

Building User Interfaces

Designing **for Web & Desktop**

Professor Yuhang Zhao

Adapted from Prof. Mutlu's slides

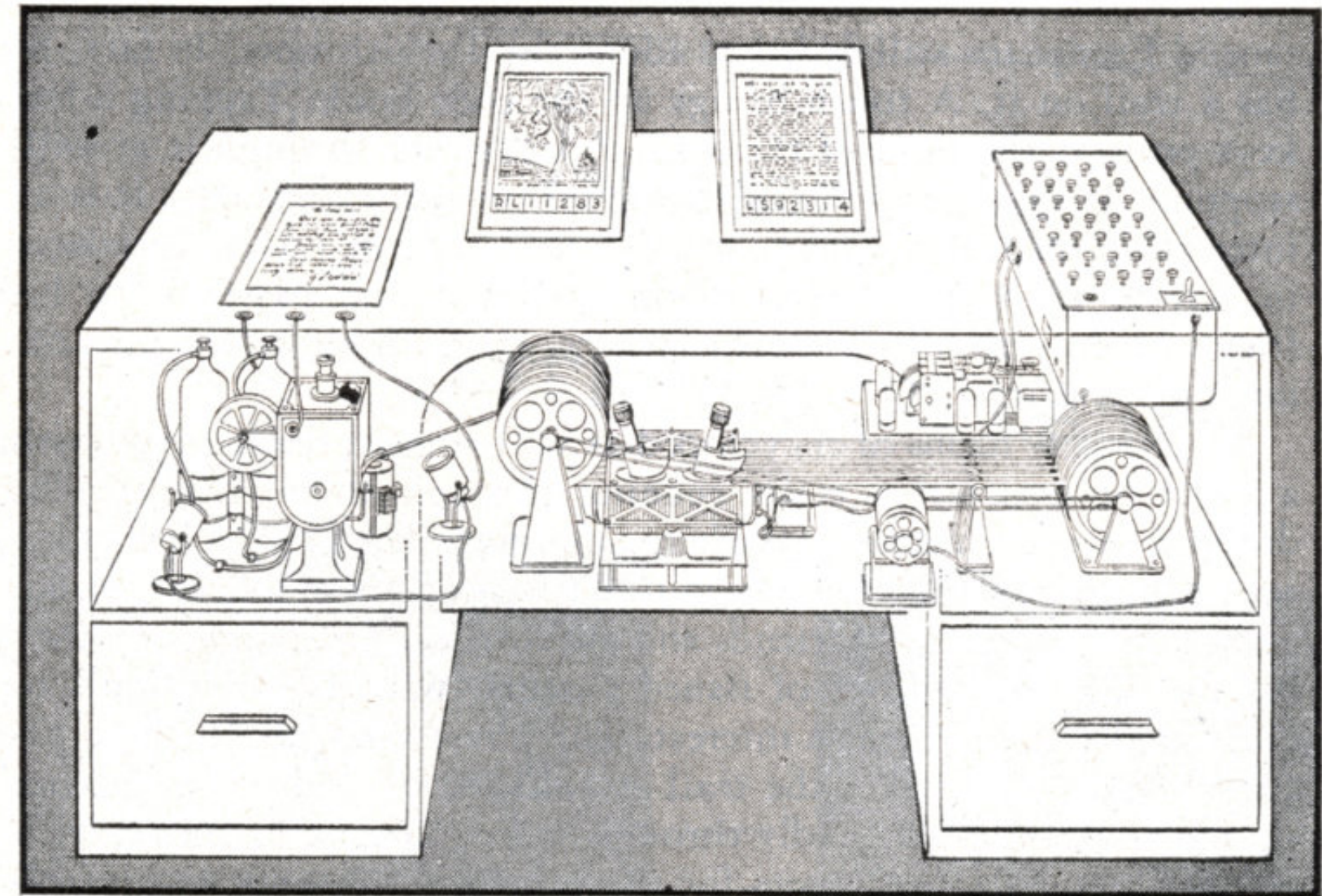
What we will learn today?

- A brief history of user interfaces
- Platform-specific design
 - Designing for the desktop
 - Designing for the web

A Brief History of User Interfaces

Milestone 1: Memex, 1945^{1 2 3}

A "proto-hypertext" system that connected documents using associated trails embedded into a desk, developed by Vannevar Bush.



MEMEX in the form of a desk would instantly bring files and material on any subject to the operator's fingertips. Slanting translucent viewing screens magnify supermicrofilm filed by code numbers. At left is a mechanism which automatically photographs longhand notes, pictures and letters, then files them in the desk for future reference.

¹Wikipedia: [Memex](#)

²[The Atlantic: As We May Think](#)

³Image Source: [Monoskop](#)

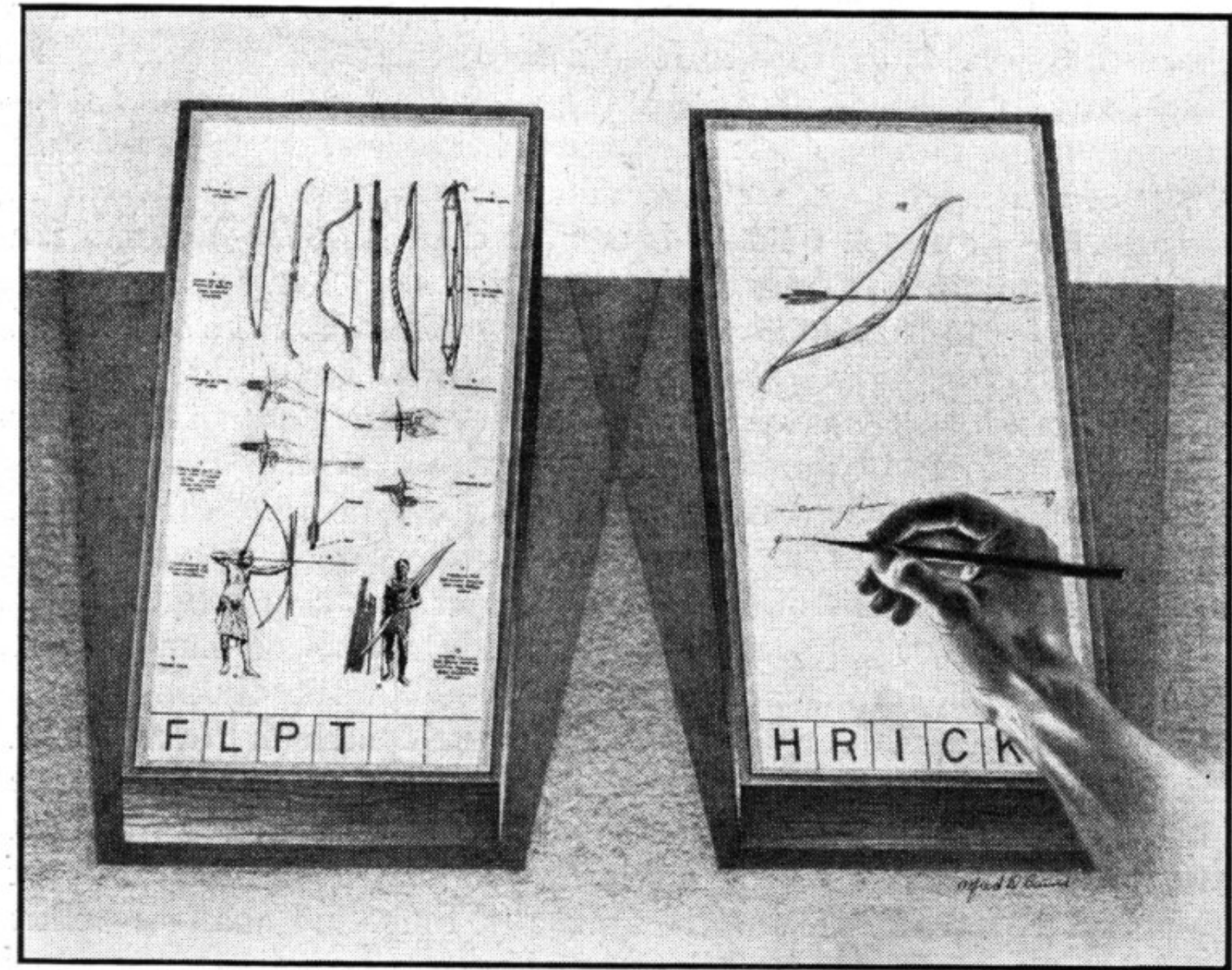
Milestone 1, Continued⁴ ⁵

“Consider a future device ... in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.”

— Vannevar Bush, 1945

⁴ The Atlantic: As We May Think

⁵ Image Source: Monoskop



MEMEX IN USE is shown here. On one transparent screen the operator of the future writes notes and commentary dealing with reference material which is projected on the screen at left. Insertion of the proper code symbols at the bottom of right-hand screen will tie the new item to the earlier one after notes are photographed on supermicrofilm.

Milestone 2: *Sketchpad*, 1963^{6 7}

The first program to utilize a complete graphical user interface and that implemented object-oriented programming, non-procedural programming, constraints, pen input, etc. Sketchpad was developed by Ivan Sutherland.

⁶ Wikipedia: [Sketchpad](#)

⁷ [Image source](#)





source

go

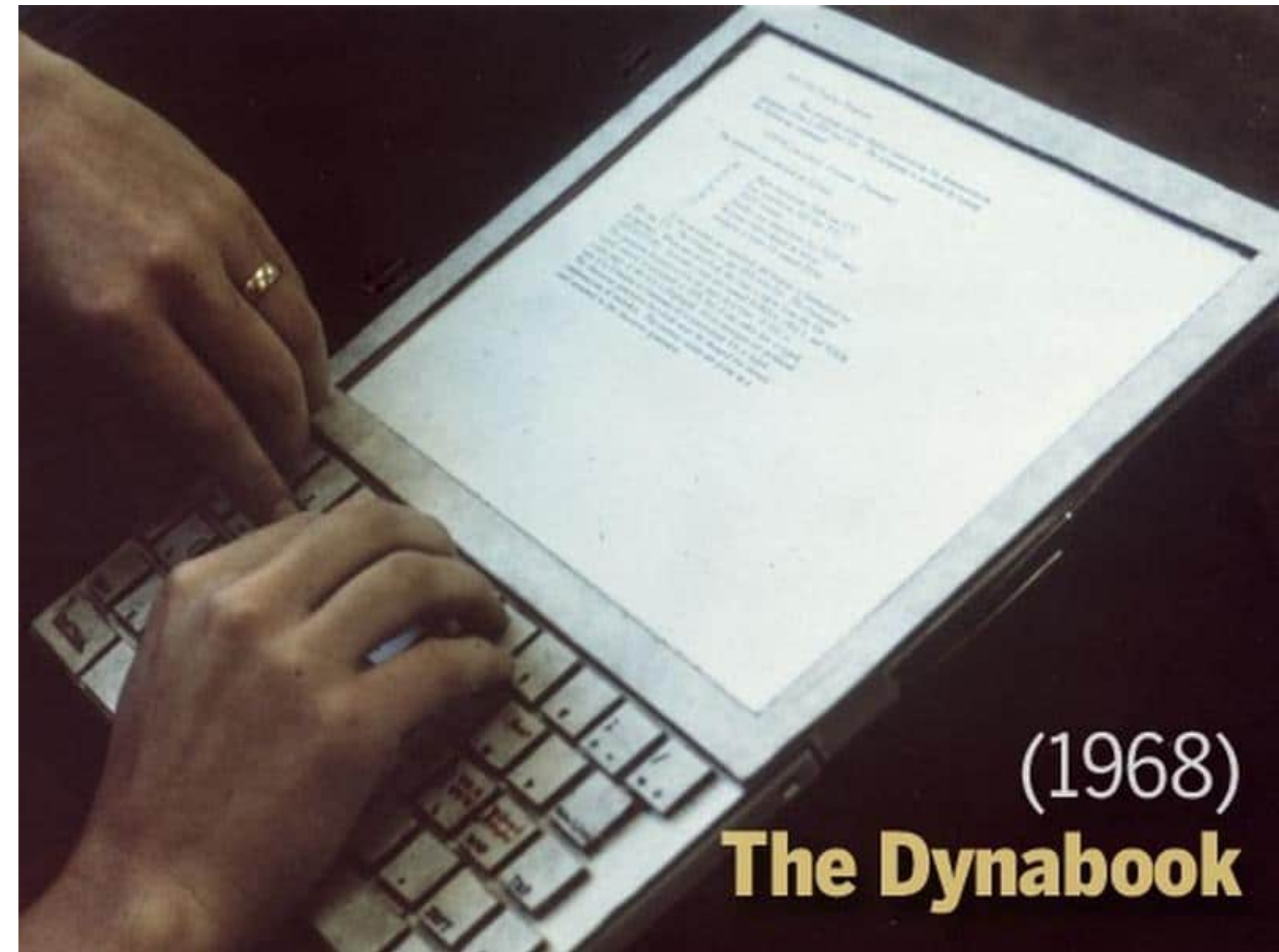
Milestone 3: Dynabook, 1968^{10 11}

A conceptual portable educational device for children (i.e., the first laptop/tablet computer) developed by Alan Kay.



¹⁰ Image sources: [left](#), [right](#)

¹¹ [A talk by Alan Kay on the history of Dynabook](#)



Milestone 4: Xerox Alto, 1973^{12 13}

The first computer to support an OS based on a GUI that integrated the ideas developed for Dynabook. It was developed at the Xerox PARC (Palo Alto Research Center).



¹² [Wikipedia: Dynabook](#)

¹³ [Image source](#)

Welcome to Smalltalk 5.5k XM November 24

Top View

UserView workspace
XEROX - Learning Research Group
user screenextent: 640@808 tab: 0@0.

Classes
SystemOrganization
'Kernel Classes'
'Numbers'
'Basic Data Structures'
'Sets and Dictionaries'
'Graphical Objects'
'Text Objects'
'Windows'
'Panels and Menus'
'Files'

Browse Window
Code Window
Font Window
Inspect Window
Notify Window
Paned Window
Project Window
Syntax Window
Window

ClassDefinition
ClassOrganization
help
Initialization
'Scheduler'
'Editing'
'Image'
'Strike format'

help
["
** sysFontWindow window displayed on easy way to play at
**to create a wind user schedule: (s
altostyle: Defa
fontnumber: 3
at: (OriginCur
[user waitb
**to create a new yourfont ← FontV
max: 177 as
**to edit newtu cr

UserView workspace Walk dictionary, and bound to the font
You can change the font, style and size of text anywhere!
Regular **Bold** *italic* Underlined
Bold-italic **Bold-underlined** *italic-Underlined*
Bold-italic-underlined
Cream10 Cream12
TimesRoman9 TimesRoman10 TimesRoman12
Helvetica 18
Gacha10
Hippo10 - αβξδεφγηησκςμνοπθρστρσψχψγ
Math10 - †°∞φ÷Λ≡≡()•±επ∴⊙⊠⊡⊢⊣⊤⊥⊦⊧⊨⊩⊪⊫⊬⊭⊮⊯⊰⊱⊲⊳⊴⊵⊶⊷⊸⊹⊺⊻⊼⊽⊾⊿⊿⊿
%V€C∇3‡CŁCŁDŁDŁ€∅α\$R≈⊥UV≡X↳|/↓→⊥X
~@∂≈↔⇒⋈ΓLJ||-◦-†@^R√\<>>∩-¼½¾

File List
[]<Robson>SF)*
[File] <Robson>SF>ScreenForm.st
[File] <Robson>SF>ScreenForm.text
[File] <Robson>SF>ScreenFormChanges.st
[File] <Robson>SF>WordGraphics.form

Rectangle fromUser origin

ScreenForm setFullPageWidth.
ScreenForm
printRectangle:
(30@5 extent: 674@790)
onFileNameed: 'ExampleScreen.press'

blueButto ,31@537 corner:
scrollBar 63@770
marker
savedAre
paragrap
startBloc

System Browser
Collections-Seque
Collections-Text
Collections-Arraye
Collections-Stream
Collections-Suppor
Graphics-Primitive
Graphics-Display C
Graphics-Media
Graphics-Paths

Interval
LinkedList
MappedCollection
OrderedCollection
SortedCollection

accessing
copying
adding
removing
enumerating
private

collect:
do:
do:andBetweenDo:
promoteFirstSuchT
reverse
reverseDo:
select: Form Editor

