MODES, METAPHORS, AND INPUT DEVICES

24 FEB 2016

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ANNOUNCEMENTS

Only one 3-4pm section this week (Diane's)

Attendance: Must be here on required Days! Late = No attendance

Counts towards participation grade!

New Required Attendance:

Section: Friday 11 March

Lecture: Monday 28 March (after Spring Break)

PROG 2-B (Due 2 Mar) 1 WEEK!!!!!

Midterm: 16 March 2:30-4pm in Sibley Auditorium

Midterm Review: Wed, 9 March 4-5pm (after class) in 310 Jacobs

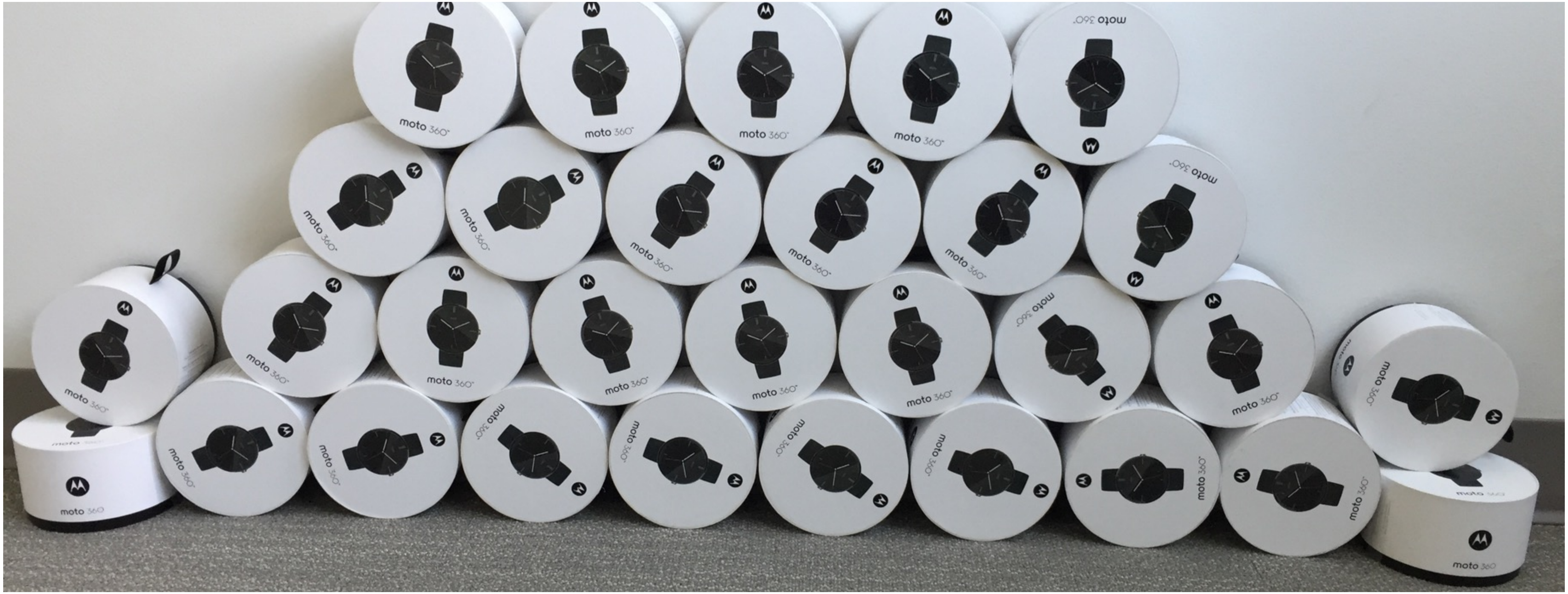
Watches on Monday after class : $100 payable to UC Regents

moto 360™
moto
moto 360™
moto 360™
moto 360™

WATCHES

FEED 02

$100 CHECK



BRAINSTORM — DO NOT LIST

Do not do list: at MOST, 10 ideas on your list can come from here

- Personal Body/Fitness tracker
- Generic personal health or diet
- Ideas tangential to healthcare, like drunk driving
- Scheduling/appointment apps
- Insurance/paperwork focused app tasks

BRAINSTORM — DO DO LIST

If you're stuck for ideas, take a look at the departments in the Oakland Children's hospital:

http://www.childrenshospitaloakland.org/main/departments-services.aspx

Departments & Services

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A
Adolescent Medicine & Teen Health
Anesthesiology
Apheresis / Photopheresis Program
Artist-in-Residence
Audiology

B
Behavioral Pediatrics Clinic
Blood & Marrow Transplantation (BMT)
Brentwood Specialty Care Clinic

C
Camp Winning Hands
Cancer & Blood Diseases (Hematology/Oncology)
Cancer Research
Cardiac Anesthesia
Cardiac Catheterization Services
Cardiology
Cardiothoracic Surgery
Cardiovascular Intensive Care
Center for Applied Genomics (CAG)
Center for Child Protection
Center for Community Health and Engagement
Center for the Vulnerable Child
Child Development Center
Child Life Services
Clinical Nutrition
Comprehensive Thalassemia Center
Cord Blood Program
Craniofacial Center
Critical Care Medicine
Cystic Fibrosis Program

D
Day Hospital
Dentistry
Dermatology
Developmental Playgrounds Program

N
National Center for Sickle Cell Disease
Neonatal Cardiovascular Care Program
Neonatal Developmental Care
Neonatal Follow-up Program
Neonatal Gastrointestinal Intensive Care (GI-NICU)
Neonatal Intensive Care Unit (NICU)
Neonatal Neurologic & Neurosurgical Care
Neonatal Pulmonary Care Program
Neonatology
Nephrology
Neurology
Neuro-oncology
Neuropsychology
Neurosciences Center
Neurosurgery
Noninvasive Cardiac Imaging
Nutrition, Clinical

O
Occupational Therapy
Oncology
Ophthalmology
Orthopaedics
Otolaryngology (ENT)
Outpatient Surgery Center Walnut Creek

P
Palliative Care Program
Parent Infant Program (PIP) / Local Early Access Program (LEAP)
Pathology & Laboratory Medicine
Peacock Cerebral Palsy & Movement Disorders Center
Pediatric Intensive Care Unit (PICU)
Pharmacy
Physical Therapy
Plastic & Reconstructive Surgery
Primary Care (Pediatrics)
Psychiatry

E
Early Childhood Mental Health
Early Intervention Services
Electrophysiology & Arrythmia Management
Emergency Medicine
Encore Medical Clinic
Endocrinology & Diabetes Care
ENT (Ear, Nose, & Throat)
Epilepsy Clinic

F
Family Outreach & Support Clinic
Family Resource & Information Center
Fetal Cardiology
Fetal Medicine Program
FIND Program

G
Gastroenterology, Hepatology, Nutrition (GI)
Gentle Hands Program

H
Hand and Reconstructive Microsurgery Program
Healthy Eating Active Living (HEAL) Program
Hearing & Speech
Heart Center
Hematology (Nonmalignant) & Complex Blood Disorders
Hematology-Oncology
Hemoglobinopathy Laboratory
Hemophilia, Hemostasis, Thrombosis Center
HIV & AIDS
HLA/Immunogenetics Laboratory
Hospitalists

I
Infectious Diseases
Infusion Center

Pulmonology & Respiratory Care

Q

R
Radiology and Imaging
Rehabilitation Medicine
Respiratory Therapy
Rett Syndrome Clinic
Rheumatology

S
San Ramon - Children's Hospital Specialty Care San Ramon
School Program
Scoliosis Center
Sickle Cell Disease, National Center for
Skeletal Dysplasia Clinic
Sleep Disorders Center
Sleep Lab
Southeast Asia Clinic
Speech & Language Therapy Clinic
Spine Center
Sports Medicine Center for Young Athletes
Surgery
Synagis Clinic

T
Thalassemia Center
Trauma Care
Tuberculosis Program
Tuberous Sclerosis Complex Jack & Julia Center

U
Urology

V
Volunteer Services

W
Walnut Creek - Children's Hospital Walnut Creek Specialty Care

BRAINSTORM — DO DO LIST

We highly encourage you to design for a specific target audience which you may have no current knowledge about. This is an opportunity to learn from the research you will conduct.

- We want apps tailored for very specific audiences. Remember that the more specific a design decision is, the greater its appeal is likely to be.
- **Specific** health conditions e.g. diabetes, Alzheimer's, allergies etc.
- **Specific** or unique lifestyle changes required from certain health conditions e.g. anemia, domestic abuse, anxiety
- **Specific** demographics: children, elderly, teenagers, single parents
- **Specific** "health categories": mental health, women's health (pregnancy, menstrual tracking), LGBTQ health
- "Positive" health apps, such as helping new parents with their baby

Reminder: intersectionality will allow you to focus on very specific user groups and design better solutions.

- "Children, aged 6-10 with Type 1 diabetes" is a more specific group than "people with diabetes."
- "Female-presenting teenagers aged 14-18 with low self esteem/body positivity issues" vs "teenagers."
- Apps don't have to be targeted for the patient: they could be designed for the caregiver, doctor, nurse, ...
- Apps can be awareness driven (i.e., a second grader with diabetes tries to explain to their friends what living with diabetes means.)

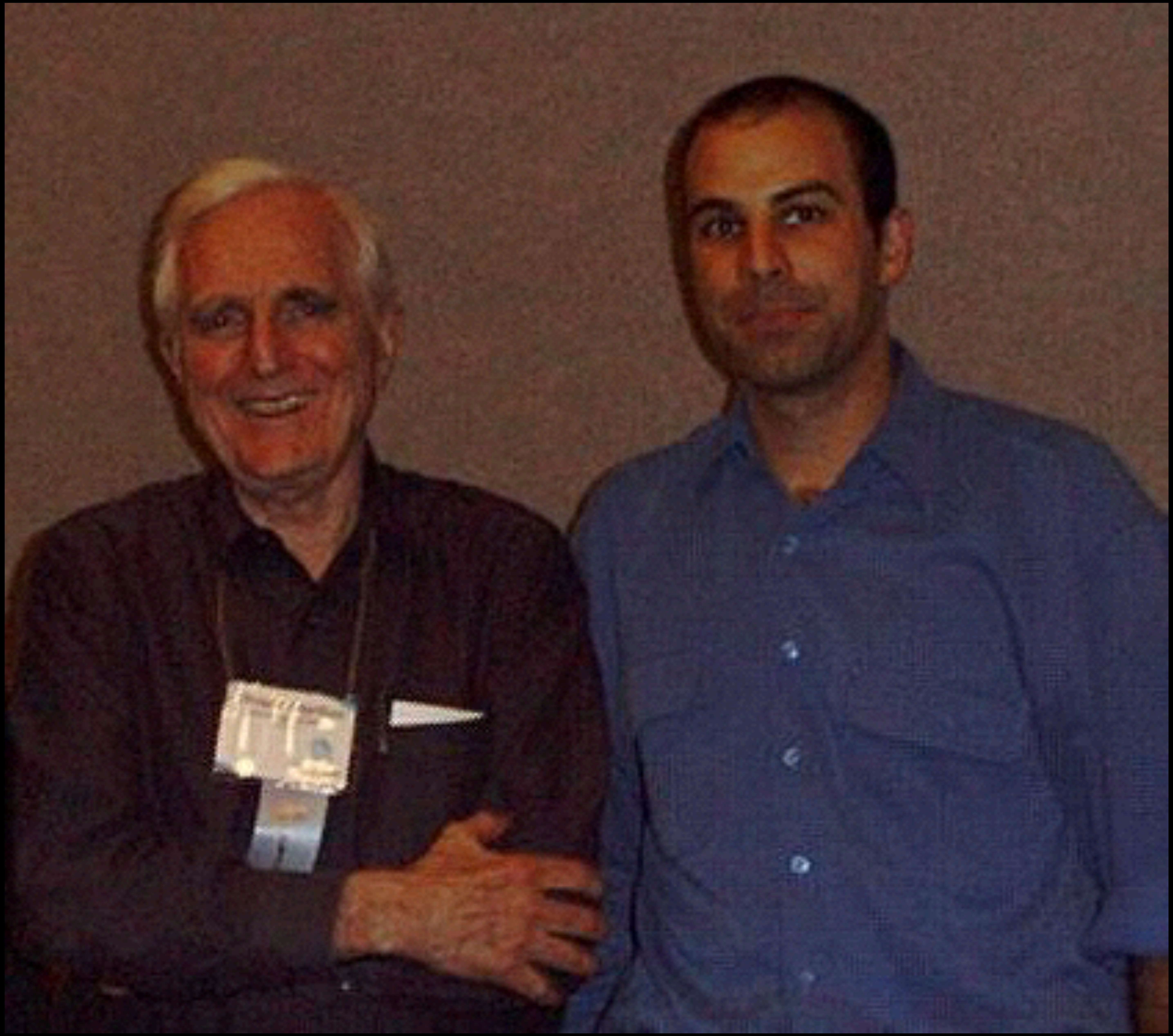

9:42 AM
SMS
Text
9
Calendar
Photos
Camera
YouTube
Stocks
Maps
Weather
Clock
Calculator
Notes
Settings
iTunes

METAPHOR IN USER INTERFACES

THE MOTHER OF ALL DEMOS

Doug Engelbart's December 9, 1968, computer demonstration at the Fall Joint Computer Conference in San Francisco. The 90-minute presentation essentially demonstrated almost all the fundamental elements of modern personal computing

- windows
- hypertext
- graphics
- video conferencing
- the computer mouse
- word processing
- dynamic file linking
- revision control
- collaborative real-time editor



Your Professor (with hair) and Doug Engelbart in 1998

December 9, 1968:
The Demo

The Basics

Control Devices

Real–Time Collaboration

1968

METAPHOR

Definition

The transference of the relation between one set of objects to another set for the purpose of brief explanation

Lakoff & Johnson

“...the way we think, what we experience, and what we do every day is very much a matter of metaphor."

in our language & thinking - “argument is war”

...he attacked every weak point
...criticisms right on target
...if you use that strategy

Metaphors can highlight some features, suppress others

INTERFACE METAPHORS

Purpose

Leverages knowledge of familiar, concrete objects/experiences

Transfer this knowledge to abstract tasks and concepts

Problem

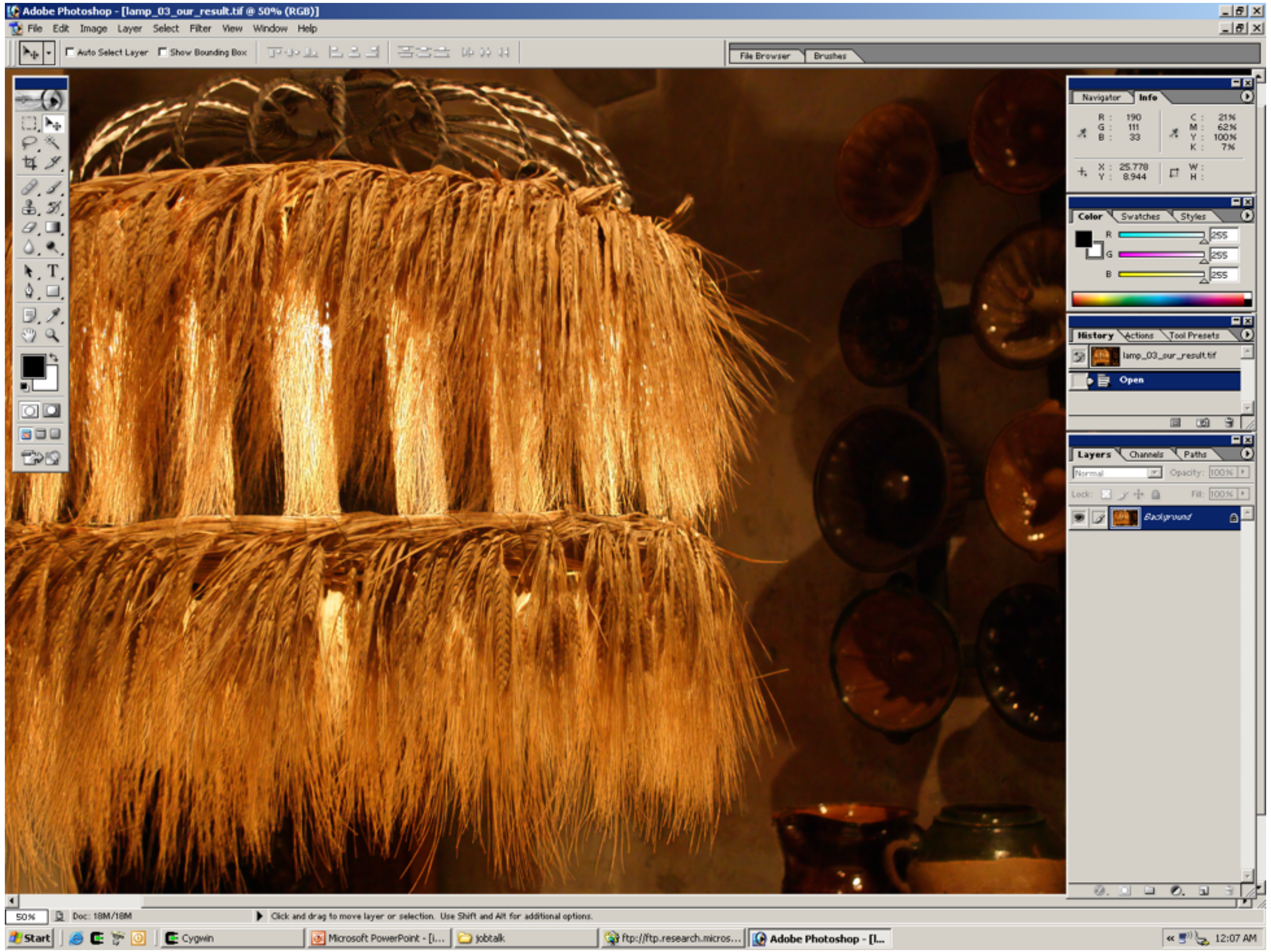
Inaccurate or naive conceptual model of the system

A presentation tool

is like

an slide projector

THE PAINTING METAPHOR



THE DESKTOP METAPHOR

Started at Xerox PARC

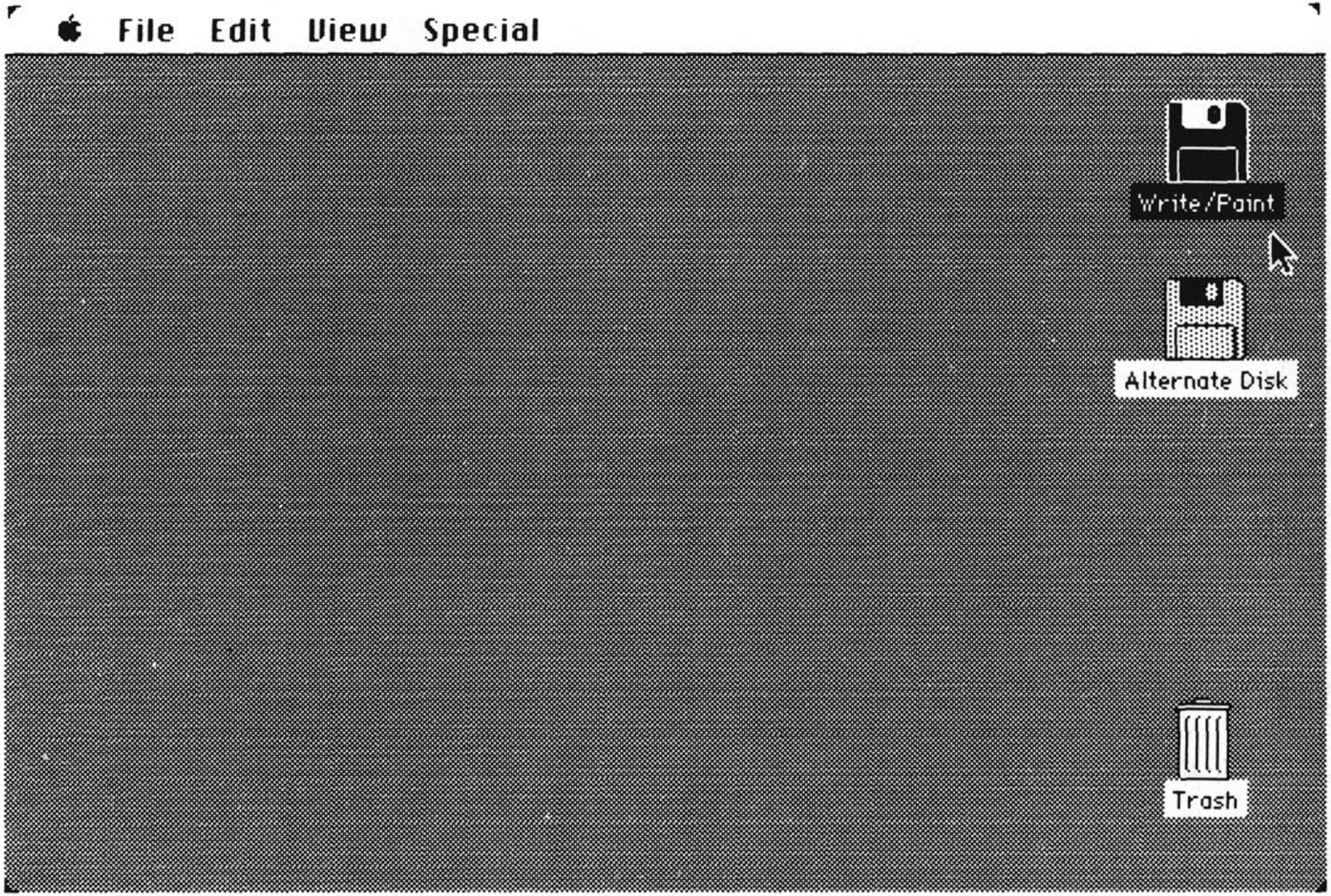
Xerox Star

Bitmapped screens made it possible

Not meant to be a real desktop

Organize information the way people use information on desktop

Allow windows to overlap – make screen act as if objects are on it


File
Edit
View
Special
Write/Paint
Alternate Disk
Trash

Finder File Edit View Go Window Help
Mon 9:23 AM
Internet Explorer 5.2.3
Eudora 6.1
Mail
Netscape
AOL
Safari alias
Snapz Pro X-
Adobe Photoshop 7
GraphicConverter 4.4
QuickTime Player
STICKIES
WEBSITE STUFF
MAC SYS X
NOTES
Documents#2
DRIVE 1 (80gb ATA) SYS 9.2
Snapz Pro X2
Desktop-OS9
Web Site
Document
DR 2A (40gb ATA) PANTHER
Acrobat Web 5.0.5
Acrobat Reader 5.0
RealOne Player
Windows Media Player
DRIVE 2B (40gb ATA) X-PHO
MacLink 13.0.2
FileView
DR 5 (120gb FireW)SHIPS,ETC
Disk Utility
DR3FireW(80 gb)COMPUTER
Norton 3.0
StuffIt Expander
Printer Setup
OS X SOFTWARE
TextEdit
Stickies
Microsoft Word X
Toast Titanium 5.2.1
CD- OSX 5.0.15
ScanWizard 5 Folder
Microtek Scanner Configuration
ScanWizard 5 V7.11
Dreamweaver MX 2004
BROTHER 6-04.dmg
DUMP3
BACKUP

