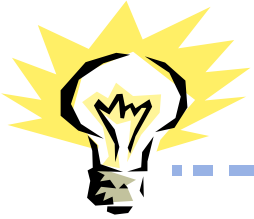


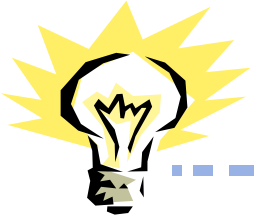
Interaction Styles

Input (and output) approaches



Agenda

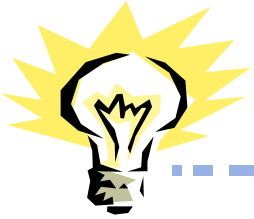
- Command languages
- WIMP
- Gestures/touch
- Direct manipulation/VR/AR
- Speech



Dialog Design

- How does a user interact with the interface?





1. Command Languages

- Earliest UI interaction paradigms
(after punch cards gave way to interaction)

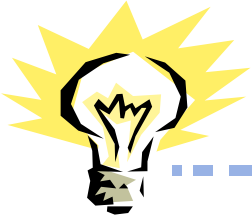
- Examples

- ❖ MS-DOS shell
- ❖ UNIX shell
- ❖ dBase
- ❖ GPSS

```
/usr/bin/login (tty2)
[localhost:~] walkerb%

acme.gatech.edu
{acmez:bw124:137} cp test01.txt temp/text01.txt
cp: cannot create temp/text01.txt: No such file or directory
{acmez:bw124:138} |

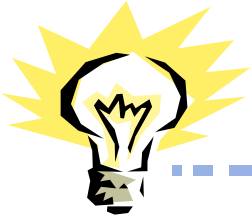
PSYCH / CS 6755
```



Command Line Attributes

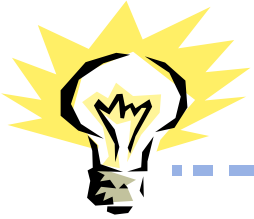
- Work primarily by recall, not recognition
- Heavy memory load
- Little or nothing is visible
so...

- Poor choice for novices
but...



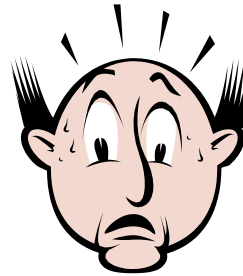
Command Line Advantages

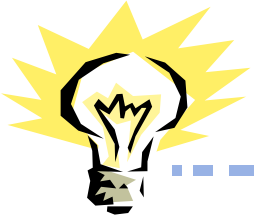
- Advantages for experts
 - ❖ Speed, conciseness
% ls (hard to beat)
 - ❖ Can express actions beyond a limited set
Flags, piping one command to another
 - ❖ Repetition, extensibility
Scripting, macros
 - ❖ Easier implementation, less overhead
Abstraction, wild cards
 - ❖ Power



Command Line Dangers

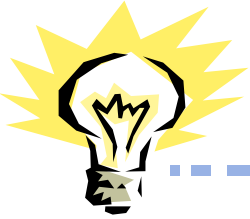
- With added power, comes added responsibility and danger
 - ❖ UNIX
 - % `rm -r *`
 - Deletes every file that you have, and you can't get them back





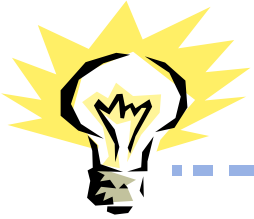
Command Line Design Goals

- Consistency
 - ❖ Syntax
 - ❖ Order
 - ❖ Etc.
- Good naming and abbreviations
- Doing your homework in design can help alleviate some of the negatives



Consistency: Syntax

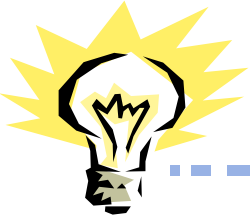
- Pick a consistent syntax strategy
 - ❖ UNIX fails here because commands were developed by lots of different people at different organizations
 - No guidelines provided
 - ❖ Simple command list
 - e.g, vi, minimize keystrokes
 - ❖ Commands plus arguments
 - realistic, can provide keyword parameters
 - % cp from=foo to=bar



Ordering

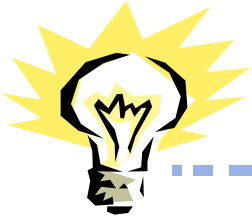
- Keep ordering consistent
 - ❖ VO seems to be the most natural
 - ❖ Typically need to pick where options go

- Example
 - ❖ % ln -s file1 file2 (how to remember?)
 - ❖ Think of % cp file1 file2 for parallel command
 - ❖ Or “make a link of the symbolic type, pointing to file1, and called file2”



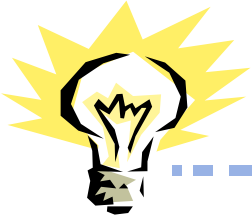
Consistency: Terminology

- Same concept expressed with same options
 - ❖ Useful to provide symmetric (congruent) pairings
 - forward/backward
 - next/prev
 - control/meta



Example

- vi text editor
 - ❖ w - forward word
 - ❖ b - backward word
- Wouldn't 'f' be better for forward?
 - ❖ 'f' already used
- How about 'fw' and 'bw' ?
 - ❖ Extra keystrokes

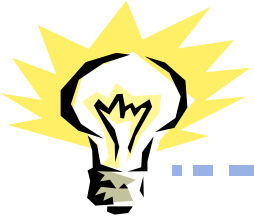


Abbreviations...