Fig.1
"Evaluate aBlock with each of my elements as the argument. C
resulting values into a collection that is like me. Answer with
collection. Override superclass in order to use add:, not at:put:."
| newCollection |
newCollection ← self species new.
self do: [:each | newCollection add: (aBlock value: each)].
↑newCollection

User Interrupt
Paragraph>>characterBlockAtPoint:
Paragraph>>mouseSelect:to:
CodeController(ParagraphEditor)>>processRedButton
CodeController(ParagraphEditor)>>processMouseButtons
CodeController(ParagraphEditor)>>controlActivity
CodeController(Controller)>>controlLoop

controlActivity
self scrollBarContainsCursor
ifTrue:
[self scroll]
ifFalse:
[self processKeybo
self processMouseE

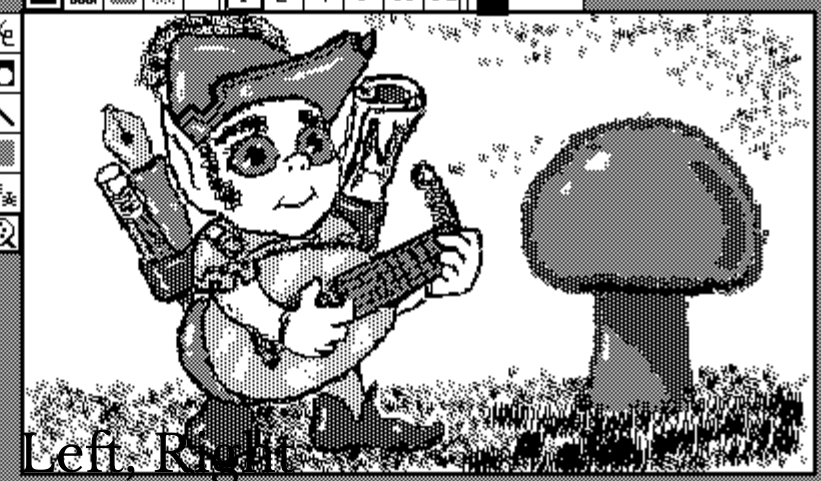
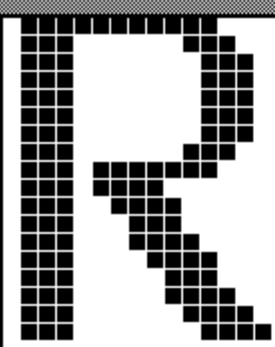



Image source: Left: Right

System Browser
Collections-Seque
Collections-Text
Collections-Arraye
Collections-Stream
Collections-Suppor
Graphics-Primitive
Graphics-Display C
Graphics-Media
Graphics-Paths

Interval
LinkedList
MappedCollection
OrderedCollection
SortedCollection

accessing
copying
adding
removing
enumerating
private

collect:
do:
do:andBetweenDo:
promoteFirstSuchT
reverse
reverseDo:
select: Form Editor

collect: aBlock
"Evaluate aBlock with each of my elements as the argument. C
resulting values into a collection that is like me. Answer with
collection. Override superclass in order to use add:, not at:put:."
| newCollection |
newCollection ← self species new.
self do: [:each | newCollection add: (aBlock value: each)].
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User Interrupt
Paragraph>>characterBlockAtPoint:
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CodeController(ParagraphEditor)>>processRedButton
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CodeController(ParagraphEditor)>>controlActivity
CodeController(Controller)>>controlLoop

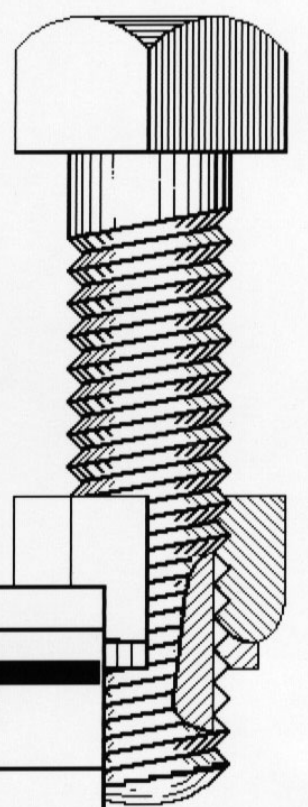
controlActivity
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ifTrue:
[self scroll]
ifFalse:
[self processKeybo
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File List
[]<Robson>SF)*
[File] <Robson>SF>ScreenForm.st
[File] <Robson>SF>ScreenForm.text
[File] <Robson>SF>ScreenFormChanges.st
[File] <Robson>SF>WordGraphics.form

Rectangle fromUser origin

ScreenForm setFullPageWidth.
ScreenForm
printRectangle:
(30@5 extent: 674@790)
onFileNameed: 'ExampleScreen.press'

(Form readFrom: 'FilledSkate.form') edit



Milestone 5: Xerox Star, 1981^{15 16 17}

First commercial system with a user interface that integrates today's technologies, including windows, icons, folders, mouse, etc.



¹⁵ Wikipedia: [Xerox Star](#)

¹⁶ Videos of the Star Interface: [Part 1](#), [Part 2](#)

¹⁷ [Image source](#)

Evolution of "Document" Icon Shape

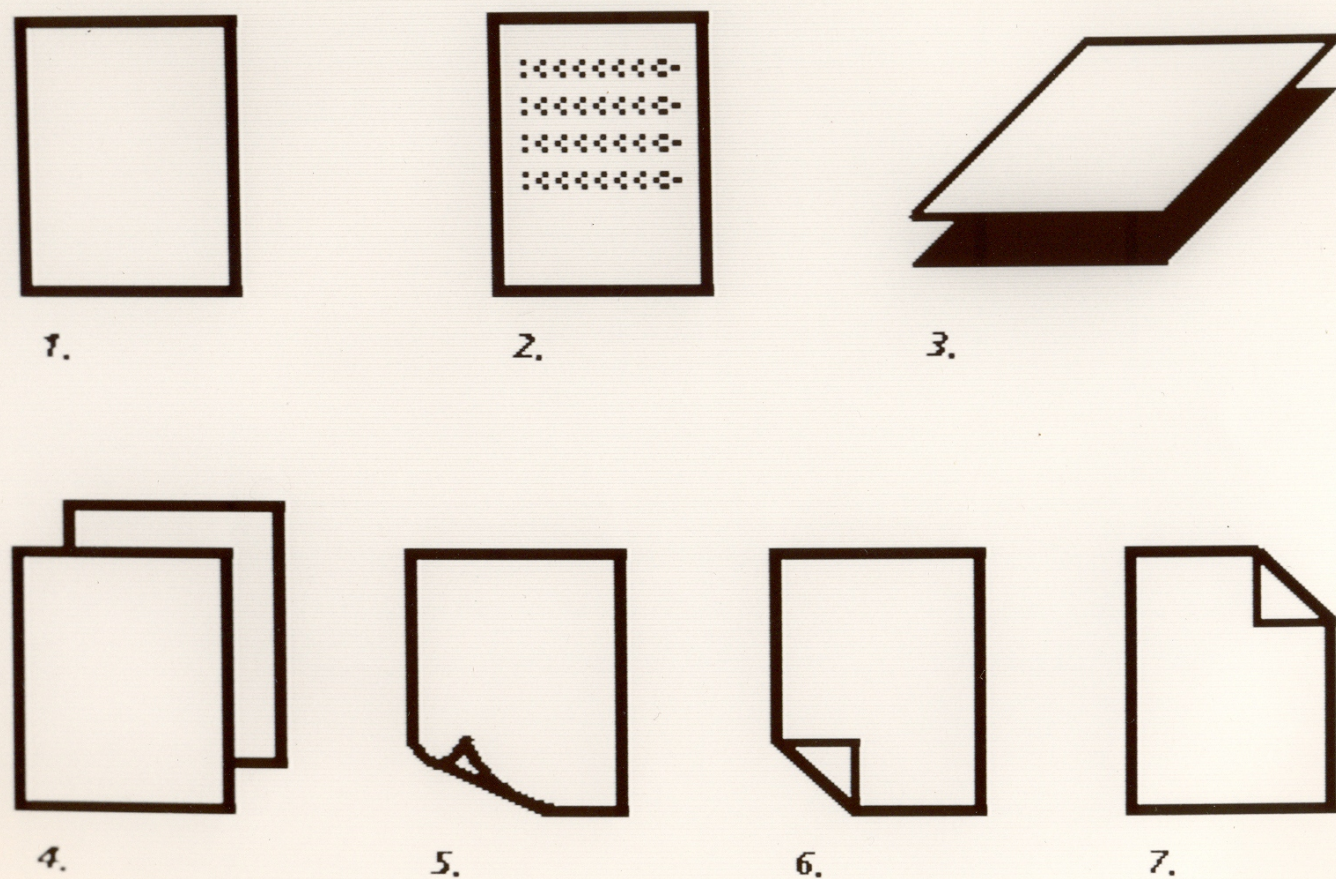
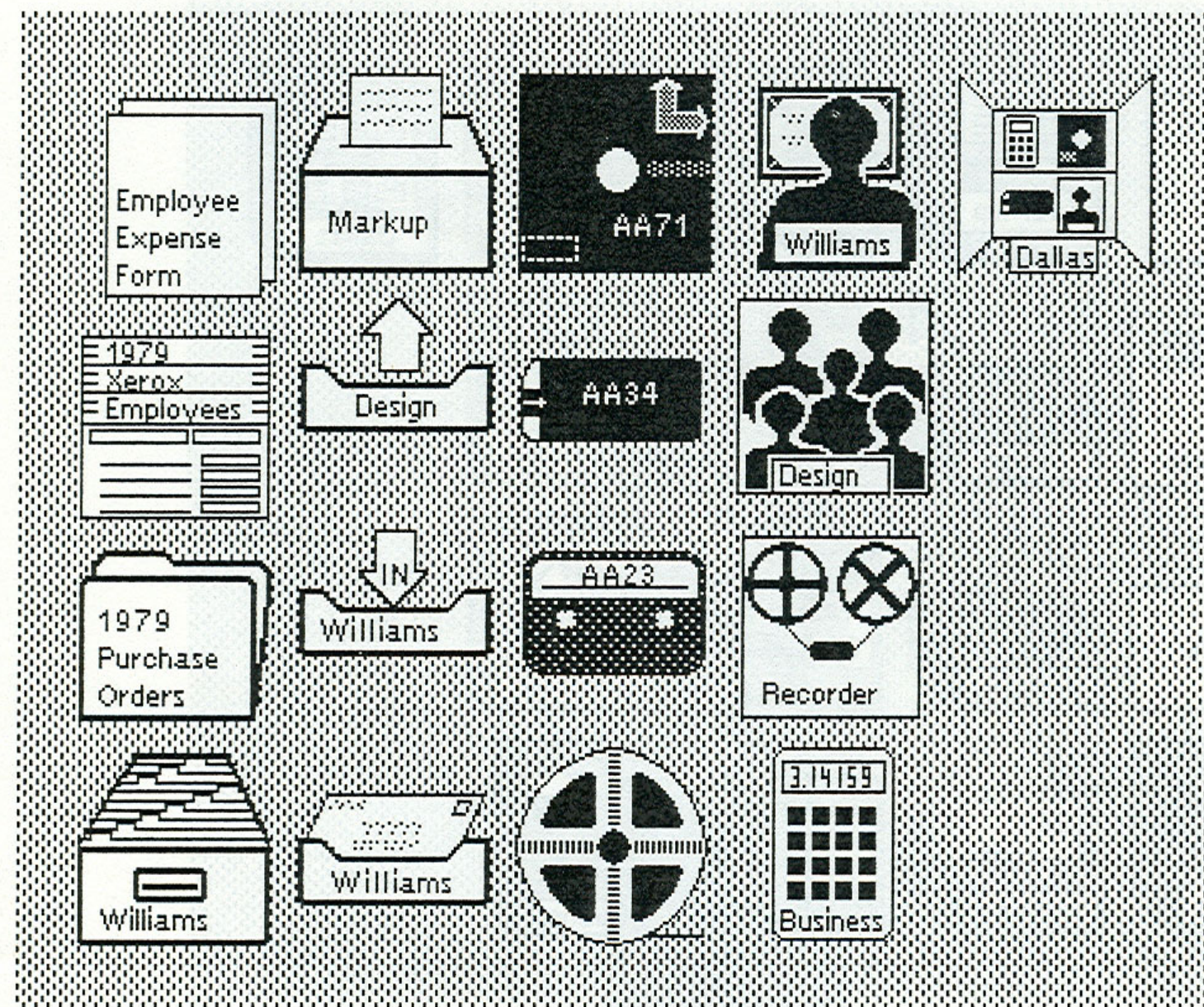


Figure 4.
Set 4 (Judd)



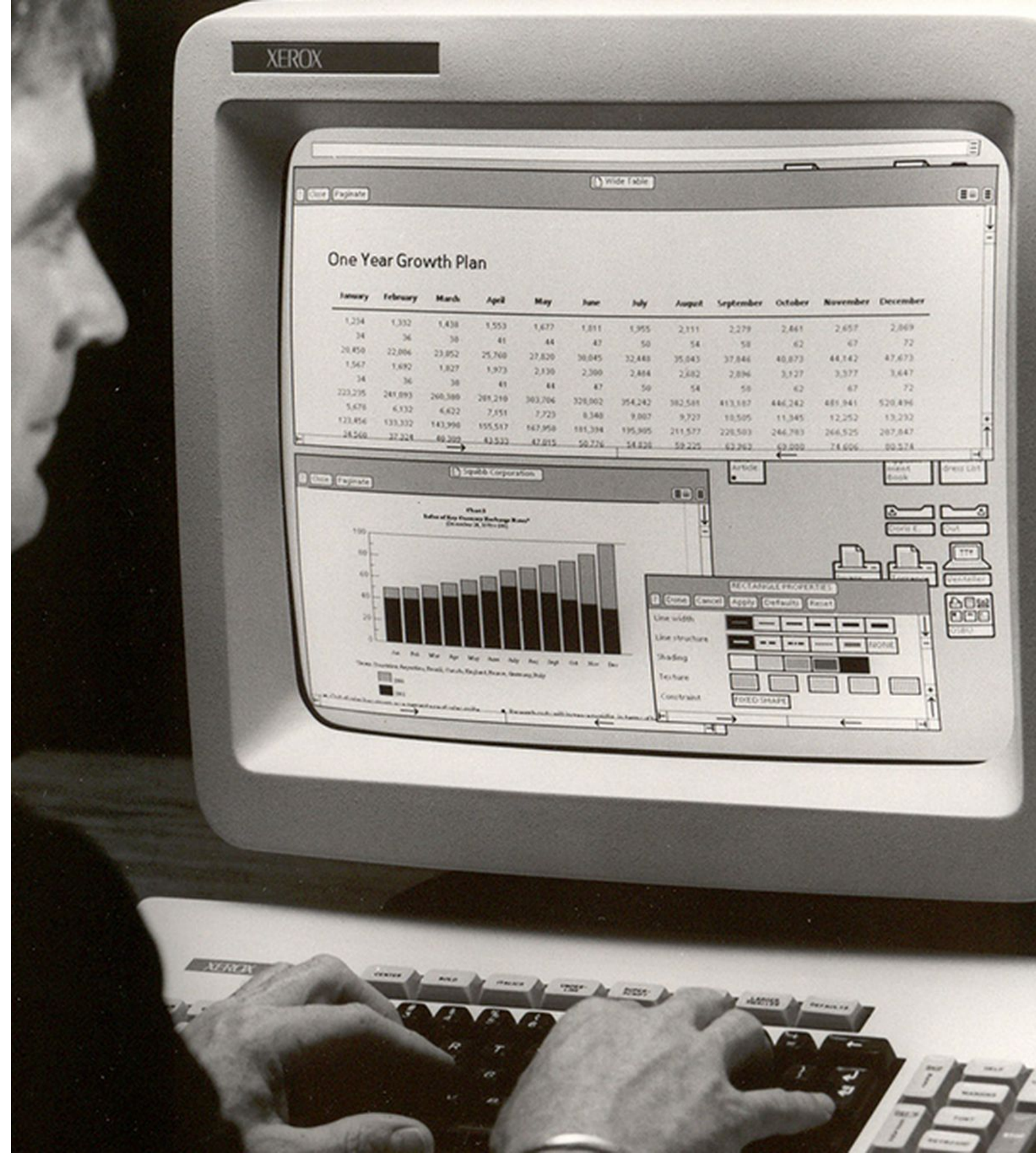
- | | | | | |
|-------------|-----------------------|-------------|------------|-----------|
| document | printer | floppy disk | user | directory |
| record file | out-basket | mag. card | group | |
| folder | in-basket | cassette | recorder | |
| file drawer | in-basket (with mail) | mag. tape | calculator | |

¹⁹ Image source: Left, Right

Designing for the Desktop

The WIMP Paradigm²⁰

Definition: *Windows, icons, menus, and pointer*, or *WIMP*, is a design paradigm that current desktop interfaces follow that dates back to the Xerox Alto (1973).

