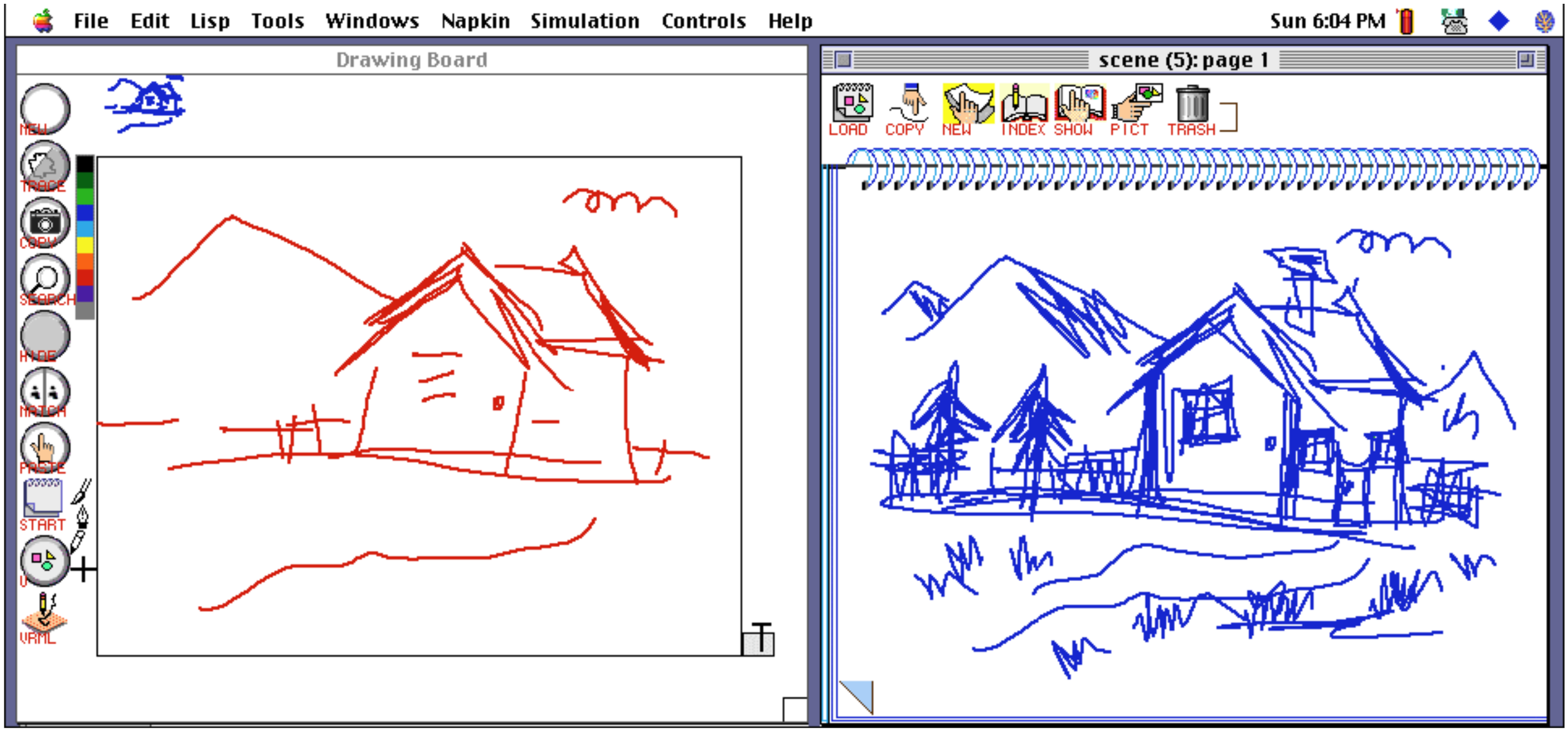






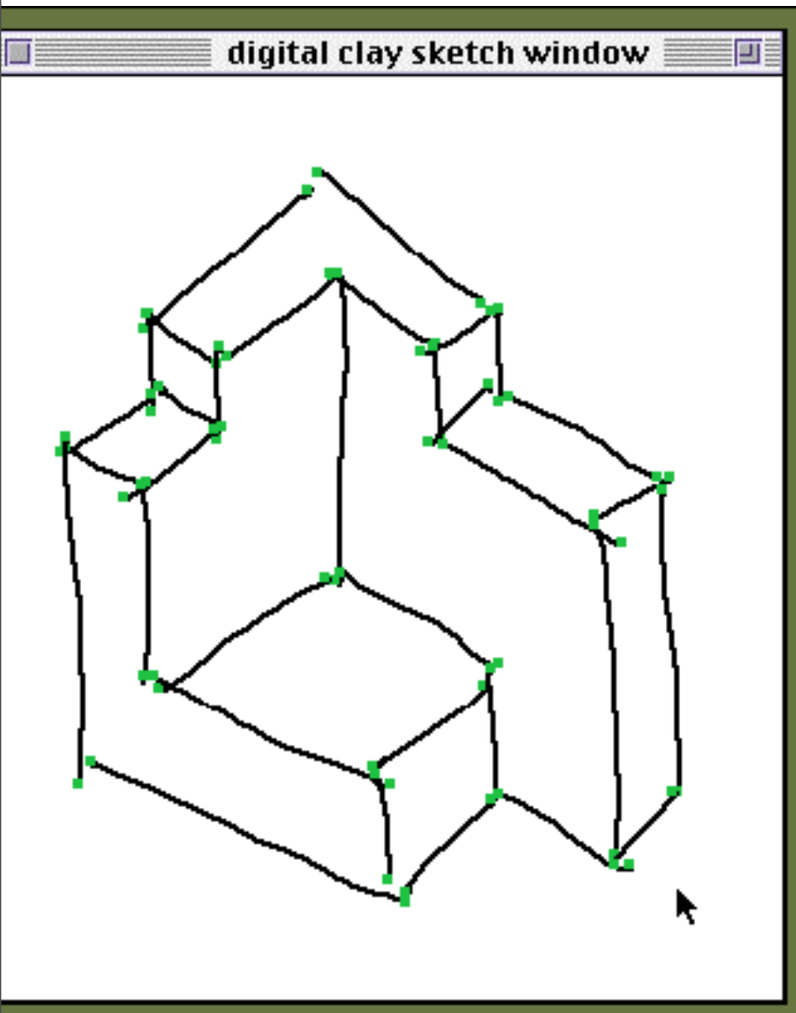


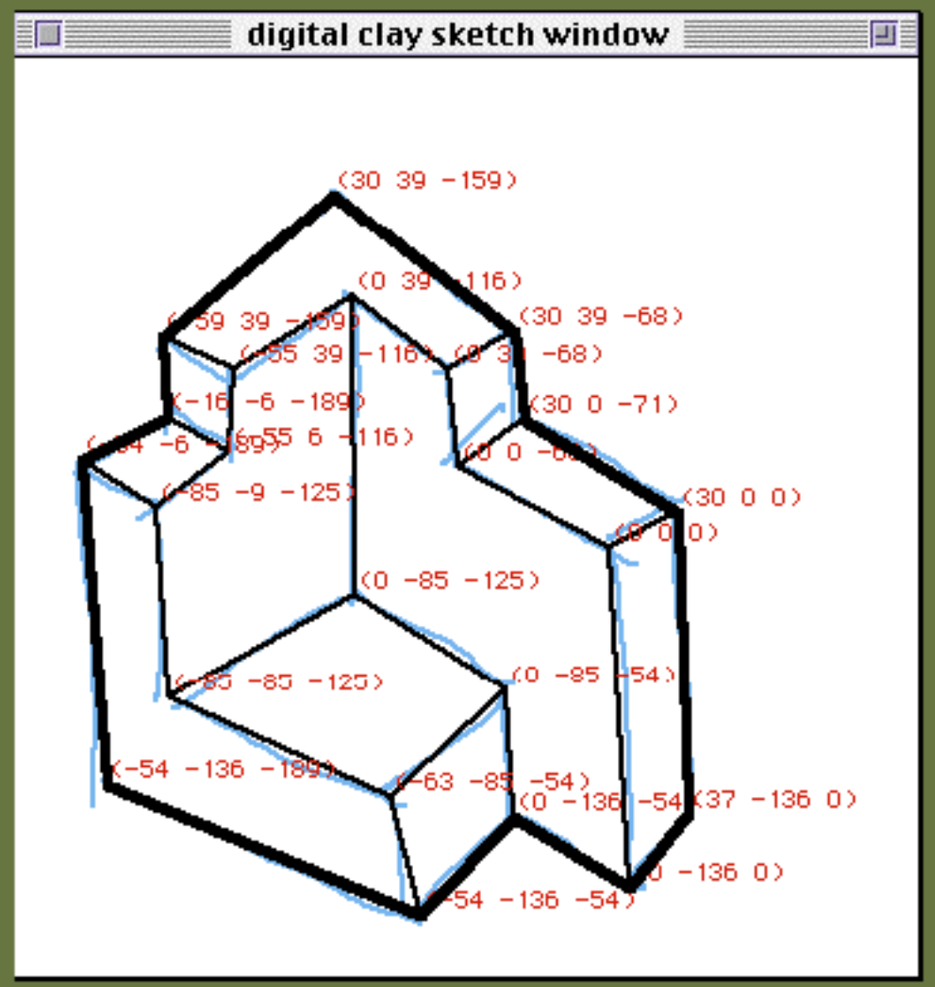
```
((A 0 1) (B 1 2) (A 2 3))
((A 0 1) (B 1 2) (B 2 3))
((A 0 1) (A 1 2) (B 2 3))

((B 0 1) (A 1 2) (B 2 3))
((B 0 1) (A 1 2) (A 2 3))
((B 0 1) (B 1 2) (A 2 3))