MICROSOFT BOB'S DESKTOP METAPHOR

BOB'S "LIVING ROOM" METAPHOR


Top-Windows-Tutorials.com
Microsoft
Bob
Good afternoon.
Click on the door to sign in...
EXIT

3D DESKTOPS

Robertson 2000

Sun’s Looking Glass

GOOGLE ART PROJECT

http://www.googleartproject.com/museums/moma

VIRTUAL ASSISTANT METAPHOR

METAPHOR CAVEATS

METAPHOR CAVEATS

Too limited

The metaphor restricts interface possibilities

Too powerful

The metaphor implies the system can do things it can’t

Too literal or cute

Makes it difficult to understand abstract concept

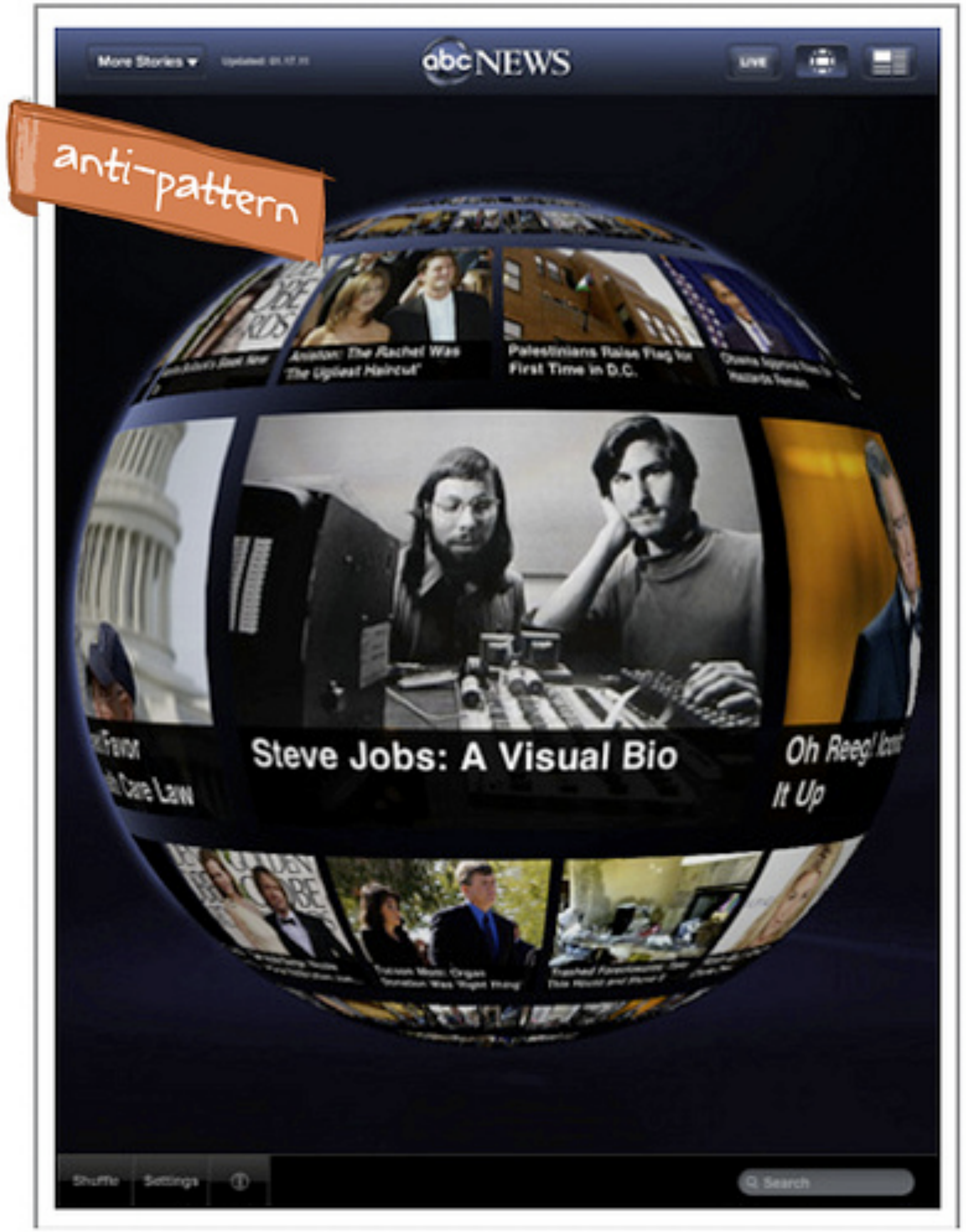
Mismatched

The metaphor conveys the wrong meaning

MISMATCHED METAPHORS

What is being controlled here?

MISMATCHED METAPHORS



MISUSED METAPHORS

Direct translations

Software music player that requires turning volume knob with mouse

Software telephone that requires the user to dial a number by clicking on a simulated keypad

Airline web site that simulates a ticket counter!

Southwest Airlines Home Gate

The Home of Southwest Airlines on the World Wide Web

GUIDELINES FOR DESIGN

Good Metaphors

Capture essential elements of the event / world

Deliberately leave out / mute the irrelevant

Appropriate for user, task, and interpretation

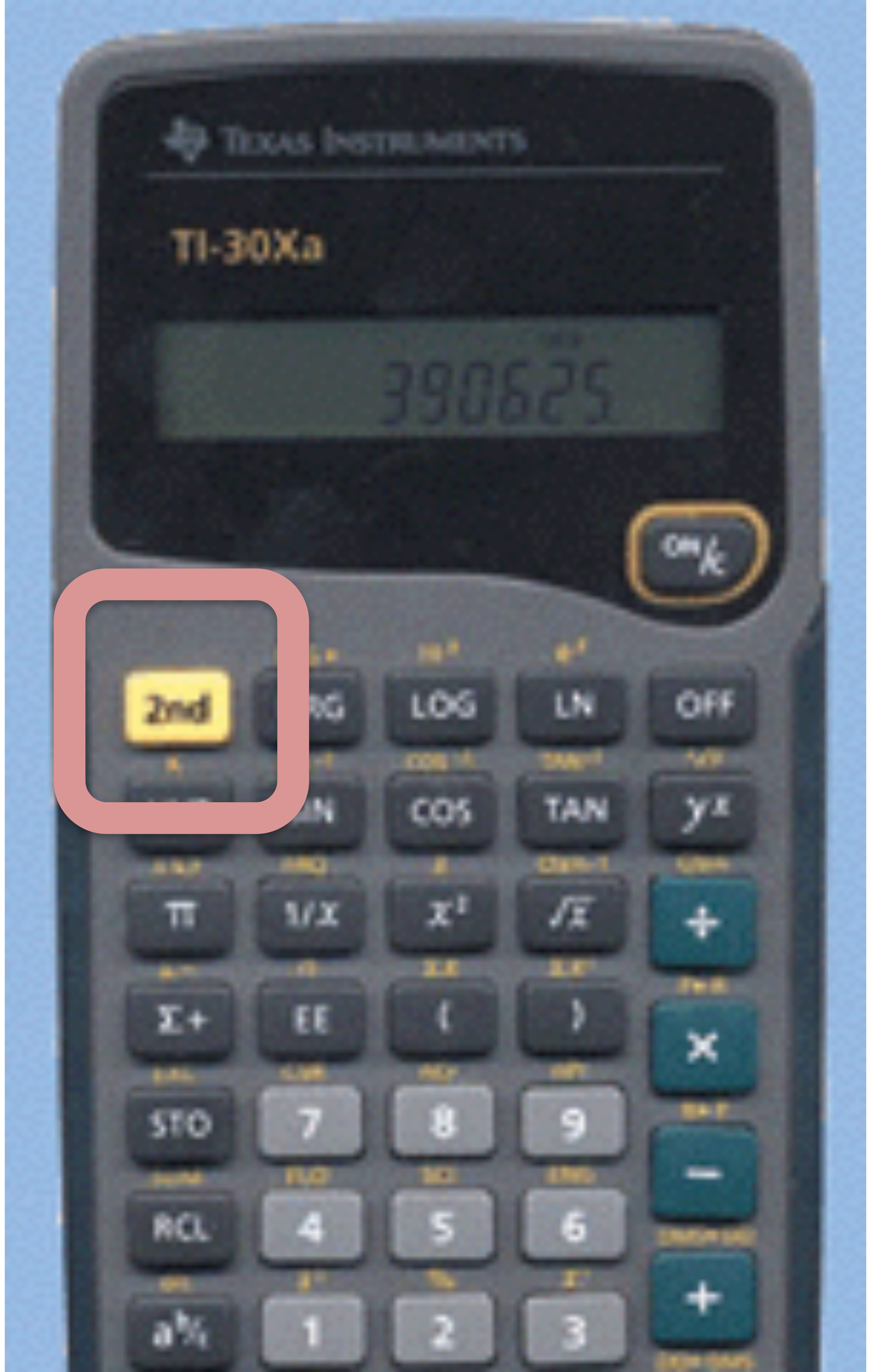
F
D
E
IR0
IR1
IR2
MD DIR
DATA CONT
SW
PAUSE
BRK PROG
BRK
LINK
GT
INT BUS
NO INT
ION
UM
IF0
IF1
IF2
DF0
DF1
DF2
0
1
2
3
4
5
6
7
8
9
10
11
STATE
STATUS
AC
MD
MQ
BUS

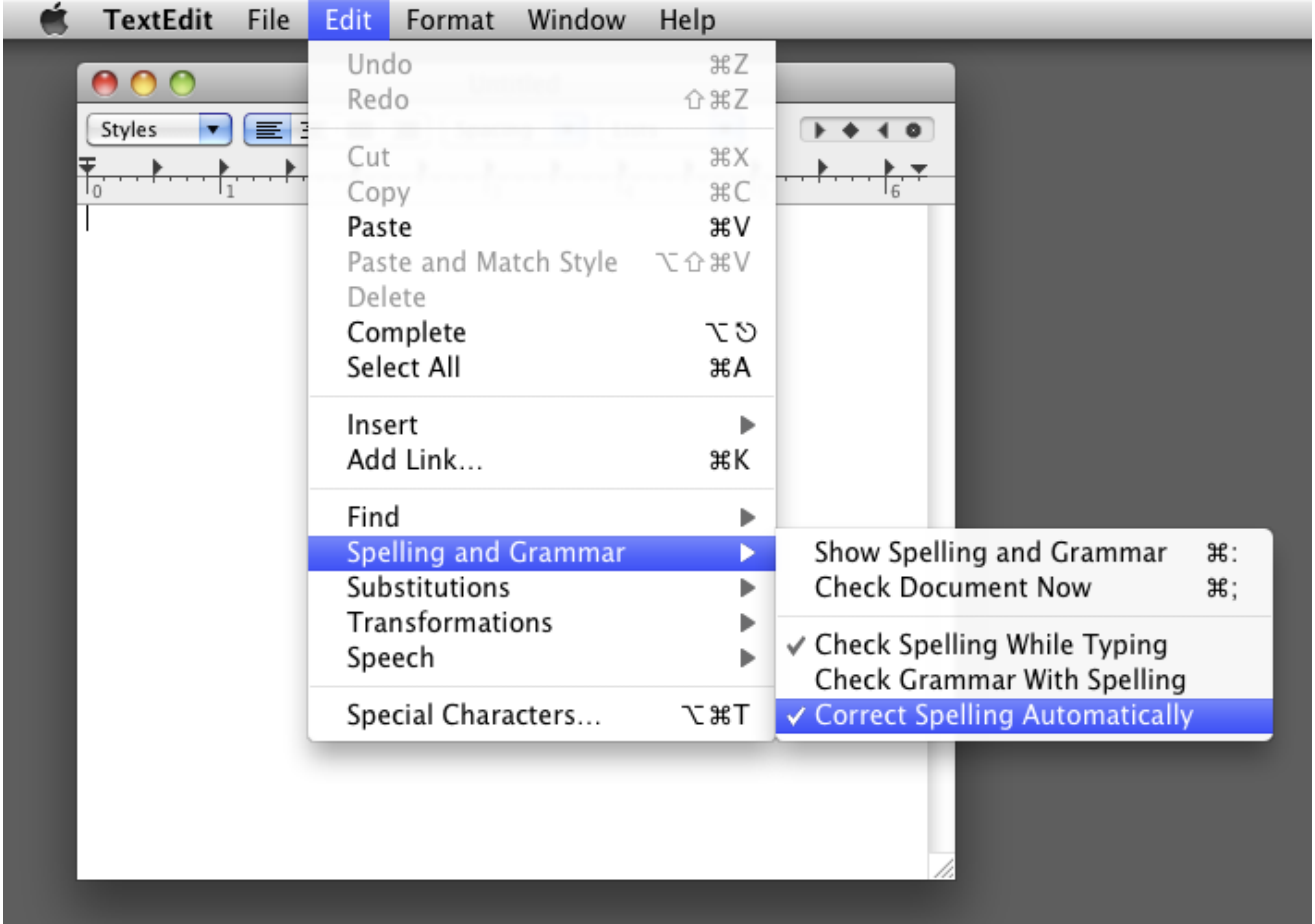
MODES

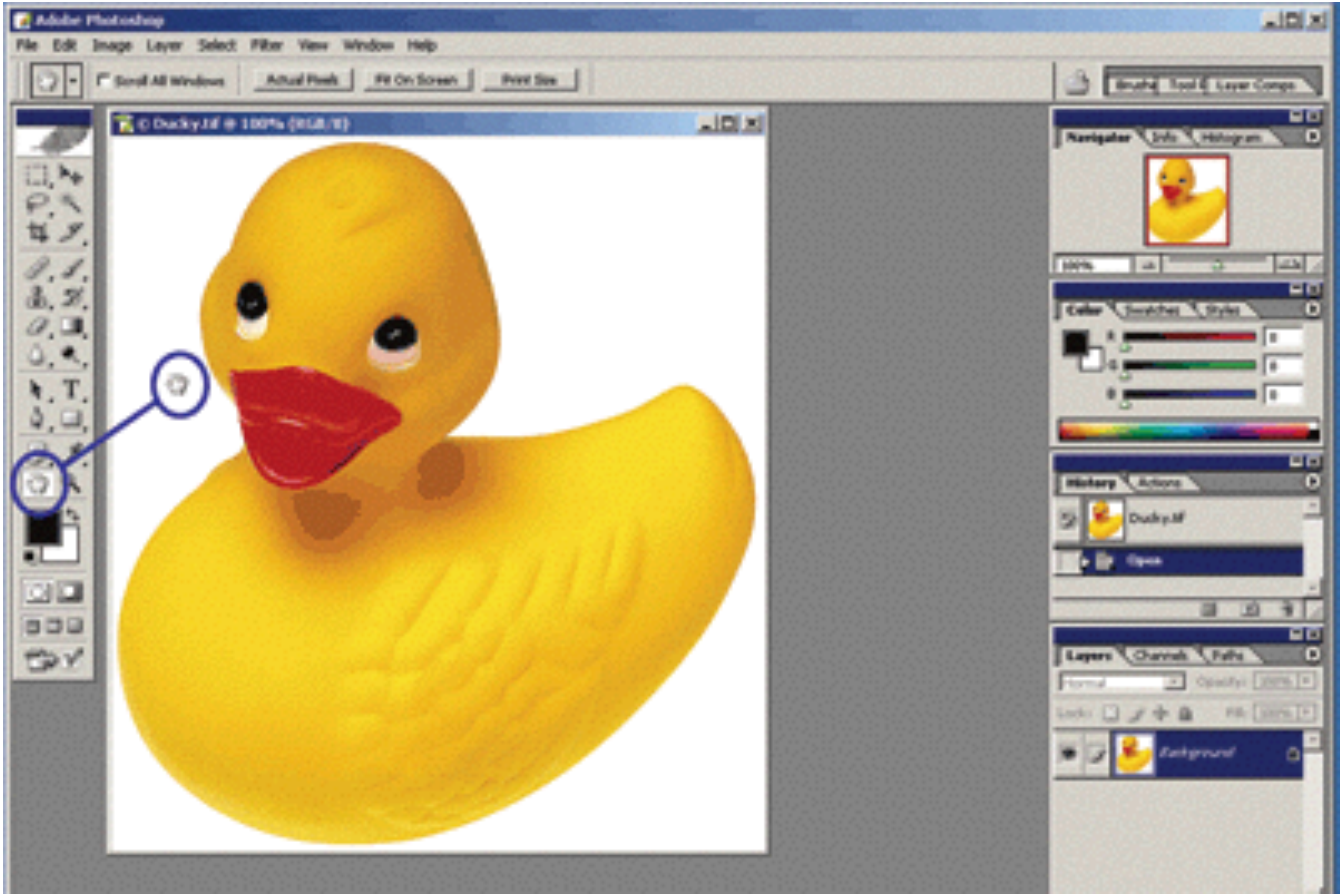
MODES: DEFINITION

The same user actions have different effects in different situations.

MODES: EXAMPLES


TEXAS INSTRUMENTS
TI-30Xa
390625
2nd
LOG
LN
OFF
COS
TAN
1/x
Σ+
EE
STO
7
8
9
RCL
4
5
6
1
2
3


TextEdit
File
Edit
Format
Window
Help
Styles
Undo ⌘Z
Redo ⇧⌘Z
Cut ⌘X
Copy ⌘C
Paste ⌘V
Paste and Match Style ⌥⇧⌘V
Delete
Complete
Select All ⌘A
Insert
Add Link... ⌘K
Find
Spelling and Grammar
Substitutions
Transformations
Speech
Special Characters... ⌥⌘T
Show Spelling and Grammar ⌘:
Check Document Now ⌘;
✓ Check Spelling While Typing
Check Grammar With Spelling
✓ Correct Spelling Automatically


Adobe Photoshop
File Edit Image Layer Select Filter View Window Help
Scroll All Windows
Actual Pixels
Fit On Screen
Print Size
Navigator
Info
Histogram
Color
Swatches
Styles
History
Actions
Open
Layers
Channels
Paths


Document1
New
Open
Save
Print
Undo
Redo
Format
Tables
Columns
Show
Navigation
Gallery
Toolbox
152%
Zoom
Overtype
Document Elements
Quick Tables
Charts
The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.
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USING MODES IN INTERFACES

When are they useful?

Temporarily restrict users' actions

When logical and clearly visible and easily switchable

Drawing with paintbrush vs. pencil

Why can they be problematic?

Big memory burden

Source of many serious errors

How can these problems be fixed?

