

PROGRAMIRANJE KORISNIČKOG INTERFEJSA

UI

- SI inženjeri još uvek moraju da vode računa o dizajnu korisničkog interfejsa, kao i o dizajnu samog softvera.
- Često je dobar dizajn korisničkog interfejsa kritičan za uspeh celog sistema.
- Interfejs težak za korišćenje, prouzrokuje veliki broj korisničkih grešaka.
- U najgorem slučaju korisnik će odbiti da nadalje koristi softver - mogućnost promene podataka ili rušenje sistema.

UI - greške

- The Therac-25 was a radiation therapy machine for treating cancer patients. It had an electron beam with two settings: a low-energy mode, beamed directly onto the patient, and a high-energy mode in which the beam was blocked by an X-ray generating filter.
- Tragically, the system's design had a race condition between the user interface and the beam controller. If the operator chose a mode, and the machine started configuring itself, and then the operator backed up and made a different choice within the 8-second interval it took for the machine to swing its magnets into place, then part of the system wouldn't receive the new setting

UI - greške

- As a result, a fast, experienced operator could inadvertently give severe overdoses, and several patients died. (Nancy Leveson, “Medical Devices: the Therac-25”, 1995)

UI – greške 2

- In 1988, the USS Vincennes guided missile cruiser shot down an Iranian airliner over the Persian Gulf with almost 300 people aboard. There were two failures in this incident.
- The radar operator interpreted the airliner as an F-14, descending as if to attack, rather than (in reality) a civilian plane that was climbing after takeoff.
- Both failures seemed to be caused by user interface.

UI – greške 2

- The IFF system was reporting the signal from an F14 on the ground at an airport hundreds of miles away, not the signal from the airliner; and the plane's altitude readout showed only its current altitude, not the direction of change in altitude, leaving to the operator the mental comparison and calculation to determine whether the altitude was going up or down.
- (Peter Neumann, "Aegis, Vincennes, and the Iranian Airbus", Risks v8 n74, May 1989).

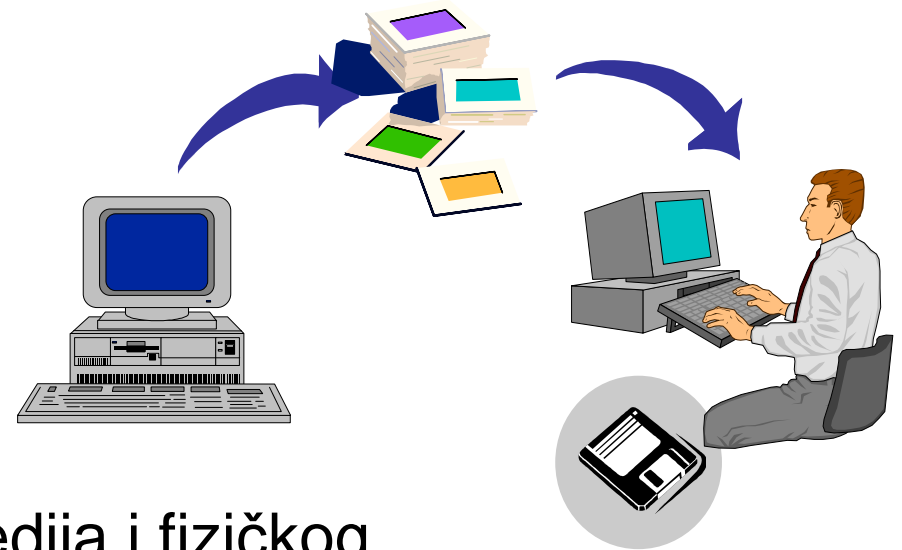
Interakcija čoveka i računara

- Interakcija između računara i čoveka se nije bitno menjala poslednje dve decenije, pa više ne odgovara niti naraslim mogućnostima računara, niti novim potrebama korisnika.
- Korisnički interfejs je usko grlo u komunikaciji.
- Nije se vodilo mnogo računa o specifičnostima čovekovih komunikacionih sposobnosti, što ograničava mogući kapacitet kanala između čoveka i računara.
- Da bi se došlo do poboljšanja treba uvažiti niz faktora prilikom kreiranja korisničkog interfejsa.

Interakcija čoveka i računara

Da bi se novi korisnički interfejs približio komunikaciji čoveka i računara, treba uzeti u obzir sledeće faktore:

- čovekovu senzorsku fiziologiju,
- čovekovu anatomiju,
- čovekovu percepciju,
- saznavne mehanizme, i
- socijalnu interakciju.



Treba uzeti u obzir i karakteristike medija i fizičkog okruženja korisnika.

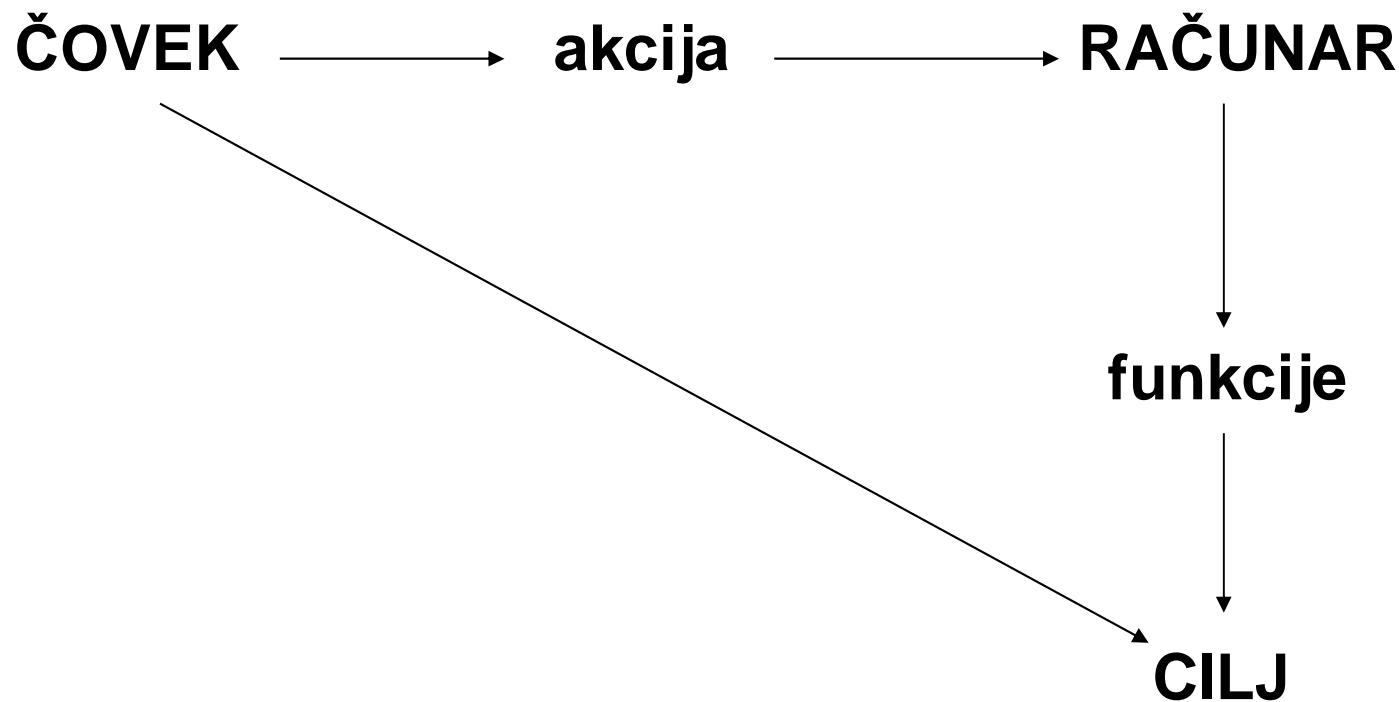
Interakcija čoveka i računara

- Sa druge strane, razvoj korisničkog interfejsa treba da uvaži i:
 - karakteristike hardverskih uređaja koji se koriste u komunikaciji sa korisnikom,
 - dostupne softverske resurse, i
 - karakteristike programskih sistema koji treba da koriste korisnički interfejs.