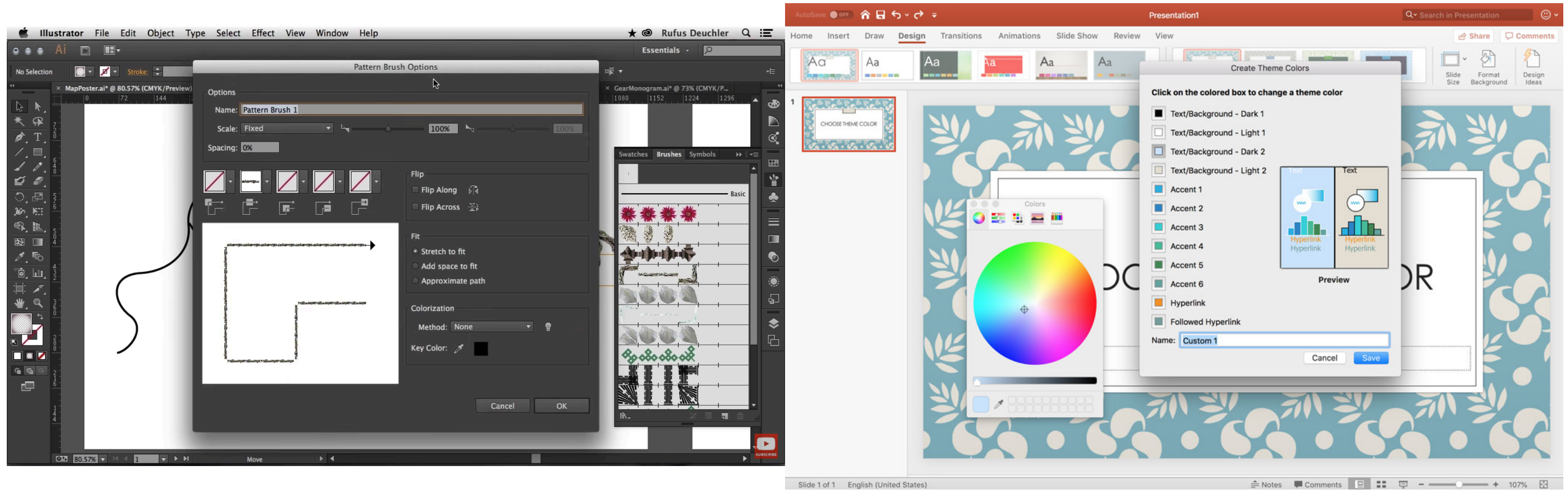


²⁰ [Image source](#)

Elements of the WIMP Paradigm: *Windows*

Definition: Windows are resizable containers of individual applications.

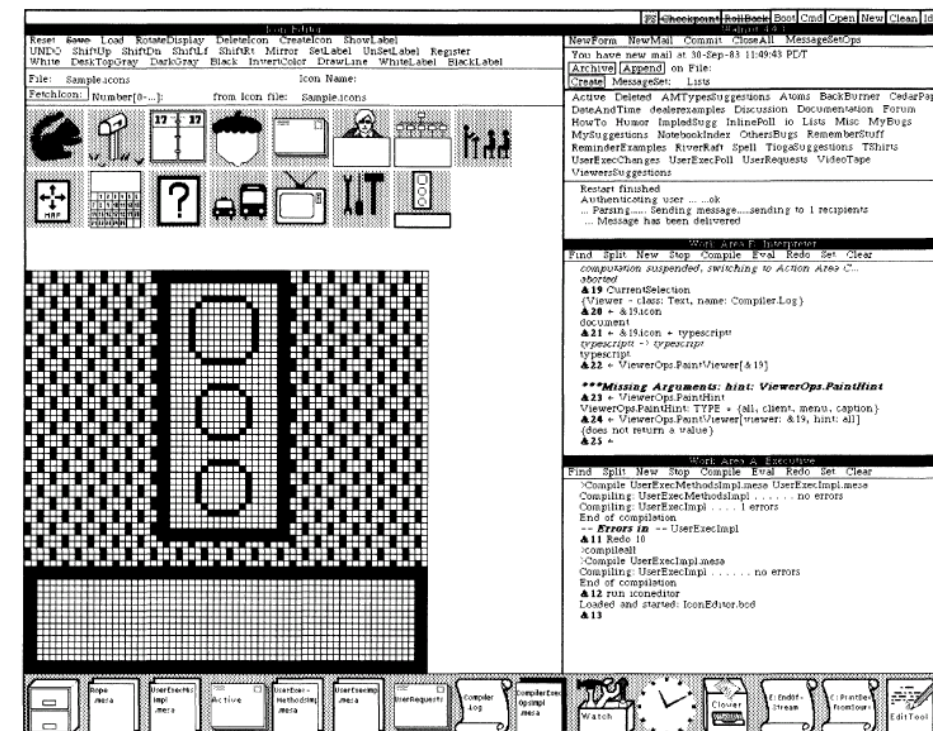
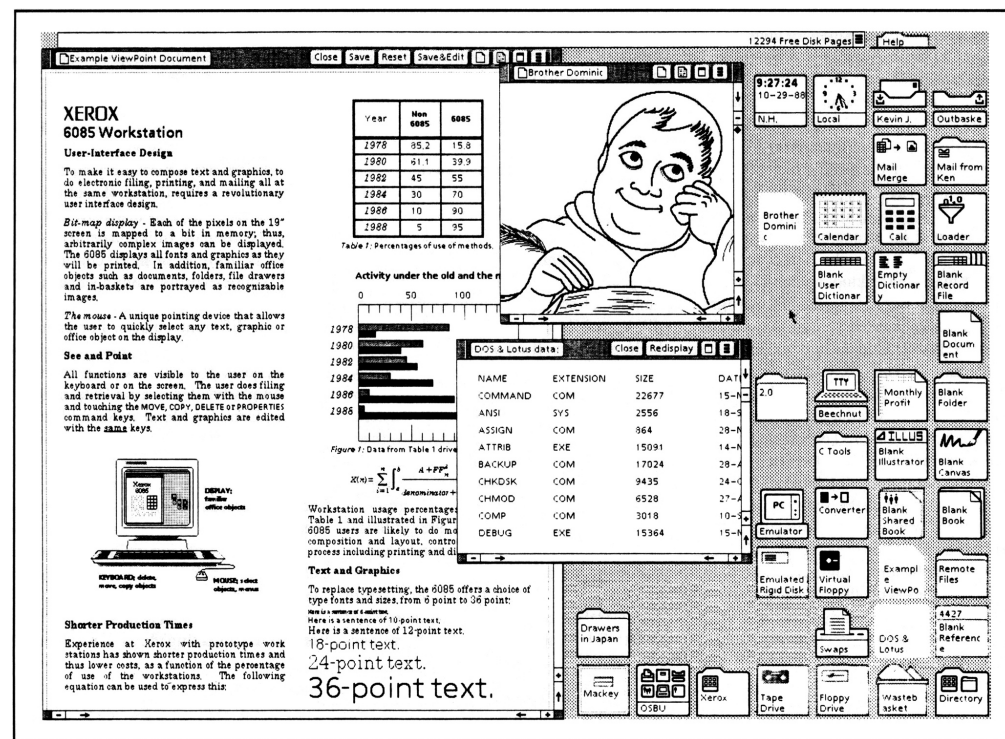
Primary windows contain elements for the main functionality of the application, such as a canvas. *Secondary* windows support main windows through modal panes, dialog boxes, etc.



21 Image source: Left, Right

Window Organization²²

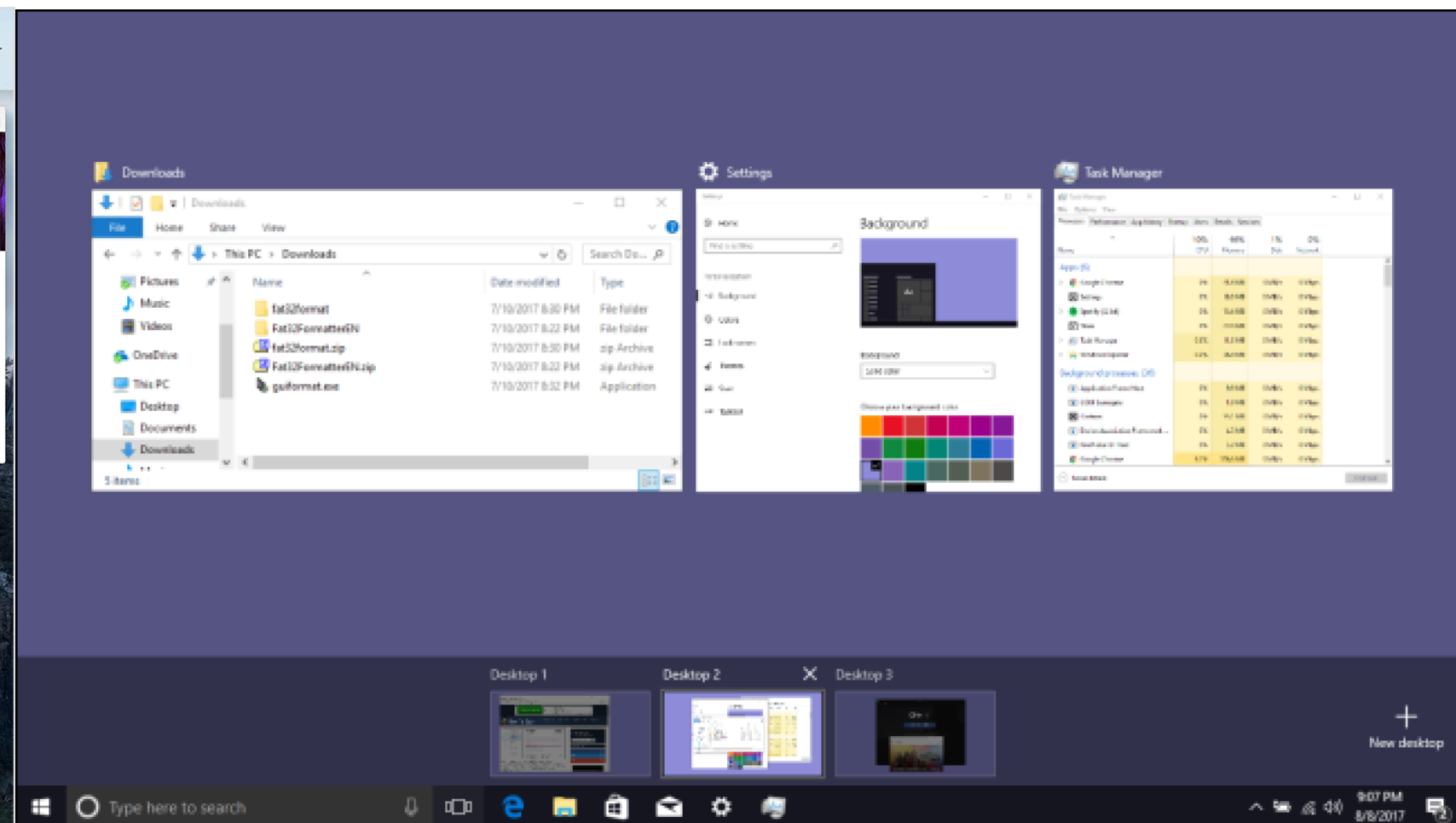
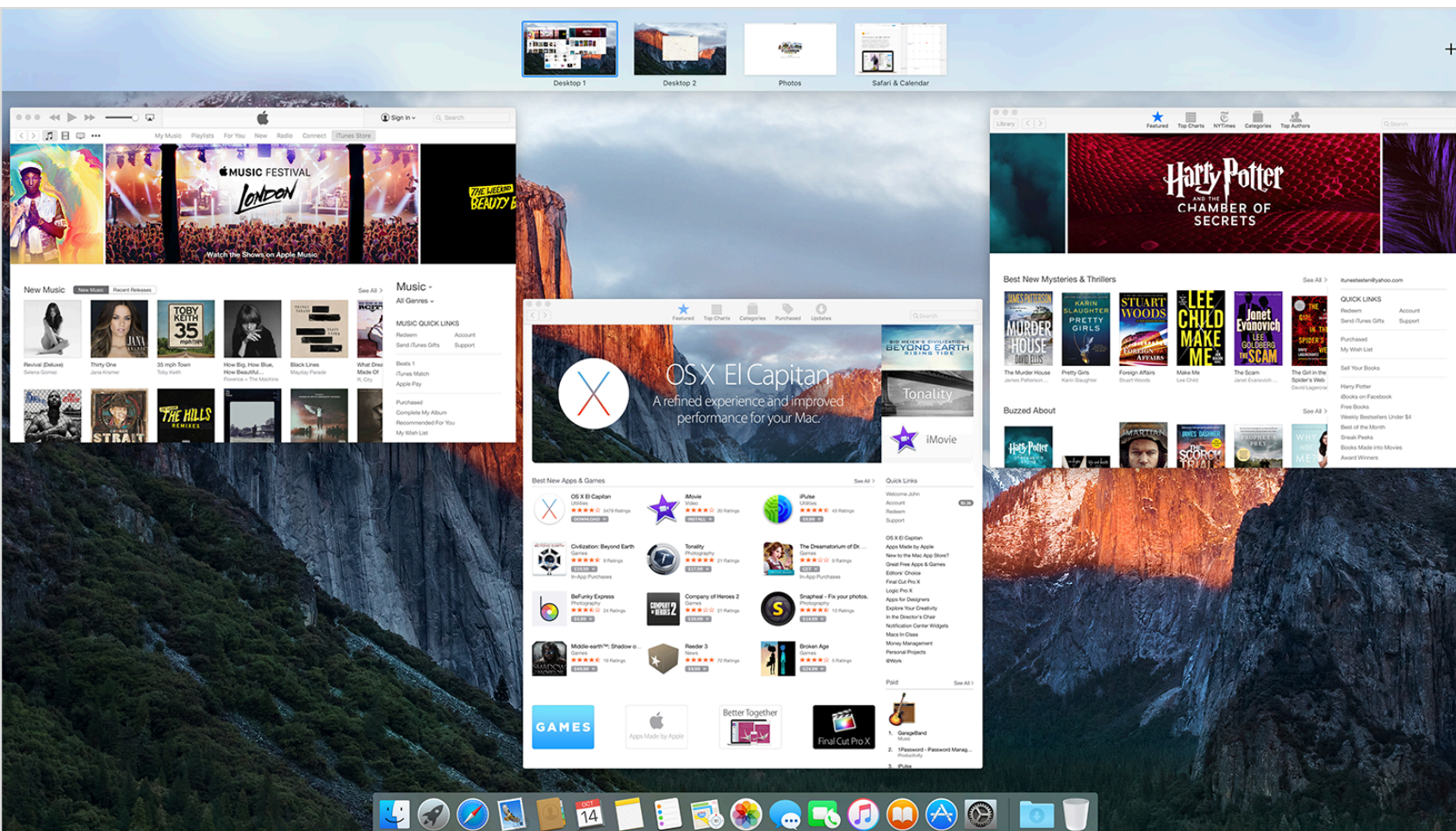
Definition: Windows can be organized in a way that overlaps several windows or tiles them across the screen.