((A 0 1) (B 1 2) (A 2 1) (B 1 0))
((A 0 1) (A 1 2) (B 2 1) (B 1 0))
```

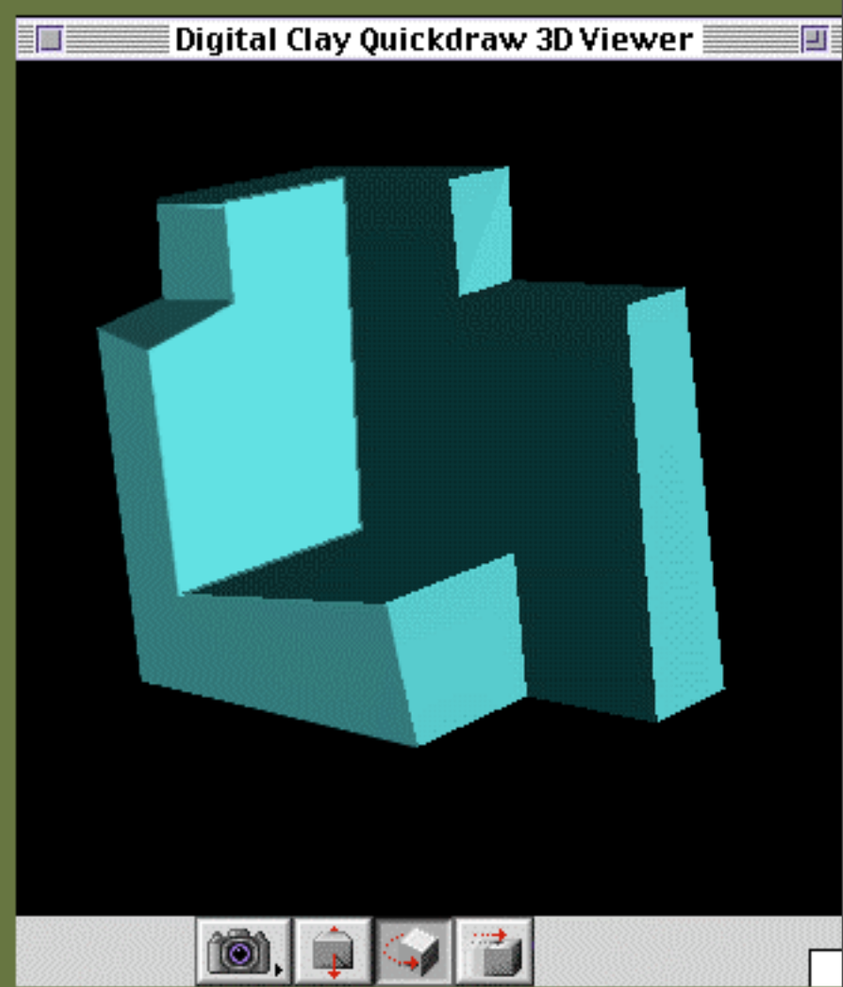

File Edit Lisp Tools Windows Napkin Simulation Controls Help
Sun 6:04 PM
Drawing Board
NEW
TRACE
COPY
SEARCH
HIDE
MATCH
PASTE
START
VRML
scene (5): page 1
LOAD
COPY
NEW
INDEX
SHOW
PICT
TRASH

filtering ...