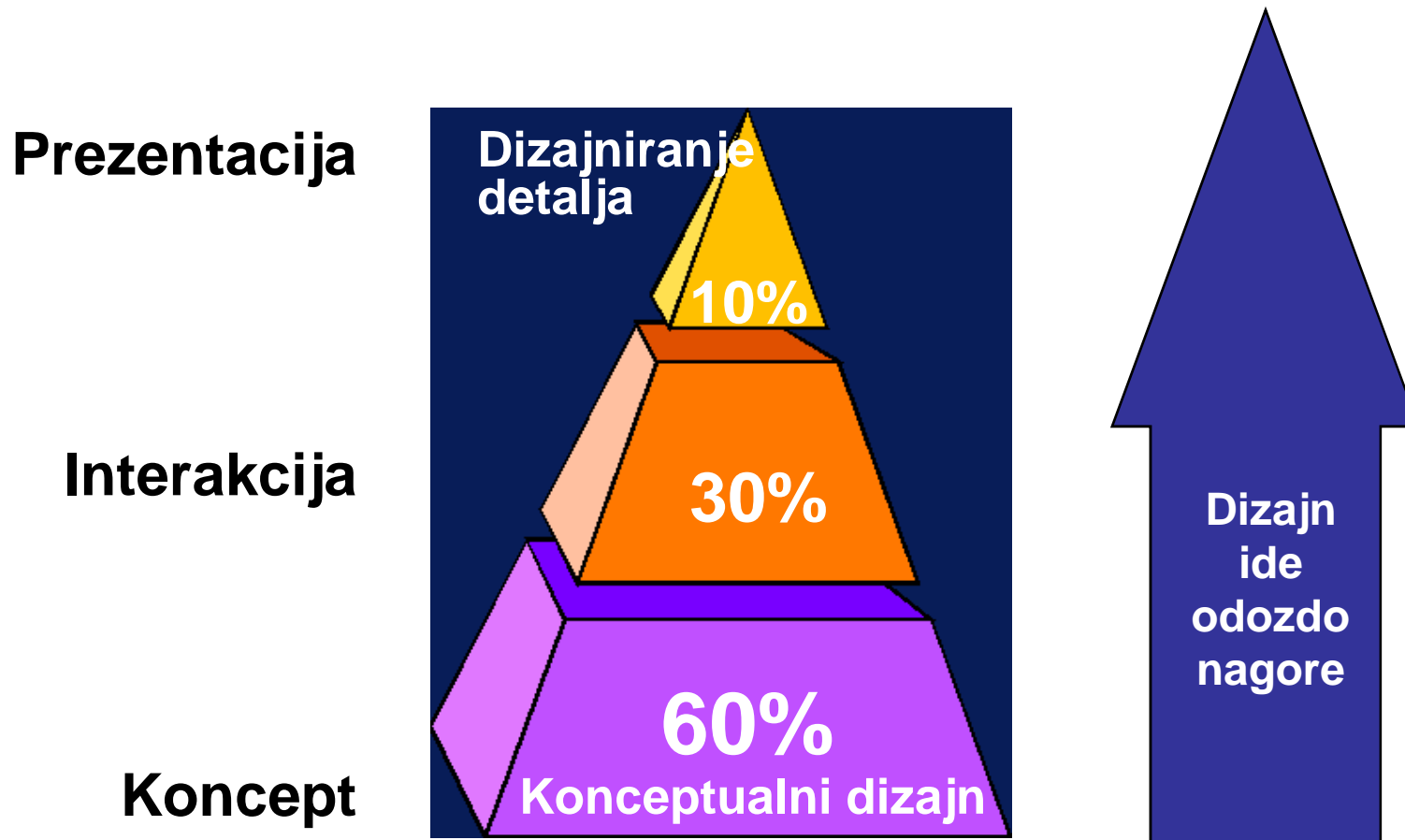


Zadatak interakcije čoveka i računara

- Što se tiče zadatka, njen zadatak je da optimizuje performanse čoveka i računara kao jedinstvenog sistema.



Balans između konceptualnog dizajna, interakcije i prezentacije grafičkog korisničkog interfejsa



Interakcija čoveka i računara

- Konceptualni dizajn – 60% sveukupnog dizajna
 - Odlučuje se o vrsti podataka, o funkcijama i njihovoj upotrebljivosti. Odlučuje se koje objekte grafički interfejs treba da ima (tastere, tastaturu, itd.), kako ih postaviti i koja je veza između njih.
- Interakcija – 30% sveukupnog dizajna
 - Kako grafički interfejs “oseća” korisnika? Kako se aktiviraju komande – pritiskom na dugme ili pomoću menija? Da li korisnik treba da ukucava podatke?
- Prezentacija – 10% sveukupnog dizajna
 - Kako interfejs izgleda? Kako se informacije prezentiraju? Koje se boje koriste? Koja je veličina objekata? Kakvi su tasteri?

Vrste korisničkih interfejsa

Prema korišćenoj tehnološkoj bazi i paradigmi interakcije, pristupi rešavanju problema komunikacije između čoveka i računara mogu da se podele uneke od sledećih grupa:

- Hardverski korisnički interfejs, dugmići isl.
- Korisnički interfejs komandne linije,
- **Grafički korisnički interfejsi,**
- Percepcijske korisničke interfejse, dodir, pokret, glasovna komanda
- Korisničke interfejse zasnovane na pažnji, gde je korisnikova pažnja, kada je momenat da se pokrene neka komanda ili prekine korisnik
- Elektro-fiziološke korisničke interfejse

Grafički korisnički interfejsi i WIMP paradigma

Većina korisnika je danas u interakciji sa računarima putem kucanja, pokazivanja i "kliktanja" korišćenjem **grafičkih korisničkih interfejsa** (*eng. graphical user interfaces - GUI*).

Komunikacija zasnovana na:

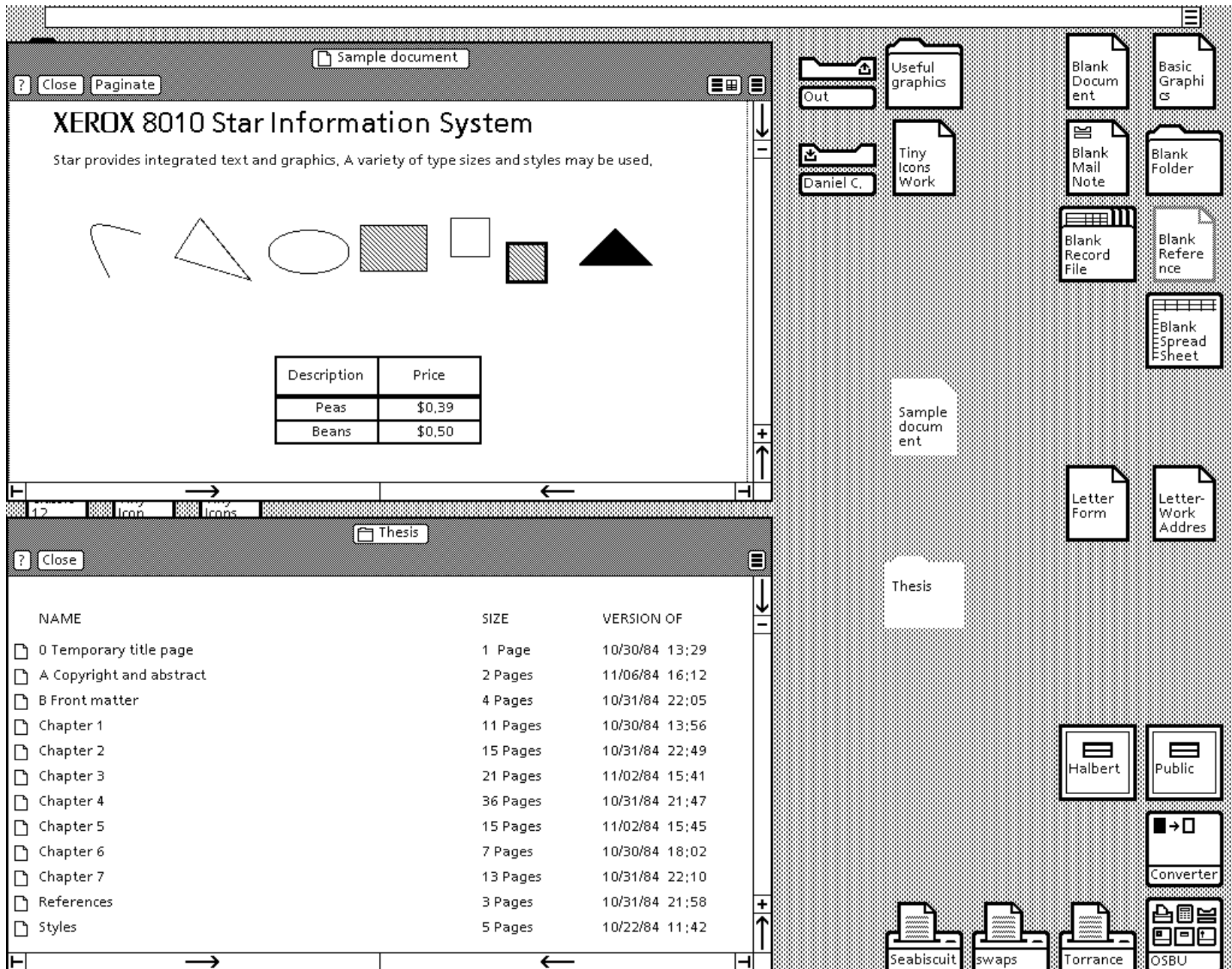
- upotrebi **prozora** kao radne površine,
- **ikona** kao reprezenta mogućih aplikacija,
- **menija** kao mehanizma odlučivanja i
- **pokazivača** kao reprezenta položaja korisnika u virtuelnom svetu generisanog programskom logikom,

često se naziva i **WIMP paradigma** (*eng. windows, icons, menus, pointer*) prema osnovnim konceptima na kojima se zasniva.

Xerox 8010

- Prvi sistem koji je inkorporisao više tehnologija koje su postale od onda standard za personalne računare
- Prvo je dizajniran interfejs, a onda način na koji će da radi
- Ključna filozofija je bila oponašanje kancelarijske paradigme kako bi korišćenje bilo što intuitivnije za korisnika
- Korišćena je *what you see is what you get* ([WYSIWYG](#)) paradigma
- Tekst se prikazivao crnom bojom na beloj pozadini kao što je i na papiru slučaj
- Komercijalno je bio neuspešan jer je bio previše spor