Don't use modes – redesign system to be modeless

Redundantly visible

REDESIGNING TO AVOID MODES

Setting the time on a clock

Modal

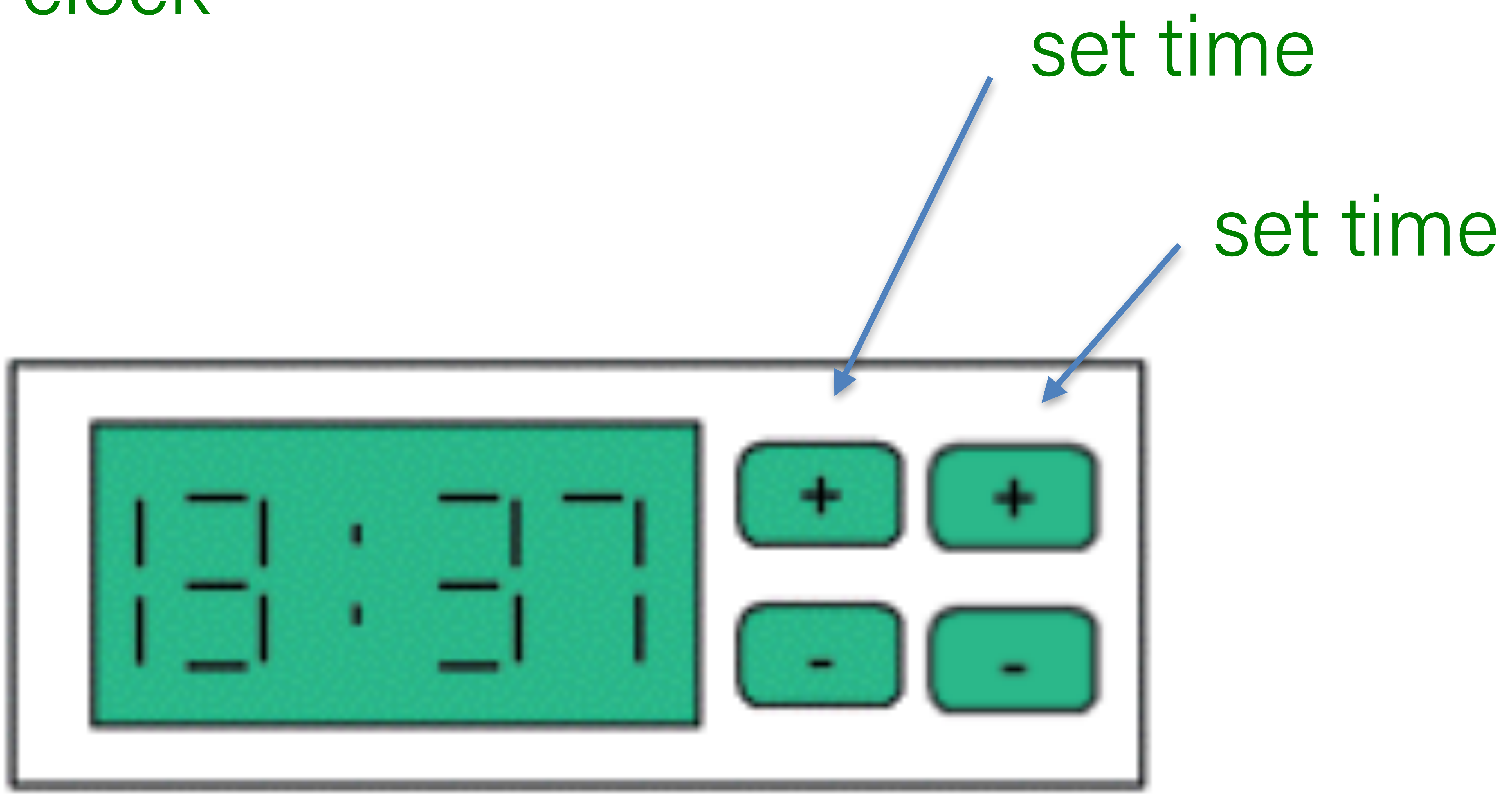
REDESIGNING TO AVOID MODES

Setting the time on a clock

Modeless

REDESIGNING TO AVOID MODES

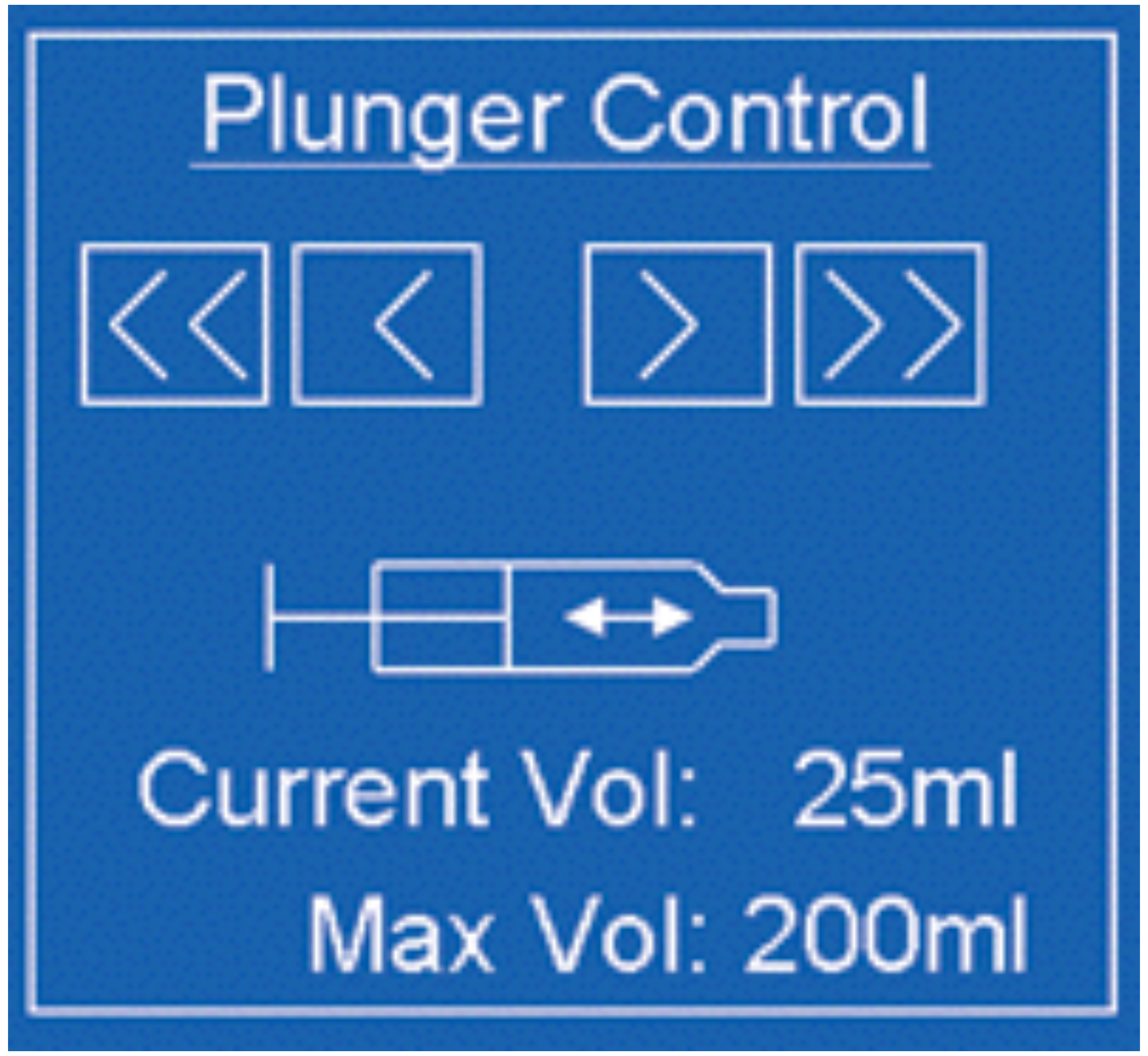
Setting the time on a clock



Modeless

MODES ARE SOMETIMES GOOD

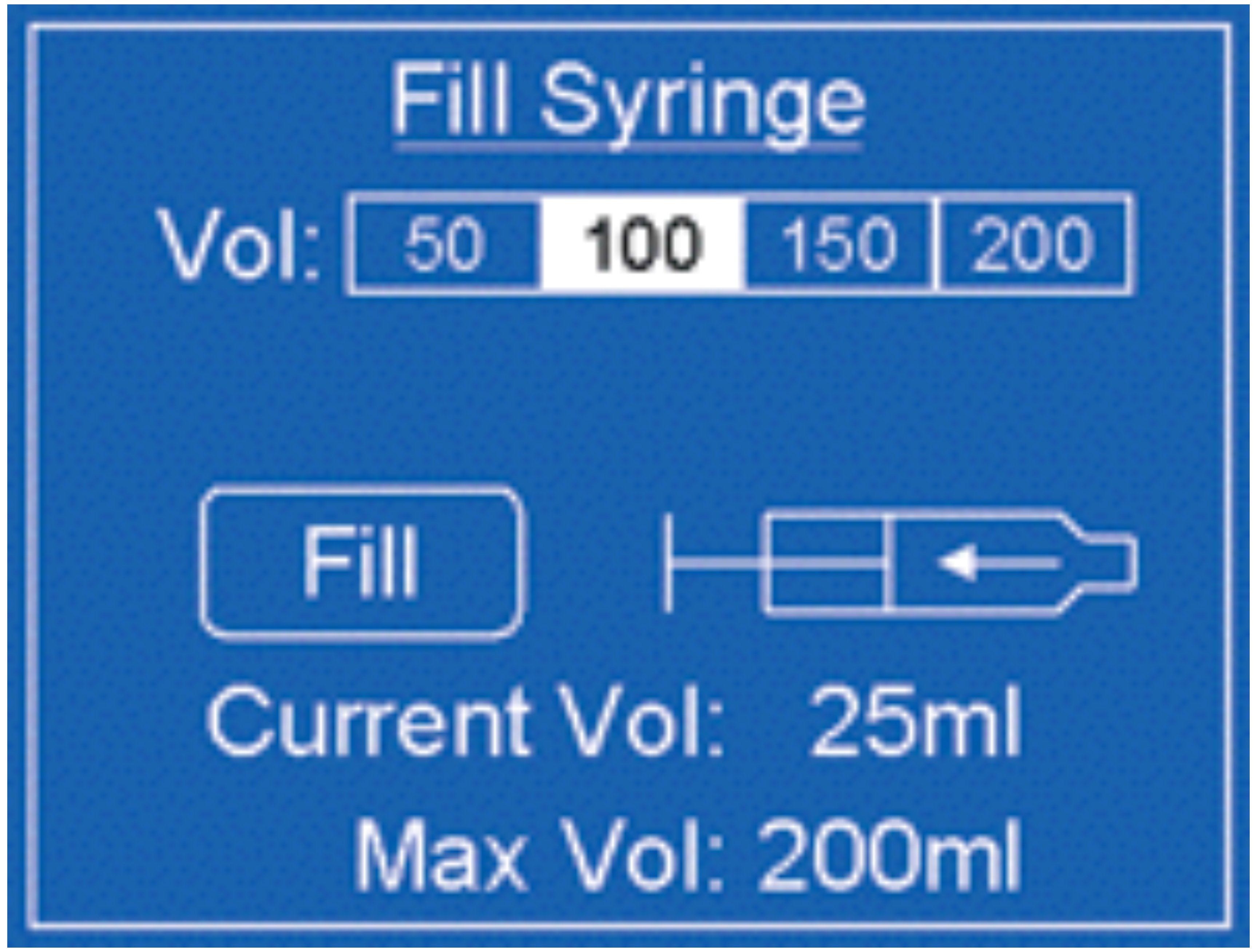
Fill and empty syringe



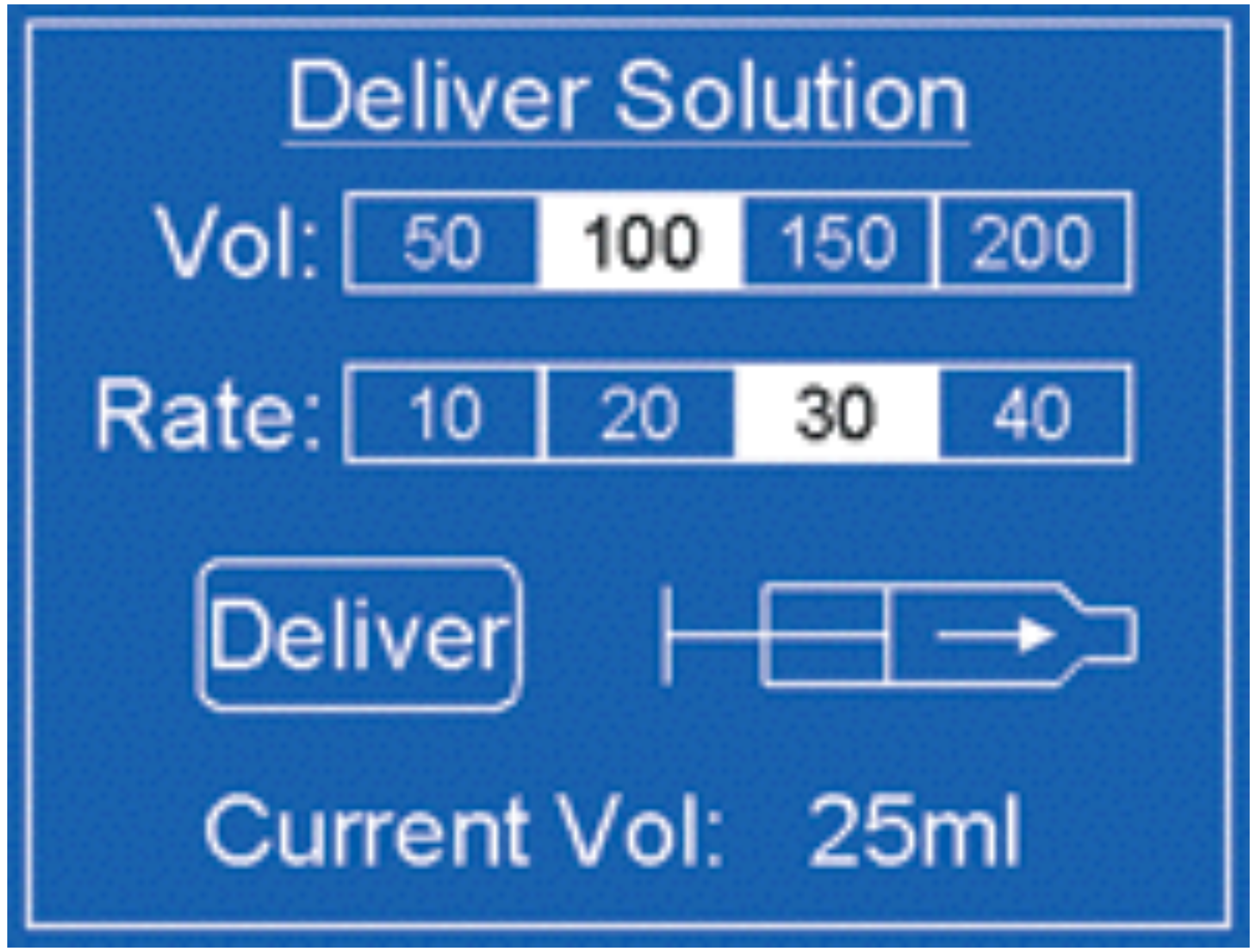
Modeless

MODES ARE SOMETIMES GOOD

If task requires modes, interface may also contain modes



Fill Mode



Deliver Mode

QUASIMODES

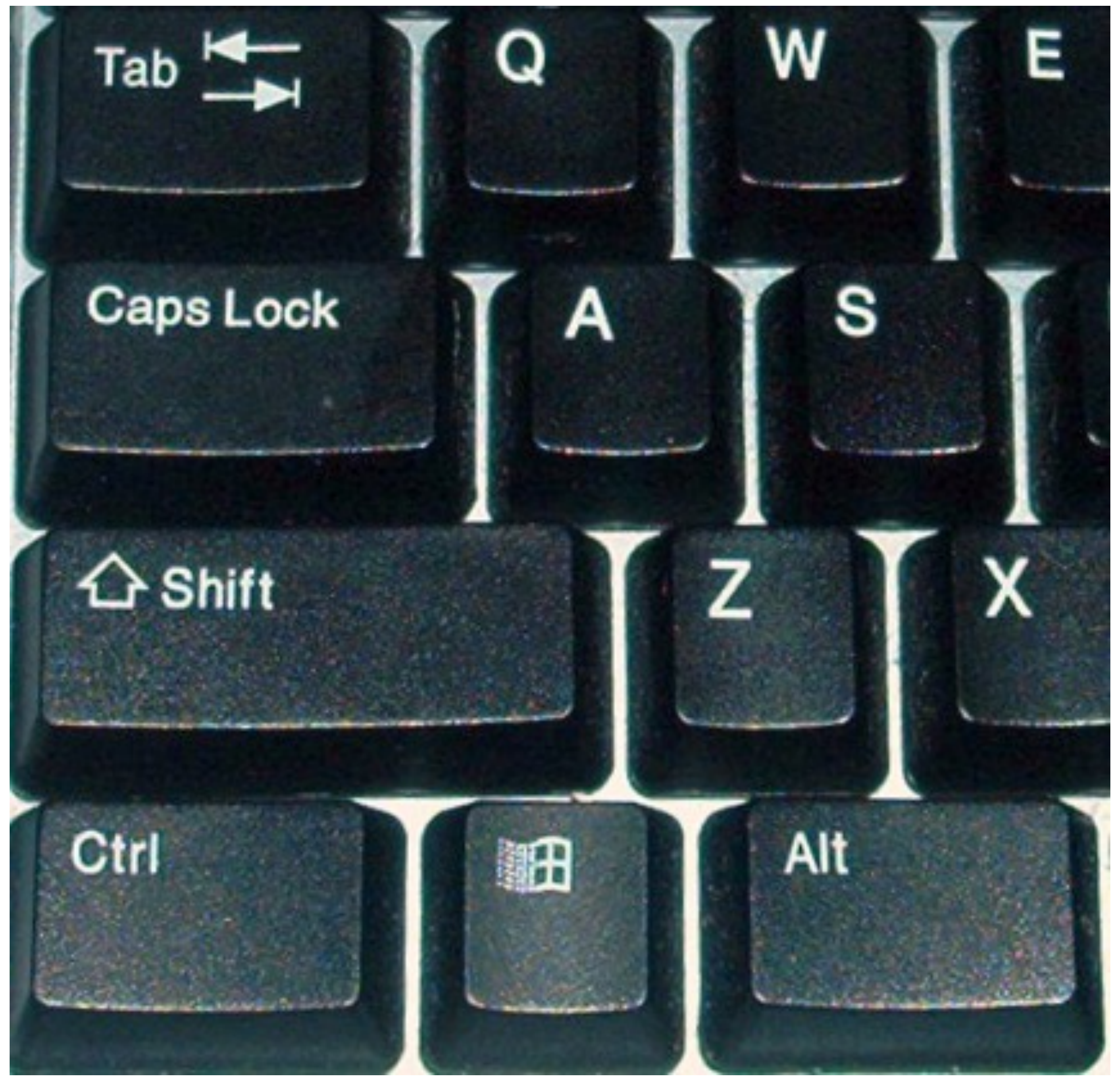
Set and hold a mode via conscious, continuous action

Shift key to capitalize (vs. Caps Lock)

Foot pedal that must remain pressed

Pull down menus

Muscle tension reminds users they are holding a mode



Also known as “spring-loaded modes”


esc
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
~ `
! 1
@ 2
# 3
$ 4
% 5
^ 6
& 7
* 8
(9
) 0
– -
tab
Q W E R T Y U I O P
{ [
caps lock
A S D F G H J K L
: ;
shift
Z X C V B N M
< ,
> .
? /
fn
control
alt
option
⌘
command
⌘
command
alt
option


-98 AT&T
12:29 PM
100%
2
Wednesday
11
Messages
Calendar
Photos
Camera
280
Maps
Weather
Clock
Twitter
Settings
Google Maps
Notes
Snapseed
1
Calculator
Skype
App Store
Instagram
14,648
Gmail
Afterlight
OSXDaily
Snapchat
4
294
Phone
Mail
Safari
Music

SUMMARY

Metaphor

Leverages knowledge of familiar objects & experiences

Transfer this knowledge to abstract tasks and concepts

Easily mismatched or misused so be careful!

Modes

Can create memory issues and cause serious errors

Avoid modes in your designs!

Reducing the number of modes will reduce the user's mental effort in using your interface

Design modes that match user tasks

3D TOUCH

Glimpse: a Novel Input Model for Multi-level Devices

CHI 2005

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{forlines, shen}@merl.com

Bill Buxton
Buxton Design
888 Queen St. East, Toronto
Ontario Canada, M4M 1J3
bill@billbuxton.com

ABSTRACT

We describe a technique that supports the previewing of navigation, exploration, and editing operations by providing convenient *Undo* for unsuccessful and/or undesirable actions on multi-level input devices such as touch screens and pen-based computers. By adding a *Glimpse* state to traditional three-state pressure sensitive input devices, users are able to preview the effects of their editing without committing to them. From this *Glimpse* state, users can undo their action as easily as they can commit to it, making *Glimpse* most appropriate for systems in which the user is likely to try out many variations of an edit before finding the right one. Exploration is encouraged as the cumbersome returning to a menu or keyboard to issue an *Undo* command is eliminated. *Glimpse* has the added benefits that the negative effects of inconsistencies in the *Undo* feature within an application are reduced.

Author Keywords

Pressure Sensitive Input, Undo, Direct Manipulation, Three-State Input, Touch Screens, Stylus, Navigation

ACM Classification Keywords

H.5.2.h Information interfaces and presentation (e.g., HCI): User Interfaces - Input devices and strategies

H.5.2.i Information interfaces and presentation (e.g., HCI): User Interfaces – Interaction Styles

INTRODUCTION

Undo is a critical feature in many computer applications as it frees the user from the fear of experimenting with changes to the application's state. Creativity is enhanced when users are able to easily retract their changes if the result is unsatisfactory. People in creative industries will often state that the quality of their end product is a direct function of how many variations they *tried out and threw away* during the development of their product. Because of the frequency with which *Undo* is used, even small improvements to this feature can have a large positive effect. Additionally, many editing operations that take place

We propose a system-wide method of providing a *Glimpse* of the results of any operation completed with multi-level input devices. By multi-level, we mean that the input device is capable of sensing at least two levels of input (e.g. a stylus that senses light and heavy pressure or a mouse with a two-state button [5]) in addition to providing positional feedback. This positional feedback can be on-screen, in the case of an on-screen mouse pointer that tracks the movement of the mouse, or implicit, in the case of a finger or stylus with which the user operates directly on the display surface with graphical elements that are positioned directly underneath the input device. Our method has the added benefit that opting out of an action is as easy to perform as committing to it, making *Glimpse* most appropriate for systems in which the user is likely to try out many variations of an edit before deciding on any particular one.

BACKGROUND PART 1: PRESSURE SENSITIVE INPUT

Figure 1 shows Buxton's three-state model for stylus input [2]. In this model, light pressure input results in the

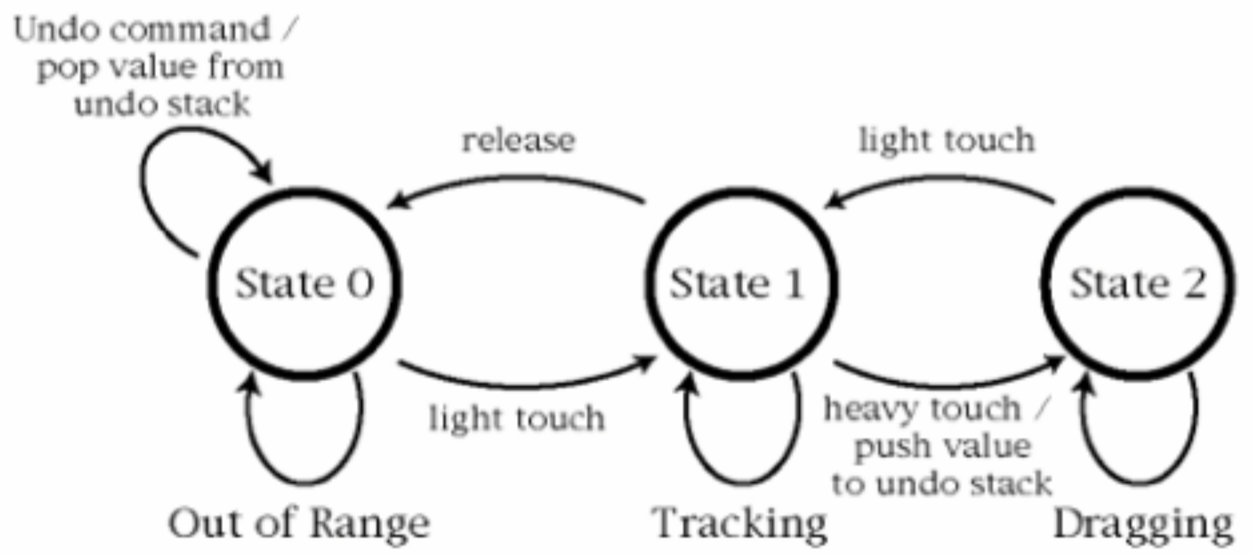

Figure 1. Buxton's three-state model for pressure sensitive input. Dragging an object results in its value being pushed onto the system undo stack. Restoring this saved value occurs after a separate command.