²² Image source: Left, Right



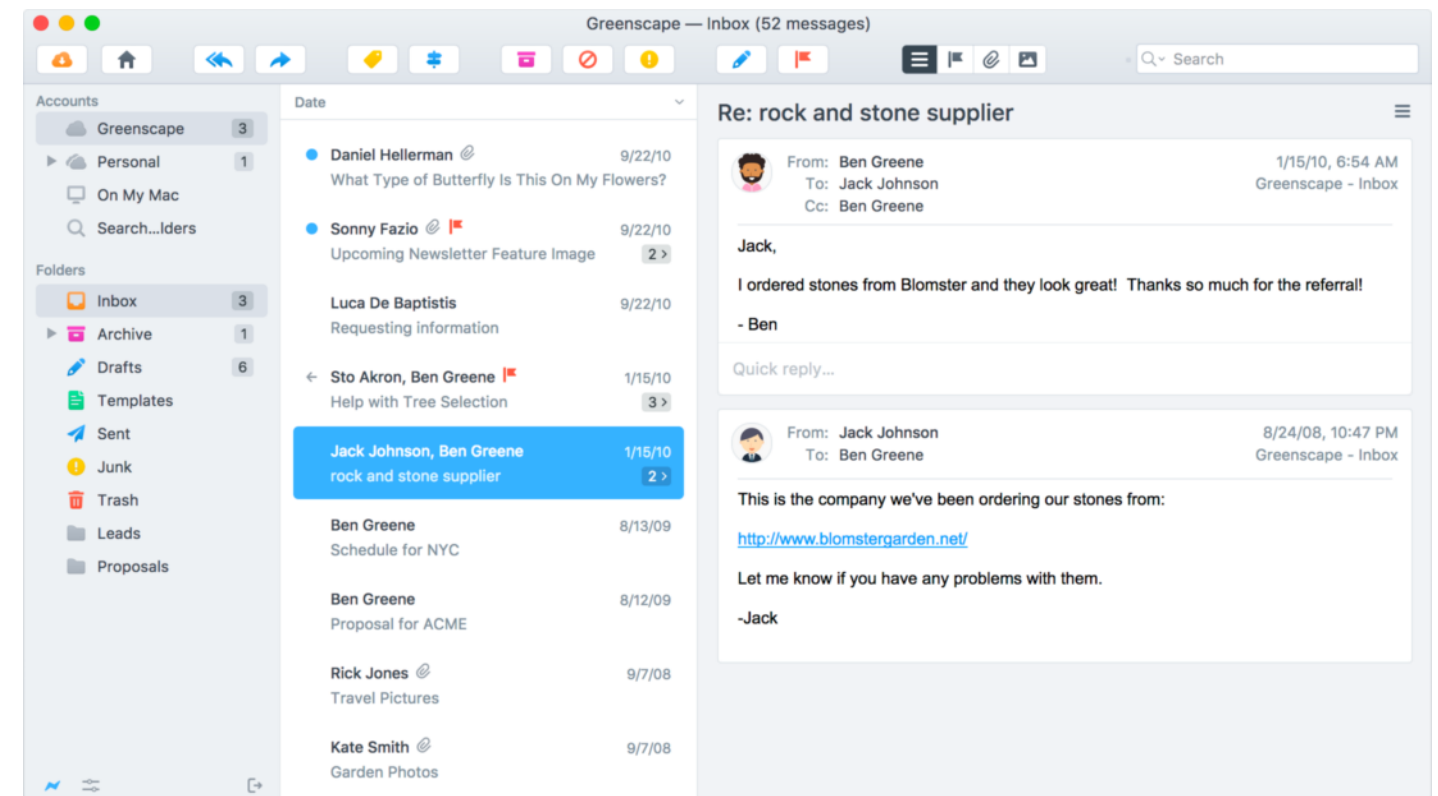
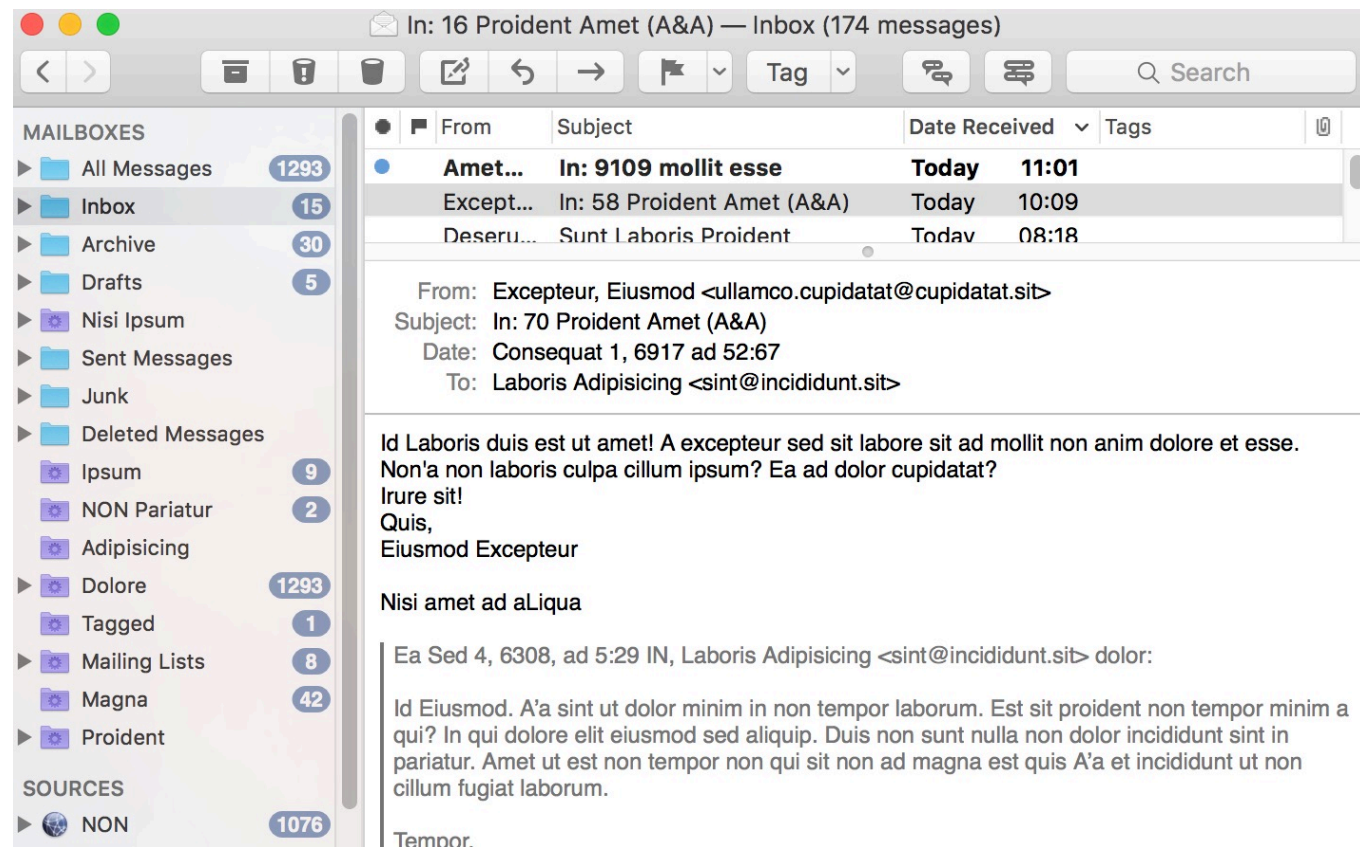
23 Image source: Left, Right



²⁴ Image source: Left, Right

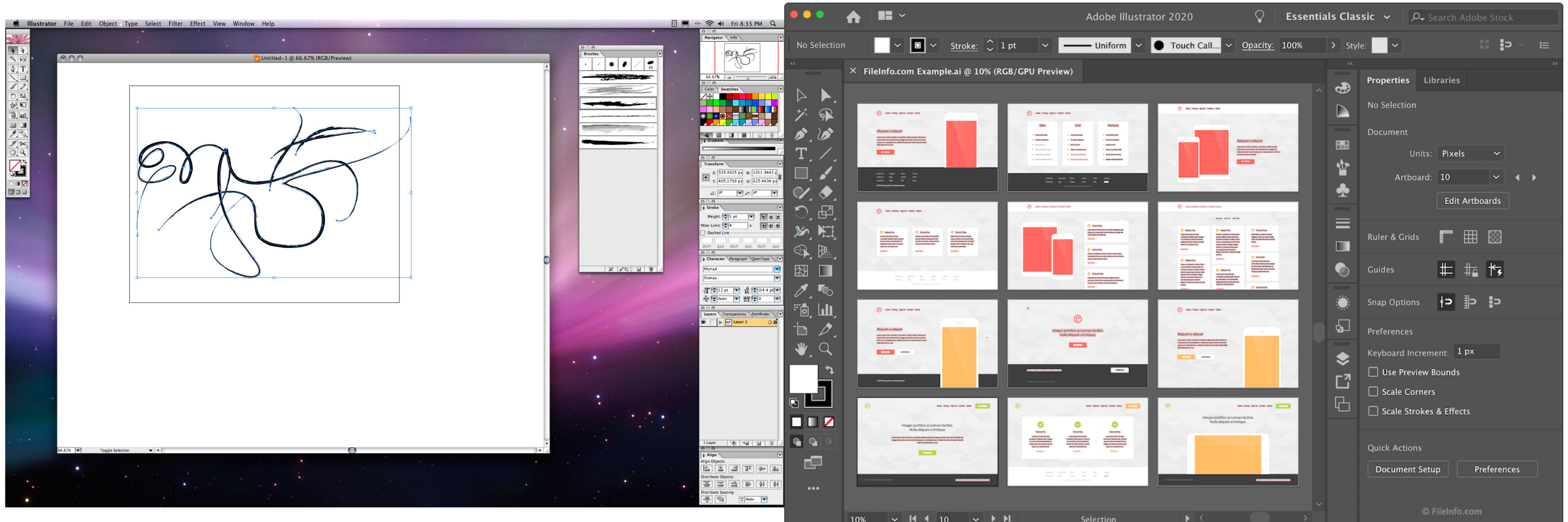
Window Structures²⁵

Windows bring together dedicated *panes* in different configurations.



²⁵ Image source: Left, Right

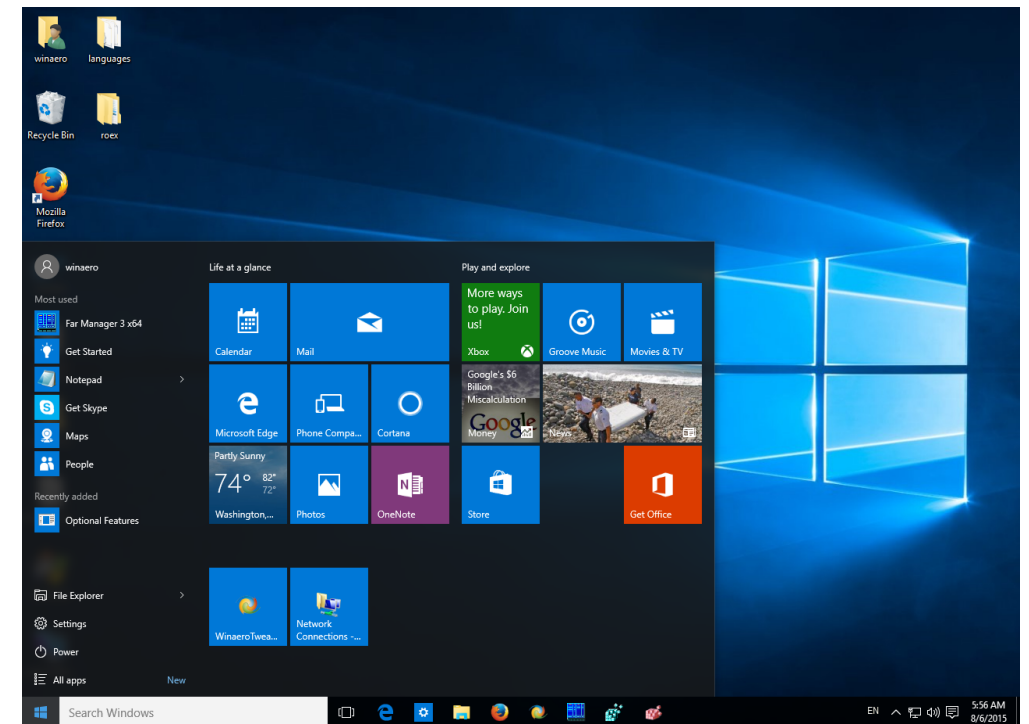
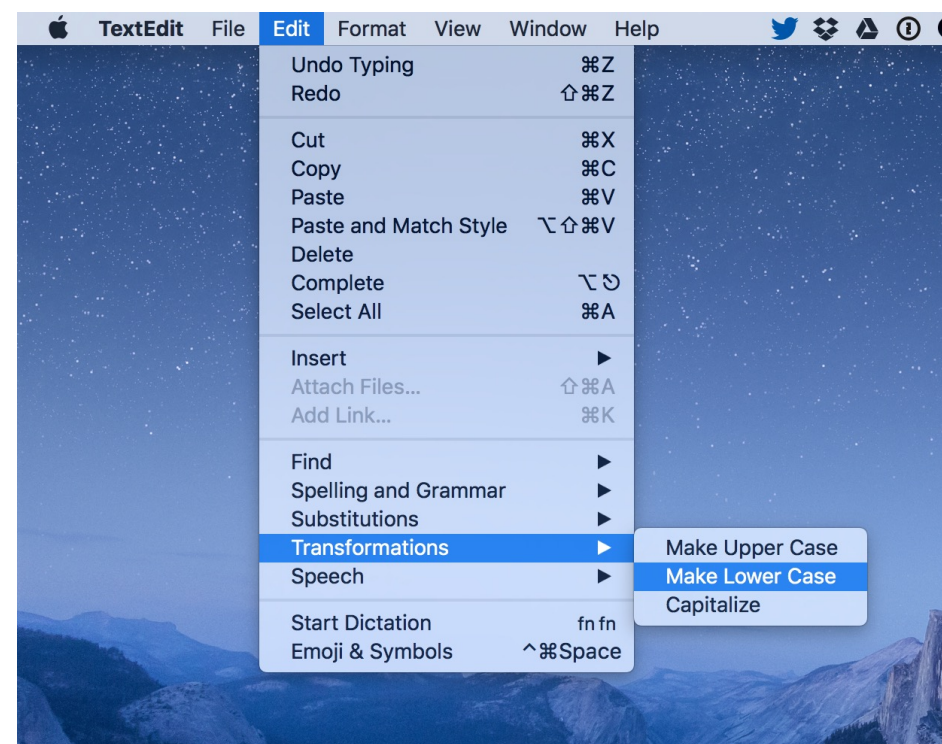
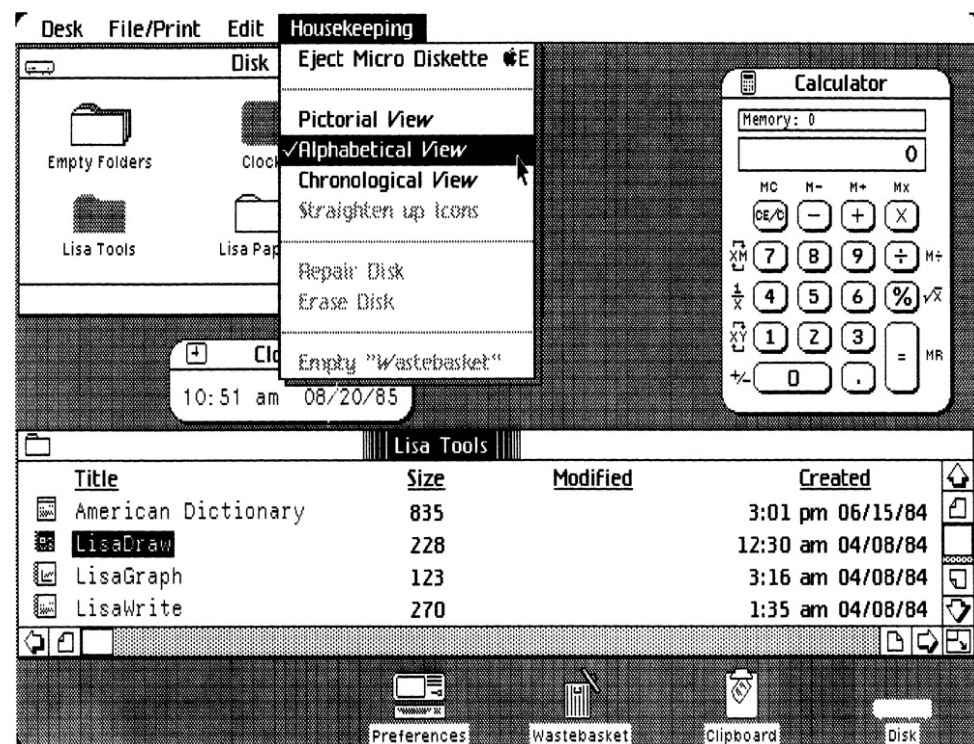
Secondary windows can be *docked*, *stacked*, and *floating*.²⁶



²⁶ Image source: Left, Right

Menus²⁷

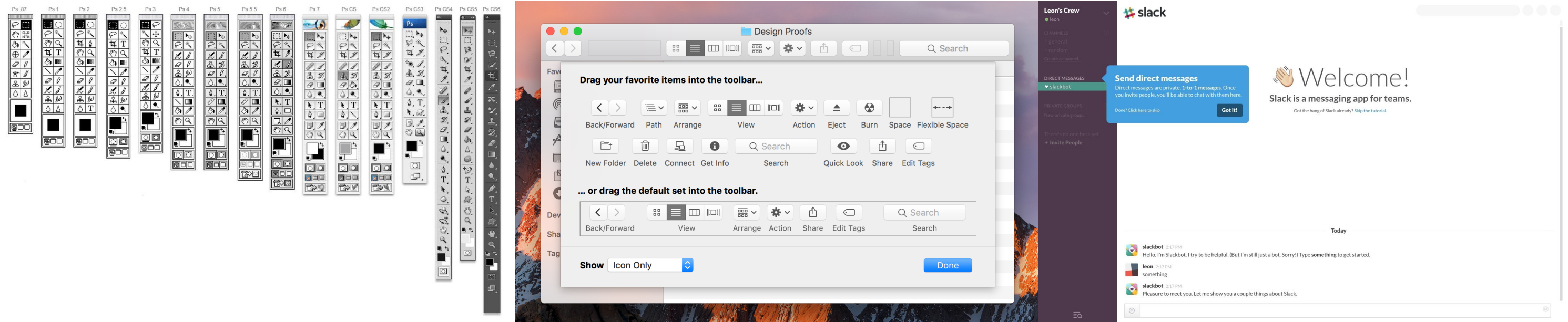
Definition: Menus list all the functions of the an application. Menu lists serve *educational* and *reference* purposes.