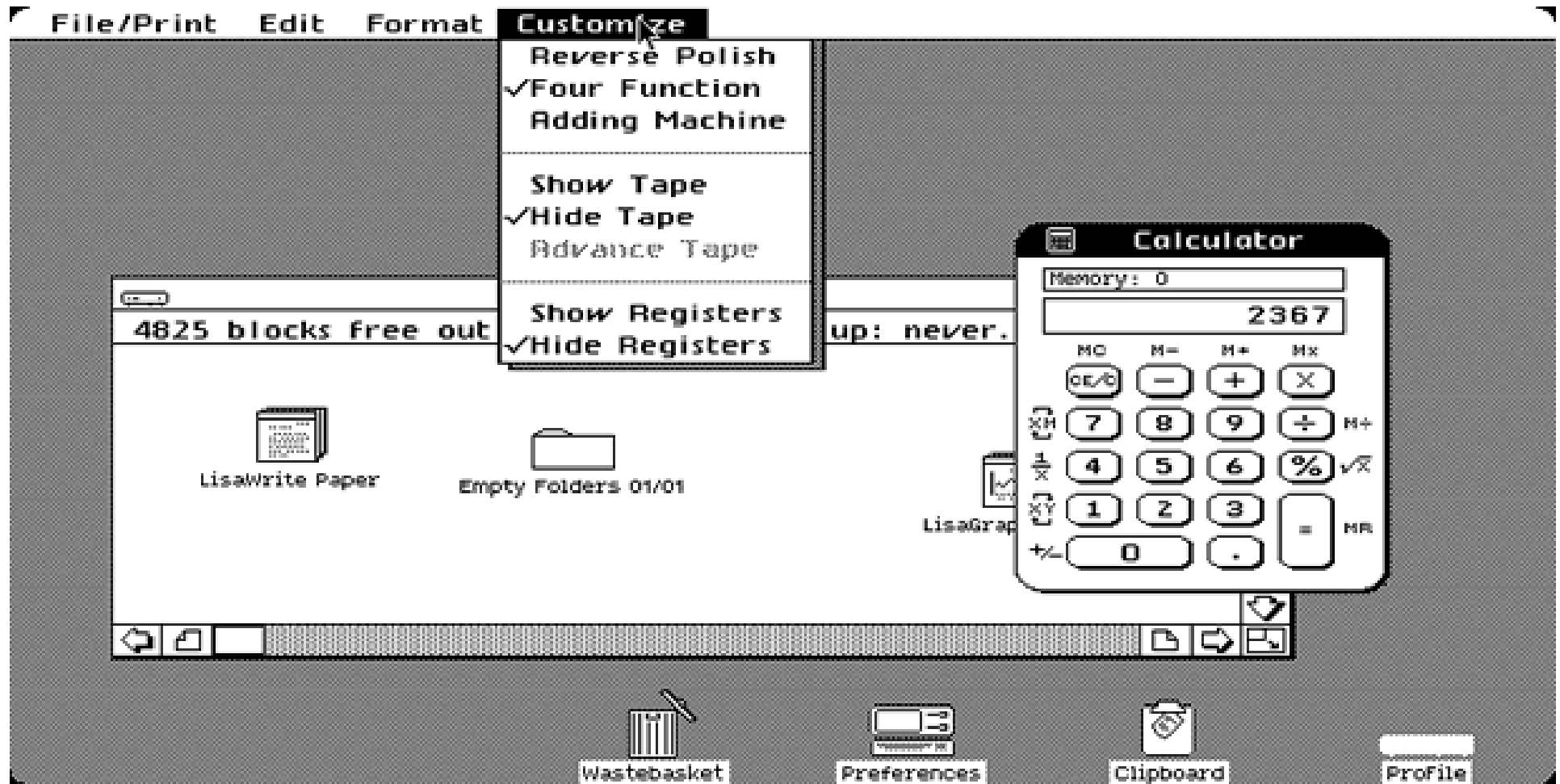
Xerox 8010 Star 1981



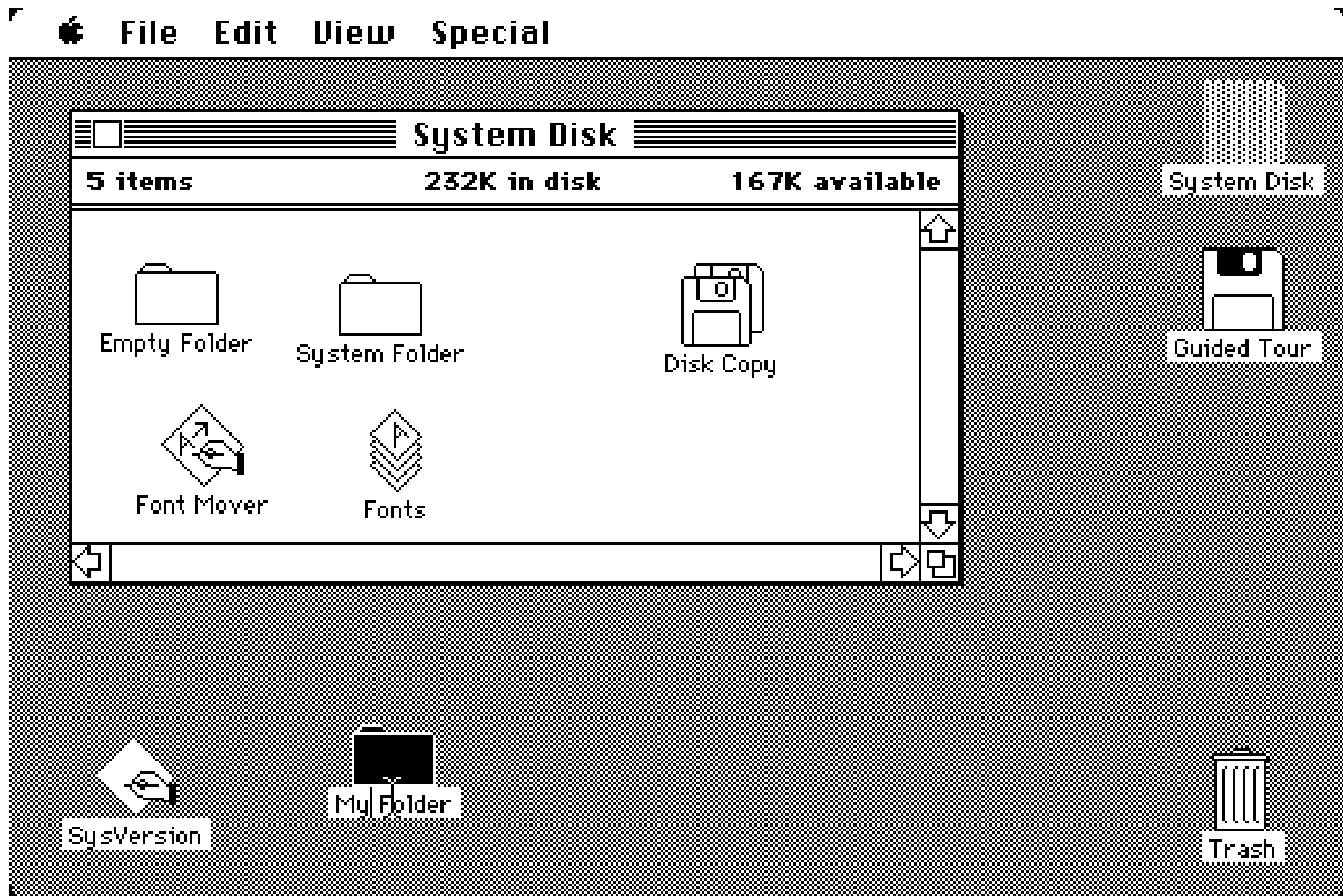
Apple Lisa

- Apple je zaposlio neke od originalnih dizajnera XEROX-a
- Nastao je Apple Lisa koji je bio ne isplativ
- 1984 nastaje Apple Macintosh koji je doživeo veliki uspeh
- U suštini Macintosh –ov GUI definiše izgled i današnjih GUI-ja
- Prvi je uveo menije, ikone, uperi i klikni