"tracking" of the input device (similar to moving the mouse while its button is up). While "tracking", a graphical pointer follows the movement of the input device on screen. Heavy pressure input results in "dragging" operations (similar to

CHI 2004


Pressure Marks
Gonzalo Ramos
Ravin Balakrishnan
Dynamic Graphics Project
University of Toronto

Pop Through Mouse Button Interactions

UIST 2001

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Providence, RI 02912
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ABSTRACT

We present a range of novel interactions enabled by a simple modification in the design of a computer mouse. By converting each mouse button to *pop through* tactile pushbuttons, similar to the focus/shutter-release buttons used in many cameras, users can feel, and the computer can sense, two distinct "clicks" corresponding to pressing lightly and pressing firmly to pop through. Despite the prototypical status of our hardware and software implementations, our current pop through mouse interactions are compelling and warrant further investigation. In particular, we demonstrate that pop through buttons not only yield an additional button activation state that is composable with, or even preferable to, techniques such as double-clicking, but also can endow a qualitatively novel user experience when meaningfully and consistently applied. We propose a number of software guidelines that may provide a consistent, systemic benefit; for example, light pressure may invoke default interaction (short menu), and firm pressure may supply more detail (long menu).

KEYWORDS: mouse, double-action, gesture, interaction, click through, buttons, pop through, input devices, haptics.

INTRODUCTION

Inspired both by the fluid interactivity of the camera button mechanism and the observation that people often press elevator buttons harder as they grow impatient, we considered a number of approaches for integrating pressure controls into computer interfaces. The choice we present, replacing mouse buttons with pop through pushbuttons (see Figure 1), increases the information bandwidth of a mouse, but we hypothesize may well be easier for users to learn, remember, and control than other choices, such as adding spatially distinct or continuously pressure-sensitive buttons. Moreover, our device is easy to deploy because it does not require visible changes to a commercial mouse, and legacy applications can be compatible simply by ignoring the added button state.

After developing a collection of novel interaction techniques to demonstrate the potential of pop through mouse interac-

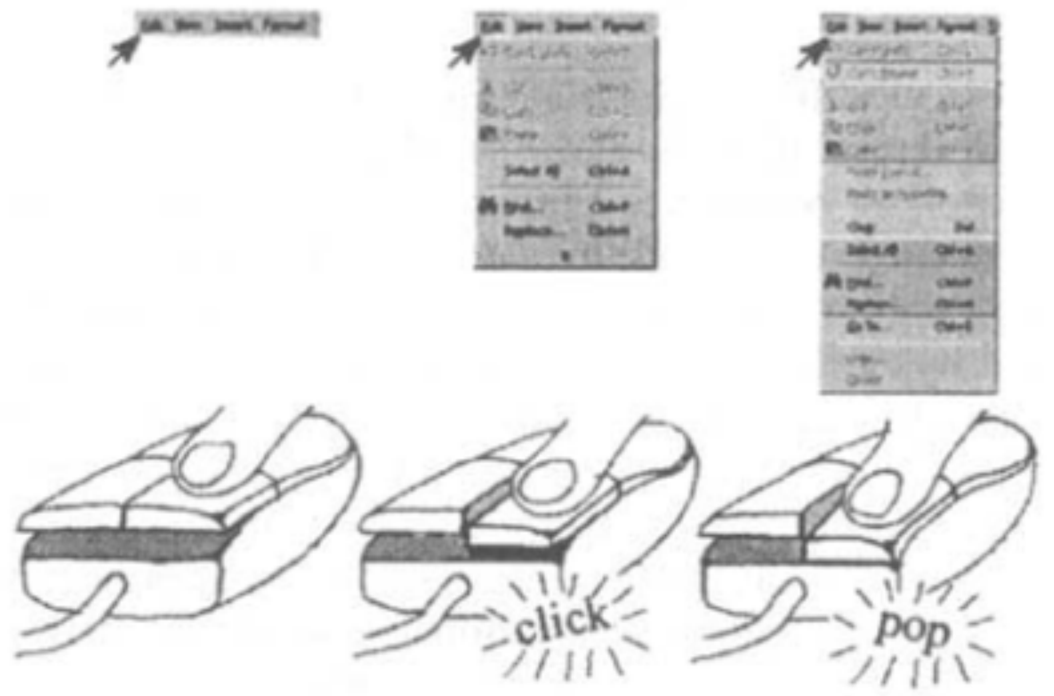


Figure 1: Pressing the button lightly clicks and in this example invokes a short menu; pressing harder pops through with a second click, in this example invoking a longer menu. (Button displacement exaggerated.)

tion, we performed a patent seach that uncovered a 1994 patent on a substantially similar device by Apple Computer [1]. Interestingly, the patent does not consider any of the interaction techniques that we present.

PROTOTYPE HARDWARE AND SOFTWARE

Hardware Design For the first of two different pop through mouse prototypes, we glued a small pushbutton on top of a mouse button and connected it to an RS232 port for software polling.[1] Because of the differing activation forces of the buttons, pressing down on the pushbutton first activates the button native to the mouse and then, with more pressure, pops-through to activate the additional pushbutton. In informal evaluation, users had no difficulty distinguishing or controlling the activations of the native or additional button.

For our second protoype, we replaced the internal button mechanism with an integrated double-action surface-mount pushbutton[2], similar to a camera's focus/shutter-release button. The activation forces for this pushbutton are quite subtle, with no perceptible click for the first contact and a very soft feel, not really a click, for the second, pop through, contact.

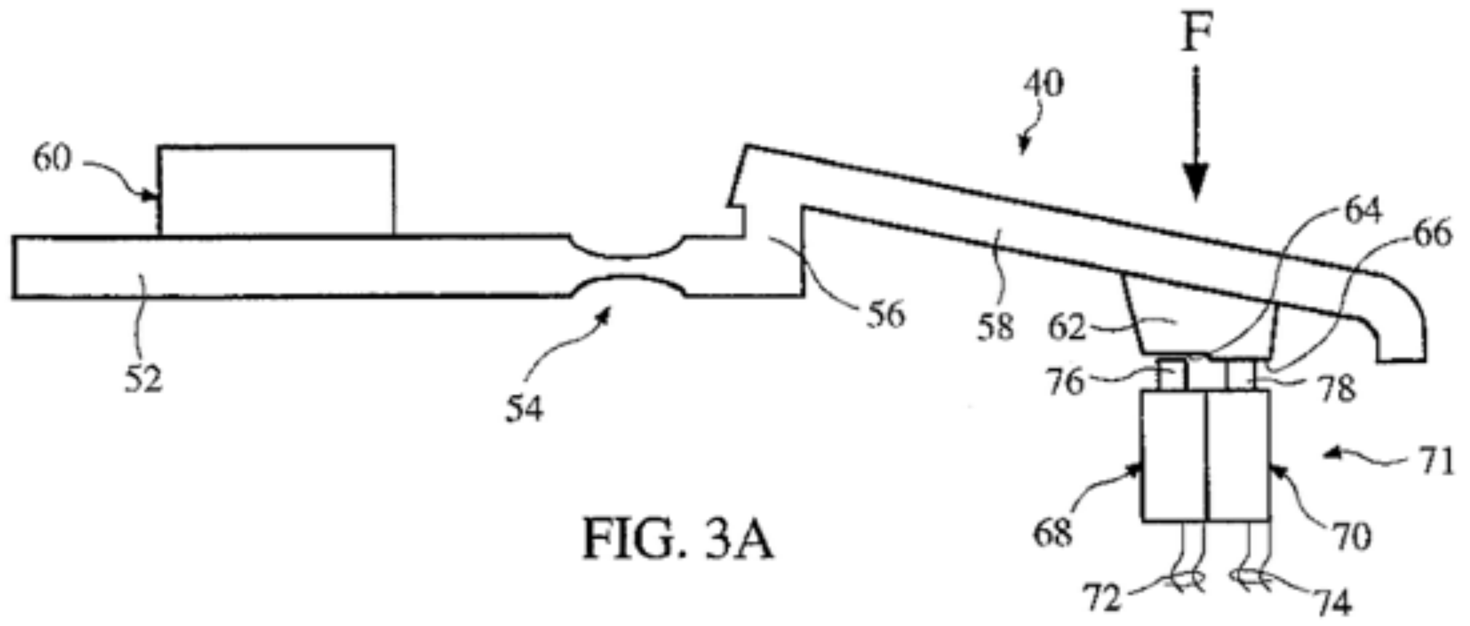


FIG. 3A

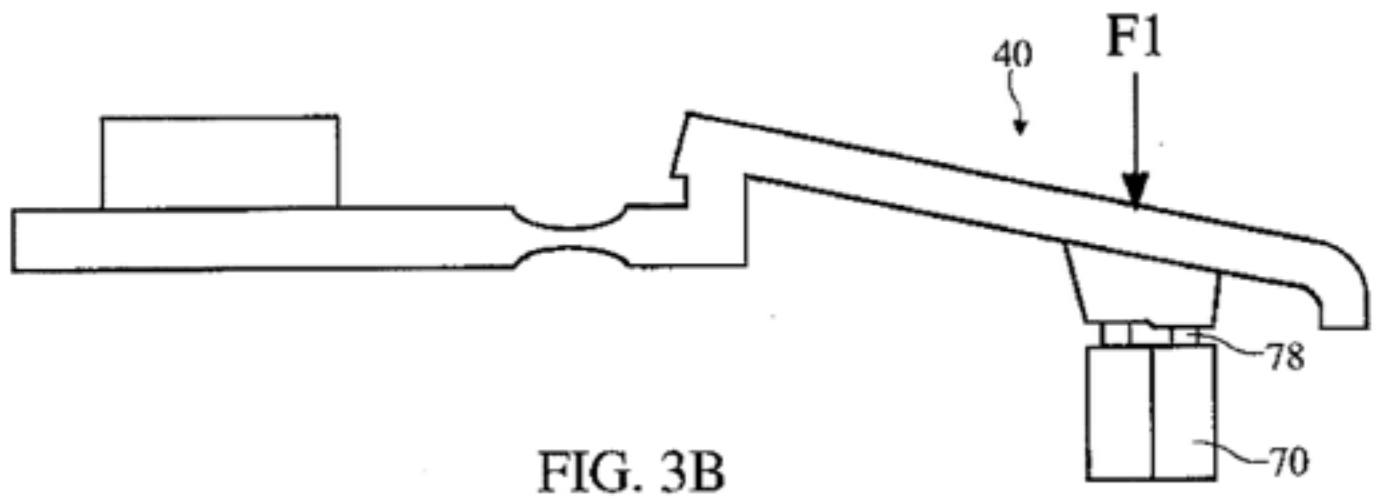


FIG. 3B

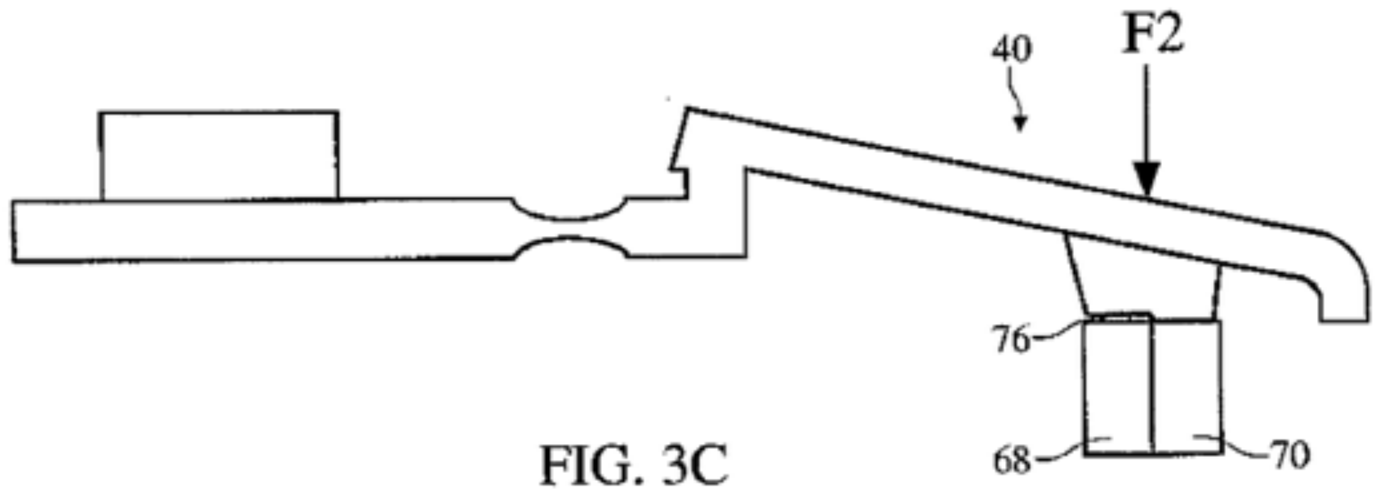


FIG. 3C

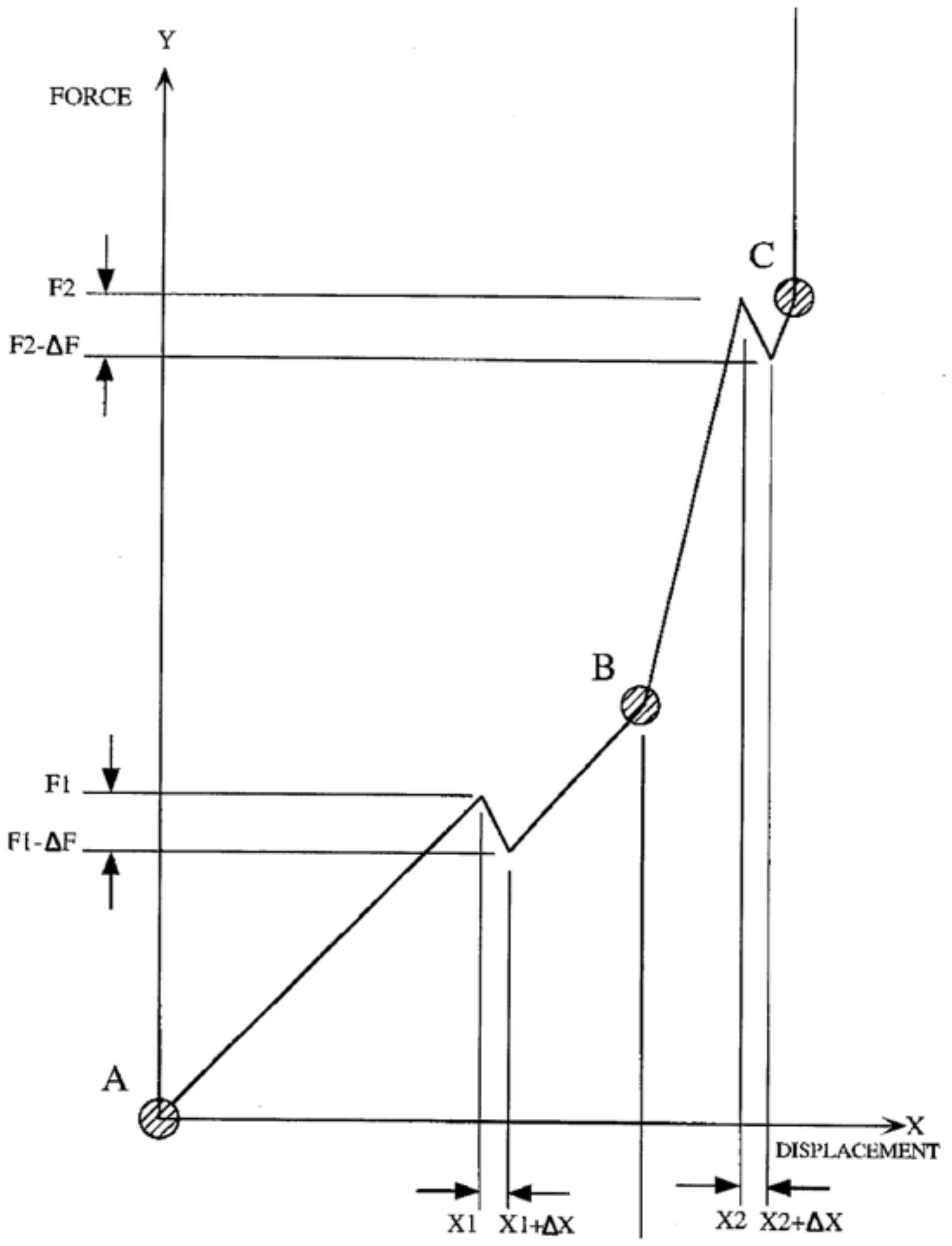


FIG. 4

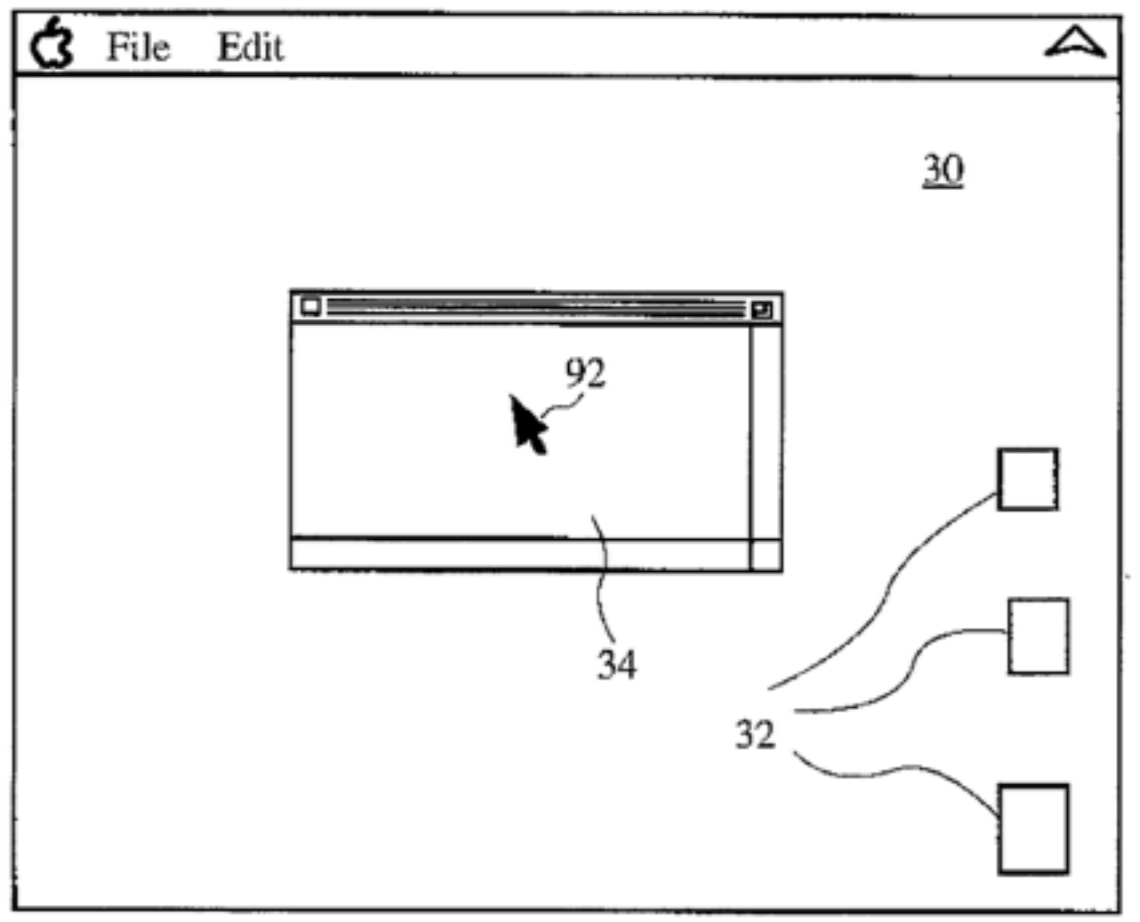


FIG. 6A

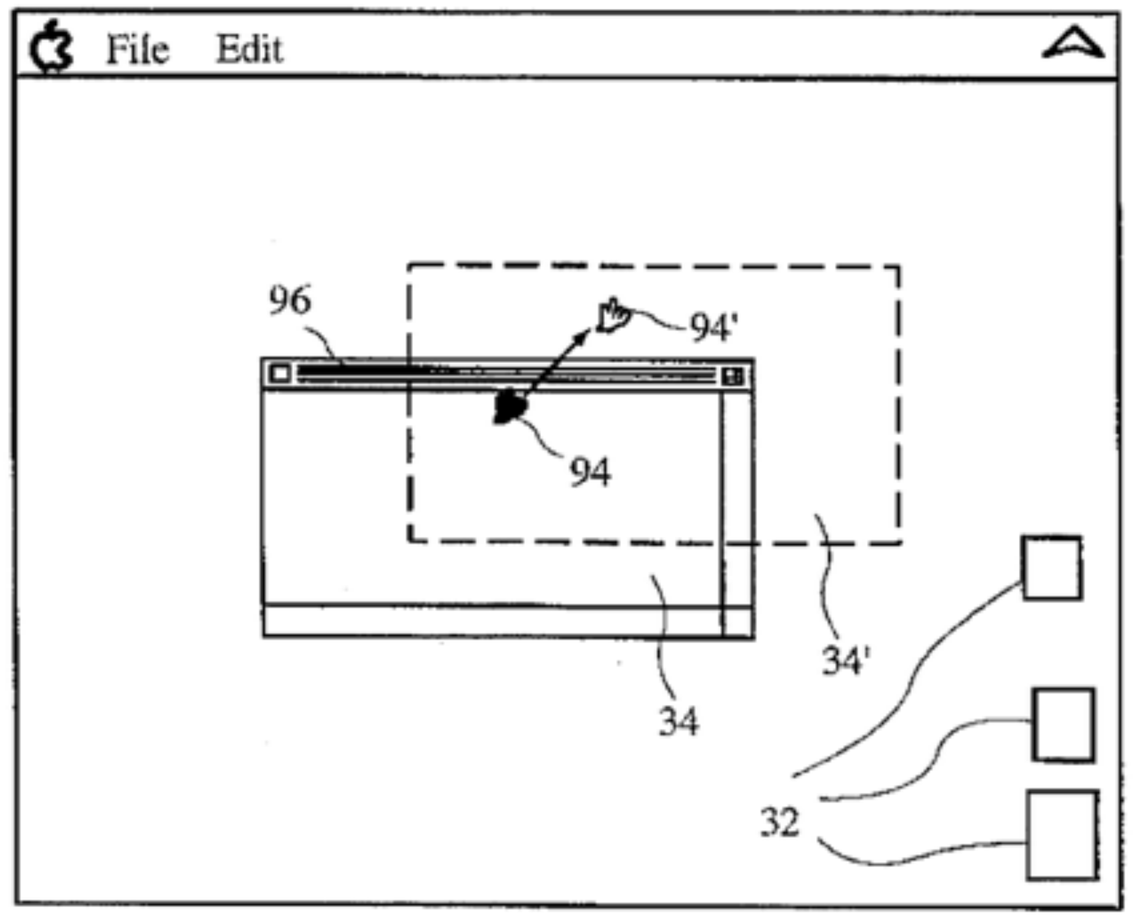


FIG. 6B

INPUT DEVICES

QUESTIONS:

What (low-level) tasks are the users trying to accomplish with an input device?