²⁷ Image source: Left, Center, Right

Toolbars, Palettes, Sidebars, & Tooltips²⁸

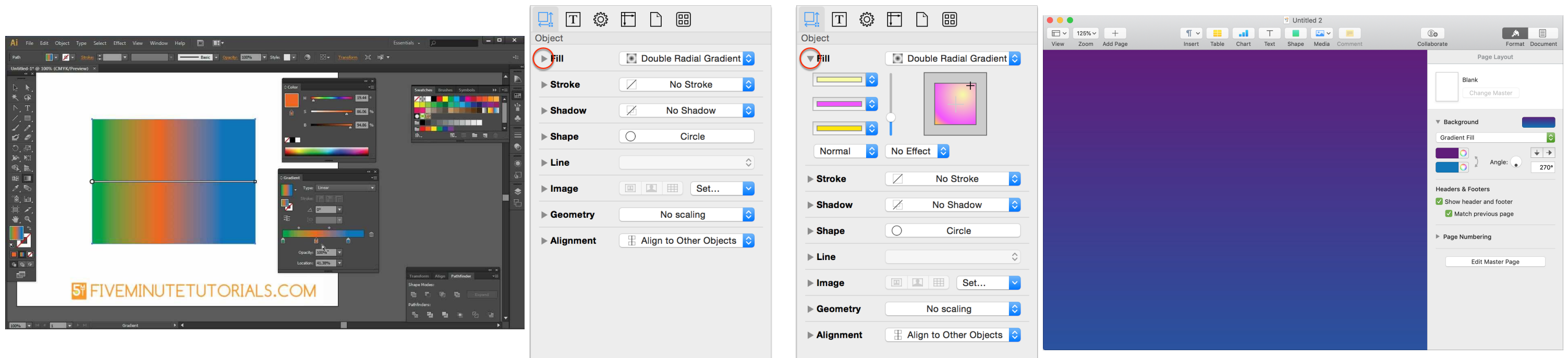
Definition: *Toolbars, palettes, sidebars, and tooltips* facilitate (visual and manipulation) access to frequently used functions.



²⁸ Image source: Left, Center, Right

Tool Palettes²⁹

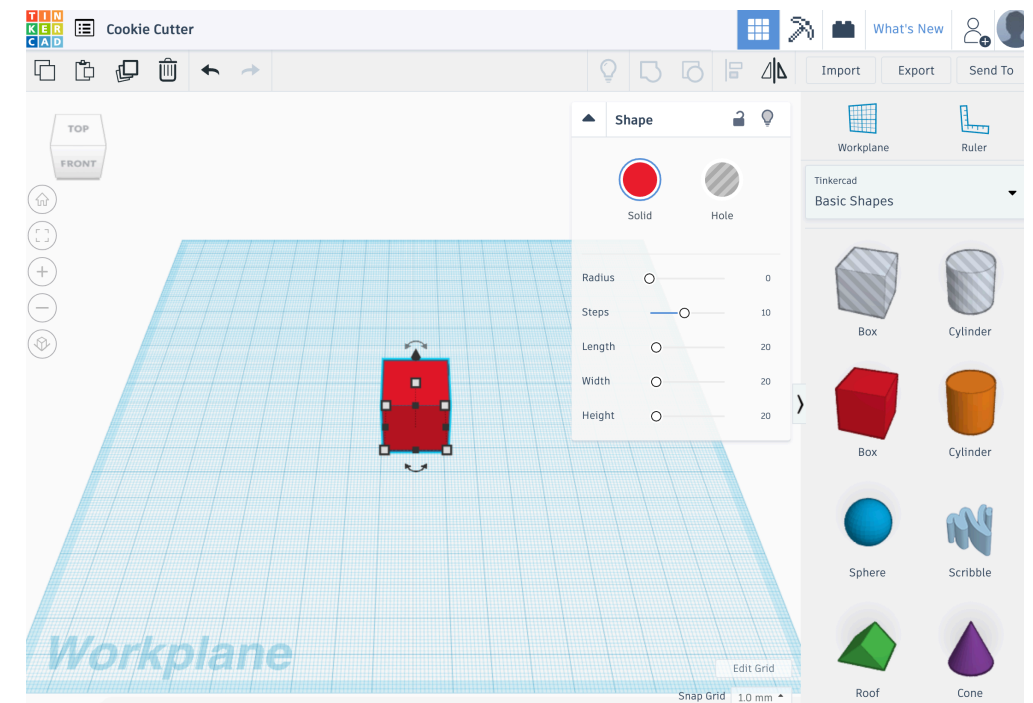
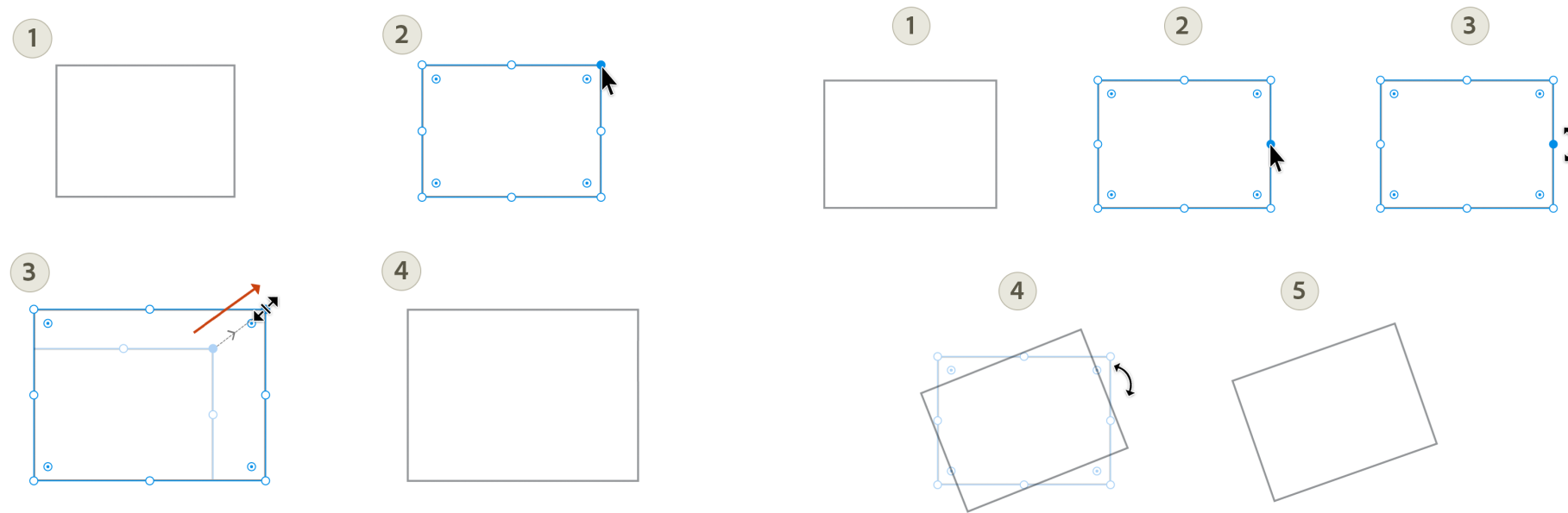
Definition: Tool palettes provide *advanced controls* for a particular function rather than frequently accessed functions.



²⁹ Image source: Left, Center, Right

Pointing³⁰

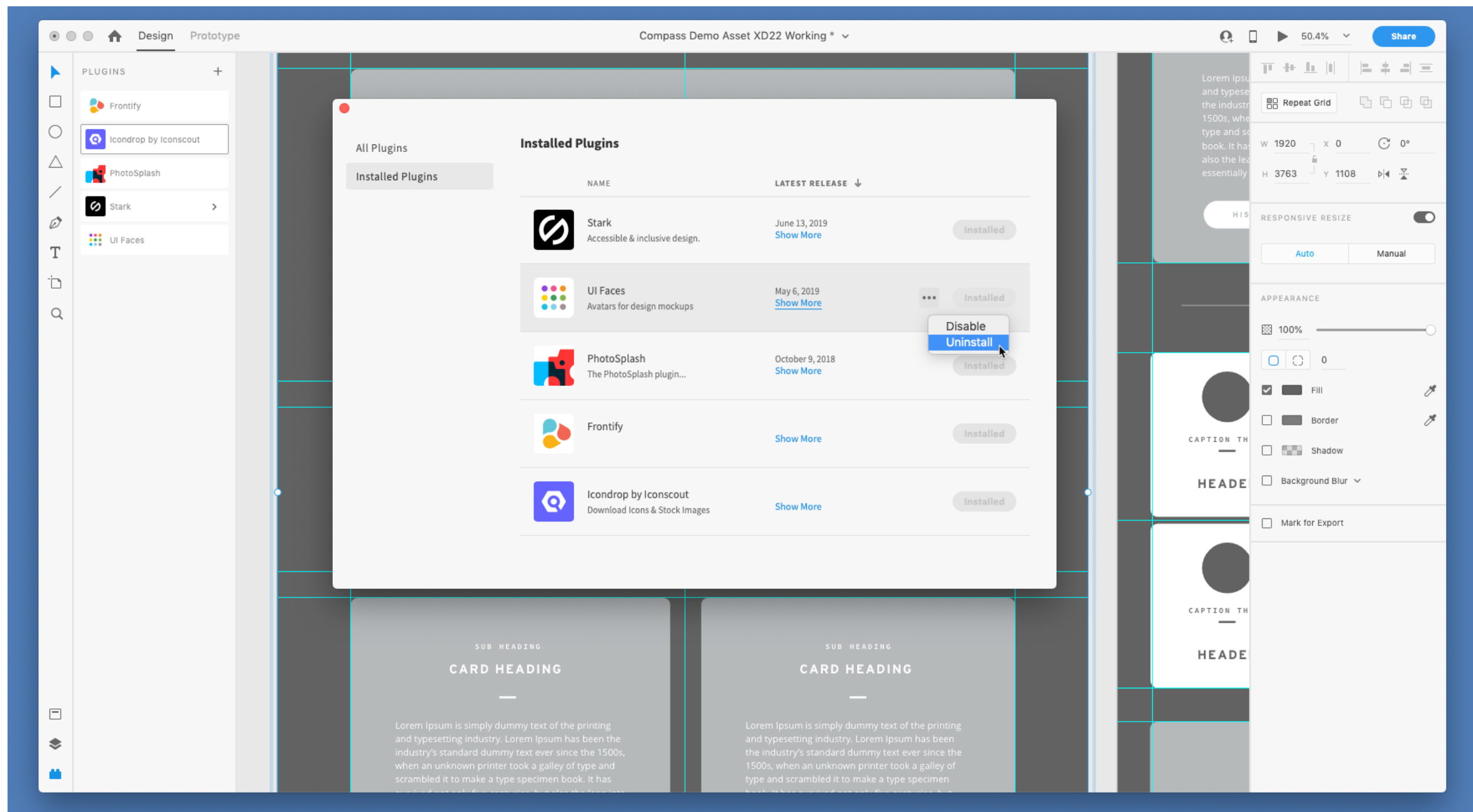
Definition: *Pointing* on an application canvas enables a range of advanced capabilities for *direct manipulation*.



³⁰ Image source: Left, Center, Right

In-Class Activity 1: Desktop Application Deconstruction

Image Source



Link to Google Drawings

Designing for the Web

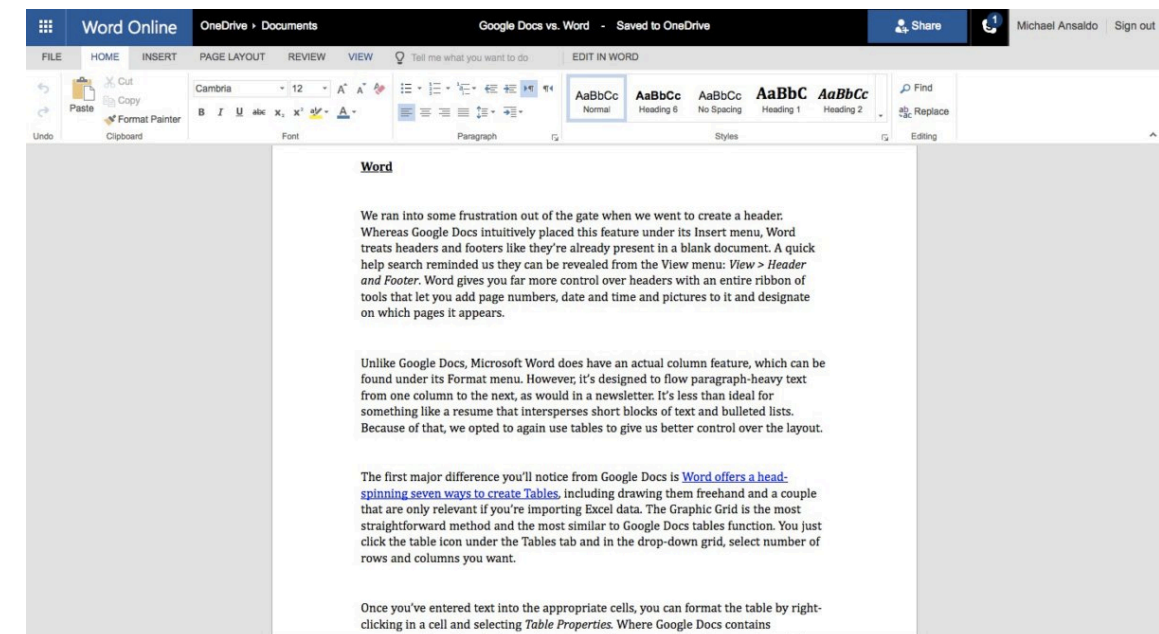
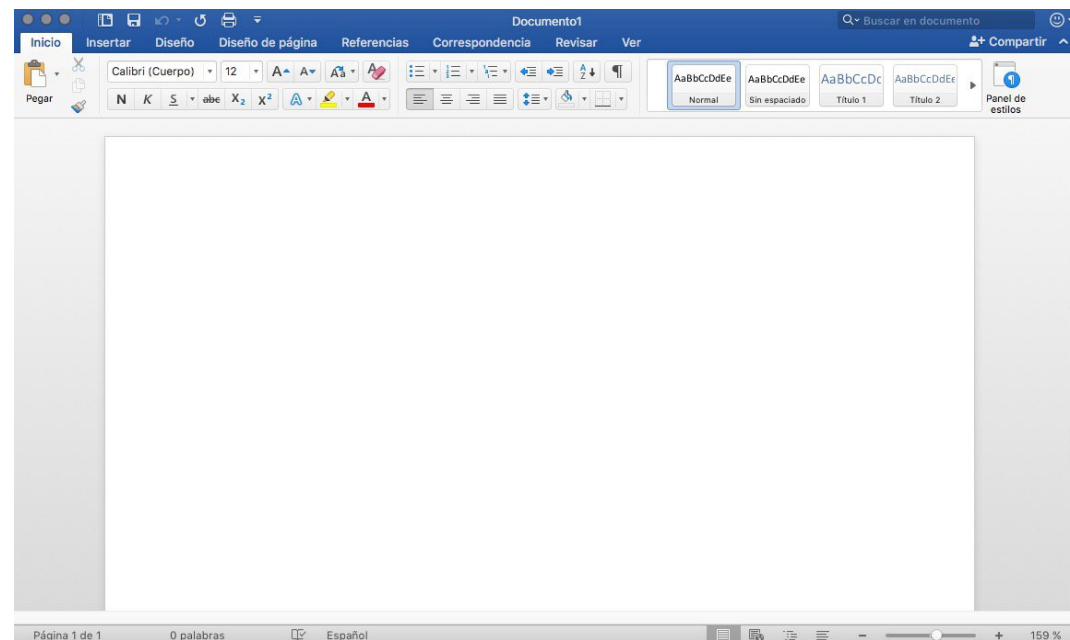
Desktop Applications vs. Websites

Desktop applications: Dynamic, persistent *screens* and supporting *components* that enable users to perform complex tasks.