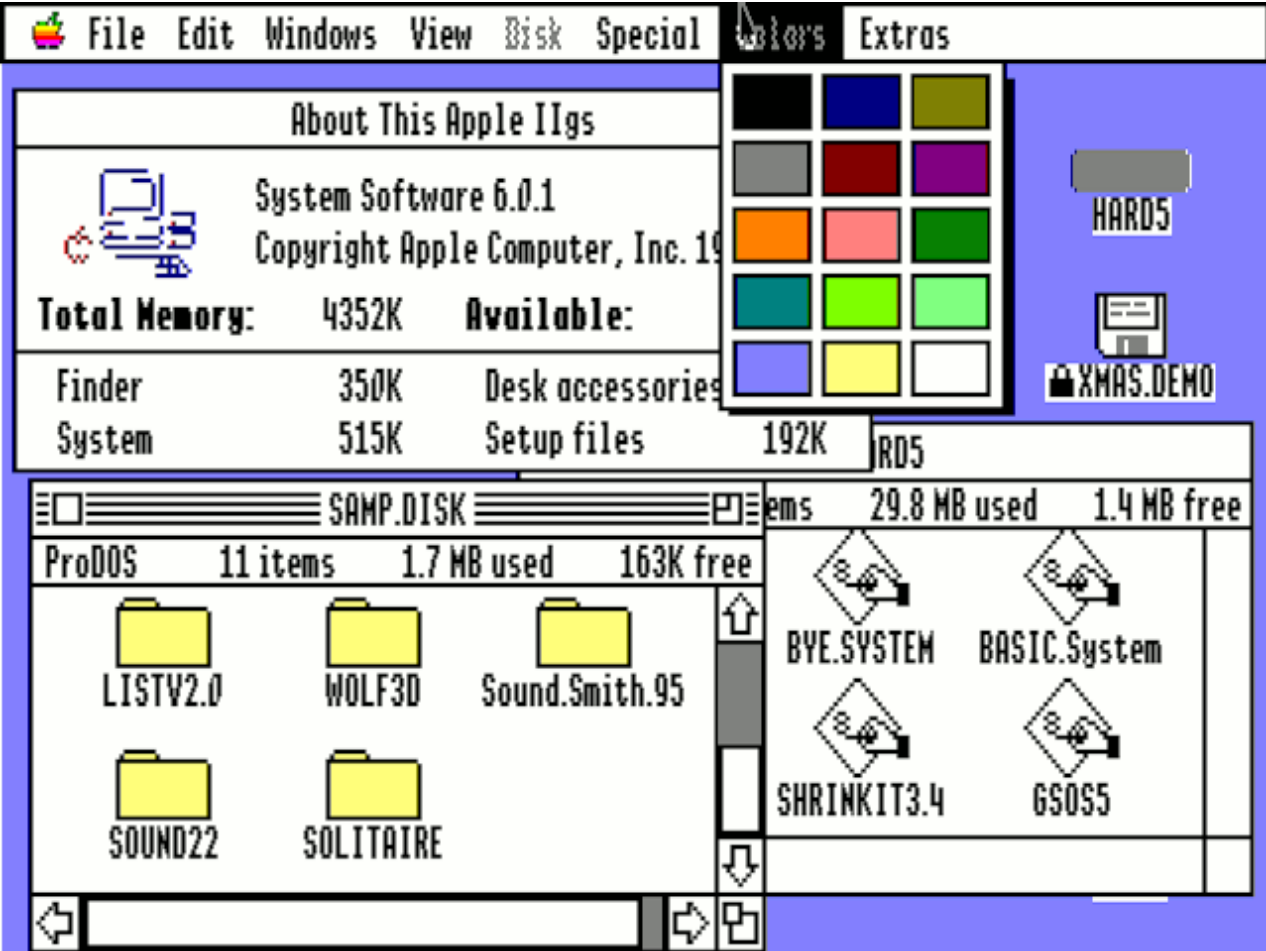
Apple Lisa Office System 1983



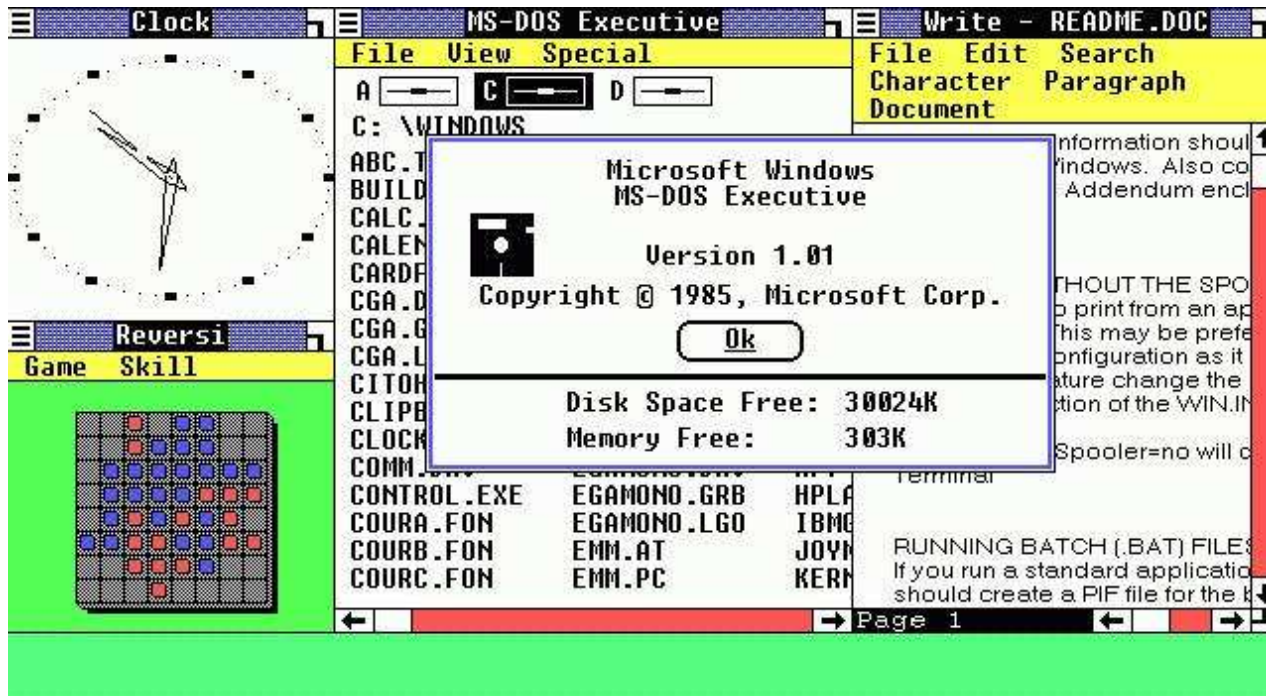
Macintosh 1984



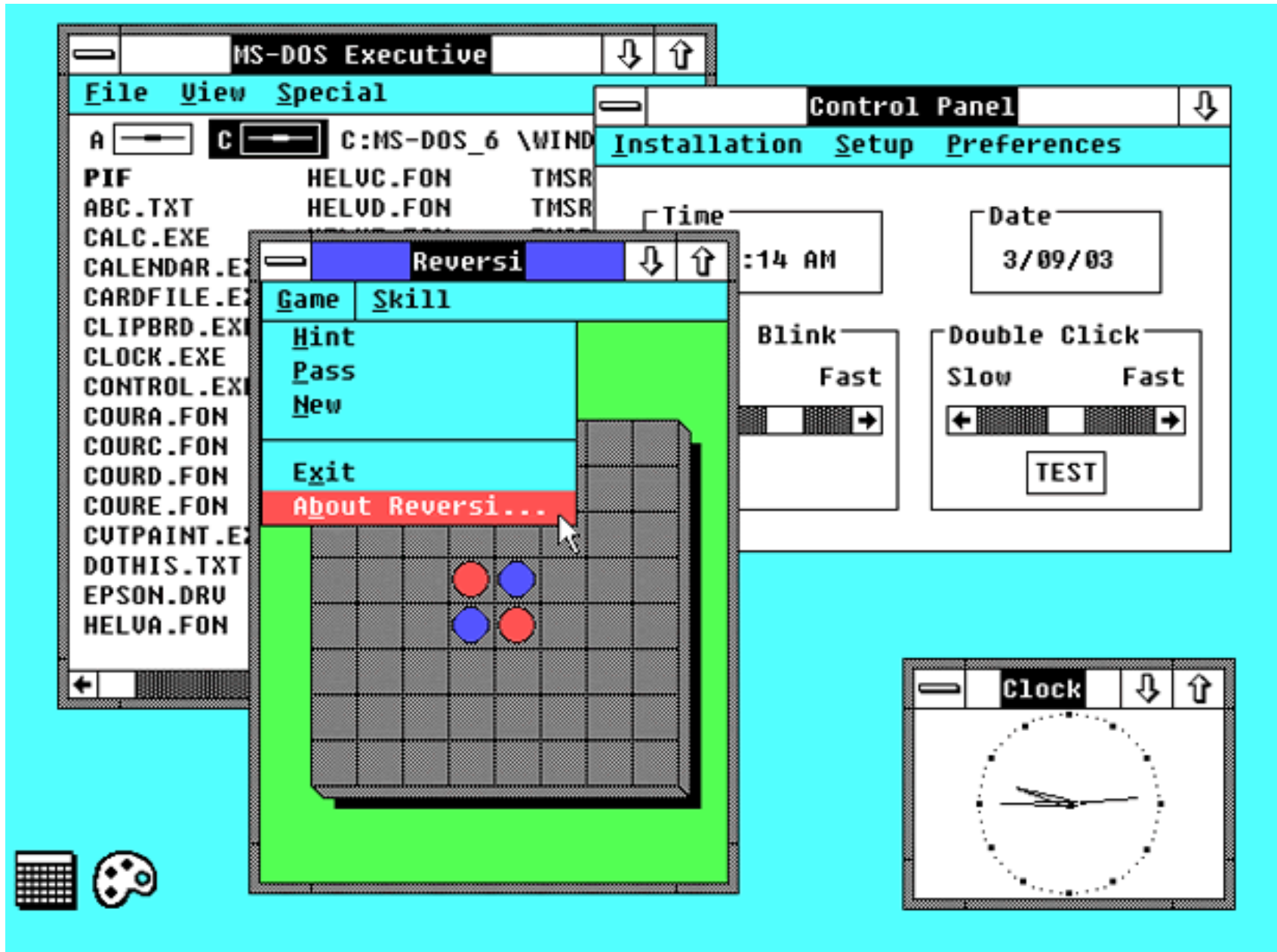
Apple1986



Windows 1.01 - 1985



Windows 2.0x 1987



Pokazivački uređaj

- Danas uobičajena neposredna interaktivna komunikacija se zasniva na korišćenju nekog **pokazivačkog uređaja poput miša**. Interaktivna komunikacija u kojoj se direktno manipuliše grafičkim objektima na ekranu,
- 1962. Daglas Engelbart (Stanford) drvena kutija sa točkićima – “x/y position indicator”
- *Sketchpad* sistem je razvio Ivan Sutherland 1963. godine, kao deo svoje doktorske teze sa svetlosnom olovkom kao pokazivačkim uređajem – pomeranje objekata, promena veličine, ...
(https://www.youtube.com/watch?v=USyoT_Ha_bA)