DILBERT

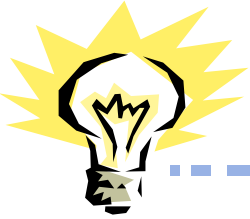
By Scott Adams





Abbreviations

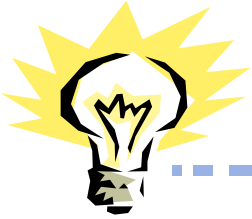
- Abbrevs. allow for faster actions
 - ❖ Expert performance begins to be dominated by motor times such as # of keystrokes
 - ❖ Not good idea for novices
 - ❖ (Allow but don't require)



Picking Good Abbreviations

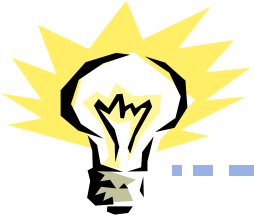
➤ Strategies

- ❖ Simple truncation (works best, but conflicts)
- ❖ Vowel drop plus truncation (avoid conflicts)
- ❖ First and last letters
- ❖ First letters of words in a phrase
- ❖ Standard abbrev from other contexts
 - qty, rm, bldg
- ❖ Phonics
 - Xqt



Abbreviation Guidelines

- Use single primary rule (with single fallback for conflicts)
 - ❖ Use fallback rule as little as possible
 - ❖ Mark use of fallback in documentation
- Let user know primary and secondary rules
- Truncation is good but generates conflicts
- Don't use abbrevs. in system output



2. WIMP

➤ Windows, Icons, Menus, Pointers

- ❖ Focus: Menus, Buttons, Forms
- ❖ Predominant interface paradigm, but giving way to touch

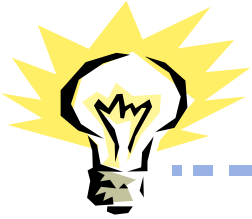
➤ Advantages:



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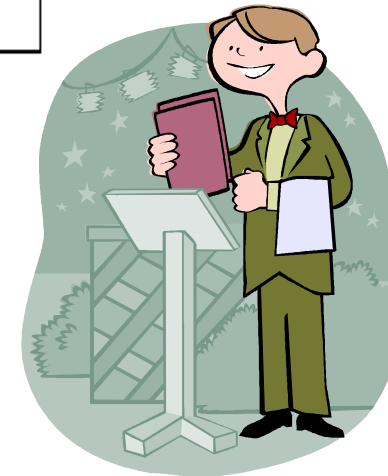
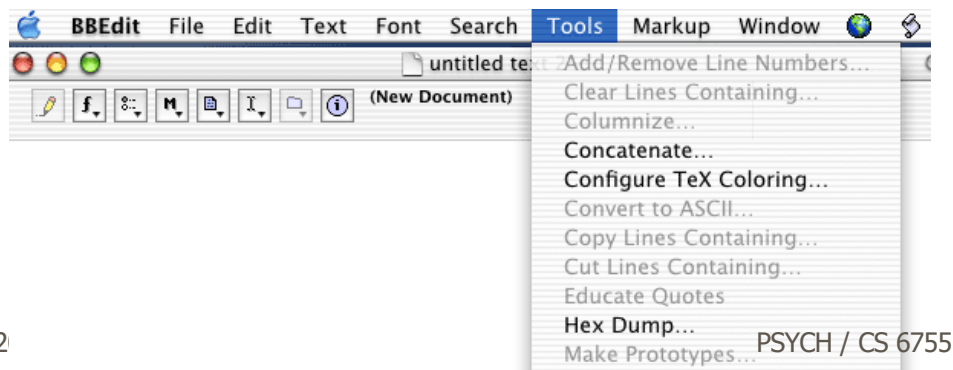
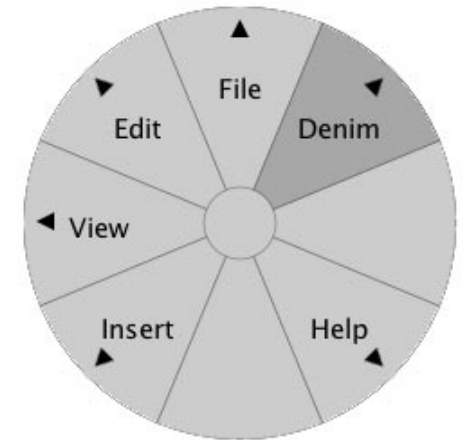
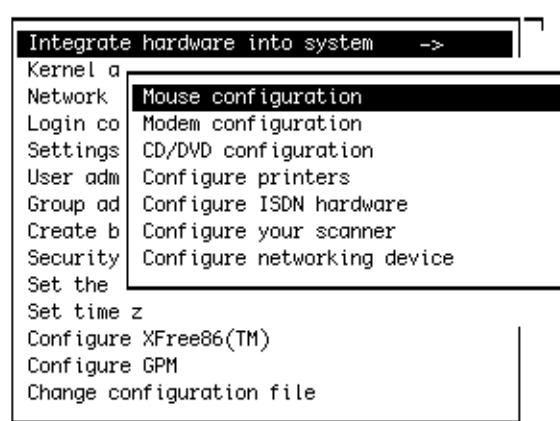
PSYCH / CS 6755

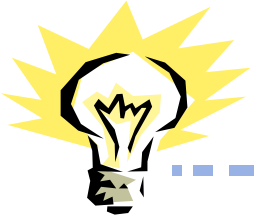


3. Menus

➤ Many different types

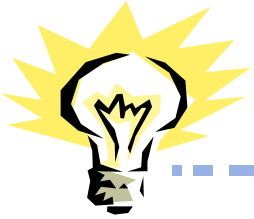
- ❖ pop-up
- ❖ pull-down
- ❖ radio buttons
- ❖ pie buttons
- ❖ hierarchies





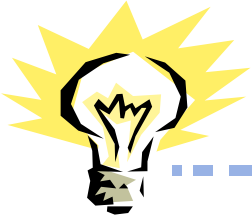
Menus

- Key advantages:
 - ❖ 1 keystroke or mouse operation vs. many
 - ❖ No memorization of commands
 - ❖ Limited input set
- Organization strategies
 - ❖ Create groups of logically similar items
 - ❖ Cover all possibilities
 - ❖ Ensure that items are non-overlapping
 - ❖ Keep wording concise, understandable



Presentation Sequence

- Use natural sort/list order if available
 - ❖ Time
 - e.g. Breakfast, Lunch, Dinner
 - ❖ Numeric ordering
 - e.g. Point sizes for font
 - ❖ Size
 - e.g. USA > Georgia > Fulton Co. > Atlanta
- Other Choices
 - ❖ Alphabetical; Group related items
 - ❖ Frequently used first; Most important first
- User studies
 - ❖ Novices: alpha > functional > random
 - ❖ Experts: categorization