Webpages: Interconnected *pages* with *aids* that help users navigate and access a large body of content.

Web Applications³¹

Definition: Single-page applications (SPAs) provide the functions of a desktop application on a webpage following the conventions of desktop applications.



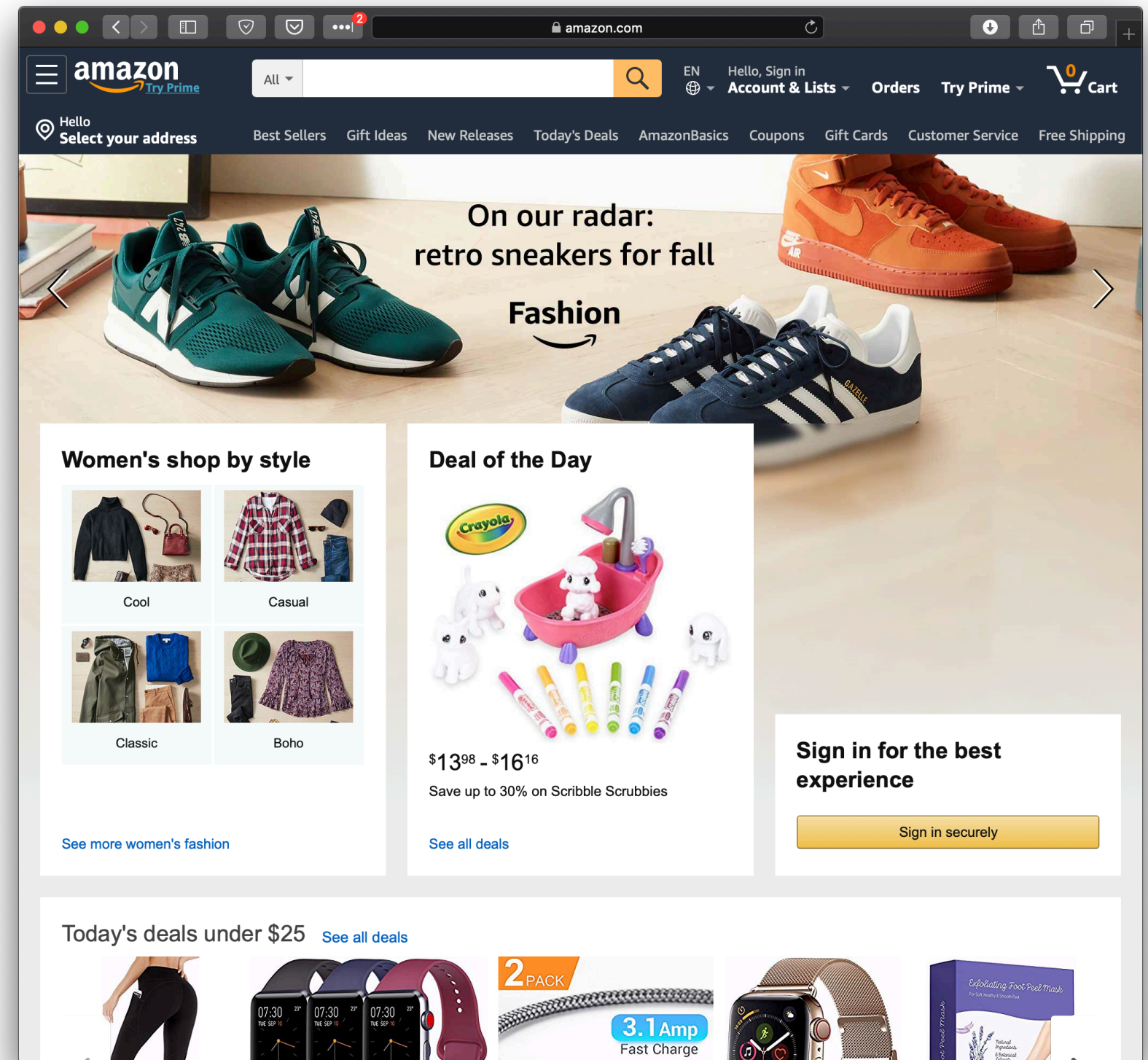
³¹ Image source: Left, Right

The Page

Since its inception, the *page*, has been the building block of web content.

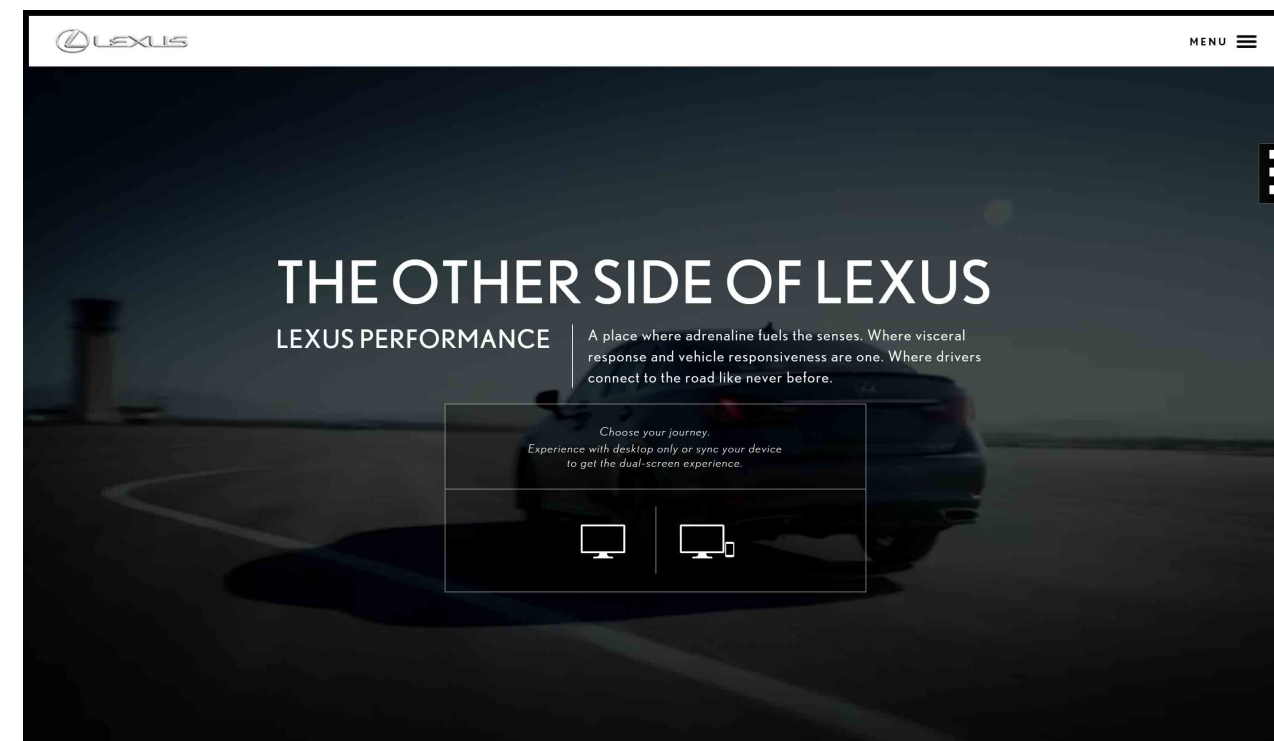
If the web is made out of pages, how do we organize and help users navigate them?

Using *primary* and *secondary* navigation aids.



Primary Navigation Aids³²

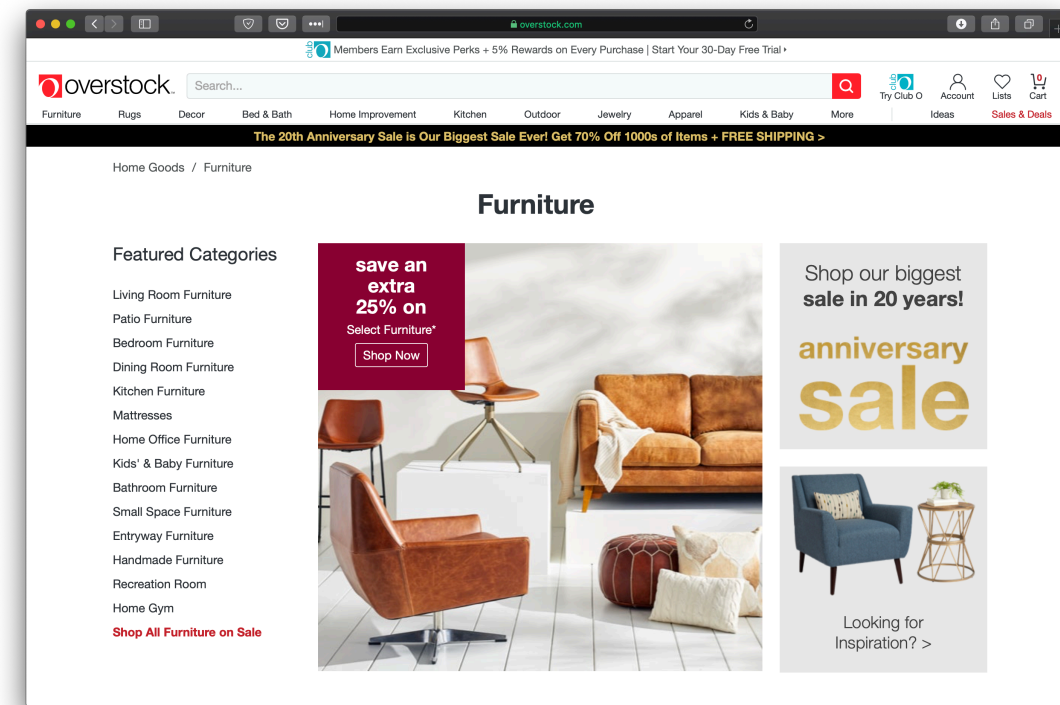
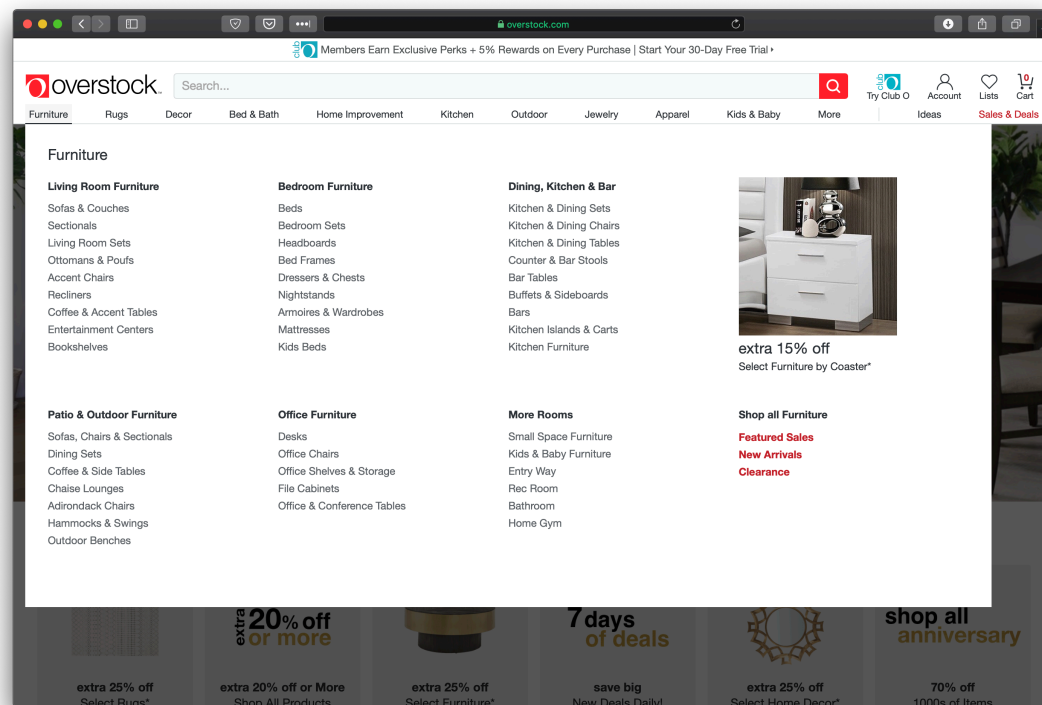
Definition: Primary navigation aids take the form of menus/menubars and reflect the major areas or sections of a website.