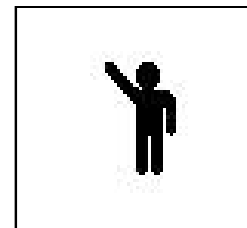
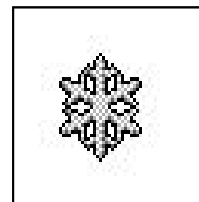
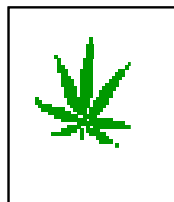
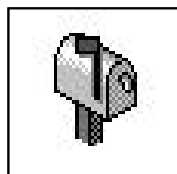
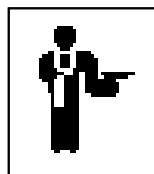
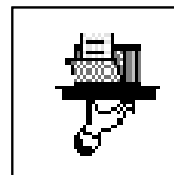
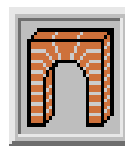
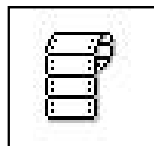
Pokazivački uređaj

- Prva grafička video igra – Space War 1962
- MIT projekat - uključivao je prvi džojstik
- **1968. Engelbart kreira NLS (oNLine System)**
- Hipermedija sistem
- Upotreba miša za grafički rad
- Više tile prozora
- adresiranje objekata
- Korišćenje linkova
- Videokonferencija
- E-mail



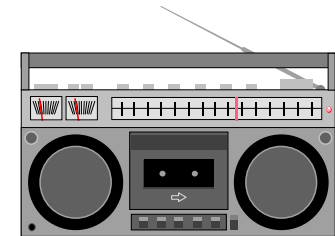
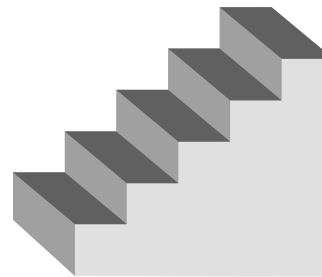
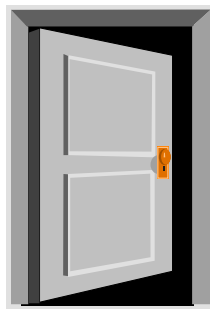
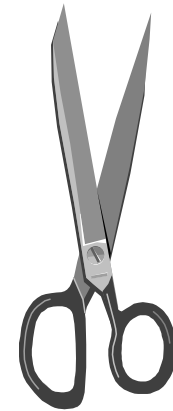
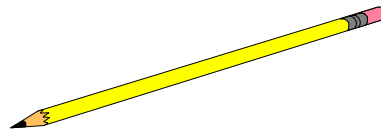
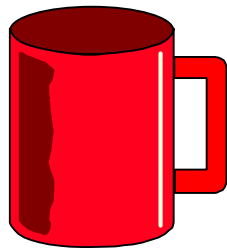
Ikone

- David Canfield Smith je u svojoj doktorskoj tezi 1975. godine uveo u upotrebu termin "ikona", koji je primenio u okviru sistem interaktivnog grafičkog komuniciranja, poznat pod nazivom *Pygmalion*. Kasnije je postao glavni projektant *Xerox Star* sistema, i zaslužan je za širu upotrebu ikona u grafičkim korisničkim interfejsima iz kojih su preuzeti osnovni koncepti u kasnijim realizacijama.
- Prvi komercijalni sistemi koji su koristili koncept interaktivne grafičke komunikacije bili su **Xerox Star** 1981. godine, **Apple Lisa** 1982. godine i **Macintosh** 1984. godine.



Ikone

- Za prikazivanje objekata treba kreirati ikonice ili sličice koje su slične stvarima iz svakodnevnog života.



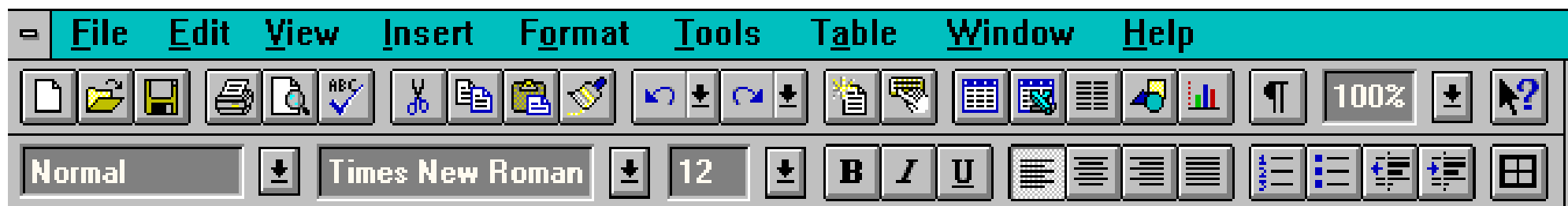
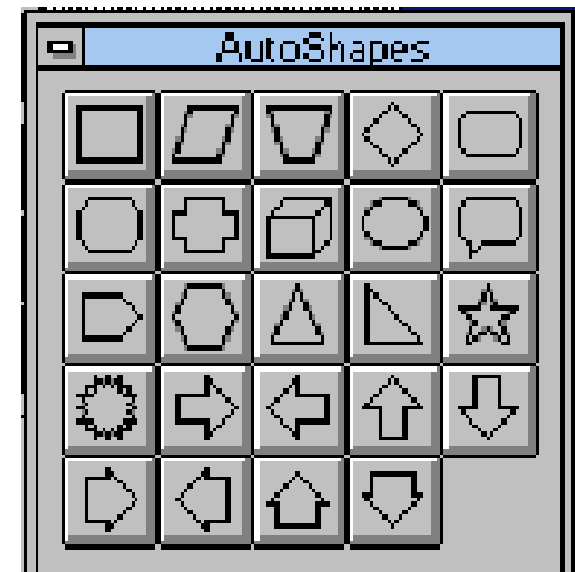
Pitanje

- Zašto ikona  znači **NAZAD** ili **PRETHODNI**?

- Zašto ikona  znači **NAPRED** ili **SLEDEĆI**?

Definicija ikona

- Slikoviti simboli – laki za pamćenje
- Reprzentuju
 - objekte
 - strukture podataka
 - proceseu formi koja odgovara realnom svetu.



Da li nešto nedostaje?