How can we think about the space of possible input devices?

What interaction techniques are encouraged/discouraged by a particular device?

IMPORTANT TASKS

Text Entry

Pointing/Marking

- Target acquisition
- Steering / positioning
- Freehand drawing
- Drawing lines
- Tracing and digitizing
- ...

TEXT ENTRY: KEYSTROKE DEVICES

Array of Discrete Inputs

Many variants of form and key layout

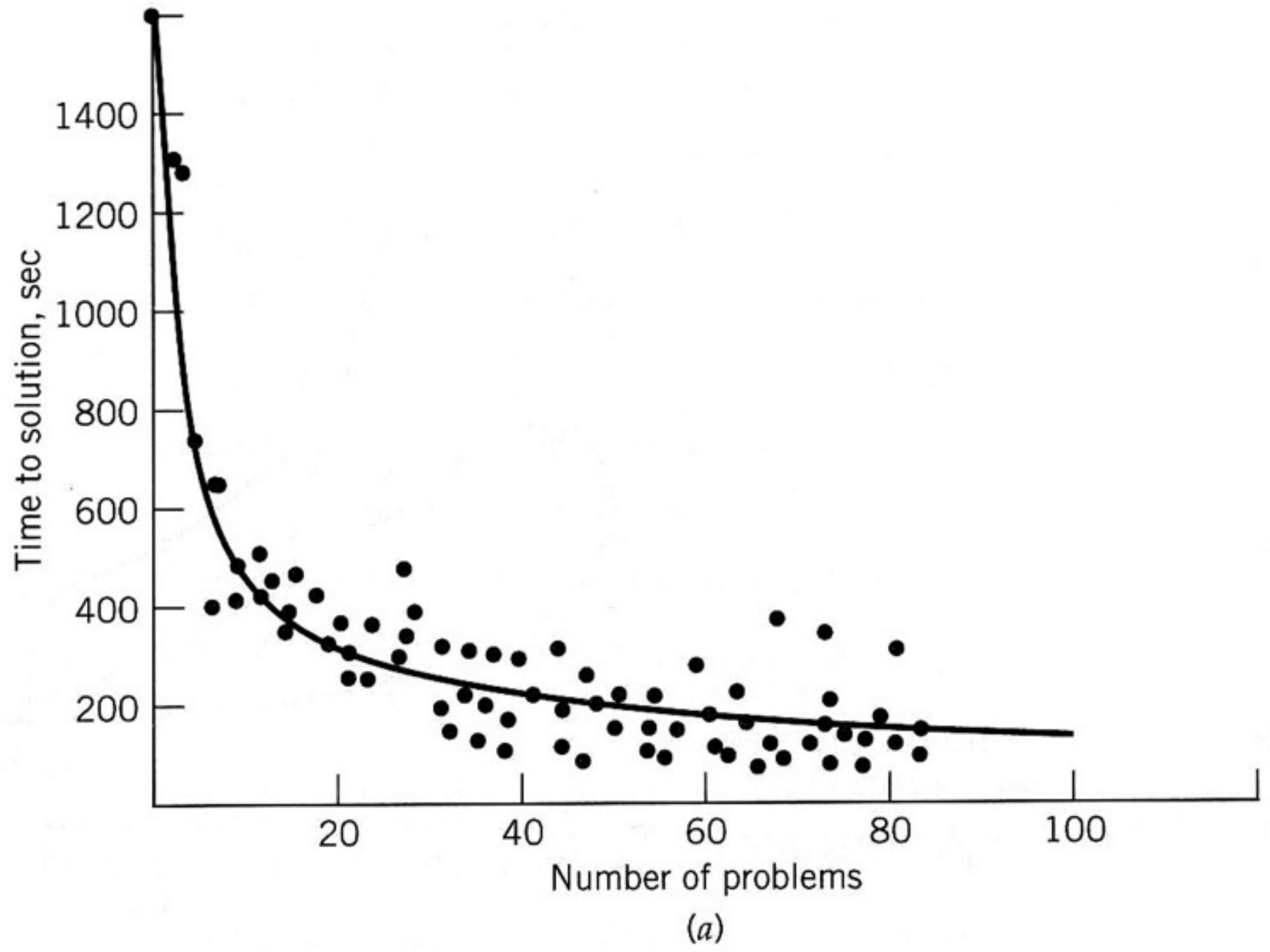
Can be one-handed or two

Wide range of sizes

Two-hand full keyboard is relatively standardized, Less standardization on others: Command keys, generic function keys, cursor movement, numeric keypad,...

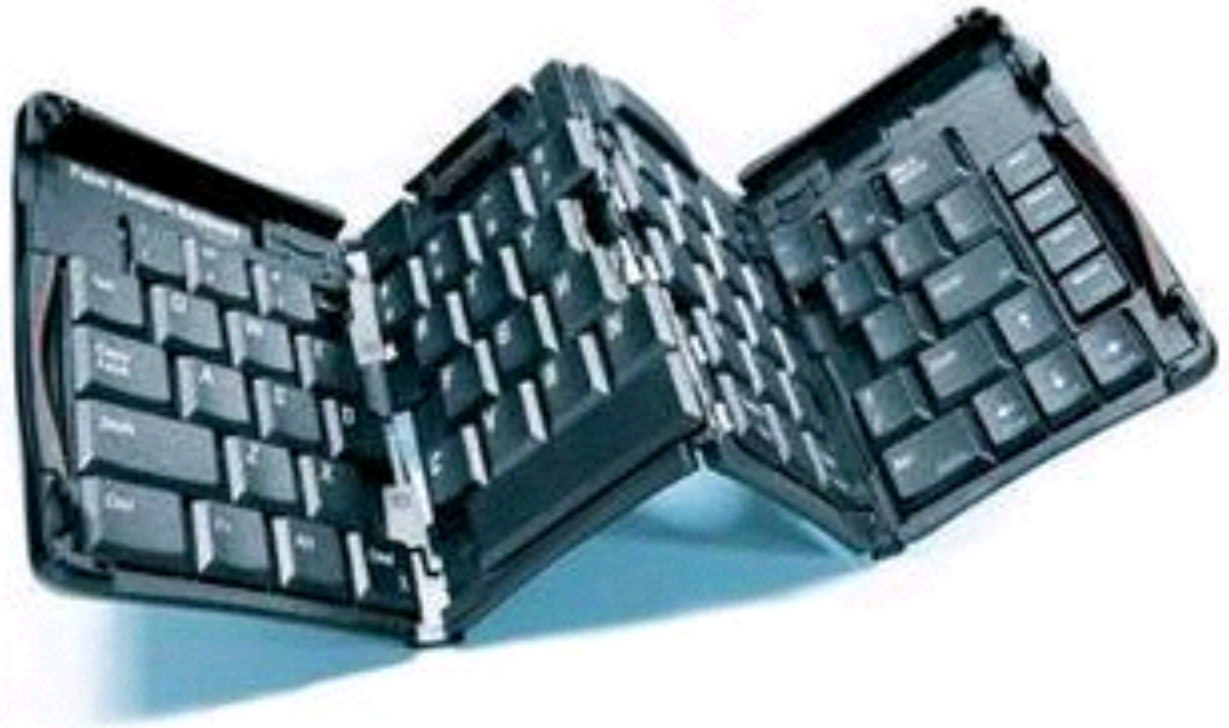
Take advantage of procedural memory

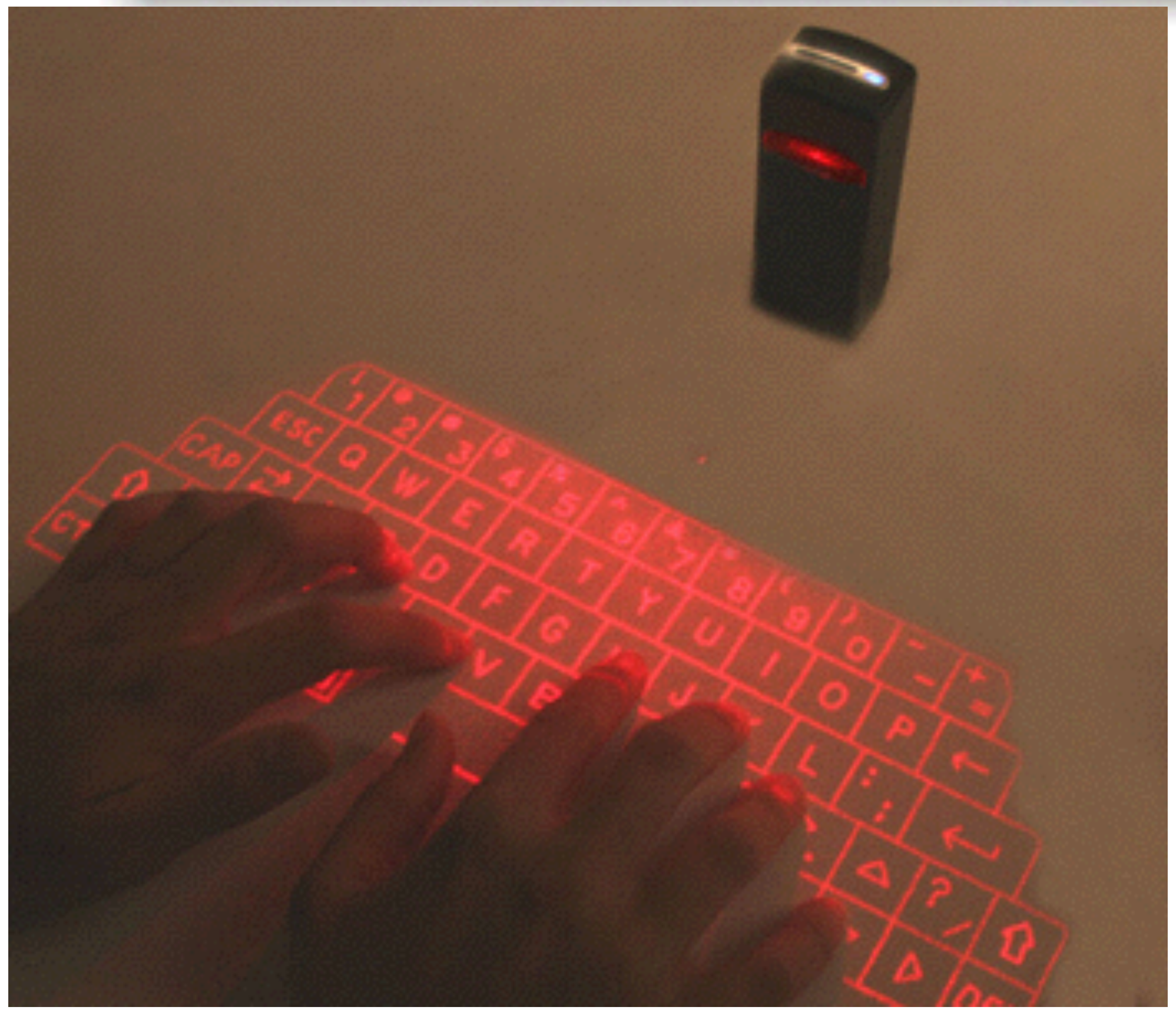
Power law of practice



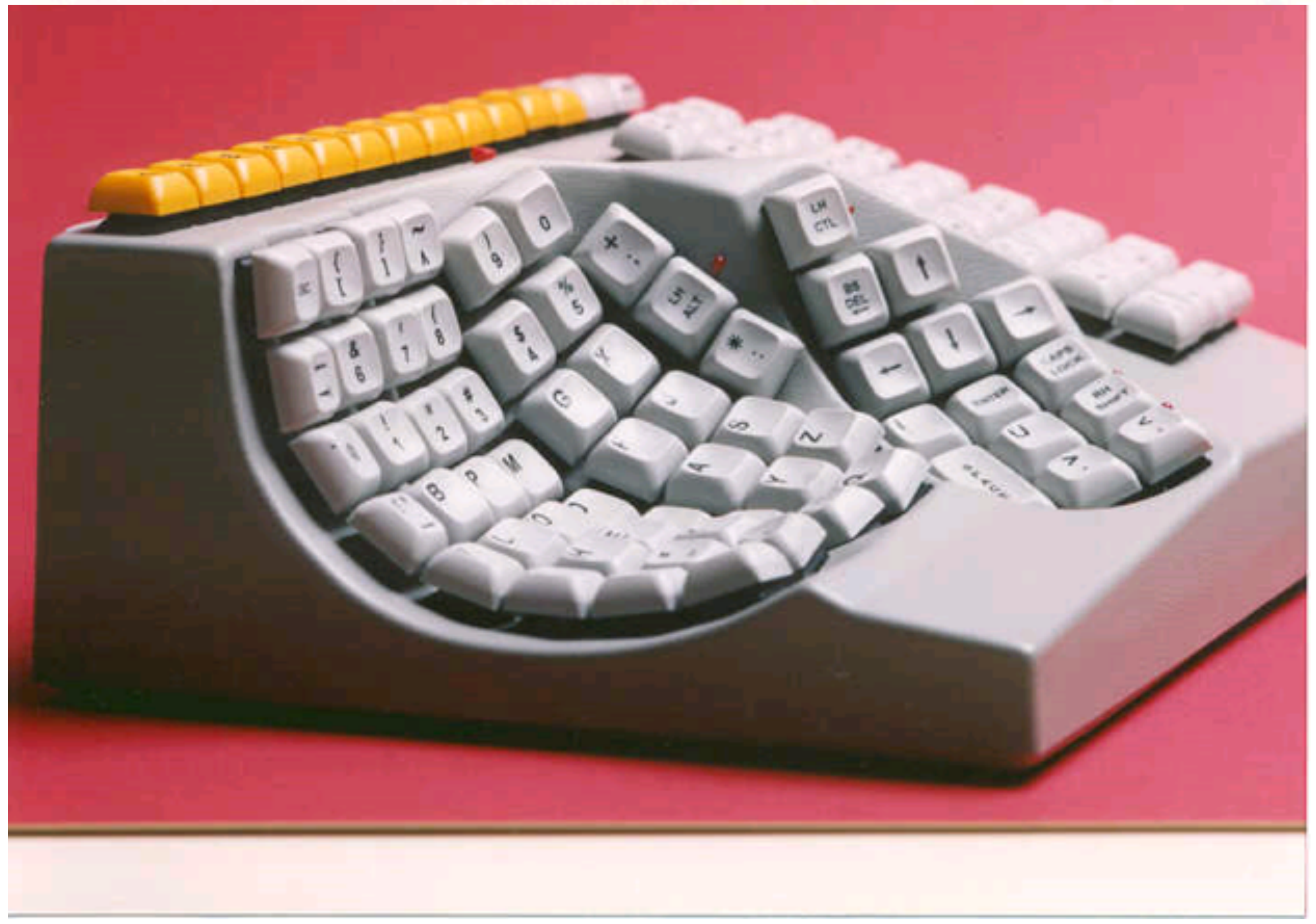
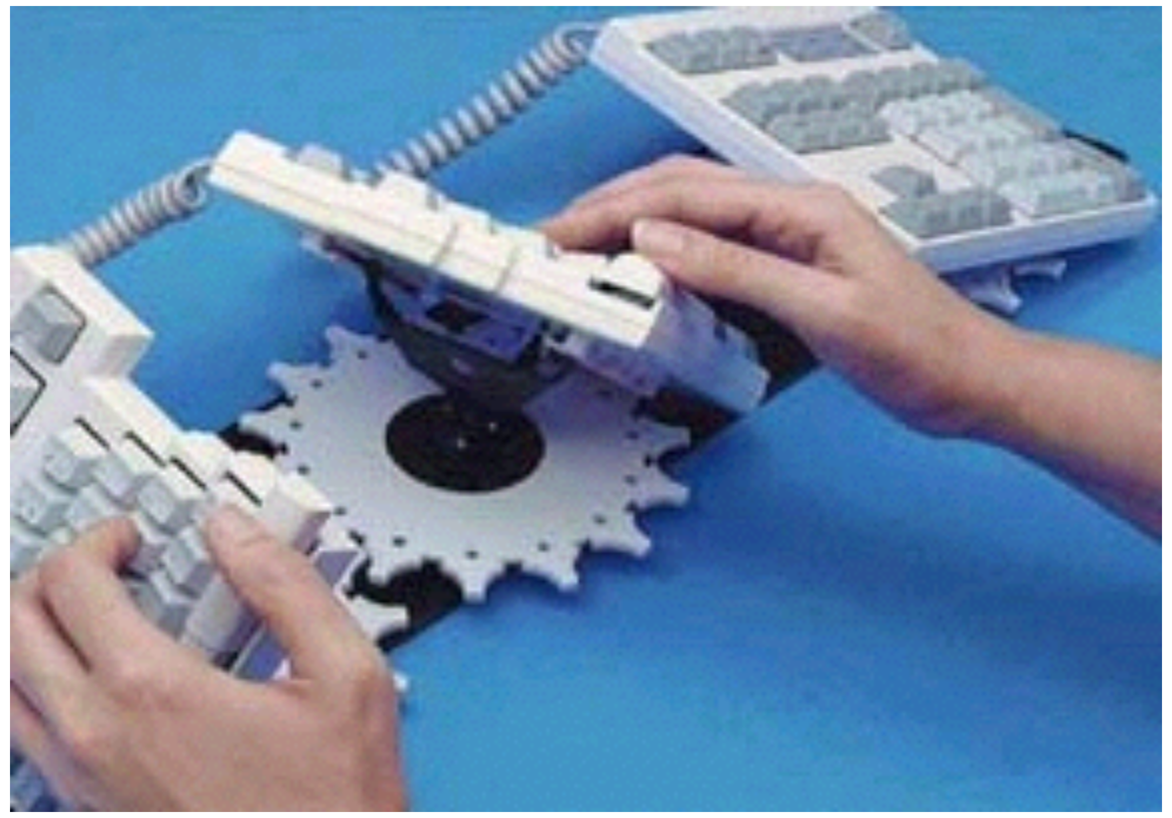
$$T_n = T_1 n^{-a} + c$$

KEYBOARDS






Maxim

KEY LAYOUTS

DIFFICULTY: TEXT ENTRY

Still very hard on mobile devices

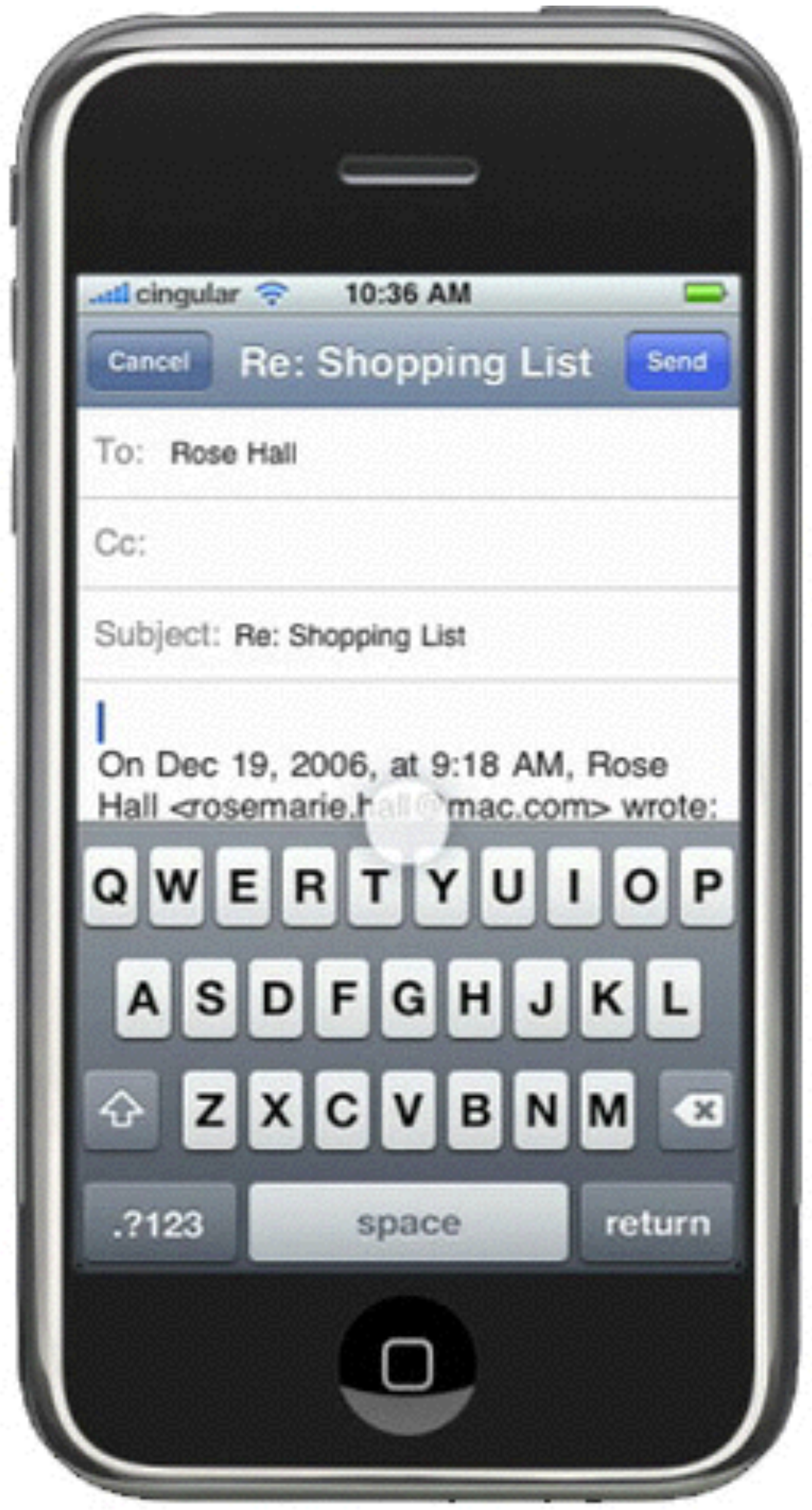
Keyboards (on-screen and thumb)