Archeological Example: YaST

```
Terminal — tcsh (tty1)

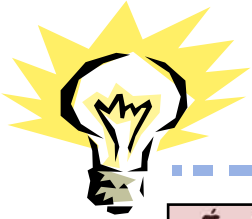
YaST - Yet another Setup Tool
YaST Version 1.11.1 -- (c) 1994-2001 SuSE GmbH

Language:      English
Media:         FTP site ftp://64.168.18.148/usr/local/distro/7.3/
Root Device:   /dev/hda3

General install
Installation se
Package Managem
Update entire s
System Administ
Show README Fil
Copyright
Exit YaST

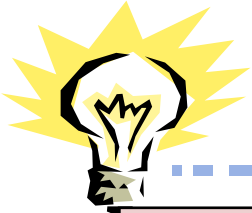
Integrate hardware into system ->
Kernel a
Network
Mouse configuration
Modem configuration
CD/DVD configuration
Configure printers
Configure ISDN hardware
Configure your scanner
Configure networking device

Set the
Set time z
Configure XFree86(TM)
Configure GPM
Change configuration file
```



Menus Today

The screenshot displays the Microsoft PowerPoint application interface. The 'Insert' menu is open, showing options such as 'New Slide', 'Duplicate Slide', 'Section Comment', 'Text Box', 'WordArt', 'Header and Footer...', 'Date and Time...', 'Slide Number', 'Add-ins', 'Table...', 'Chart', 'SmartArt', 'Picture', 'Audio', 'Video', 'Equation', 'Symbol...', 'Shape', 'Action Buttons', 'Action Settings...', 'Object...', and 'Hyperlink...'. The slide in the background is titled 'Menus Today' and features a lightbulb icon and a text box with the placeholder text 'Click to add text'. The slide is part of a presentation named '115-interaction-styles.pptx'. The status bar at the bottom left indicates 'Fall'.



Menus Today...

The screenshot displays the Microsoft PowerPoint application interface. The 'Insert' menu is open, showing options such as 'New Slide', 'Duplicate Slide', 'Slides From', 'Section Comment', 'Text Box', 'WordArt', 'Header and Footer...', 'Date and Time...', 'Slide Number', 'Add-ins', 'Table...', 'Chart', and 'SmartArt'. The background shows a slide titled 'Presentation Sequence' with a list of items and a navigation pane on the left. A lightbulb icon is visible in the bottom right corner of the slide area.

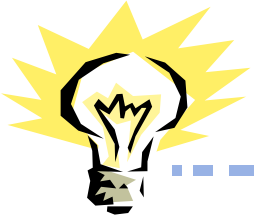
PowerPoint File Edit View **Insert** Format Arrange Tools Slide Show Window Help

New Slide ⌘N
Duplicate Slide ⌘D
Slides From ▶
Section Comment
Text Box
WordArt
Header and Footer...
Date and Time...
Slide Number
Add-ins ▶
Table...
Chart ▶
SmartArt ▶

Not Secure — sonify.psych.gatech.edu/~walkerb/cl...
/omble PCS AutoUI 2018 Papers Arris Gateway - Home
115-interaction-styles
Slide Show Review View Acro...
40 A A A
X₂ AV Aa A

20 **Presentation Sequence**
• Use natural sort/list order if available
• Time
• e.g. Breakfast, Lunch, Dinner
• Numeric ordering
• e.g. Point sizes for font
• Size
• e.g. USA > Georgia > Fulton Co. > Atlanta
• Other Choices
• Alphabetical; Group related items
• Frequently used first; Most important first
• User studies
• Novices: alpha > functional > random
• Experts: categorization

21

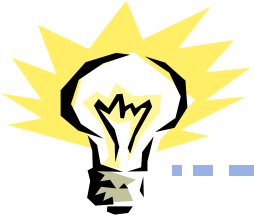


Menus Today??



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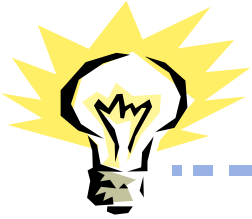


Gut Check...

- Menu Issues?...

- Pros?
- Cons?

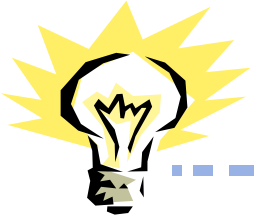
- Usability of these input methods?
- Accessibility
 - ❖ ...of the method?
 - ❖ ...of the method embedded in a system?



4. Pen Input

DILBERT / SCOTT ADAMS, scottadams@aol.com





Personal Digital Asst. (PDA)



Apple Newton (1993)



Palm VII



Palm IIIc

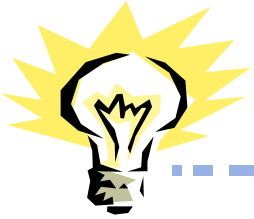


Handspring Visor



HP Jornada

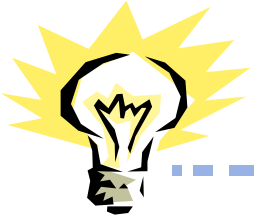




Yet More Pen Input...

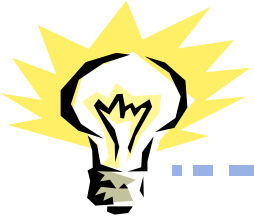


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Pen Input

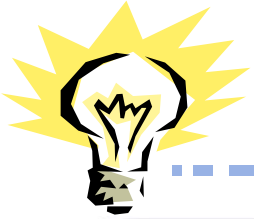
- Main pen input techniques
 - ❖ Free-form ink
 - ❖ Soft keyboards
 - Tapping (pointing) & double tapping
 - ❖ Recognition systems



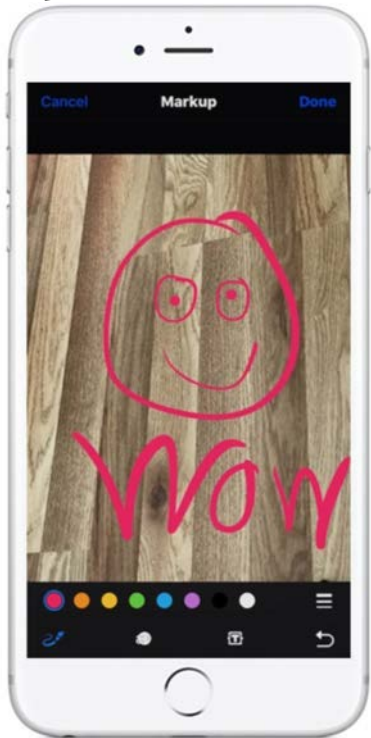
Free-form Ink

- Ink is the data, take as is
- Like a sketch pad
- Human is responsible for understanding and interpretation



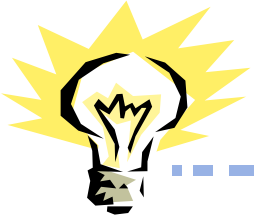


Pen Input??