2D sketch to 3D model





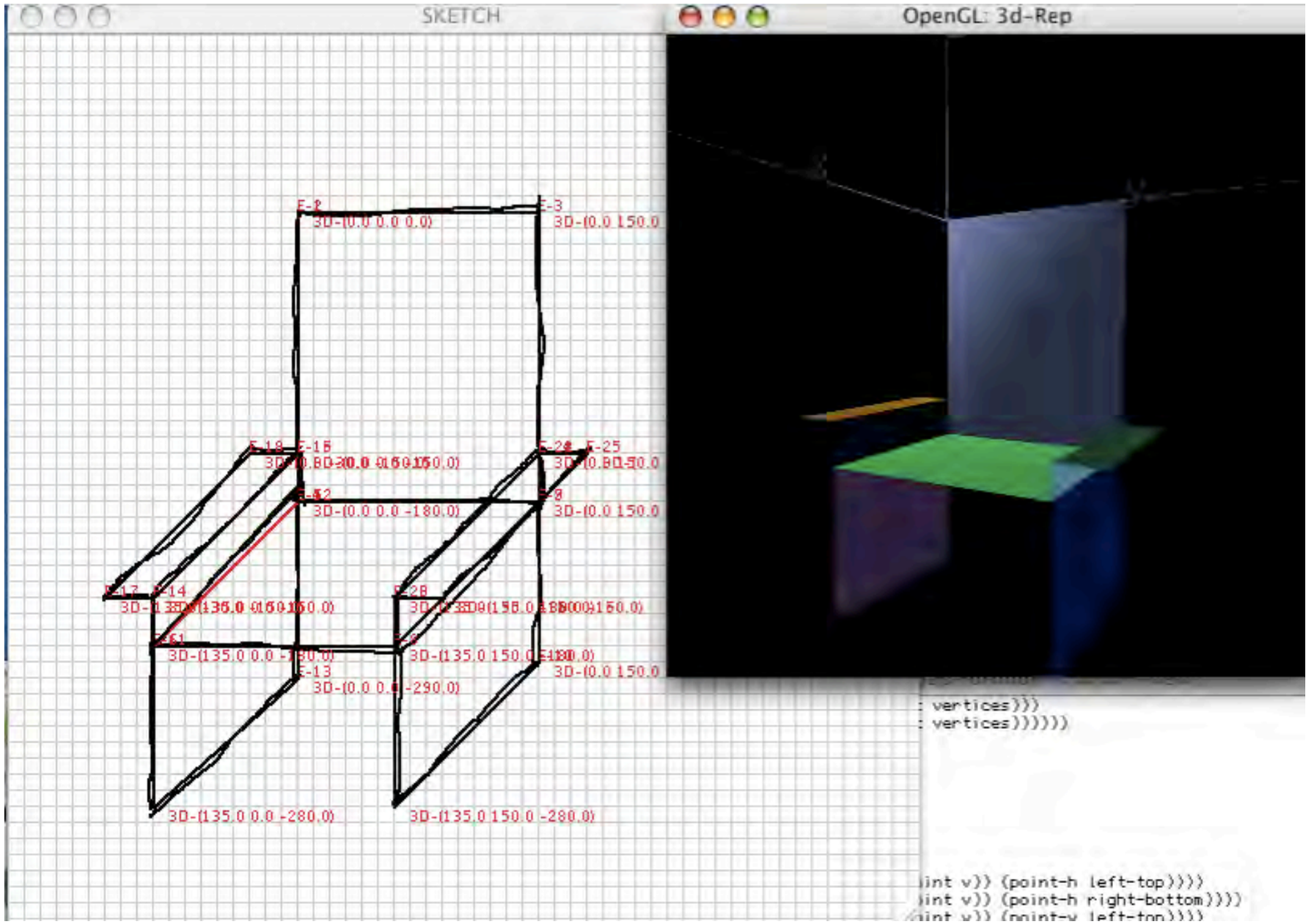


digital clay (eric schweikardt)

Huffman / Clowes constraint propagation

digital clay movie

digital clay movie



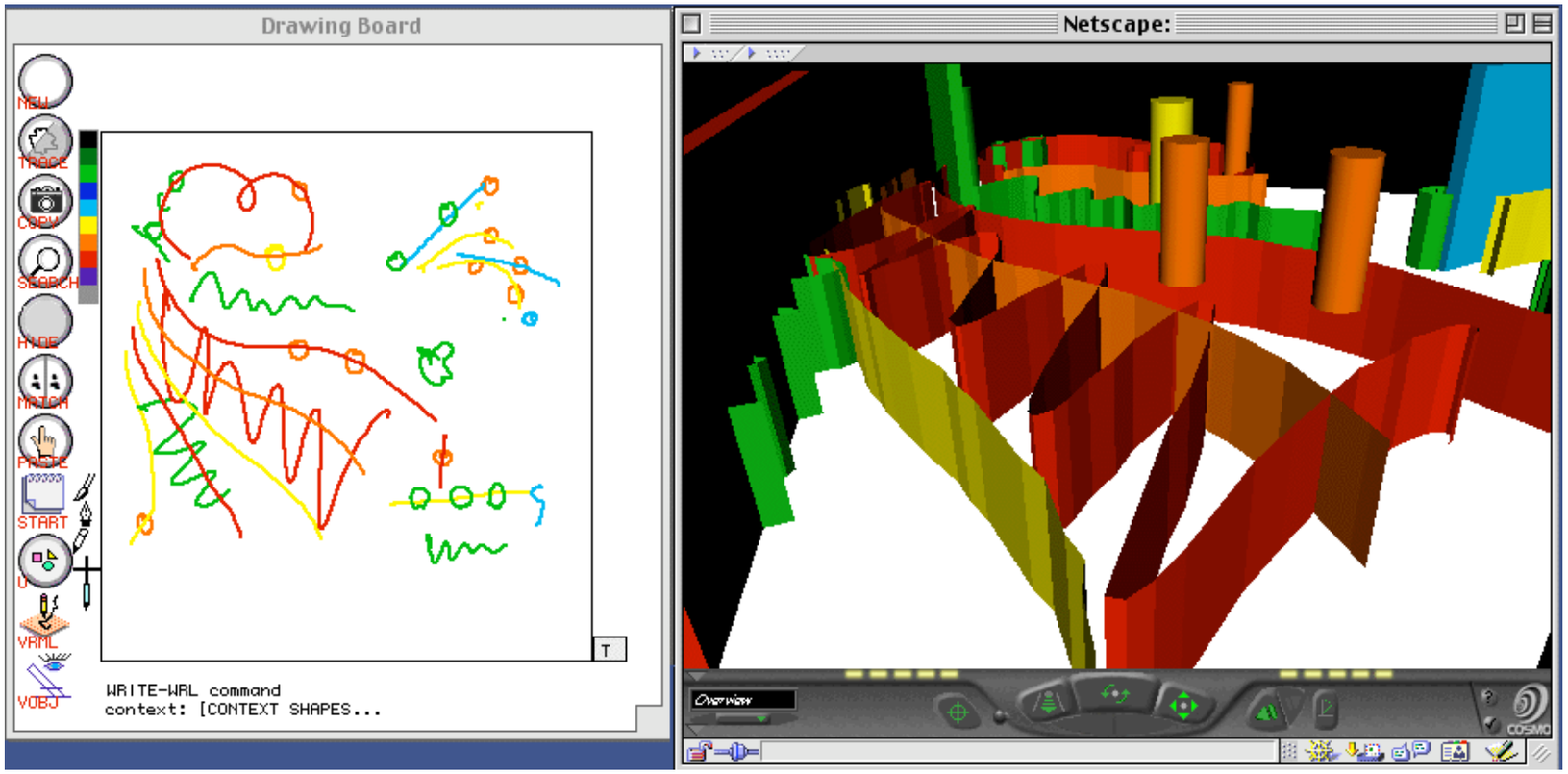
Furniture Factory (yeonjoo oh)