Full hand-writing recognition

Graffiti

EdgeWrite

ShapeWriter



MOBILE TEXT ENTRY: KEYPADS

Multi-tap mappings

Multiple presses per letter

Ambiguity resolution

One press per letter, dictionary lookup

MOBILE TEXT ENTRY: KEYPADS

Chording

Multiple keys pressed simultaneously

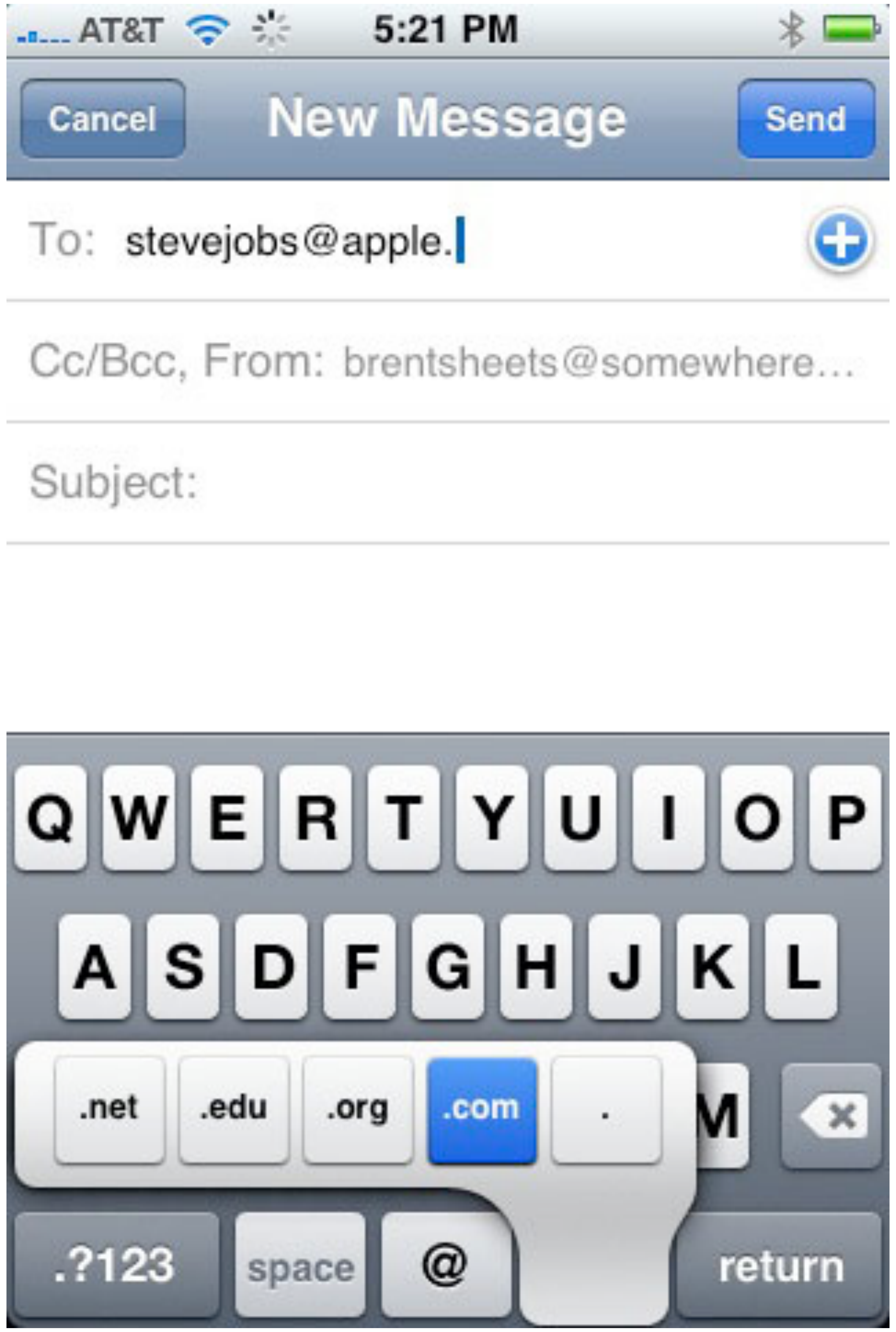
2^n combinations for n keys

Twiddler2, HandyKey

MOBILE TEXT ENTRY: SOFT KEYS

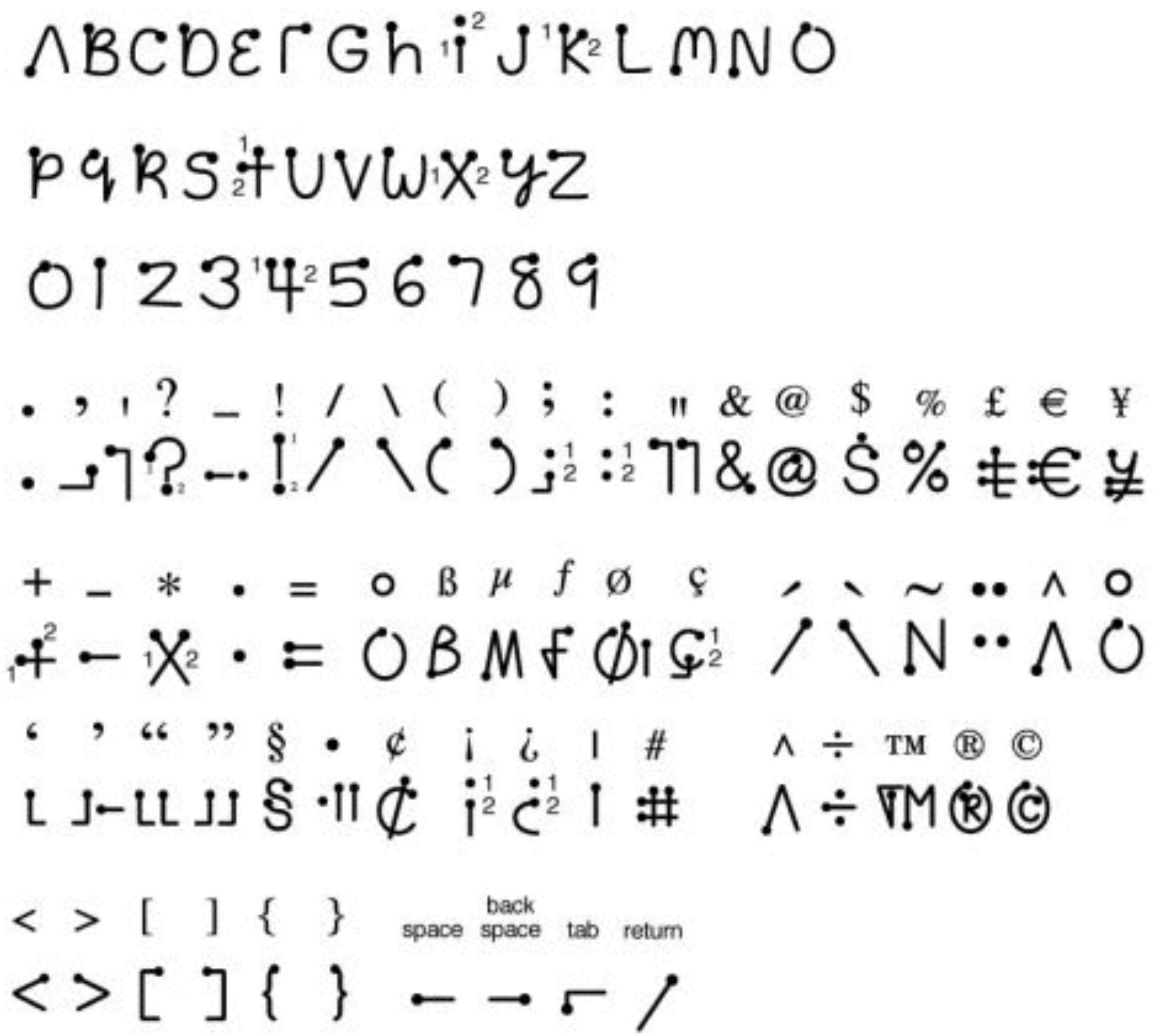
Soft Keyboards

Benefits? Drawbacks?



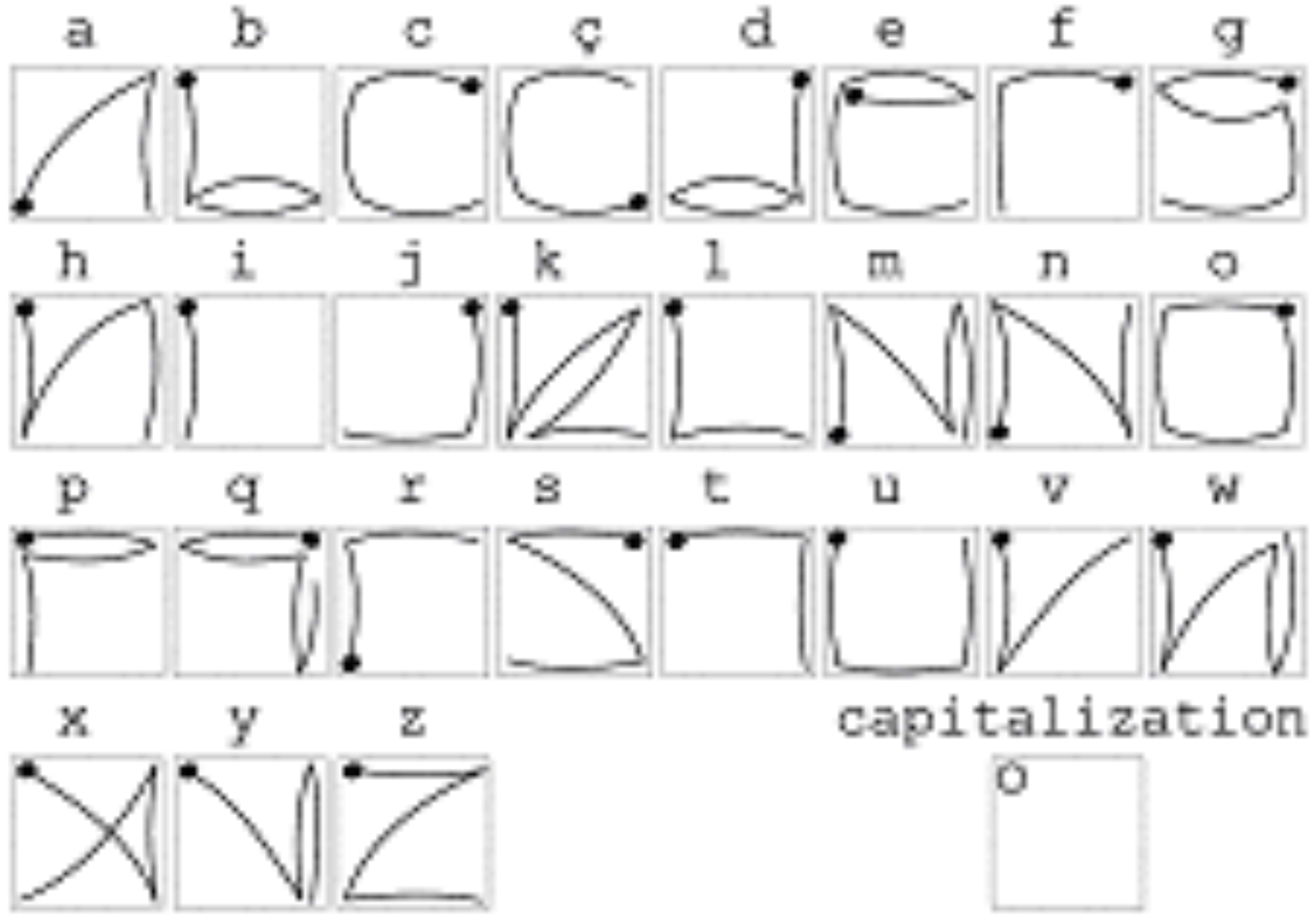
MOBILE TEXT ENTRY: HANDG RECOG

GRAFFITI – UNISTROKE TEXT ENTRY



EDGEWRITE

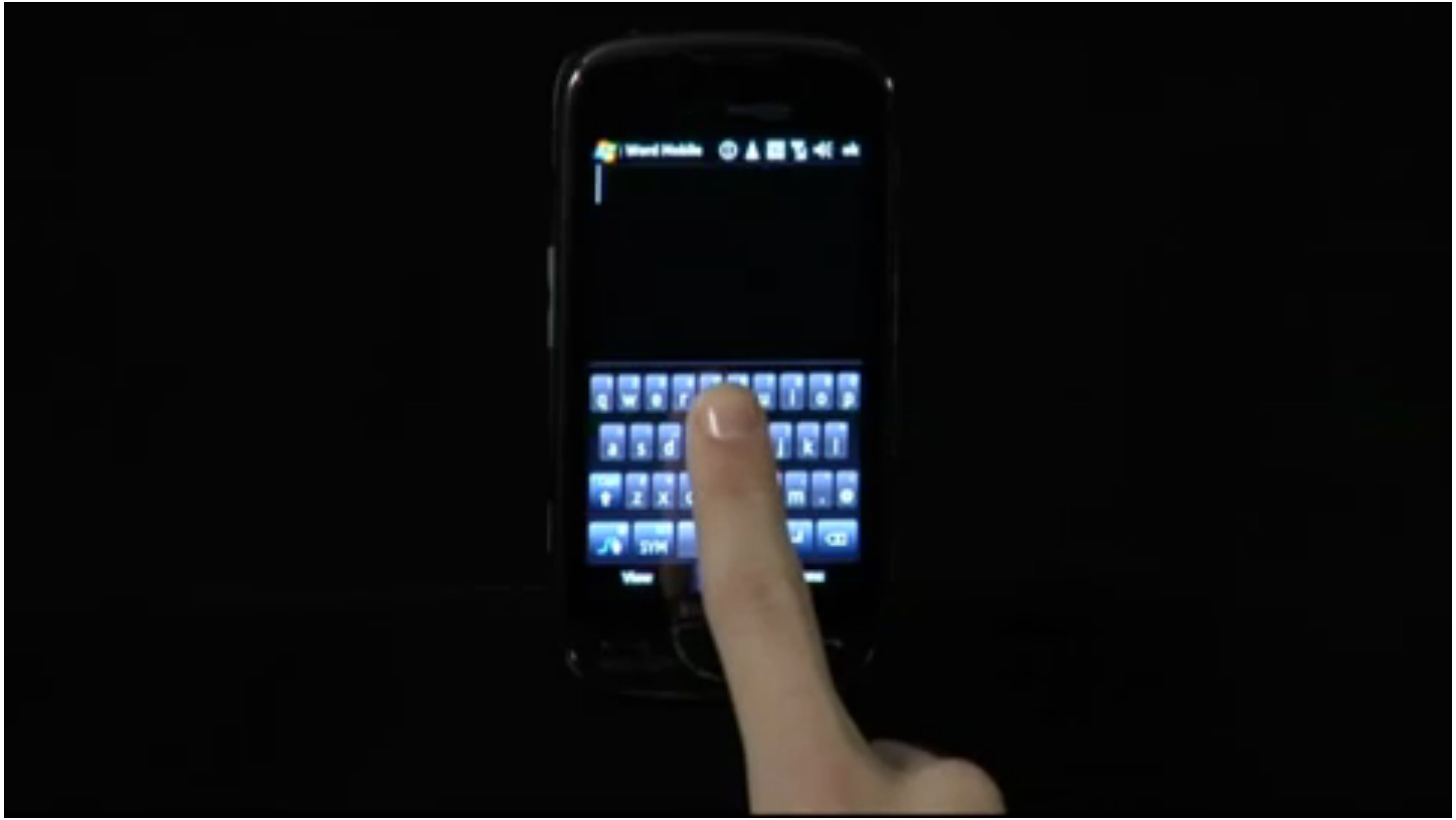
- Corner-based text input technique
- Makes use of physical edges and corners to improve input time
- Particularly effective for users with motor impairments
  - Edges provide stability
- Implementable in many different input modalities
  - stylus, joysticks, trackball



Jacob Wobbrock, UIST 2003

MOBILE TEXT ENTRY: TOUCH / STYLUS

Stroke Entry Methods (e.g., Swype, ShapeWriter)

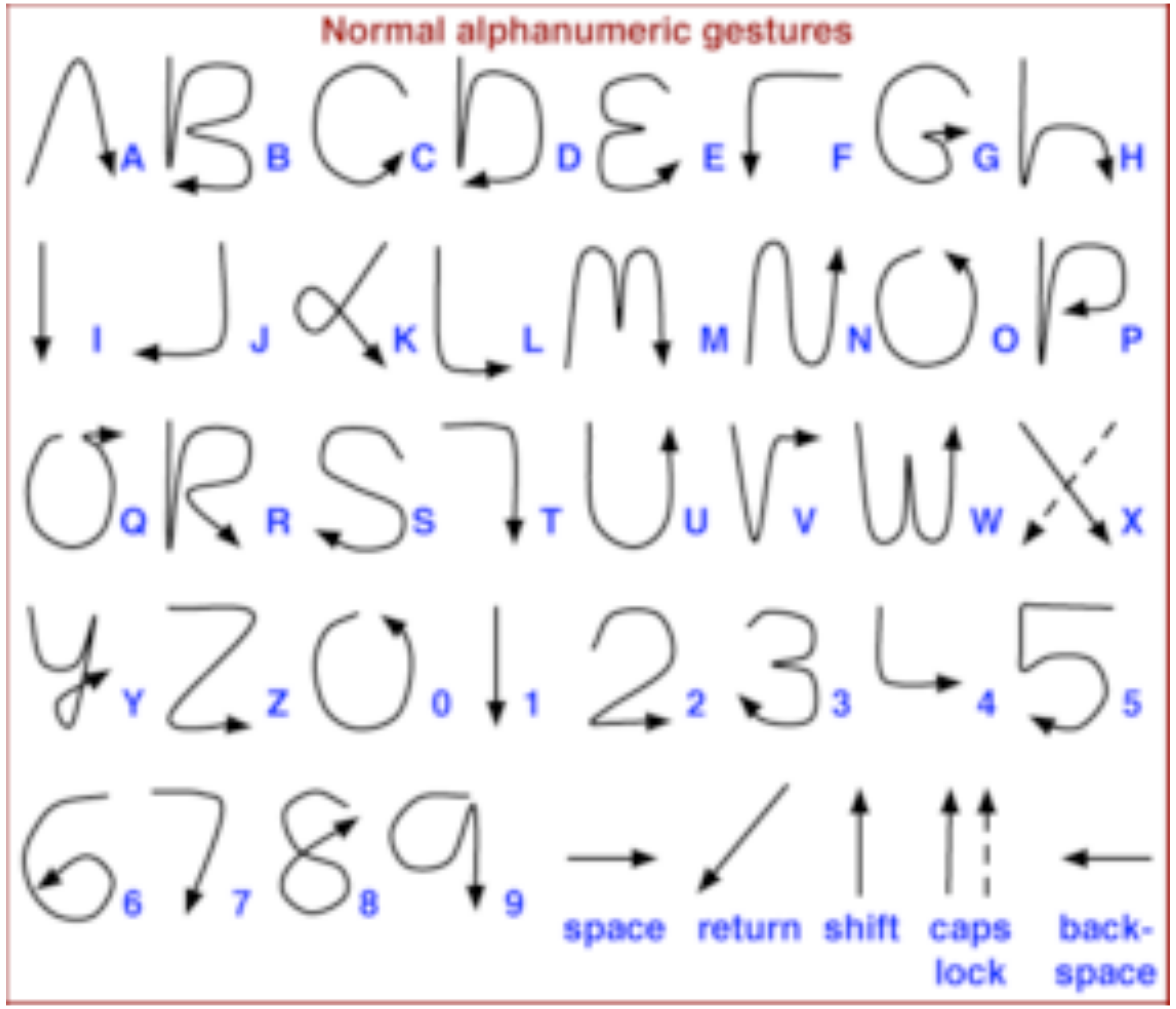


MOBILE TEXT ENTRY: TOUCH / STYLUS

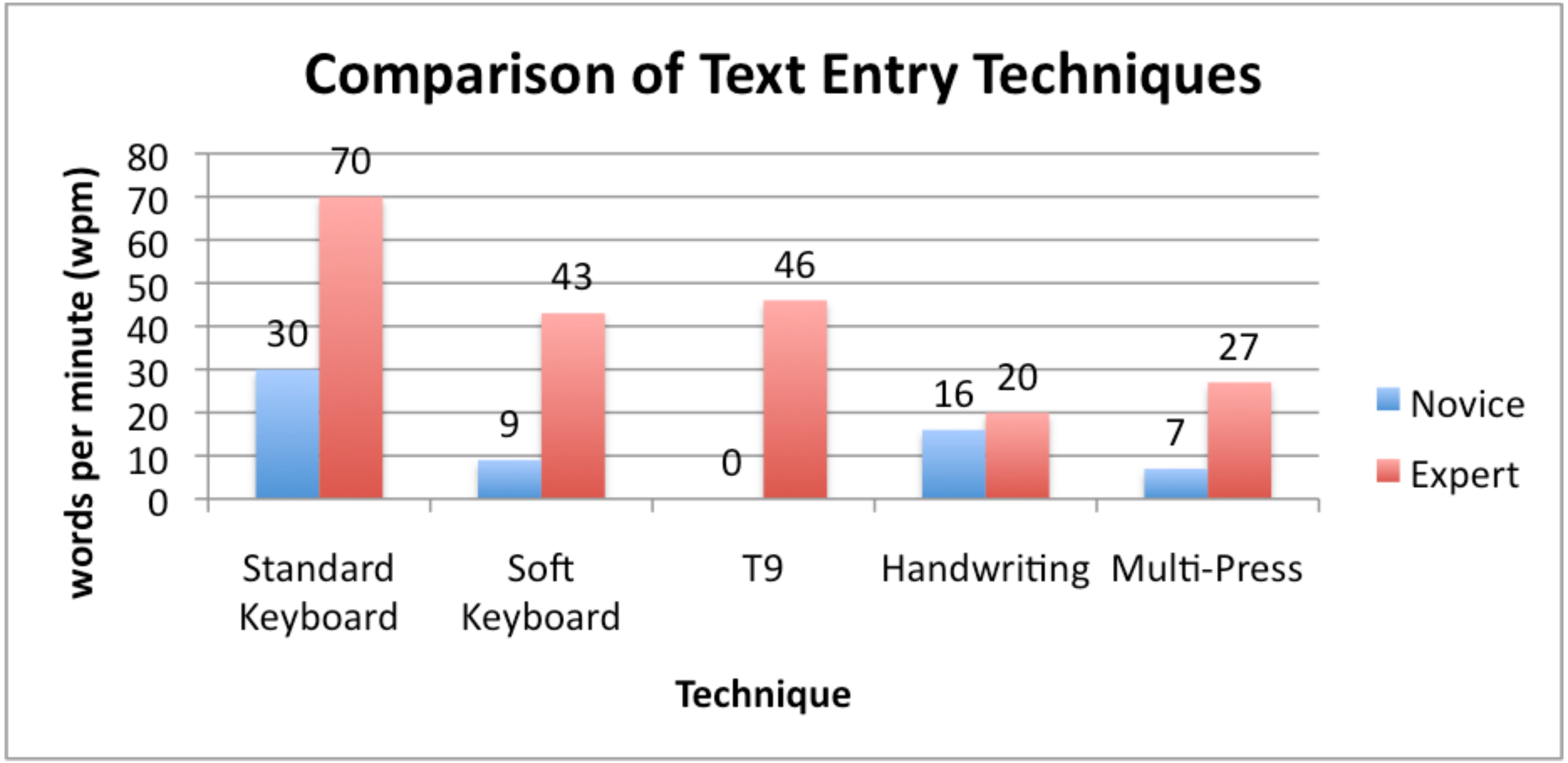
Custom symbol sets

improve recognition accuracy;

appropriate for indirect (eyes-free) input



WHICH IS FASTEST?