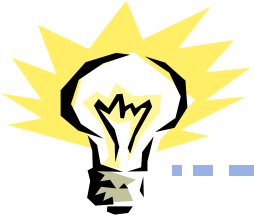
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PSYCH / CS 6755



Handwriting Recognition

- Lots of systems (commercial too)
- English, kanji, etc.
- Not perfect, but people aren't either!
 - ❖ People - 96% handprinted single characters
 - ❖ Computer - >97% is really good
- OCR (Optical Character Recognition)



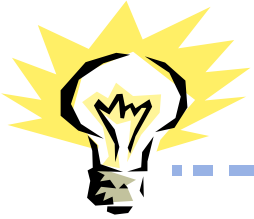
Recognition Issues

➤ Off-line vs. On-line

- ❖ Off-line: After all writing is done, speed not an issue, only quality
- ❖ On-line: Must respond in real-time

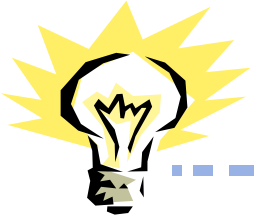
➤ Bitmapped vs. Vectorized

- ❖ Bitmapped: Usually off-line, like OCR
- ❖ Vectorized: On-line, uses angle, direction, speed, pressure, acceleration, etc.



More Issues

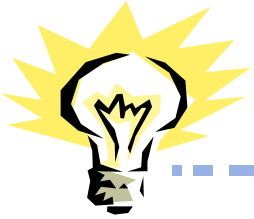
- **Boxed vs. Free-Form input**
 - ❖ Sometimes encounter boxes on forms
- **Printed vs. Cursive**
 - ❖ Cursive is much more difficult
- **Letters vs. Words**
 - ❖ Cursive is easier to do words



More Issues

- Using context & words can help
 - ❖ Usually requires existence of a dictionary
 - ❖ Check to see if word exists
 - ❖ Consider 1/I/I

- Training - Many systems improve a lot with training data



Special Alphabets

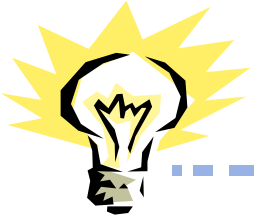
- Graffiti - Unistroke alphabet on Palm PDA

- ❖ Experience?

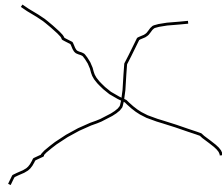


- Other alphabets or purposes

- ❖ Gestures for commands
- ❖ iPhone “pinches”

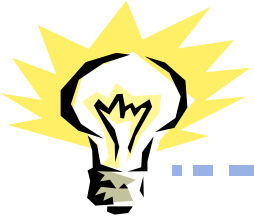


Pen Gesture Commands



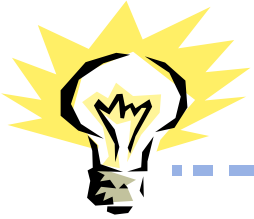
- Might mean delete

Define a series of (hopefully) simple drawing gestures that mean different commands in a system



Error Correction

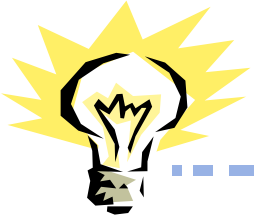
- Having to correct errors can slow input tremendously
- Strategies
 - ❖ Erase and try again
 - ❖ n-best list
 - ❖ ...



Interesting Applications

- Signature verification
- Note-taking
 - ❖ Academic course
 - ❖ Corporate meeting
- Sketching systems
 - ❖ Designers' aids