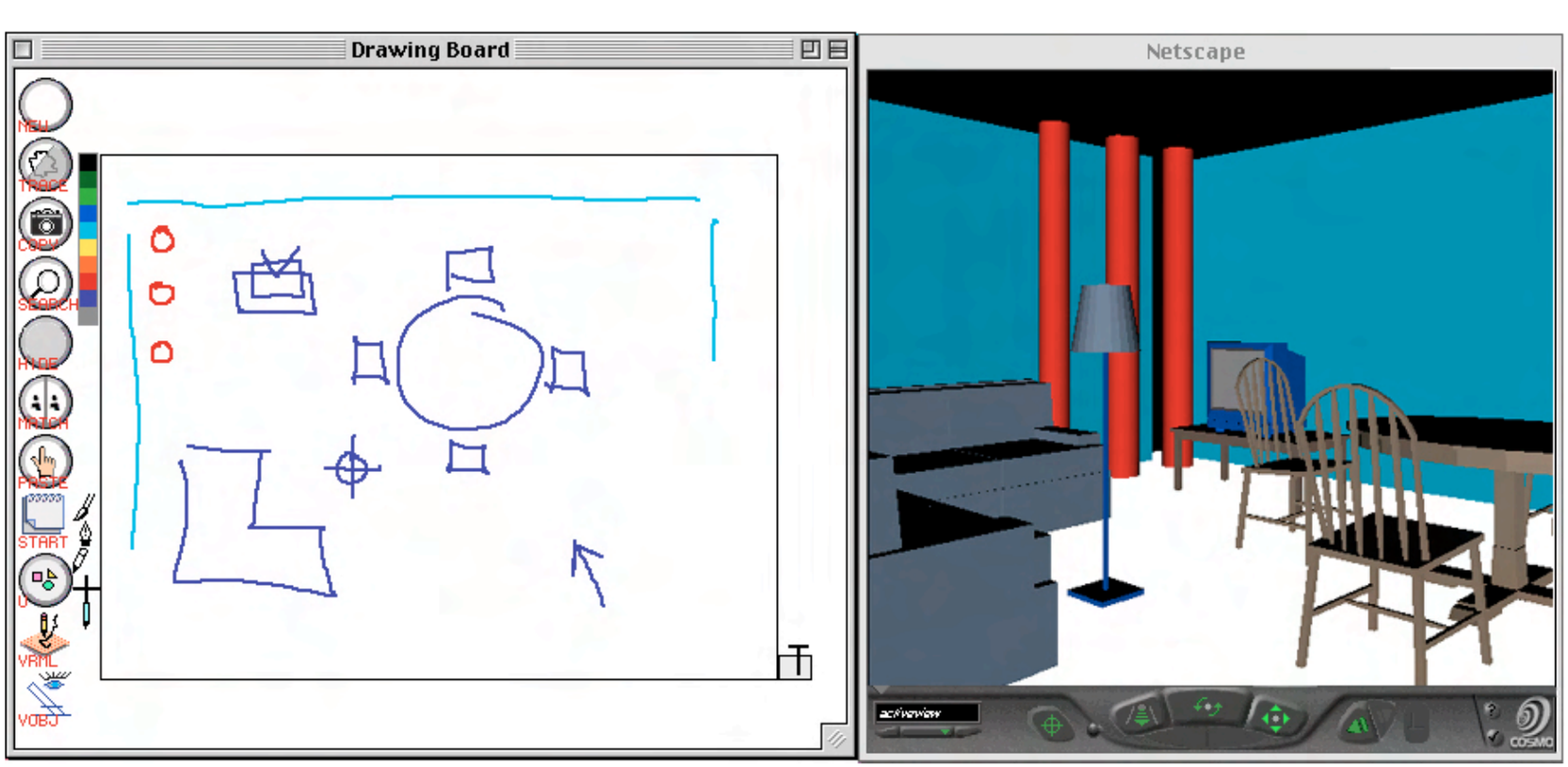
- angular distribution => coordinate axes,
- cycles => planes