WHAT ABOUT SPEECH RECOGNITION?

Dictation is faster than typing (~100 wpm)

WHAT ABOUT SPEECH RECOGNITION?

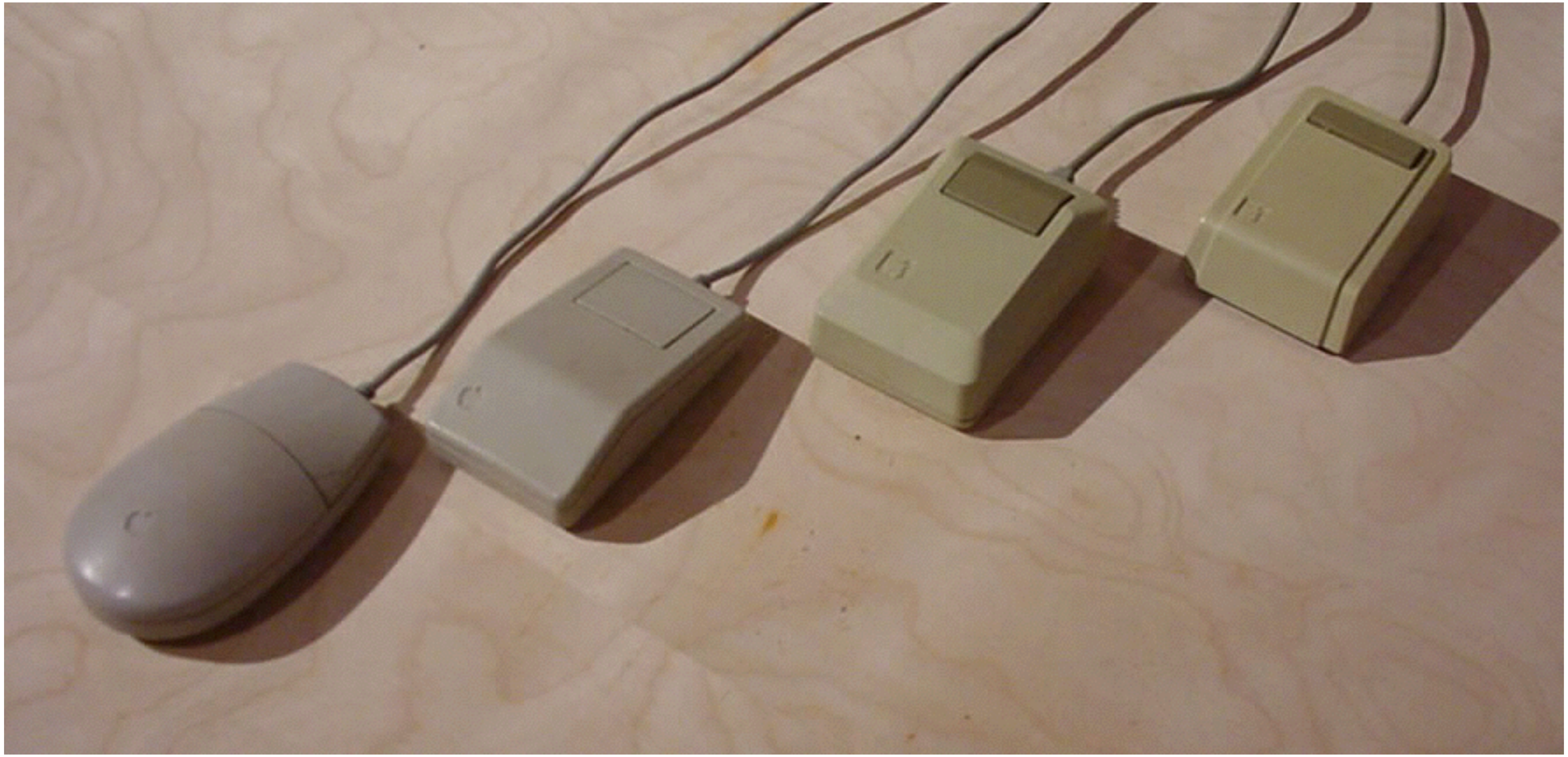
Dictation is faster than typing (~100 wpm), BUT:

Speech is different from written language:
Speaking in well-formed, complete, print-ready sentences is cognitively challenging

High cost of correcting errors through speech channel alone

Social awkwardness?

POINTING DEVICES

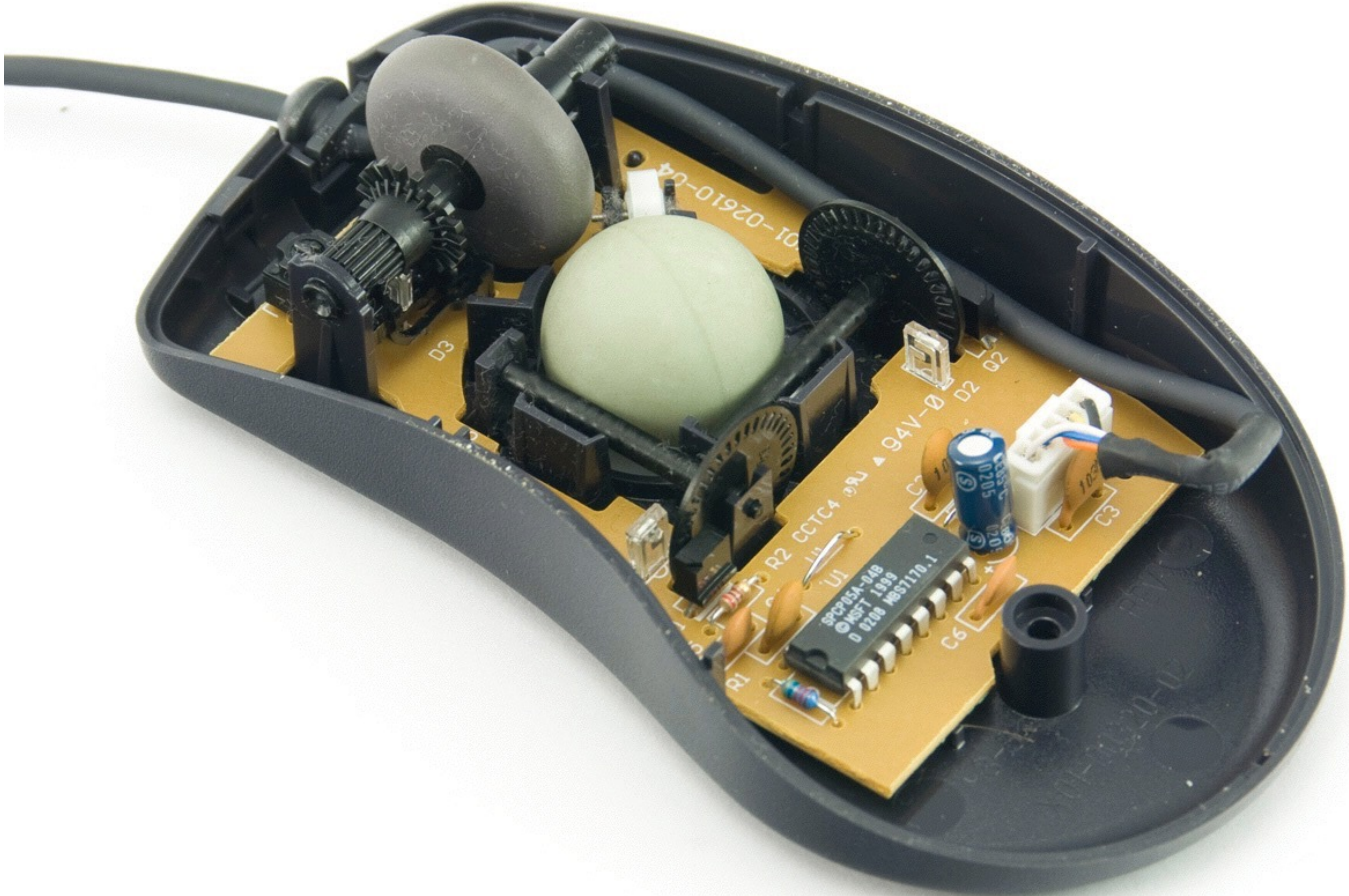


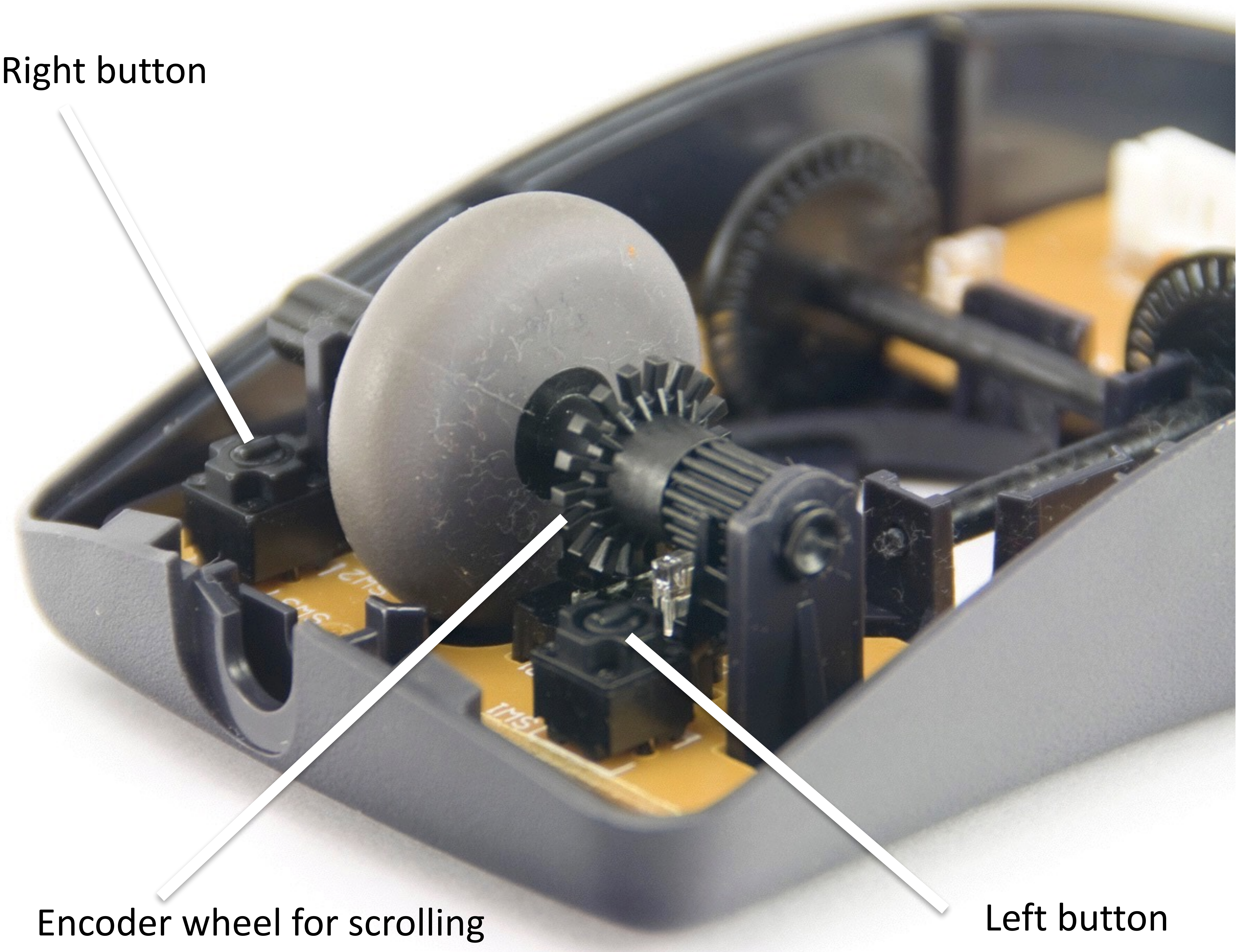
(cc) Flickr photo by Mike fj40

Mouse. Engelbart and English ~1964

Source: Card, Stu. Lecture on Human Information Interaction. Stanford, 2007.

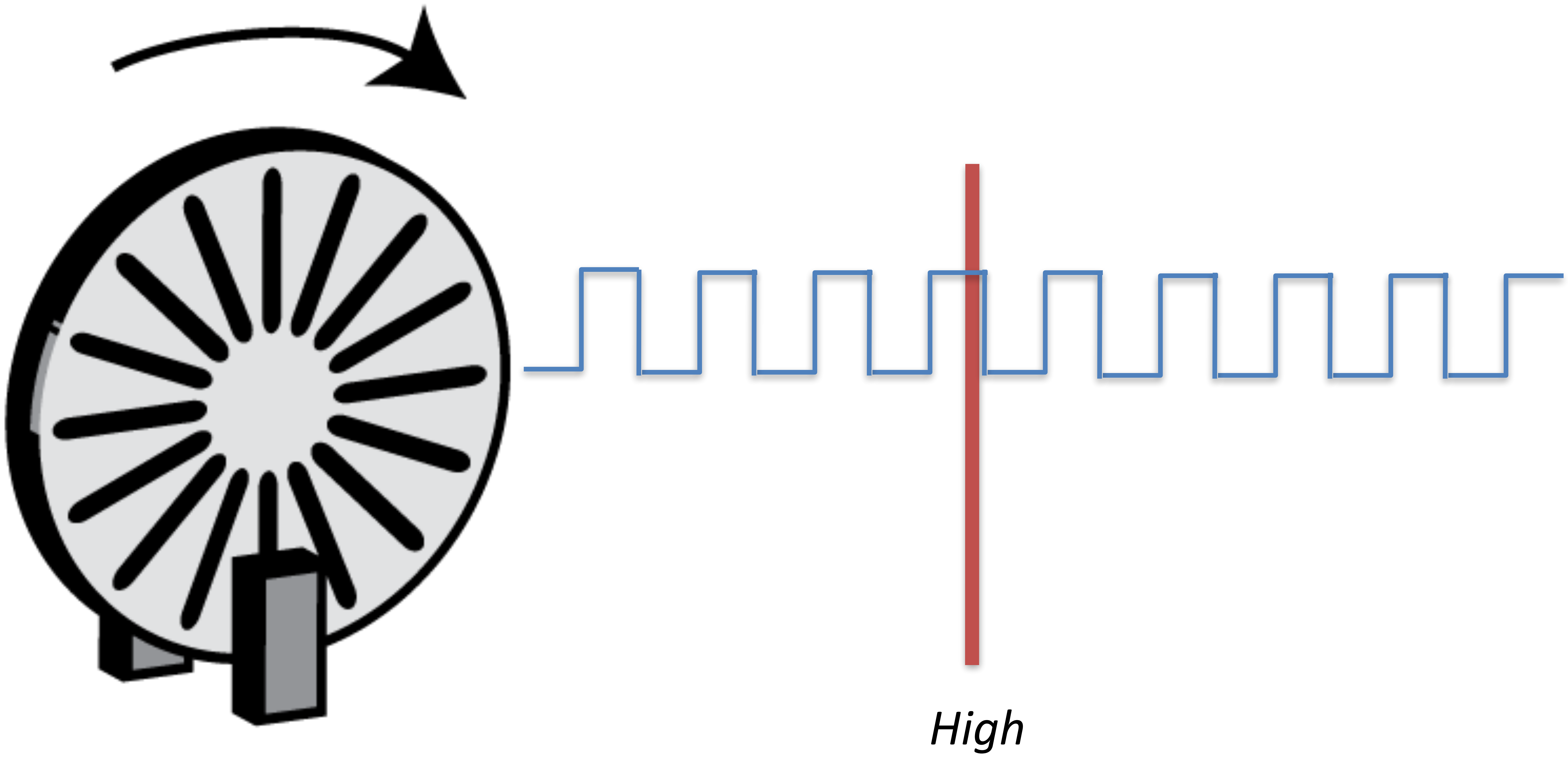

DELL
by Microsoft


SPCP05A-04B
MSFT 1999
D 0208 MBS7170.1
CCTC4
D3
D2
Q2
C3
C6
R1
R2
U1


Right button
Encoder wheel for scrolling
Left button


slotted wheel
(between emitter & detector)
IR emitter
IR detector

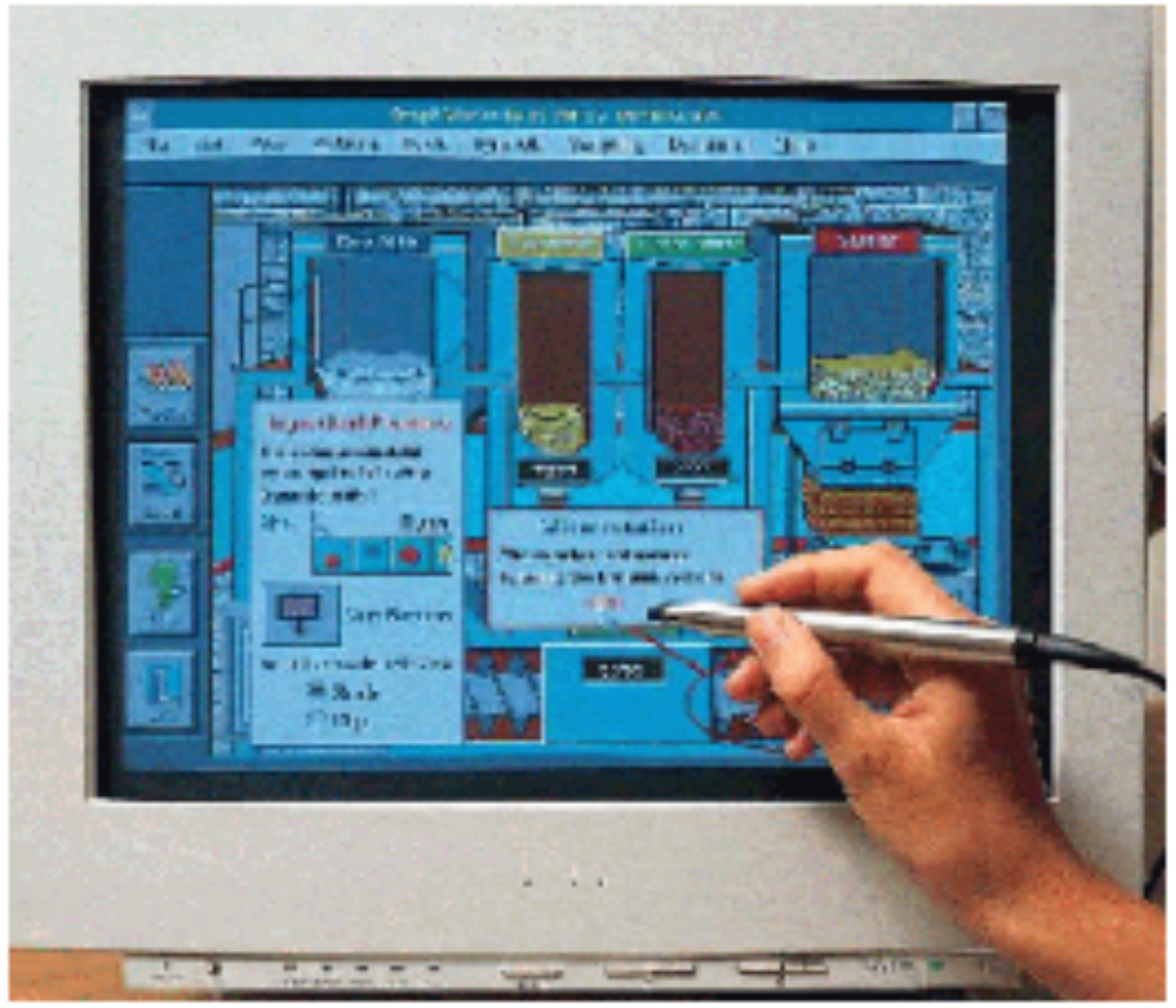
SENSING: ROTARY ENCODER



ABSOLUTE VS RELATIVE

Track Ball (relative, indirect locator)

Mice (relative, indirect locator)



Light Pen (absolute, direct locator)

Touch Screen (absolute, direct locator)

Absolute locators: have an origin location and locate in this frame of reference

Relative locators: report location relative to their previous location, rather than relative to a fixed origin