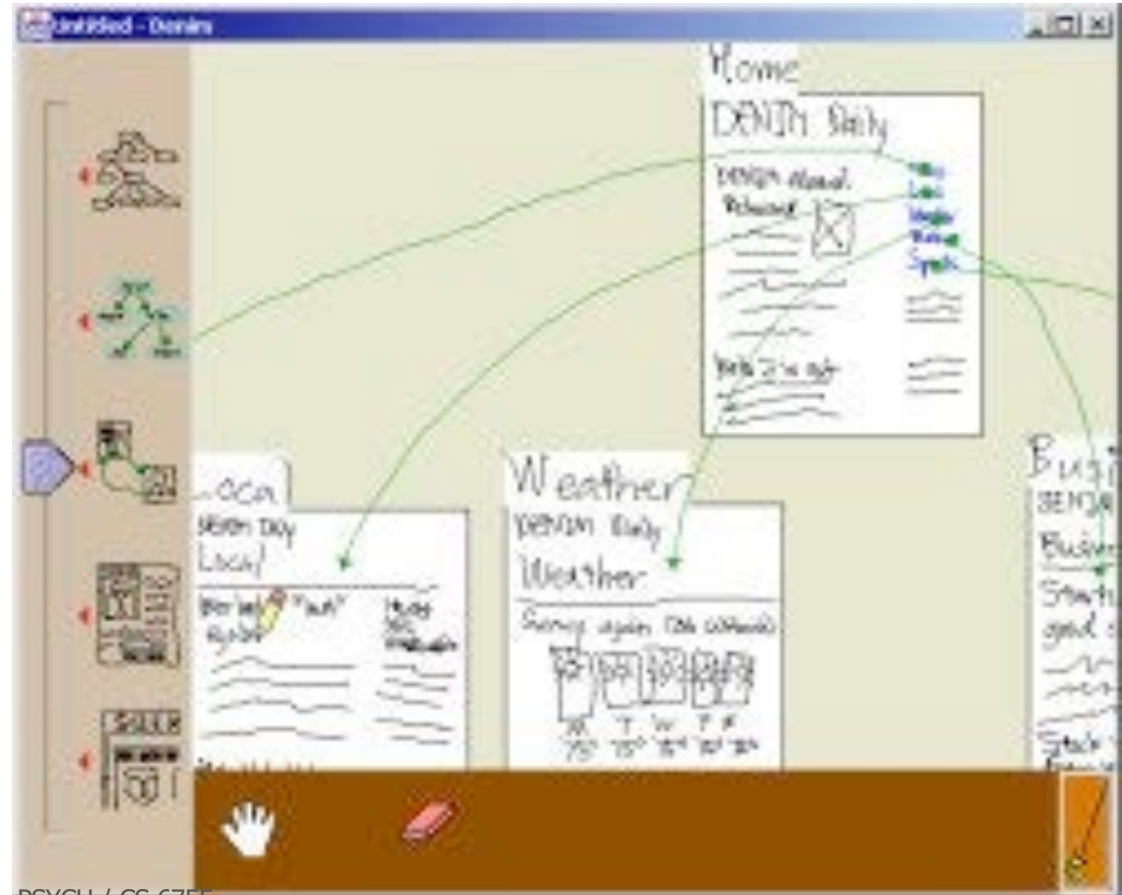


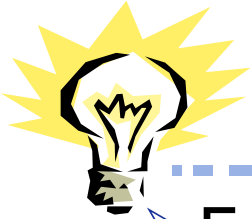


Archeological Example

- Denim - J. Landay, Berkeley GUIR
 - ❖ Video, CHI '96
 - ❖ Software download

Handwriting recognition





Another Example

EdgeWrite and Wheelchair text entry

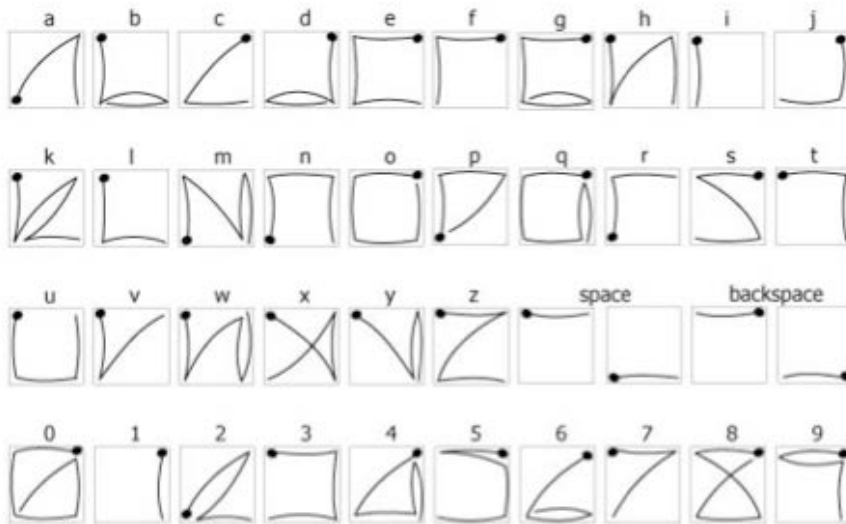


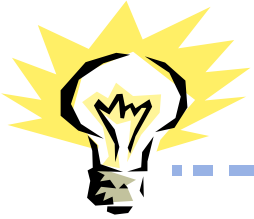
Figure 2. The EdgeWrite alphabet. Alternate forms exist for most characters (not shown). The bowing of line segments is only illustrative and does not depict actual movement, which is in straight lines. For more detail, see [27].

Modified graffiti for joystick entry



Figure 6. The selection keyboard used in our experiment. This keyboard was based on 3 selection keyboards from Microsoft's Xbox. Here the selector is positioned over the letter "a." The dark buttons are Xbox-specific and were not used in the study.

<https://www.youtube.com/watch?v=381xrjMzqvo>

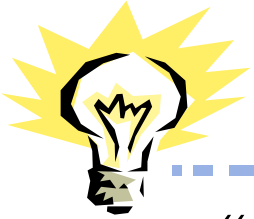


Pen vs. Touchscreen?

- Similarities?
- Differences?

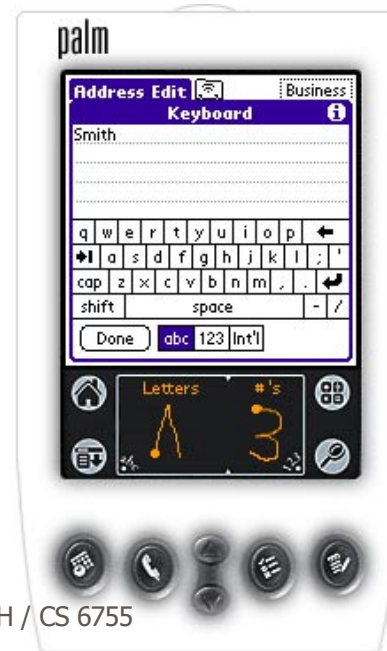
- iPad, iPod, iPhone vs. desktop?

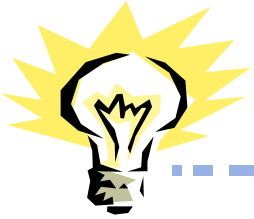
- Form factor of device vs. input mode?
 - ❖ Is pen input slow to take off because tablets are so bulky?
 - ❖ Resolution of screen for input needs to be higher?
 - ❖ Losing the pen/stylus?