see Lipson

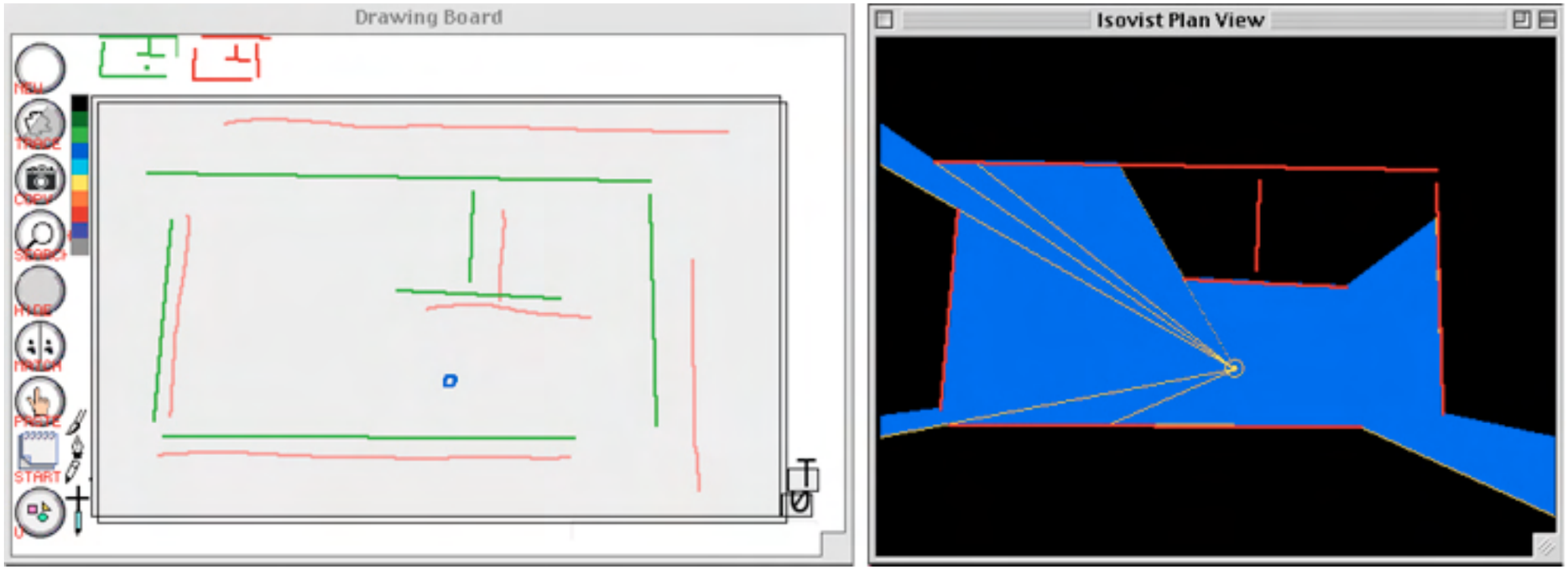
applications

("sketching as an interface to just about everything")

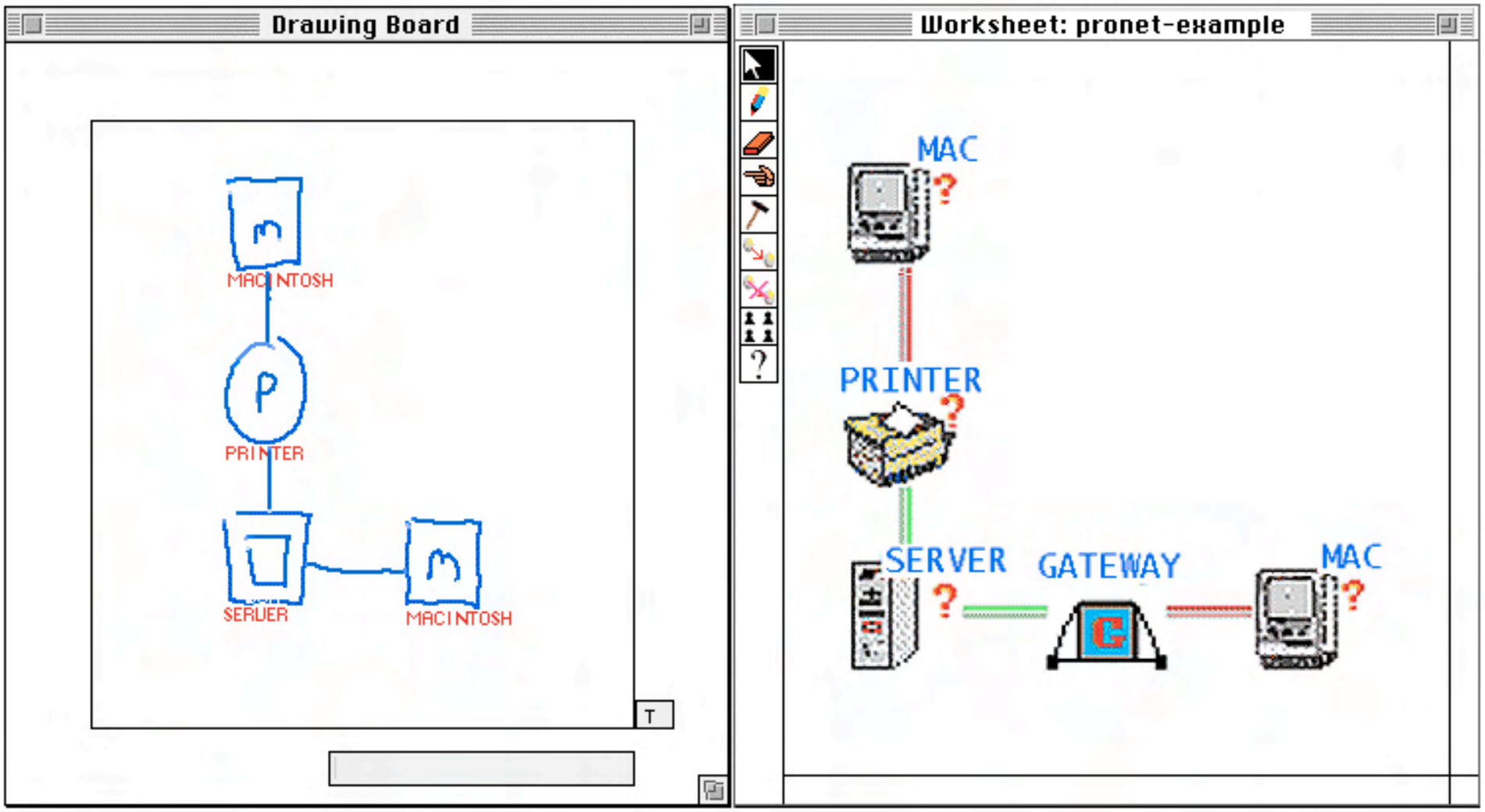




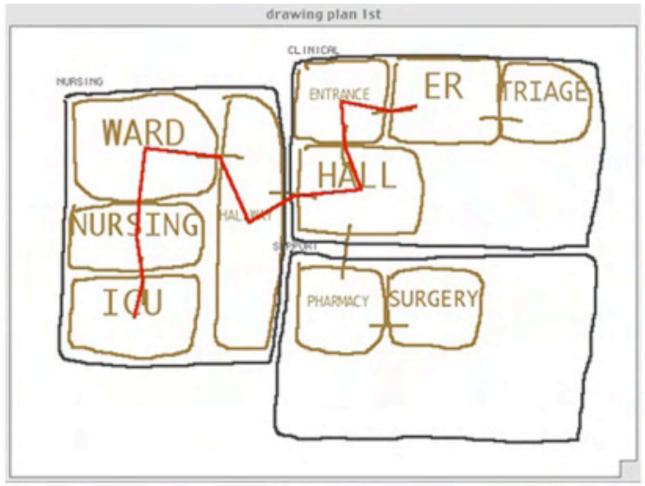
VR sketchpad (ellen yi-luen do)