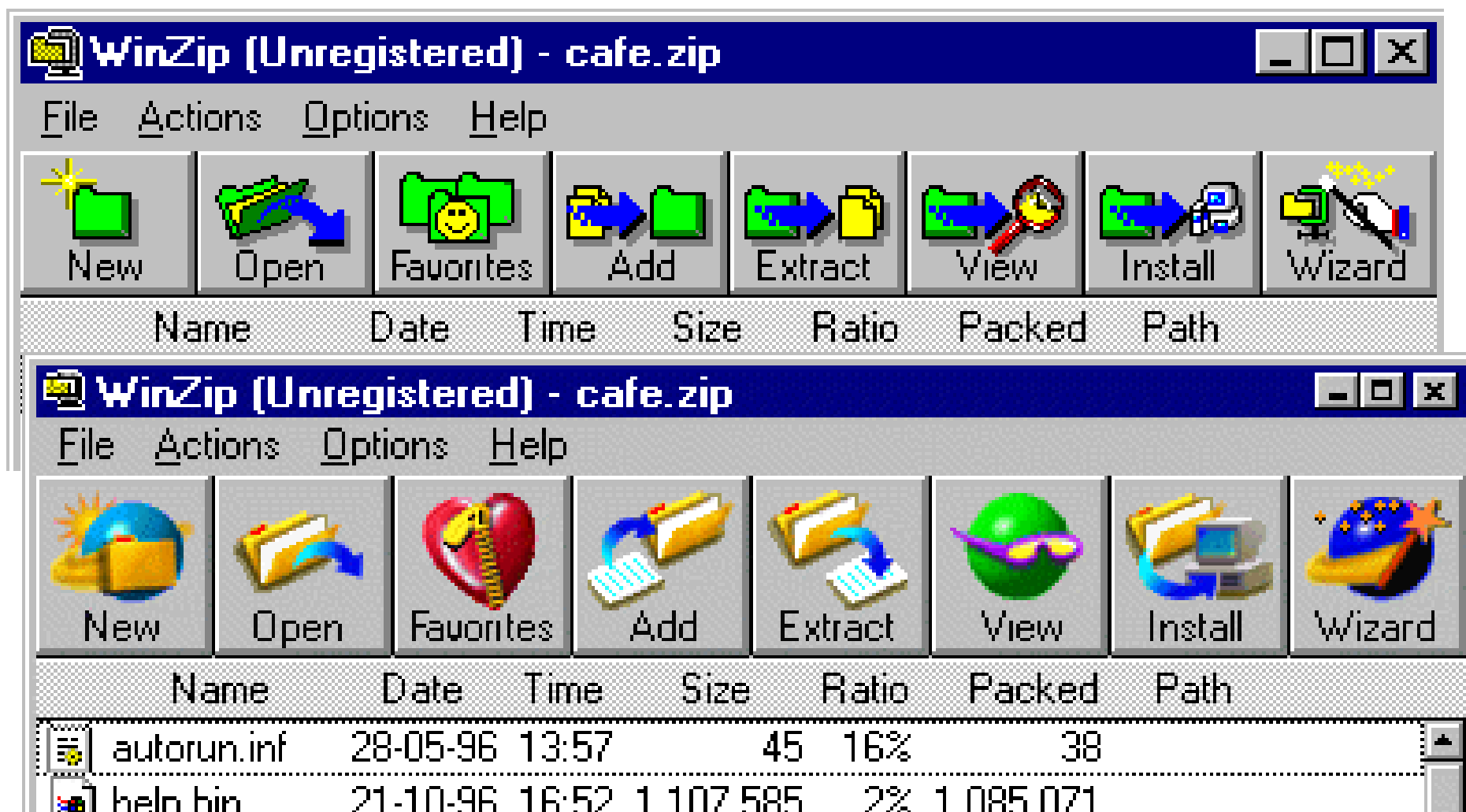


Dodatak tekstualnih komentara!

Dobro ili loše?



Dizajniranje i redizajniranje ikona



Prozori - *Windows*

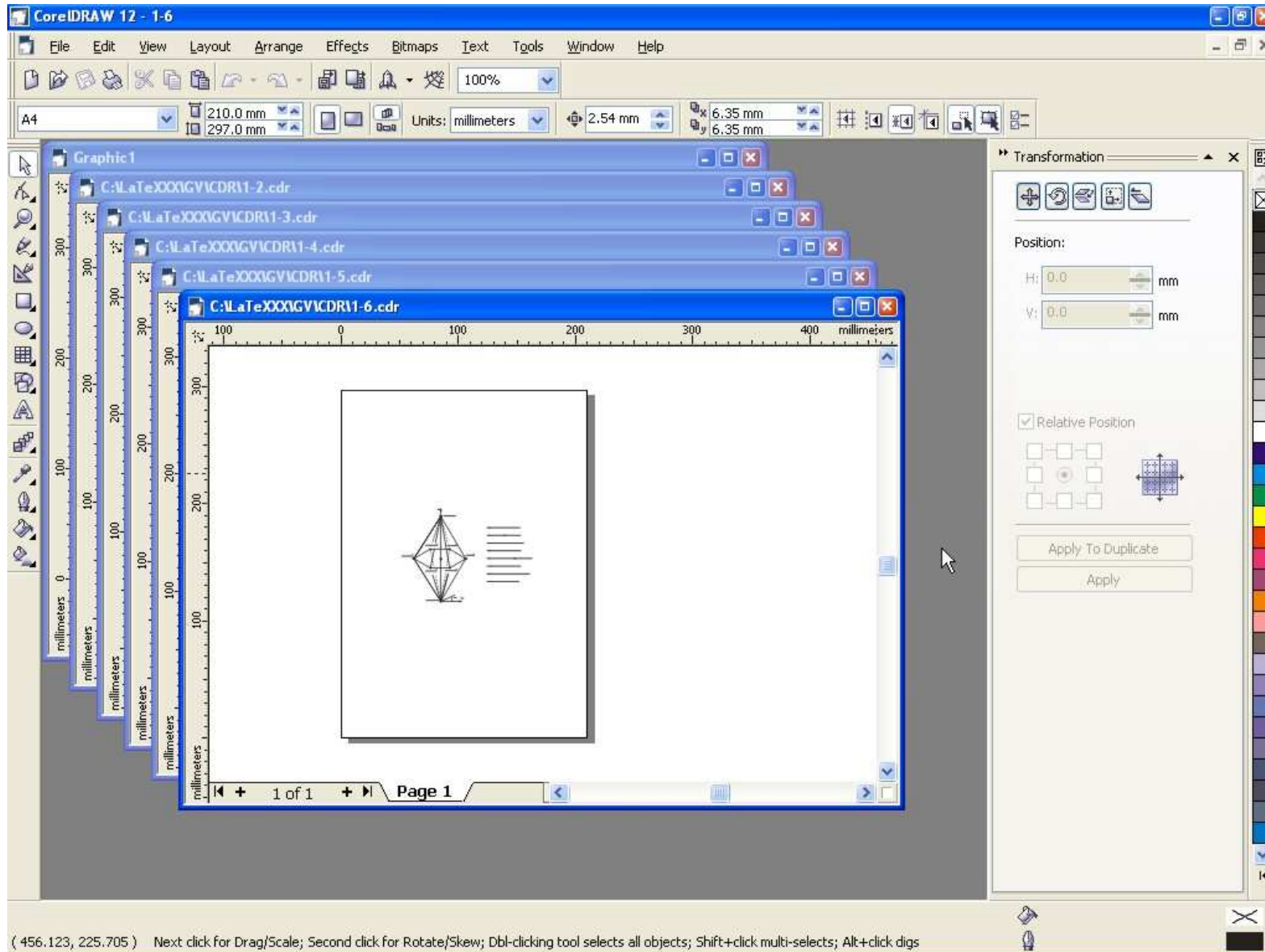


Sledeći bitan element tehnologije korisničkih interfejsa jesu **prozori** (eng. *windows*). Prva demonstracija sistema **sa više prozora u obliku pločica** (eng. *tiled windows*) prikazana je **1968. godine** u Engelbart-ovom NLS sistemu.