Soft Keyboards

- “Pen” is your finger
 - ❖ (securely attached to you)
- Common everywhere, now
- Many varieties
 - ❖ Tapping interface
 - ❖ Stroking interface





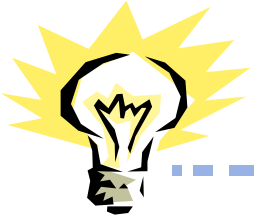
Swype

- Soft keyboard with sweeping gestures

<http://www.swype.com/>

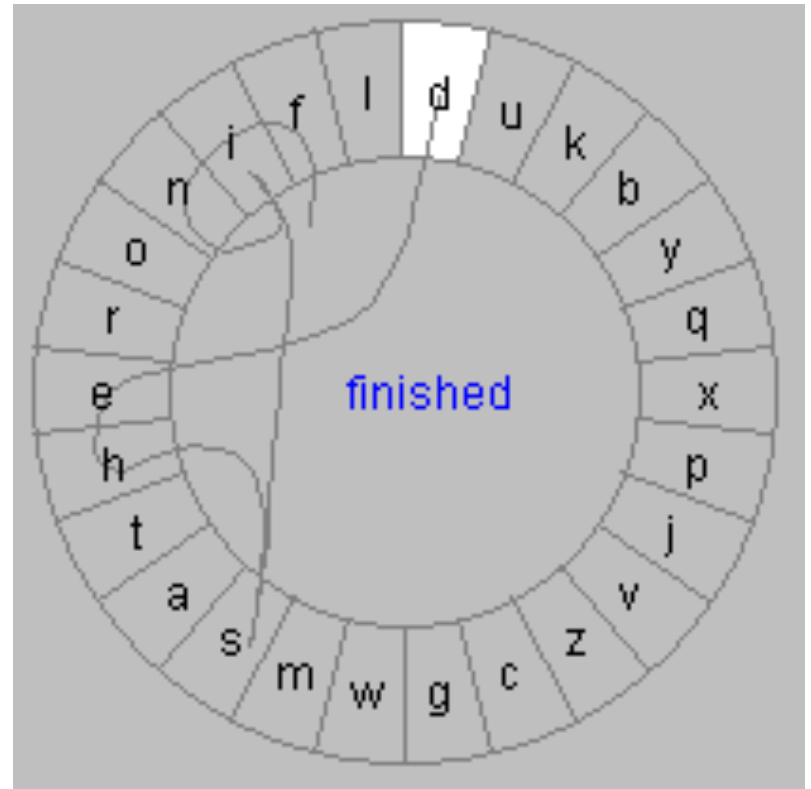
<http://www.youtube.com/watch?v=BCTjgbEtYKY>

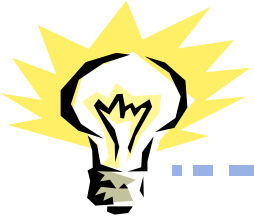




Cirrin

- CIRcular INput
- Developed by Jen Mankoff (GT->Cal->CMU)
- Word-level unistroke technique

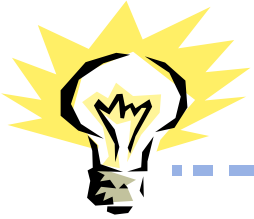




The 8 Pen

- Figure-8 swiping gestures
- <https://www.youtube.com/watch?v=99vsUF4NuLk>
- Usability?
- Utility?



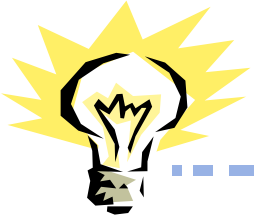


Gut Check...

- Pen/finger input?...

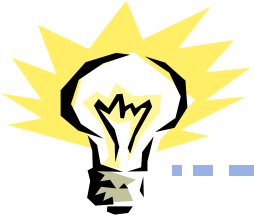
- Pros?
- Cons?

- Usability of these input methods?
- Accessibility
 - ❖ ...of the method?
 - ❖ ...of the method embedded in a system?



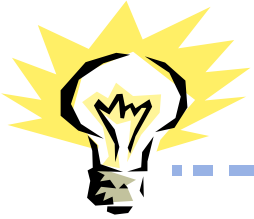
Direct Manipulation

- Representation of reality that can be manipulated
- The user is able to apply intellect directly to the task
- The tool itself seems to disappear



Direct Manipulation Details

- 1) Continuous visibility of the objects and actions of interest
- 2) Rapid, reversible, incremental actions whose effect is immediately noticeable
- 3) Replacement of command language syntax by direct manipulation of object of interest (physical actions, buttons, etc.)



Direct Manipulation Examples

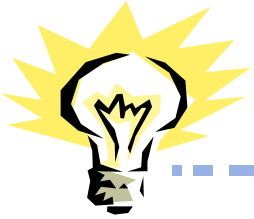
- WYSIWYG editors and word processors
- VISICALC - 1st electronic spreadsheet
- CAD
- Desktop metaphor
- Video games
- ...drag and drop



DM

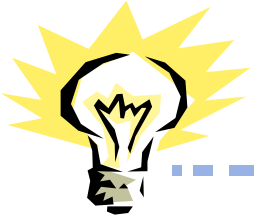
Excel File Edit View Insert Format Tools Data Win

	A	B	C	D	E
1	EXPERIMENT 1				
2	Uncorrected Results - ANOVA on Retest only, no covariate				
3					
4	Effect of Y				
5		grandmean	means	deltas	squared
6	no Y	15.848	18.34	2.492	6.210064
7	y-stat	15.848	18.098	2.25	5.0625
8	y-dyn	15.848	11.106	-4.742	22.486564
9	a	3		sumofsqrs	33.759128
10				sumsq/a	11.2530427
11	stdev-error	10.2331305		stdevmeans	3.35455551
12	standarderror	0.809		Cohens f =	0.32781322
13	N	160			
14					
15					
16					
17	Effect of X				
18		grandmean	means	deltas	squared
19	no X	15.848	16.895	1.047	1.096209
20	x-clicks	15.848	14.801	-1.047	1.096209



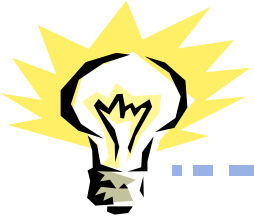
DM Advantages

- Easier to learn & remember, particularly for novices
- Direct WYSIWYG
- Flexible, easily reversible actions helps reduce anxiety in users



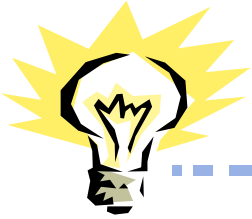
DM Advantages

- Provides context & instant visual feedback so user can tell if objectives are being achieved
- Exploits human use of visual spatial cues
- Limits types of errors that can be made



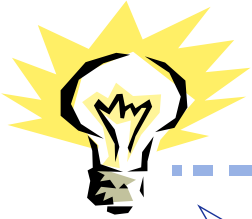
DM Problems

- Screen space intensive (info not very dense)
 - ❖ (does this always apply?)
- Need to learn meaning of components of visual representation
- Visual representation may be misleading
- Mouse ops may be slower than typing
- Not self-explanatory (no prompts)
 - ❖ ...but wait a minute...(?)