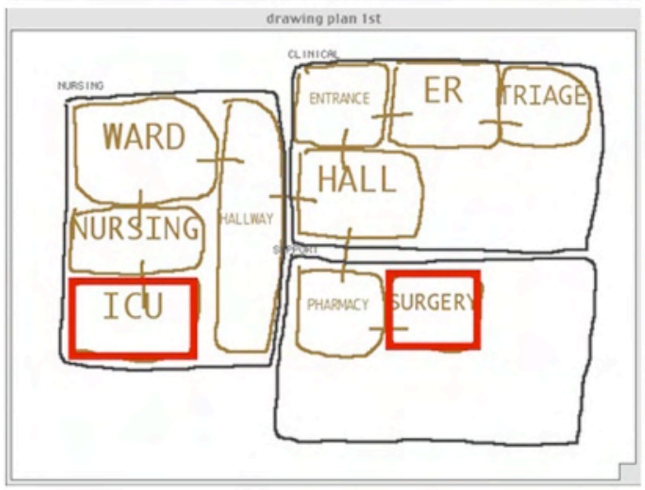


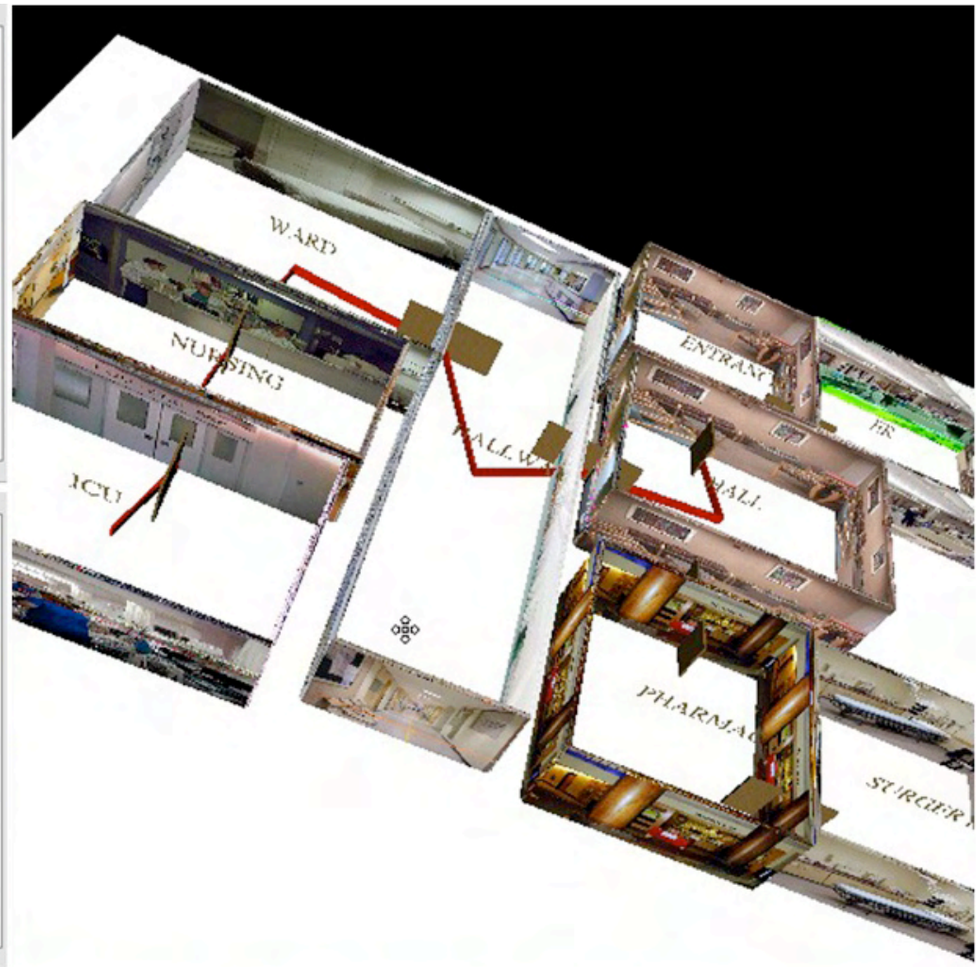
isovist (simulation)