³² Image source: Left, Right

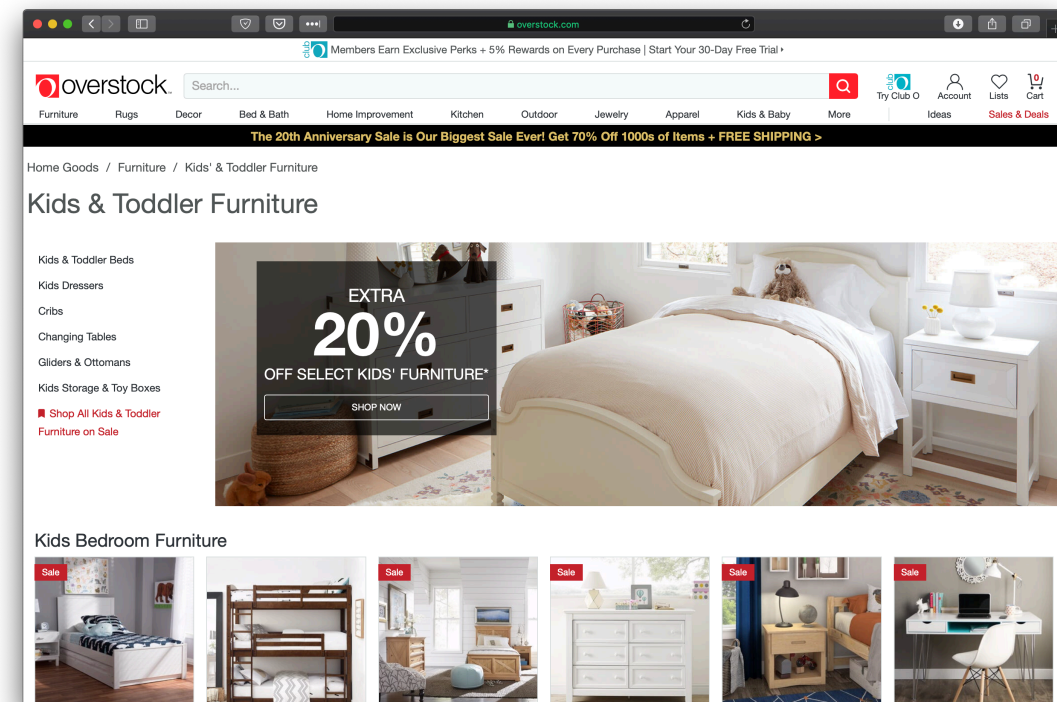
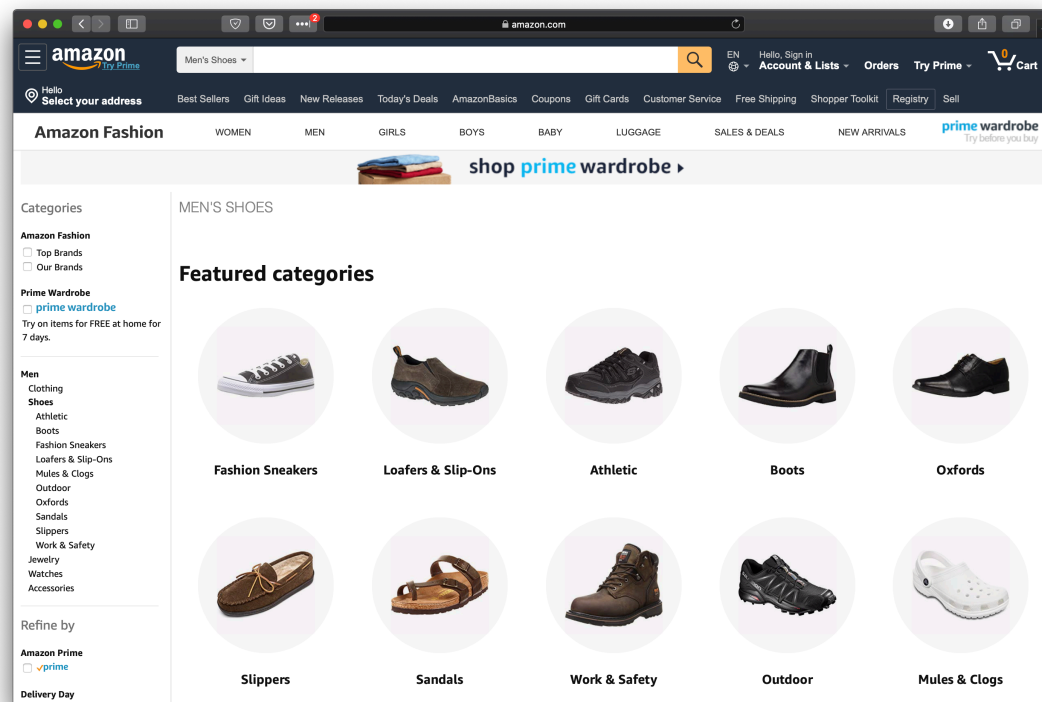
Secondary Navigation Aids

Definition: Secondary navigation aids provide comprehensive links to specific content on the site as *fat navigation*, *left-hand navigation*, *footer navigation*, etc.



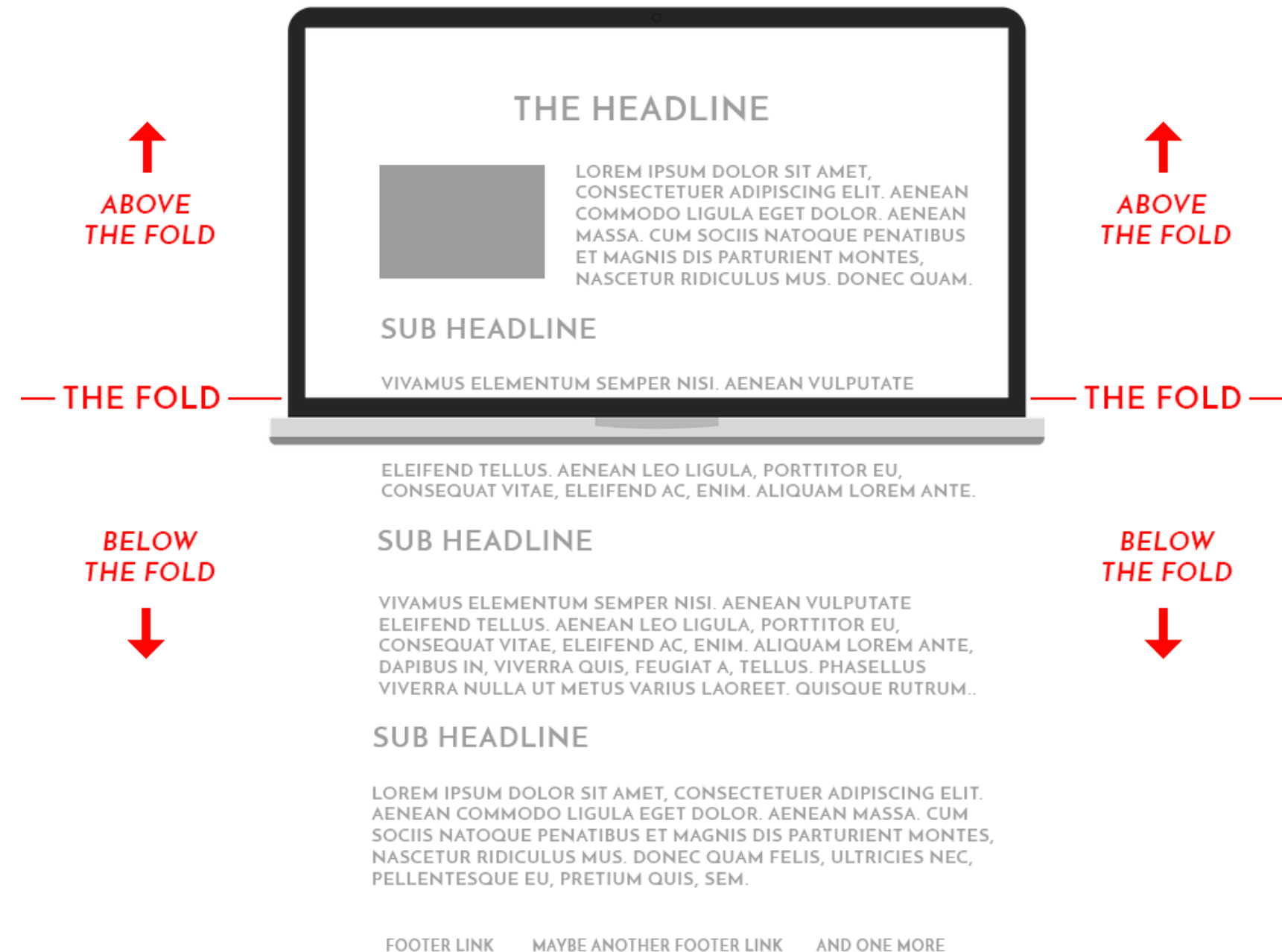
How do we get home?

A key problem in complex sites is to get back to previous pages or other pages that are higher in the navigation hierarchy. *Breadcrumbs* and *hierarchical lists* are solutions to this problem.

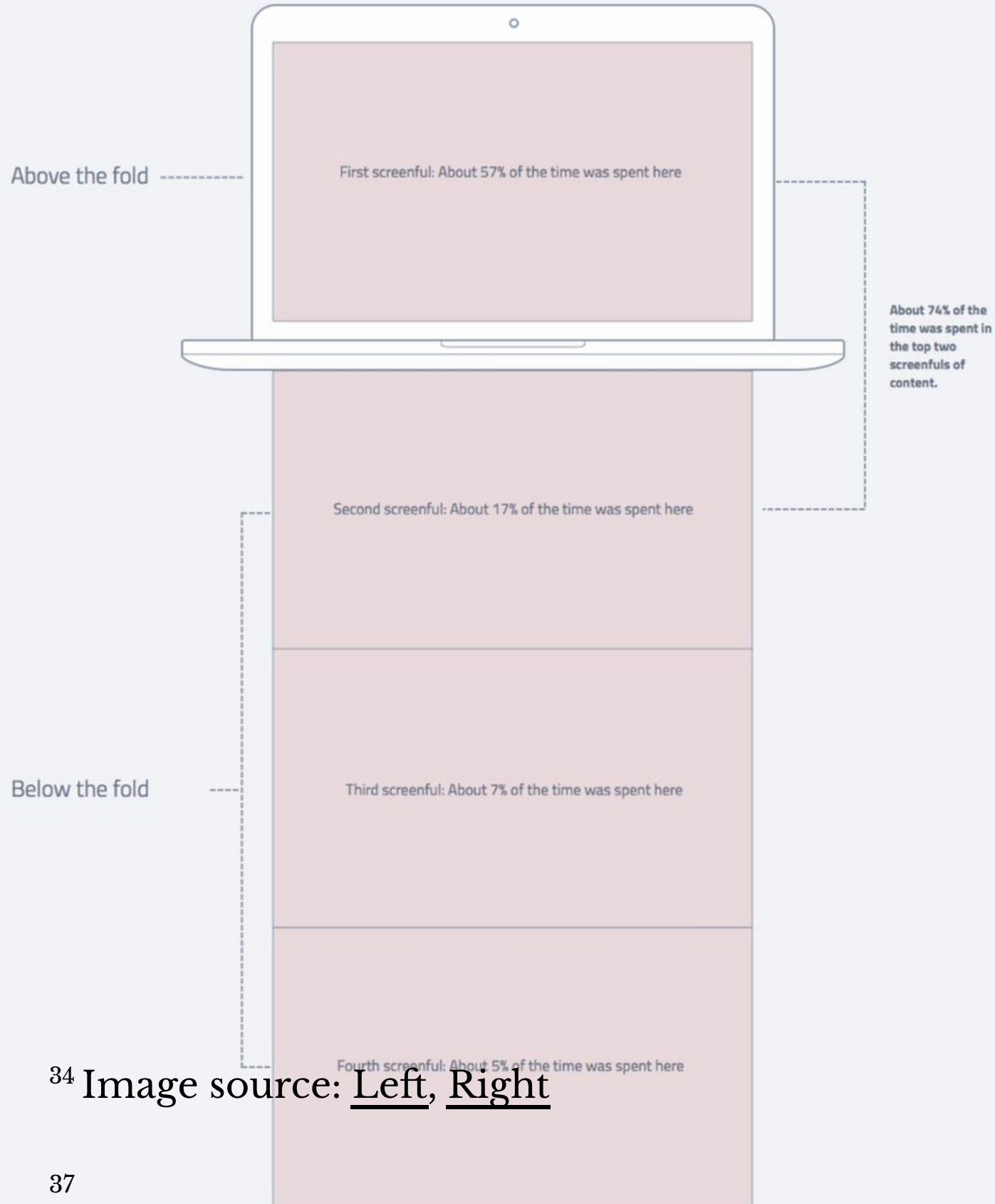


Organizing Page Content: The Fold³³

Definition: The *fold* is the dividing line between the area that is visible when a page first loads and the remainder of the page.

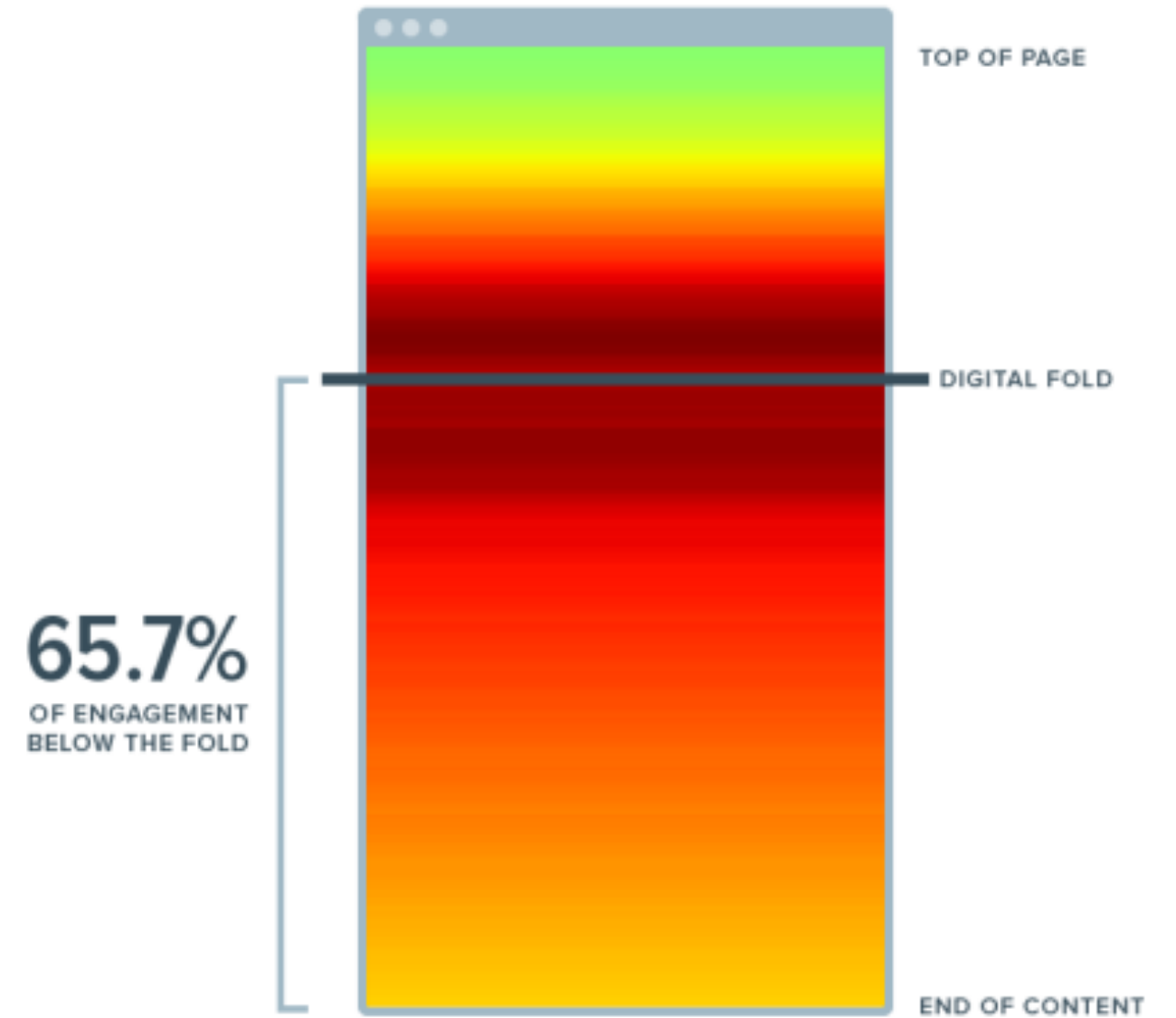


³³ Image Source



34 Image source: Left, Right

WHERE WE SPEND TIME READING



ENGAGEMENT

LOW HIGH

Data from 1 million visitors on 10 publishers over a 24 hour period

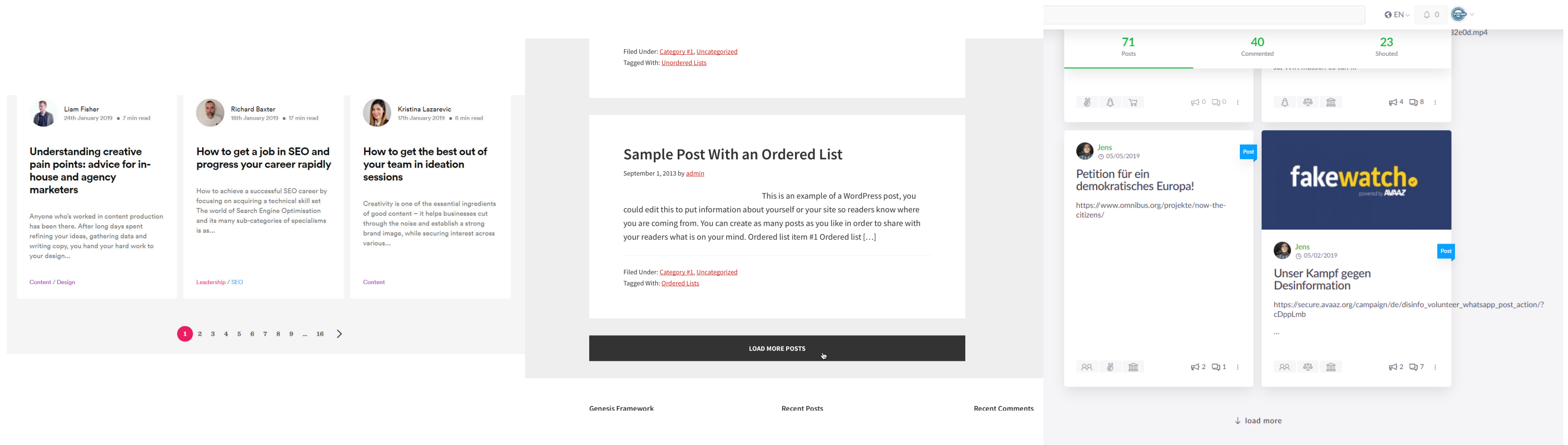
Organizing Page Content: Fitting It All in³⁵

Large volumes of content is either broken into discrete pages through *pagination* or incrementally loaded through *infinite scroll*.