DM Problems

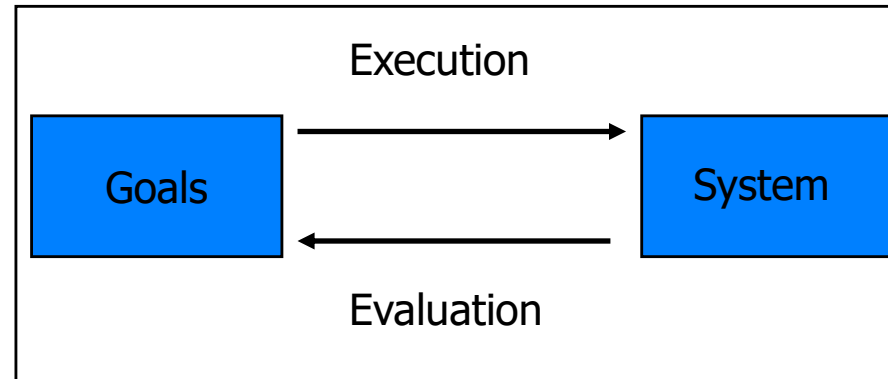
- Not good at
 - ❖ Repetition, scripting
 - ❖ History-keeping (harder)
 - ❖ Certain tasks (Change all italics to bold)
 - ❖ Abstract elements (variables)
 - ❖ Macros harder



Distance: Two “Gulfs”

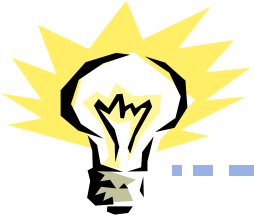
➤ Gulf of execution

- ❖ Distance between user’s goals and means of achieving them in system
 - Does the system allow the user to do what the user wants to do?



➤ Gulf of evaluation

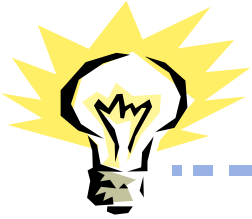
- ❖ Amount of effort person must expend to interpret system state and judge if intention was achieved
 - Can user perceive if progressing favorably?



Directness and Distance

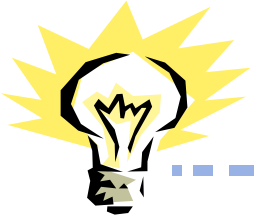
➤ Two types

- ❖ Semantic - Relation between what user wants to express and what is available in interface
 - Can I say what I want (concisely)?
- ❖ Articulatory - Relation between meanings of expressions and their physical form(s)
 - Is the way to perform an action expected and clear (appropriate)?