Direct locator: user points directly at the screen

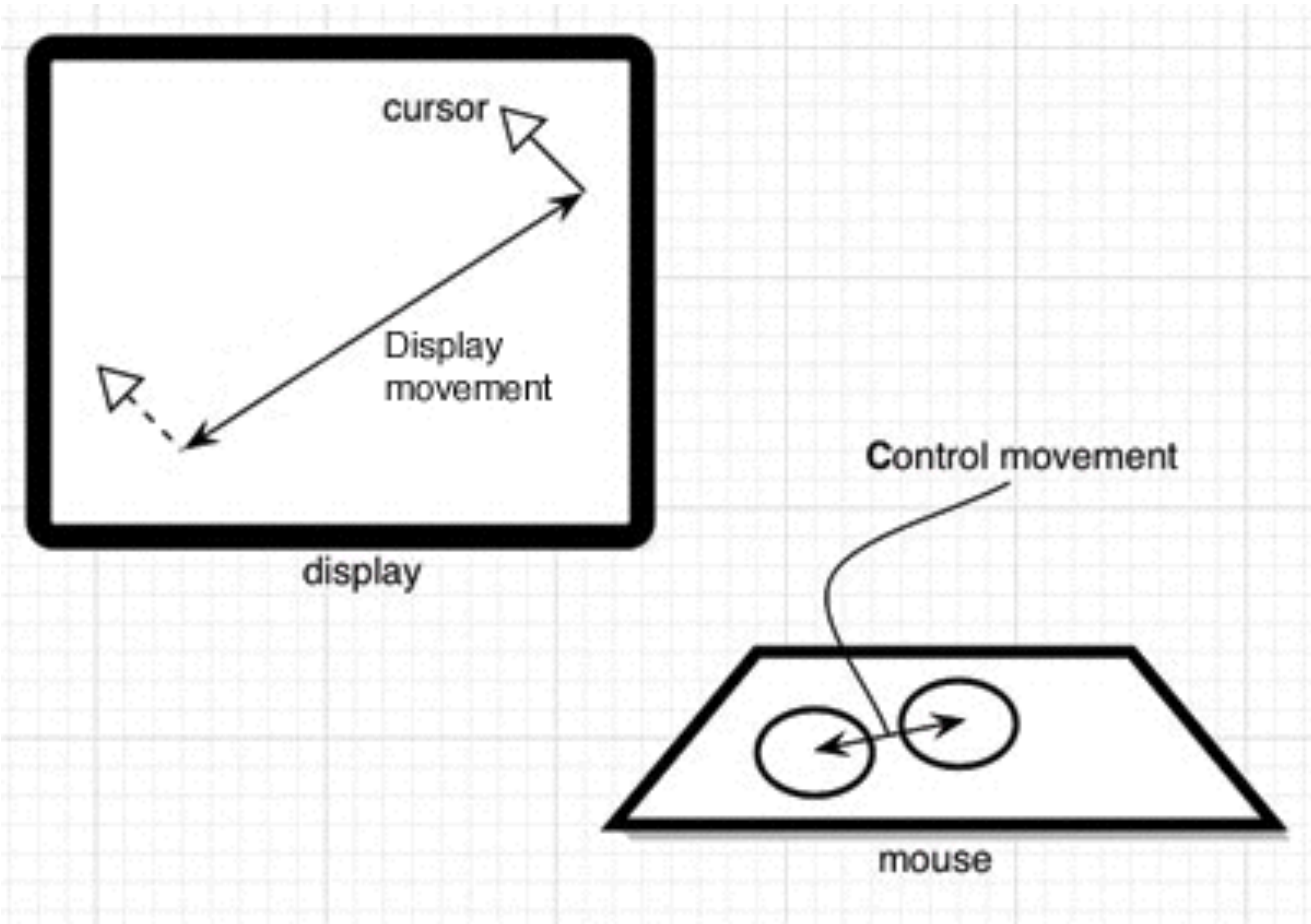
Indirect locator device user moves a cursor on the screen using a device separate from the screen

CONTROL TO DISPLAY RATIO (C:D RATIO)

Ratio of the speed of hand movement (**C**ontrol) to the speed/distance of cursor movement (**D**isplay) for a continuous locator device

Large ratio - large hand movement / small cursor movement (Good for accurate positioning, poor for long movements)

Small ratio - small hand movement / large cursor movement (Good for rapid movements across long distances, poor for accurate positioning)



OTHER DEVICE PROPERTIES:

Indirect vs. Direct

Direct: Input and output space are unified

C:D Ratio

For one unit of movement in physical space, how far does the cursor travel in display space?

Q: What is the C:D ratio for direct touch screen input?

Device Acquisition Time

MOBILE POINTING

D-Pad
(see: arrow keys)

Trackball

Direct touch
(see: Trackpad)

Stylus

Everything is best for something and worst for something else.

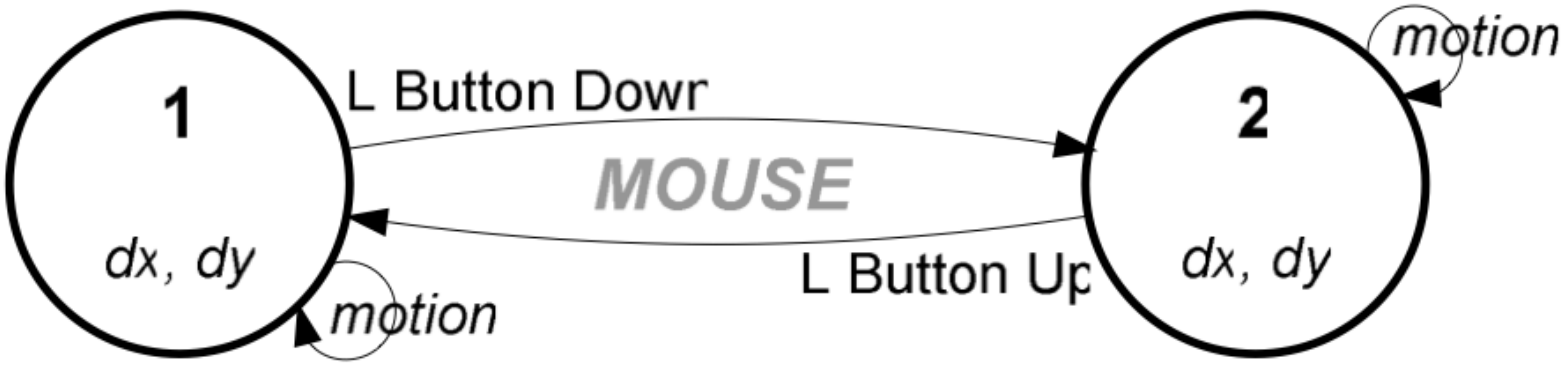
- Bill Buxton

3-STATE MODEL OF INPUT (BUXTON)

State	Description
0	*Out Of Range:* The device is not in its physical tracking range.
1	*Tracking:* Device motion moves only the cursor.
2	*Dragging:* Device motion moves objects on the screen.

(Table from Hinckley Reading)

MOUSE



(Figure from Hinckley Reading)

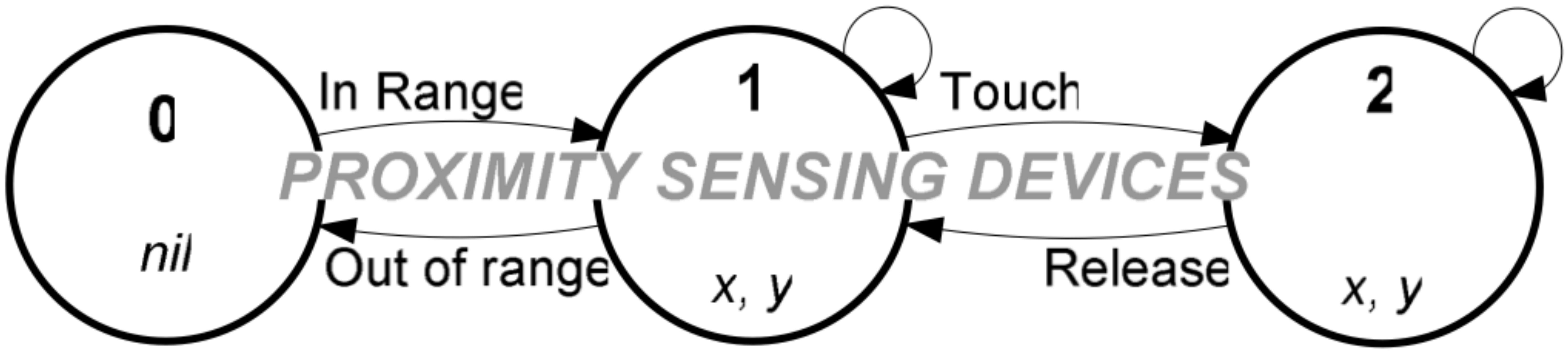
State	Description
0	*Out Of Range:* The device is not in its physical tracking range.
1	*Tracking:* Device motion moves only the cursor.
2	*Dragging:* Device motion moves objects on the screen.

TOUCH SCREEN

(Figure from Hinckley Reading)

State	Description
0	*Out Of Range:* The device is not in its physical tracking range.
1	*Tracking:* Device motion moves only the cursor.
2	*Dragging:* Device motion moves objects on the screen.

STYLUS ON TABLET



(Figure from Hinckley Reading)

State	Description
0	*Out Of Range:* The device is not in its physical tracking range.
1	*Tracking:* Device motion moves only the cursor.
2	*Dragging:* Device motion moves objects on the screen.

(MULTI-) TOUCH


cingular
9:55
Tuesday, January 9
slide to unlock

STRENGTHS

Direct input allows maximal screen space for mobile devices (ocular centrism).

More degrees of freedom.

“Virtual input devices” are adaptable.

No extra pieces to lose or break (styli!)

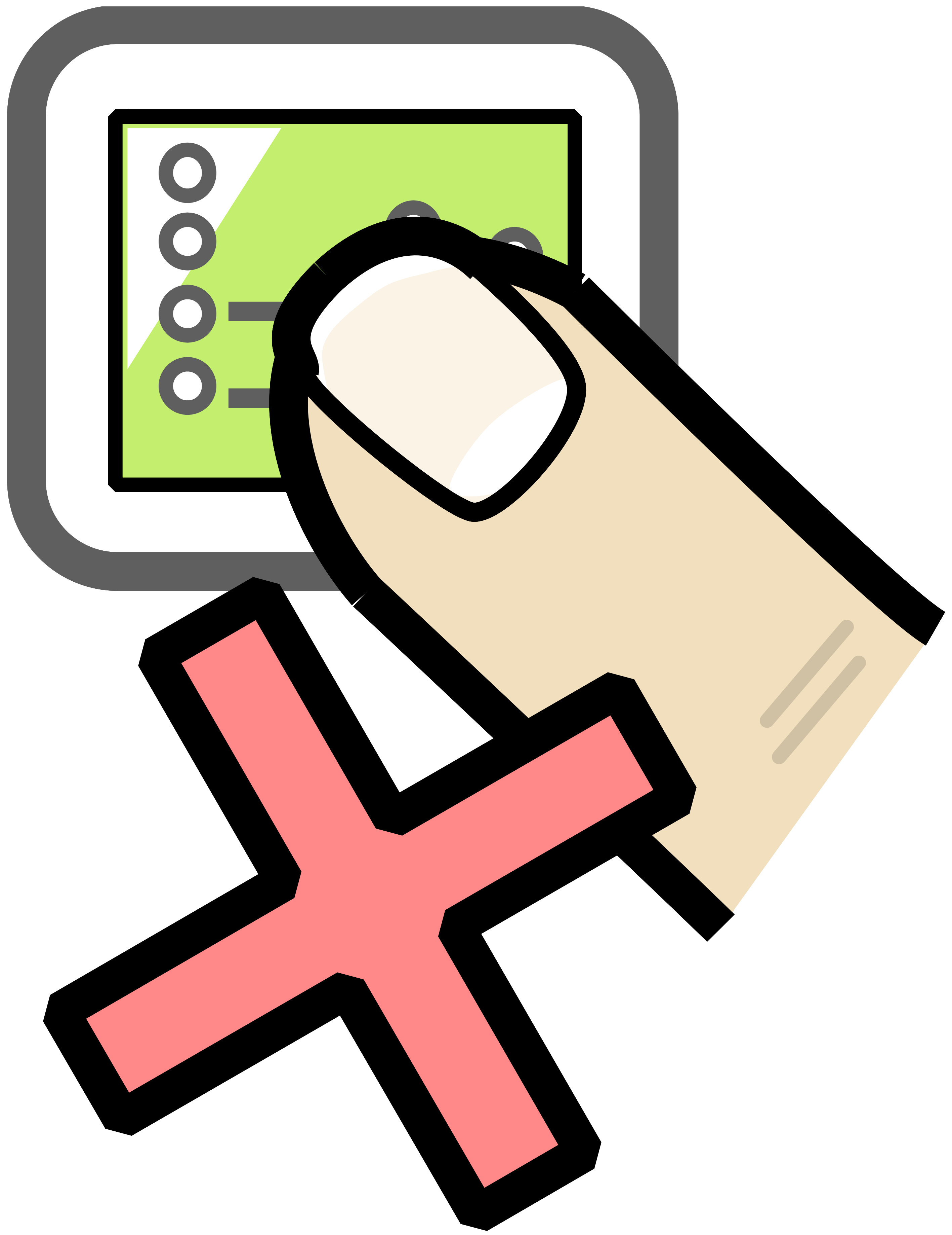
CHALLENGES

No tactile feedback.

Requires free use of (both) hands and eyes.

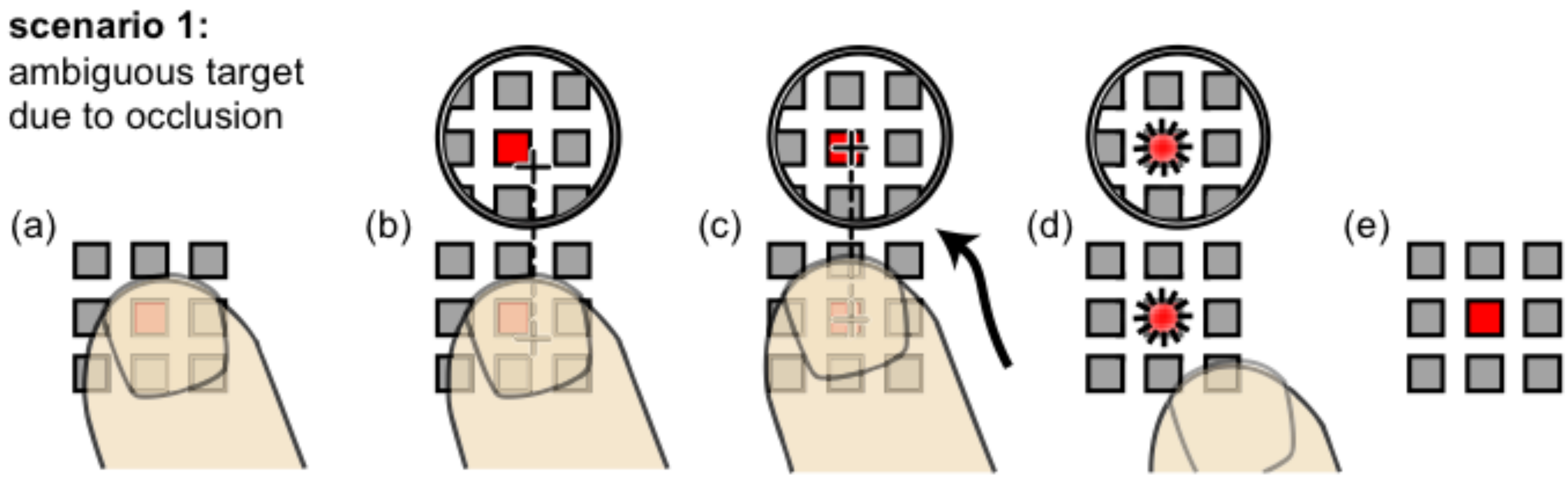
“Fat Finger” problems – precision & occlusion

THE "FAT FINGER" PROBLEM



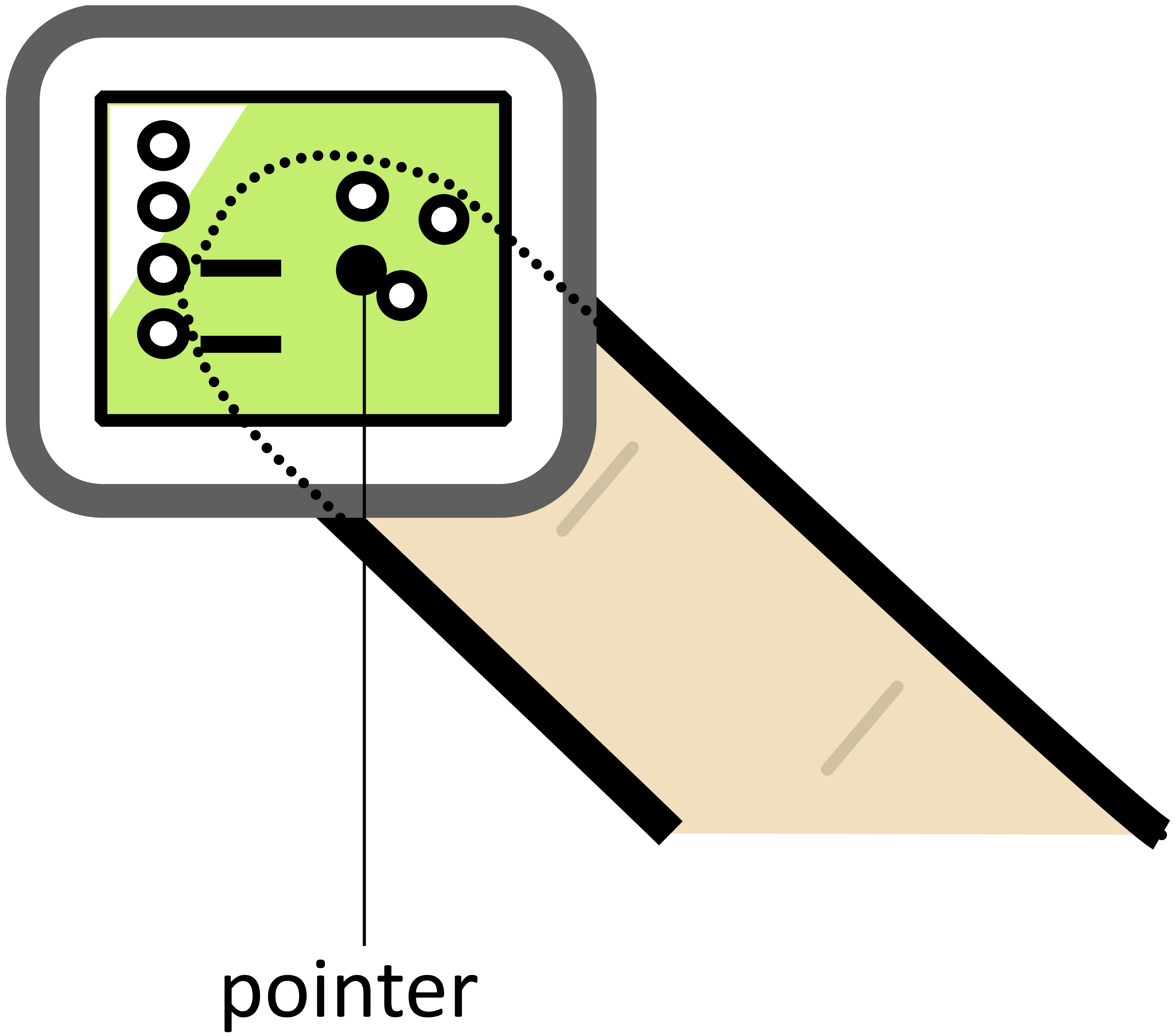
Graphics: Patrick Baudisch, nanoTouch

A SOFTWARE SOLUTION

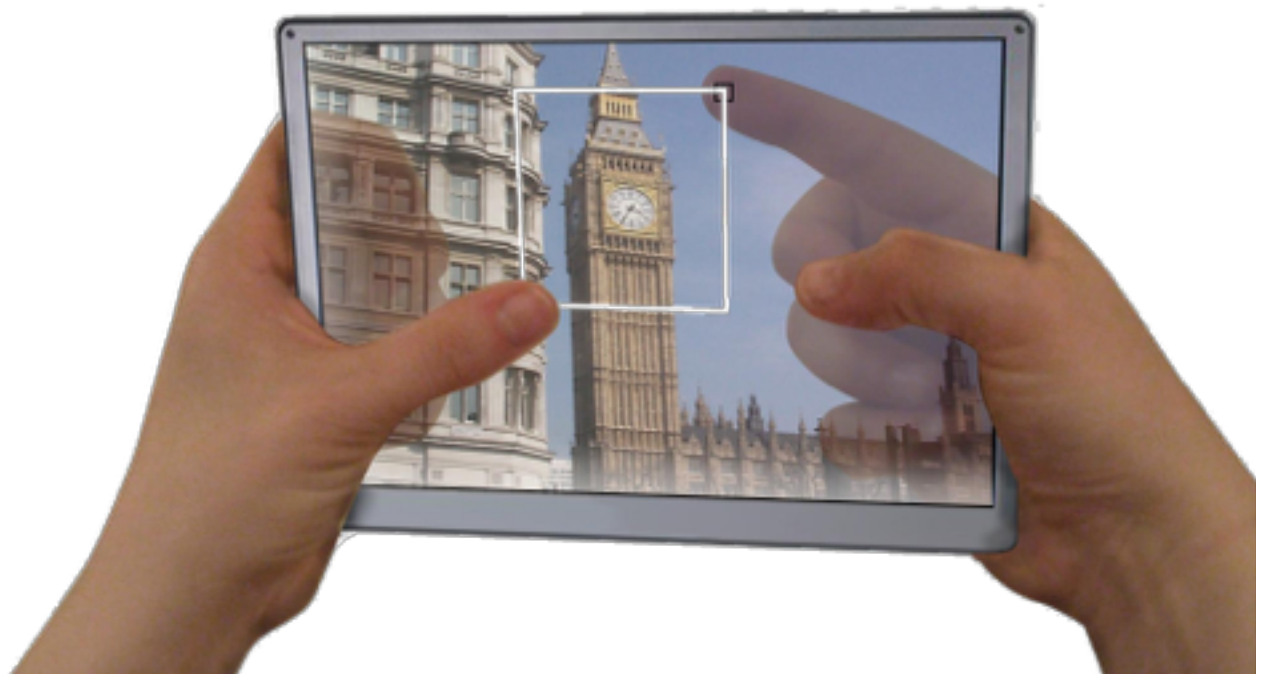


Graphics: D. Vogel, P. Baudisch - Shift

A HARDWARE SOLUTION: USE THE BACKSIDE



Graphics: Patrick Baudisch, nanoTouch



LUCID TOUCH

THE MANUAL INPUT SESSIONS: "NEGDROP"

golan levin / zach lieberman . 2004