³⁵ Image Source

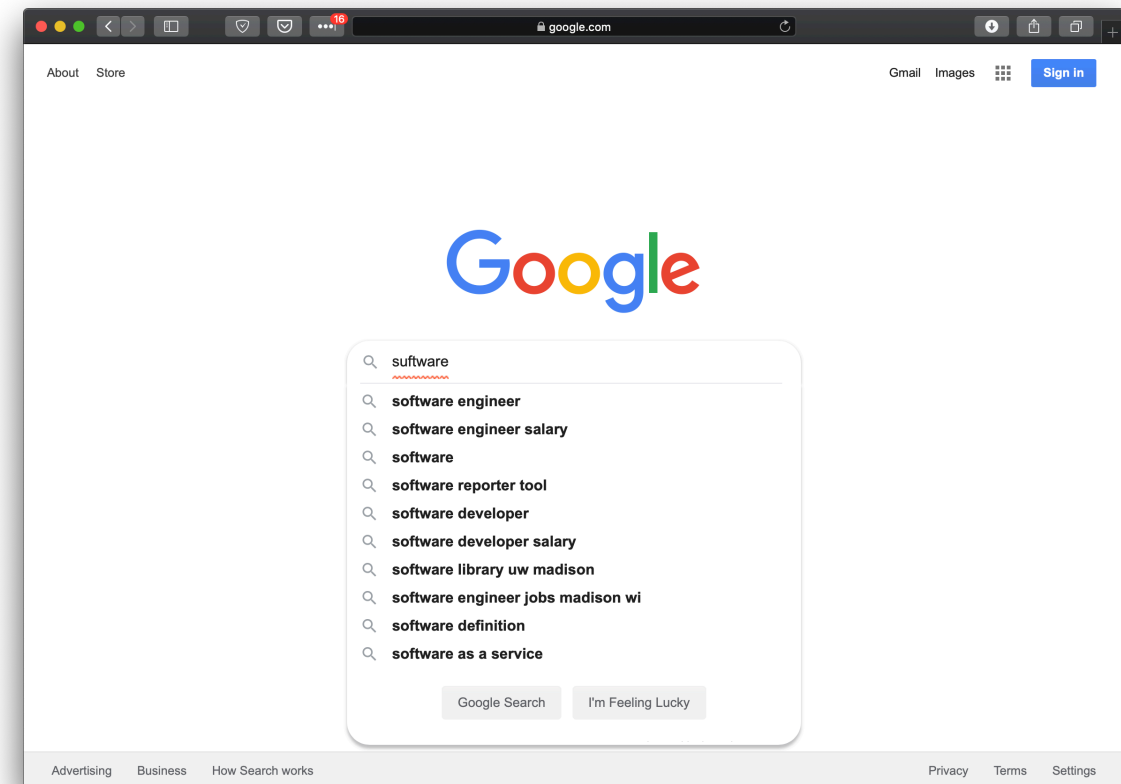
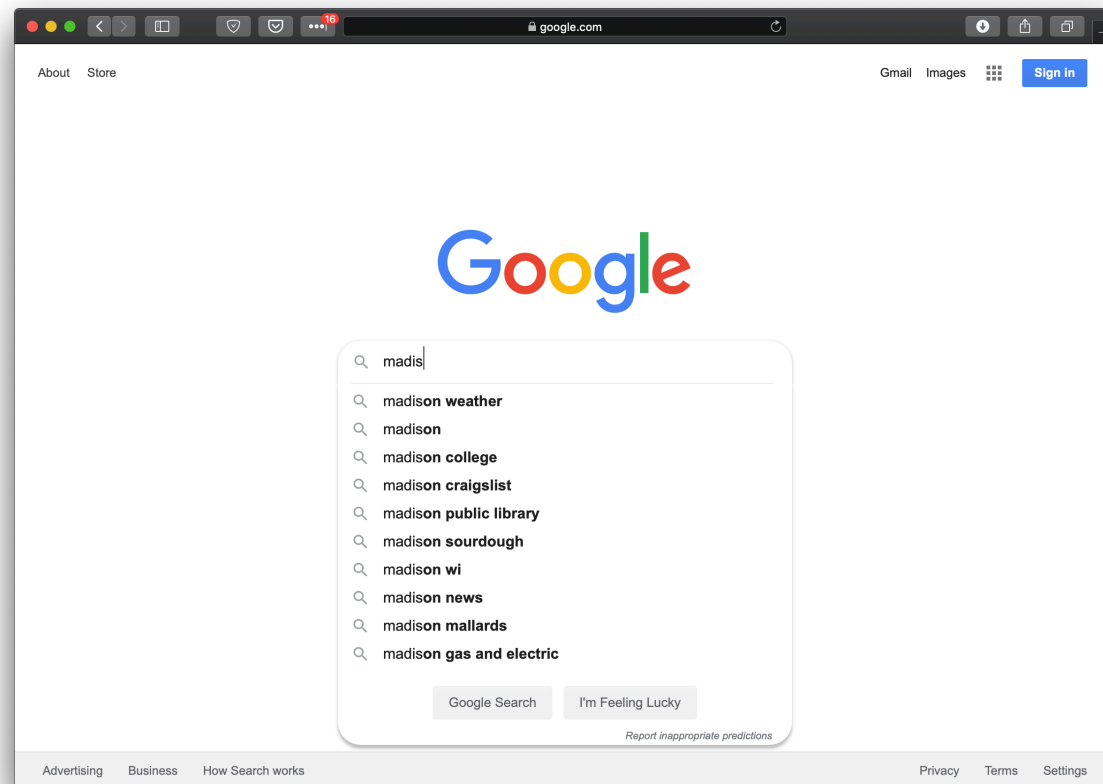
Examples of pagination and infinite scroll:³⁶



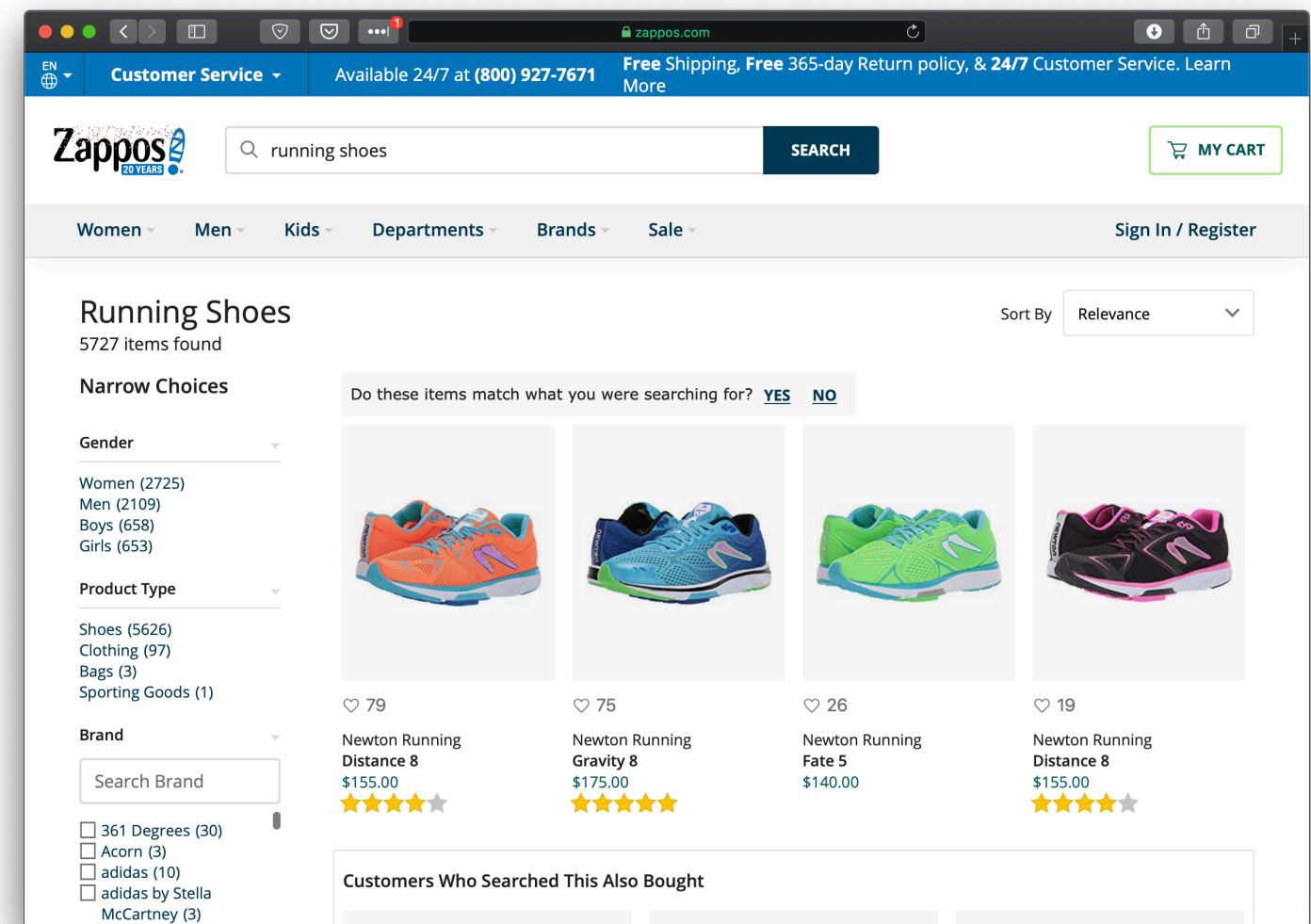
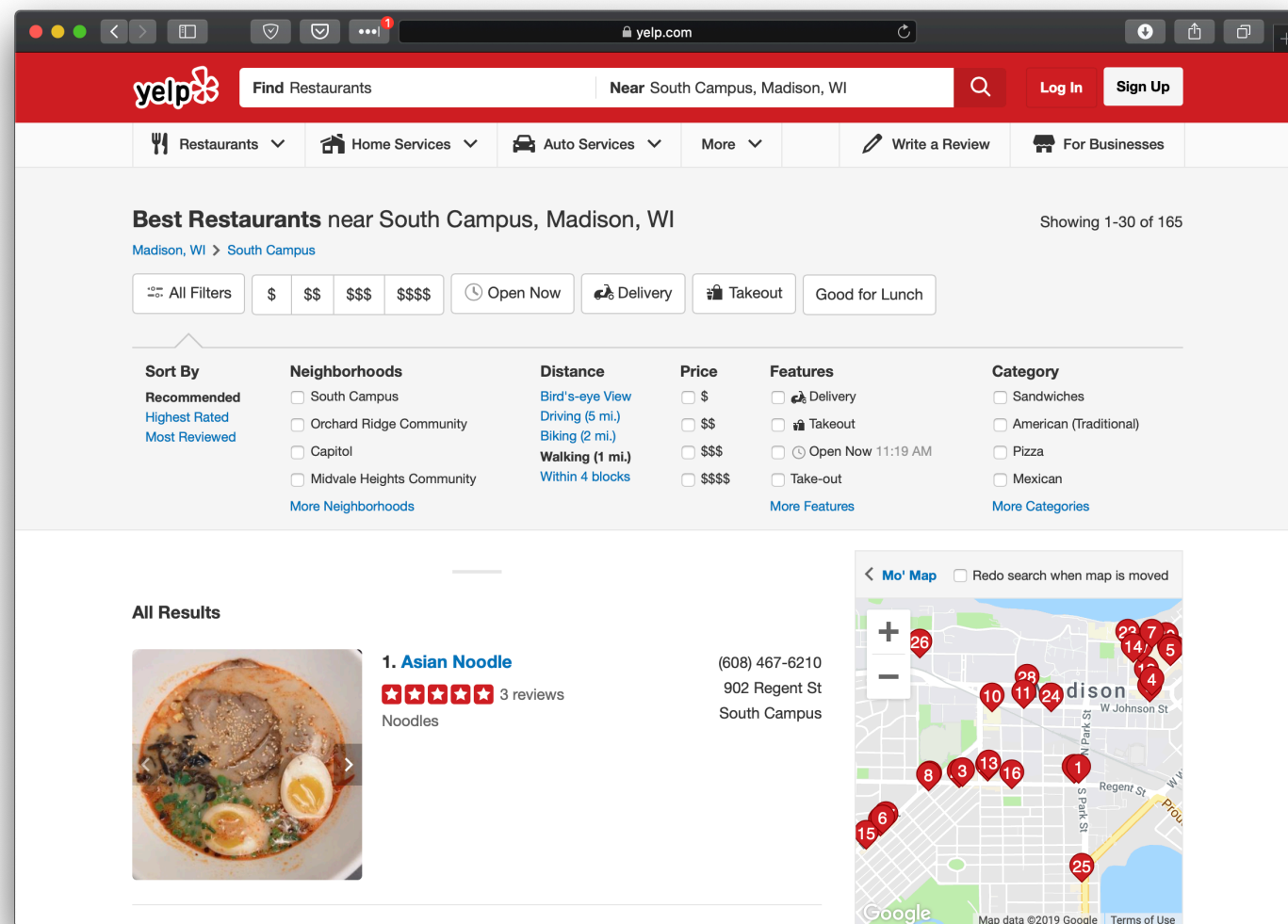
³⁶ Image source: Left, Center, Right

Search

Definition: Search, an alternative to page navigation, provides users with listings of content based on a search query.



Faceted search helps users narrow down a search once results are returned based on a simple query by providing functions to sort and filter the results.



In-Class Activity 2: Web Application Deconstruction


Image Source

[Hello](#) [Select your address](#)
[Best Sellers](#)
[Customer Service](#)
[New Releases](#)
[AmazonBasics](#)
[Today's Deals](#)
[Whole Foods](#)
[Gift Cards](#)
[Free Shipping](#)
[Registry](#)
[Sell](#)
[Coupons](#)
[#FoundItOnAmazon](#)
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[Shop by Category](#)
[Shop by Brand](#)
[Shop by Character](#)
[Save on Toys](#)

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 Beyblade
 Disney
 Fisher-Price
 Funko
 Gund
 Hatchimals
 Hot Wheels
 Kidkraft
 Learning Resources


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 L.O.L Surprise!
 Melissa & Doug
 NERF
 Osmo
 Play-Doh
 Playmobil
 Playskool
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[Musical Instruments](#)
[Party Supplies](#)
[Pretend Play](#)
[Puppets & Puppet Theaters](#)

[Crayola Reusable Cloth Kids Face Mask Set, Halloween](#)
 ★★★★★☆ 18
 \$21.59 - \$47.99


[HOZZQ DIY Halloween Party Supplies PVC 3D Decorative Scary Bats Wall Decal Wall...](#)
 ★★★★★☆ 1,800
 \$11.99

[Play-Doh Modeling Compound 10 Pack Case of Colors, Non-Toxic, Assorted Colors, 2 Oz...](#)
 ★★★★★☆ 12,356
 \$7.99 - \$22.99


[LeapFrog 100 Animals Book](#)
 ★★★★★☆ 18,031
 \$9.47 - \$59.99

#5



[LEGO City Advent Calendar 60268 Playset, Includes 6 City Adventures TV Series...](#)
 ★★★★★☆ 122

#6


[Tara Toys Ariel Necklace Activity Set - Amazon Exclusive](#)
 ★★★★★☆ 16,371

#7


[The First Years Stack Up Cup Toys](#)
 ★★★★★☆ 28,092
 \$3.99 - \$16.99

#8


[SunWorks Heavyweight Construction Paper, 9 x 12 Inches, Black, 100 Sheets](#)
 ★★★★★☆ 5,228

Link to Google Drawings

What we learned today?

- A brief history of user interfaces
- Platform-specific design
 - Designing for the desktop
 - Designing for the web