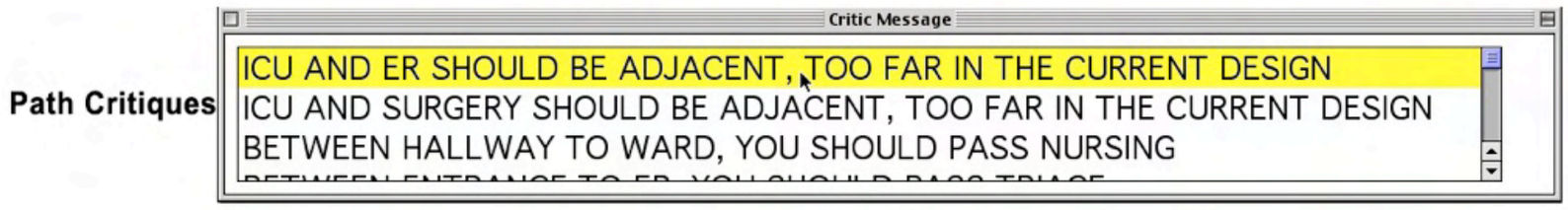


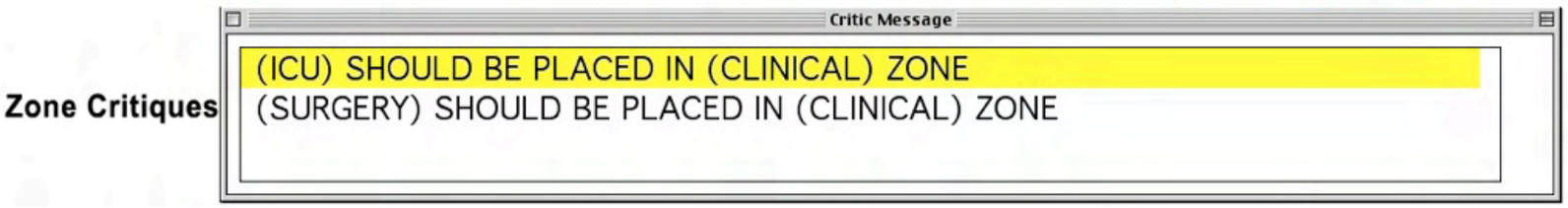
simulation & advisor



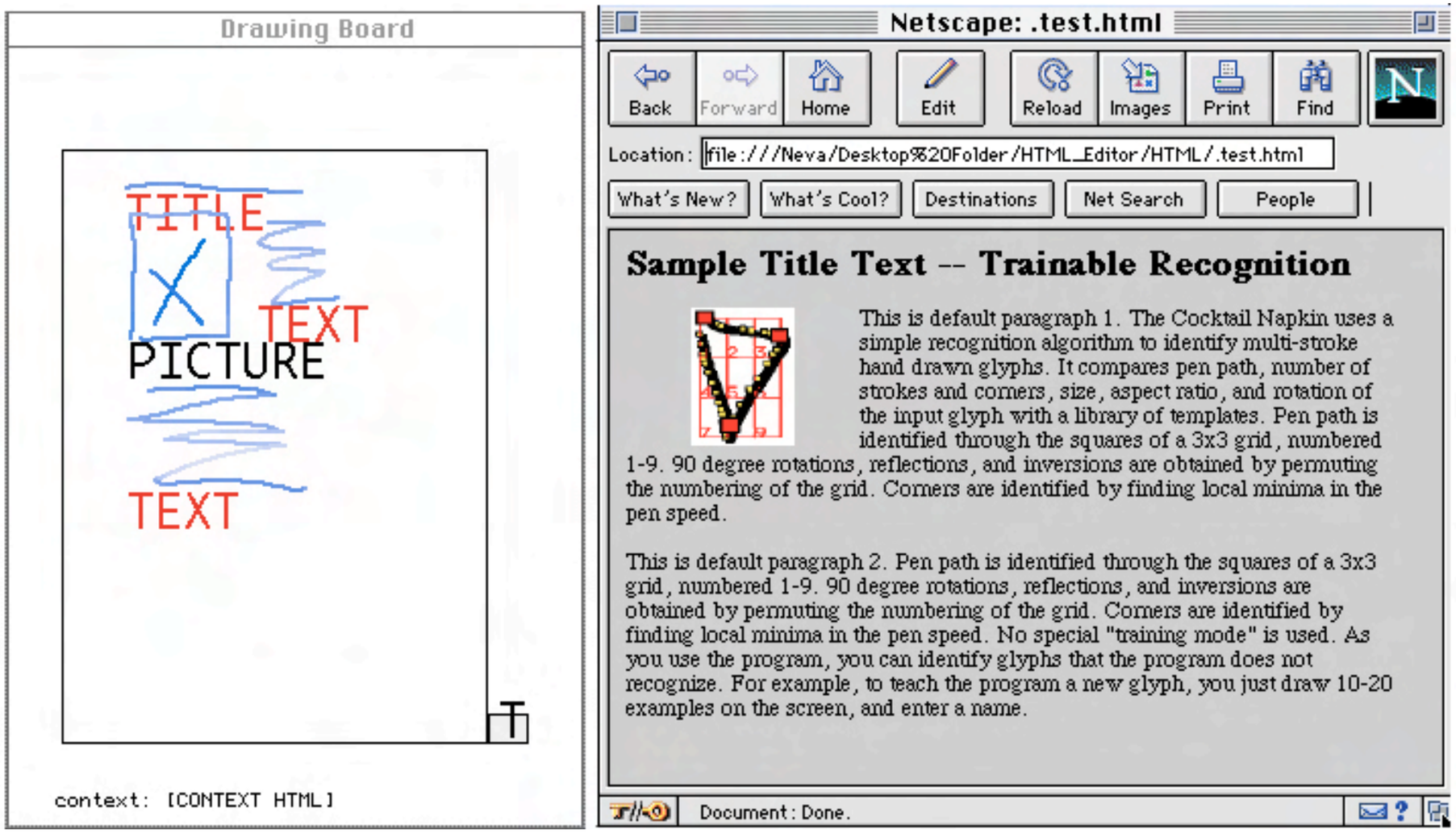


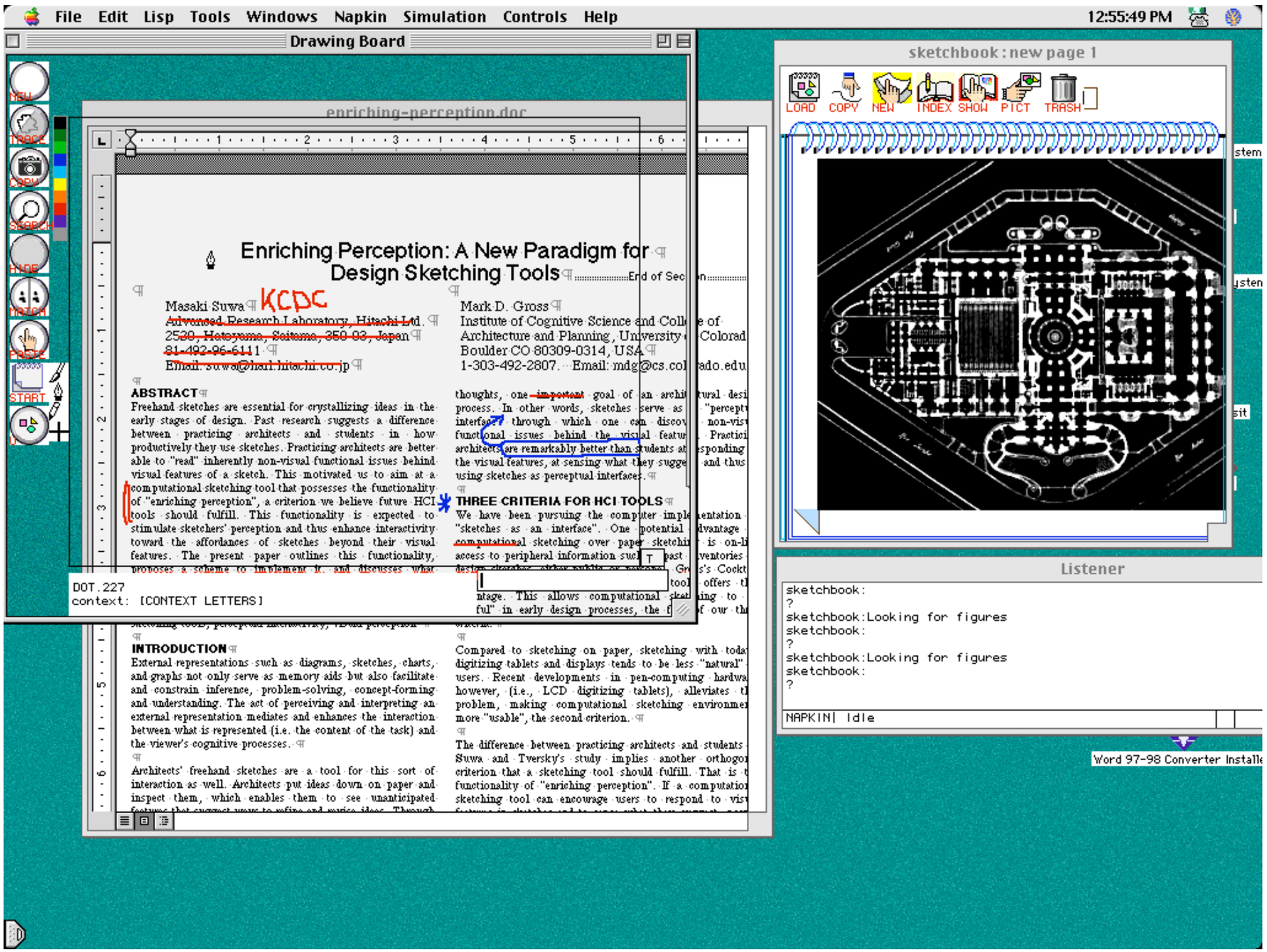






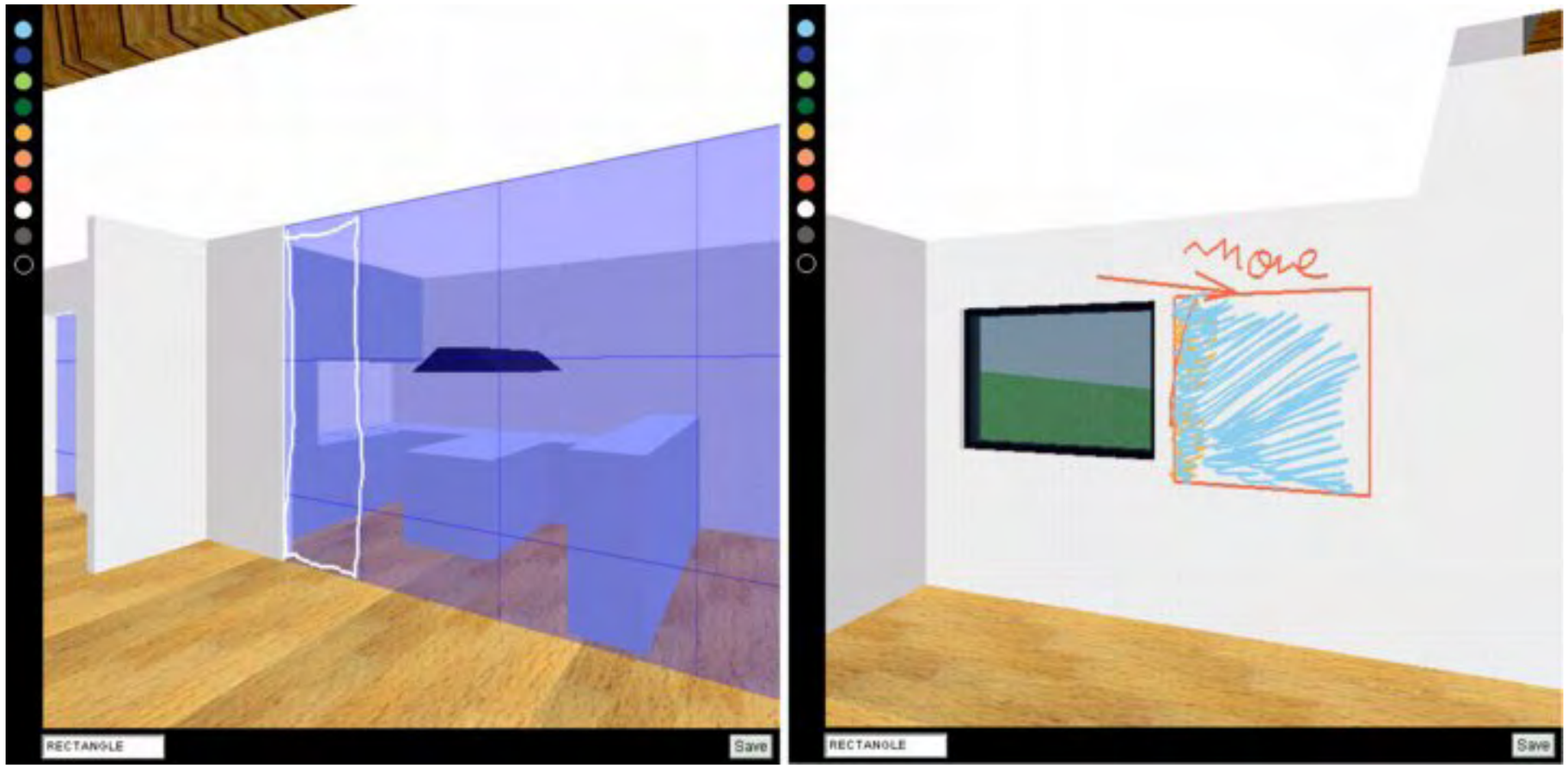
design evaluator (yeonjoo oh)


Drawing Board
TITLE
TEXT
PICTURE
TEXT
context: [CONTEXT HTML]
Netscape: .test.html
Back
Forward
Home
Edit
Reload
Images
Print
Find
Location: file:///Neva/Desktop%20Folder/HTML_Editor/HTML/.test.html
What's New?
What's Cool?
Destinations
Net Search
People
Sample Title Text -- Trainable Recognition
This is default paragraph 1. The Cocktail Napkin uses a simple recognition algorithm to identify multi-stroke hand drawn glyphs. It compares pen path, number of strokes and corners, size, aspect ratio, and rotation of the input glyph with a library of templates. Pen path is identified through the squares of a 3x3 grid, numbered 1-9. 90 degree rotations, reflections, and inversions are obtained by permuting the numbering of the grid. Corners are identified by finding local minima in the pen speed.
This is default paragraph 2. Pen path is identified through the squares of a 3x3 grid, numbered 1-9. 90 degree rotations, reflections, and inversions are obtained by permuting the numbering of the grid. Corners are identified by finding local minima in the pen speed. No special "training mode" is used. As you use the program, you can identify glyphs that the program does not recognize. For example, to teach the program a new glyph, you just draw 10-20 examples on the screen, and enter a name.
Document: Done.



transparent overlay to interact with * by sketching

indexing database by sketches (query-by-sketch)



annotating and creating geometry in 3D worlds by sketching (thomas jung, CHI, IUI 2002)

space-pen - annotating in 3D

light-pen - expert system advisor for lighting design

thanks

ellen yi-luen do (1994-2000)
gabe johnson (2004-)
thomas jung (1999 - 2003)
yeonjoo oh (2002 -)
eric schweikardt (1997-1998)

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