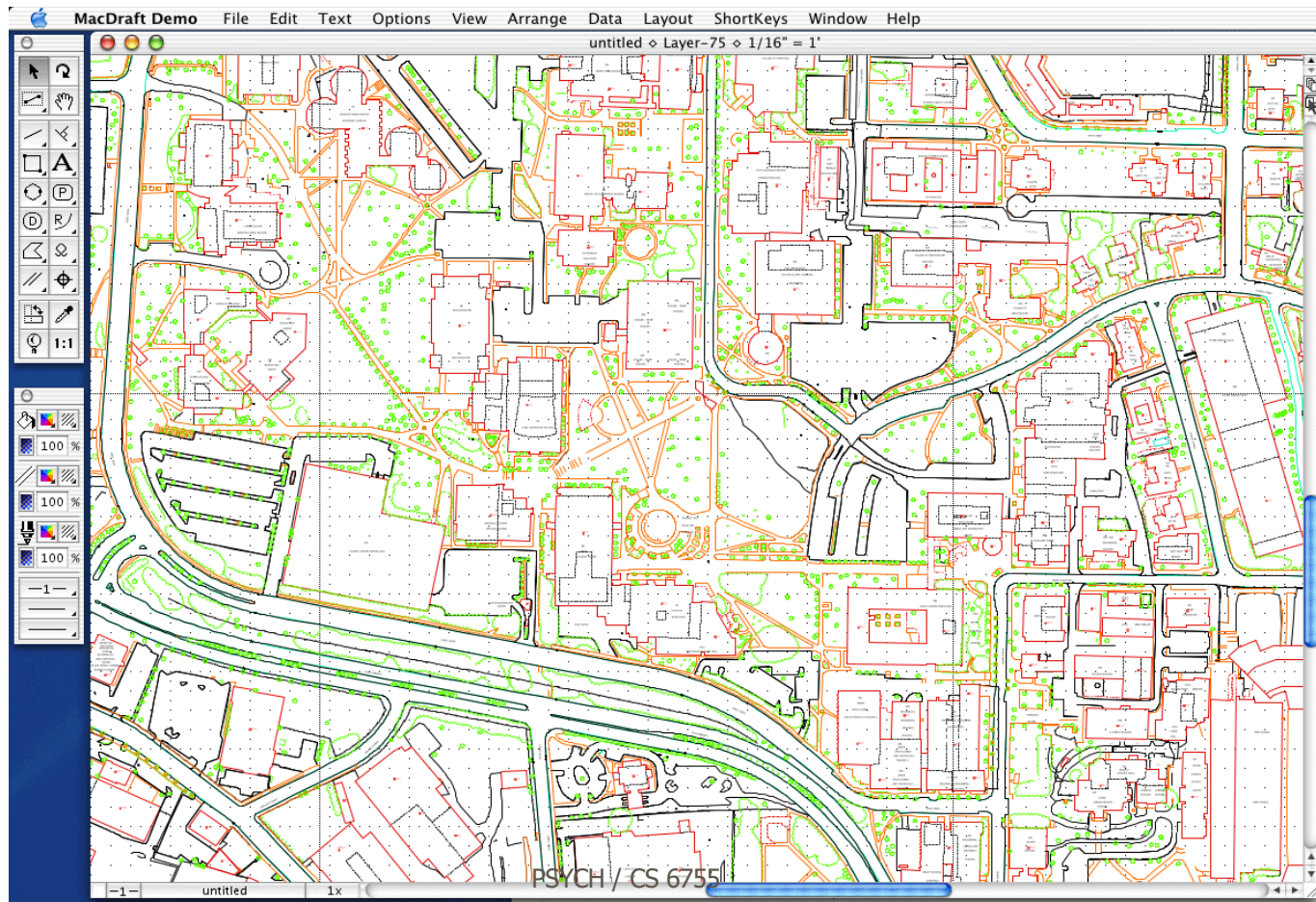


Engagement

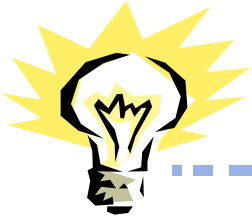
- Feeling that you are directly manipulating the objects of interest
- Promoted by
 - ❖ Unobtrusive interface
 - ❖ Minimizing gulfs of execution and evaluation
 - ❖ Appropriately responsive system



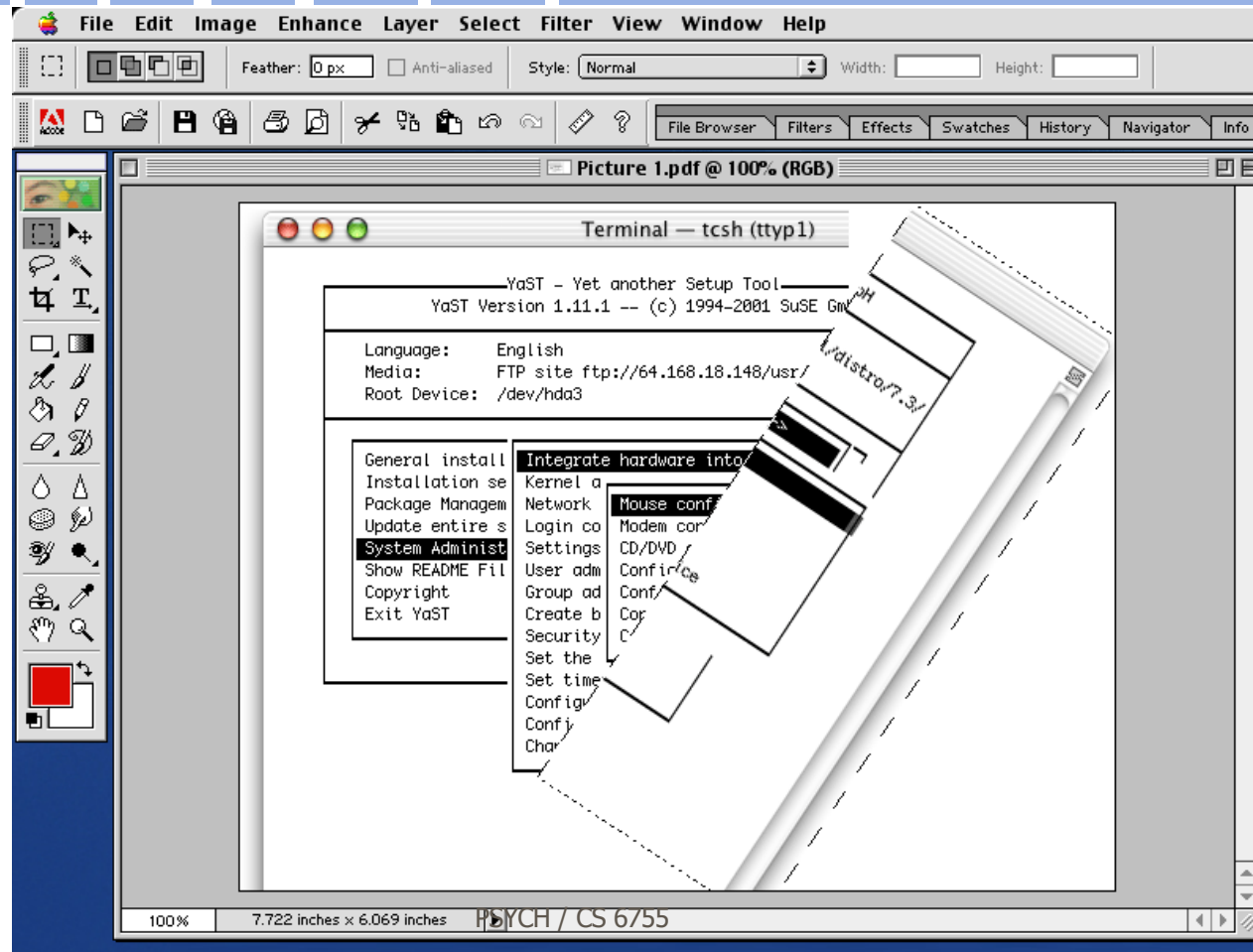
DM Example: CAD

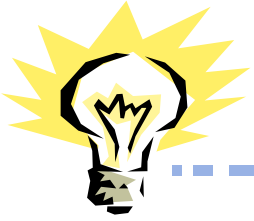


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Example: Photoshop

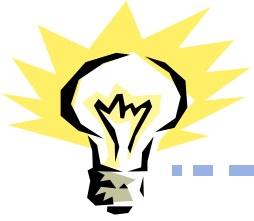




Example: Oculus Rift



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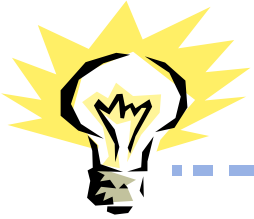


Example: MS Hololens



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Upcoming

▶ Participatory Design