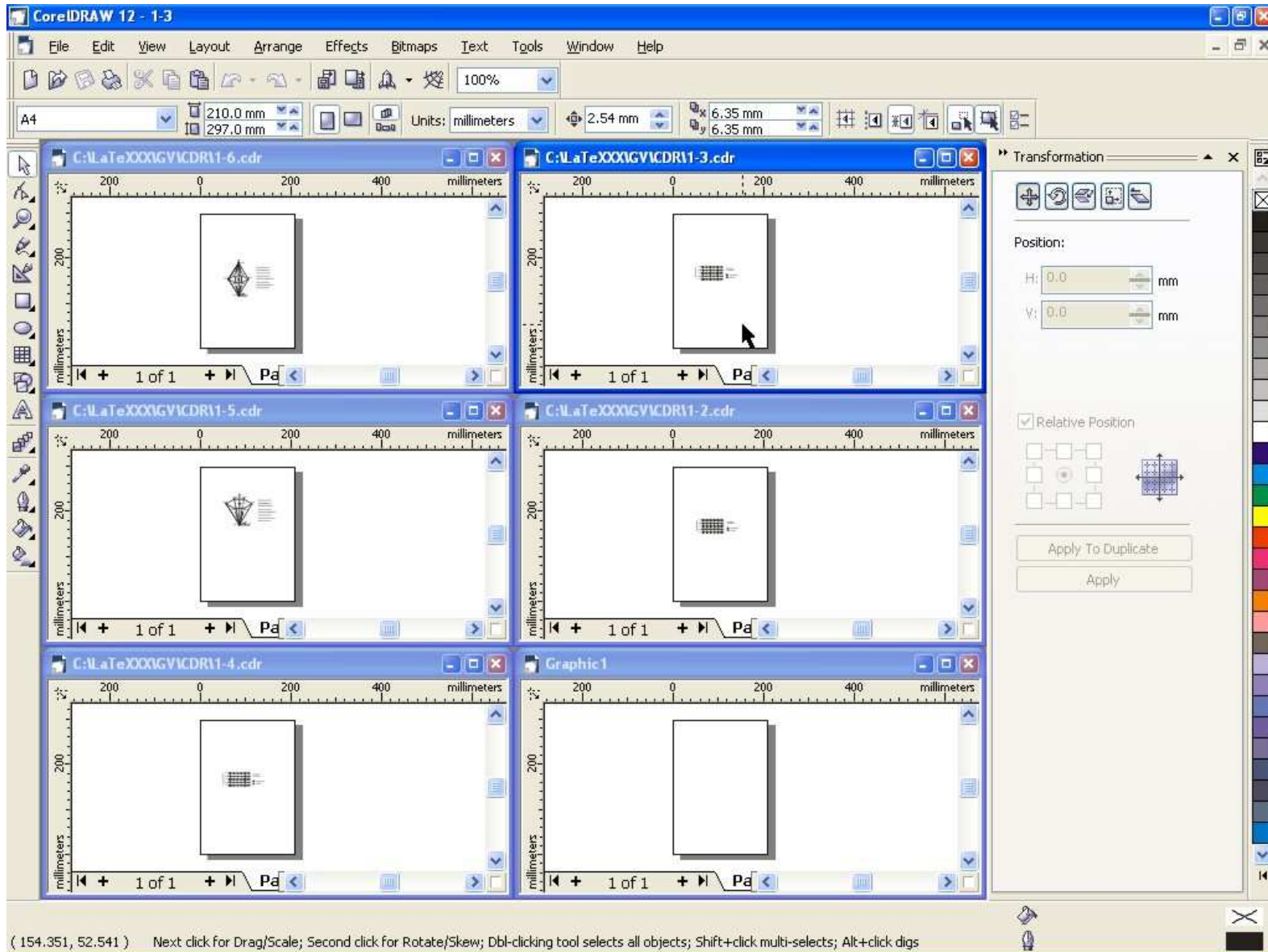
Alan Kay je **1969. godine** u svojoj doktorskoj tezi prvi predložio ideju **preklapajućih** (eng. *overlaped*) prozora.

Iako je i ranije bilo nekih komercijalnih upotreba prozora, glavni sistemi koji su popularizovali prozore bili su *XeroxStar* 1981. godine, *Apple Lisa* 1982. godine i **možda najvažniji Macintosh** 1984. godine. Rane verzije *Start* sistema i *Microsoft Windows-a* koristili su prozore kao pločice, ali su kasnije i oni prešli na koncept preklapajućih prozora.

Prozori - Windows



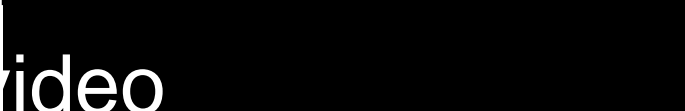
Prozori - Windows



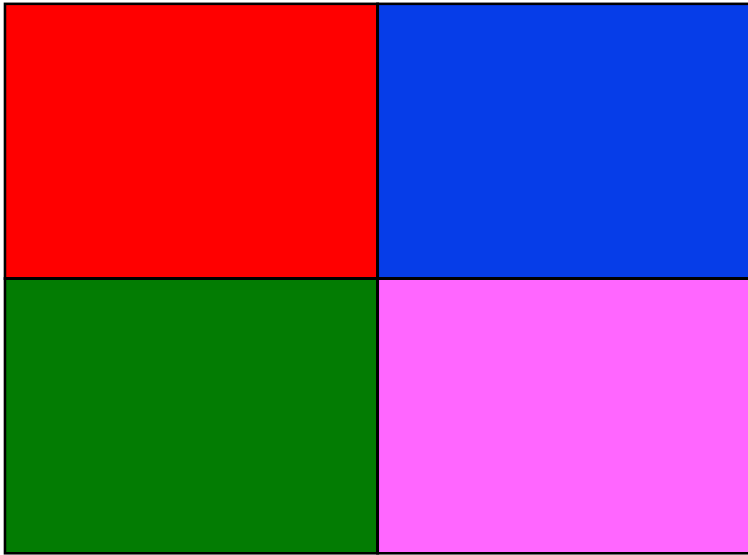
I dalje...

- Paraleleno sa razvojem tehnologija grafičkih korisničkih interfejsa, išao je i razvoj novih aplikacija koje eksploatišu mogućnosti i prednosti ovih tehnologija.
- Prvi od takvih programa su programi namenjeni crtanju i projektovanju uz pomoć računara (CAD). Ivan Sutherland je u svom *Sketchpad sistemu* 1963. godine demonstrirao većinu tehnologija koje se danas koriste u programima za crtanje i projektovanje.
- Današnji operativni sistemi poput Windows, Macintosh i Linux sistema u svojim grafičkim okruženjima koriste rezultate navedenih istraživanja, ne donoseći mnogo novina.

Veličina slova i boje

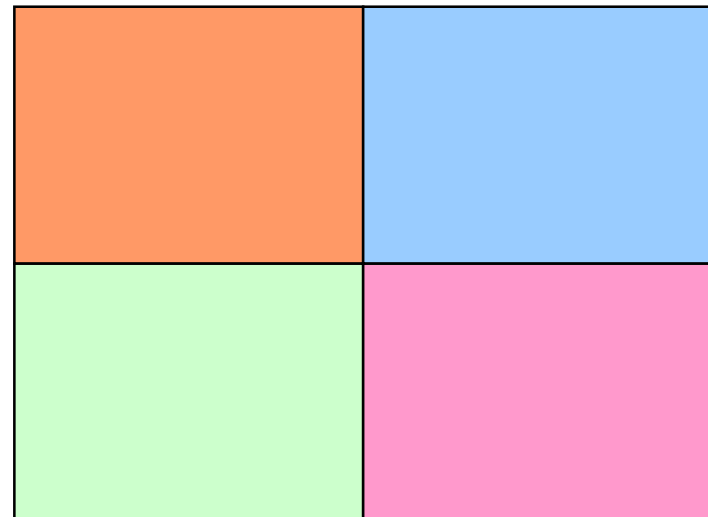
- Intensity (**brightness, lightness**)
- Shape e.g. box frame
- **Colour** and/or **shading**
- Underlining
- Blinking/animation
ideo 
- Character **size** and *font*
- Movement e.g. 'microns'
- Sound and/or synthesized speech

Boje...

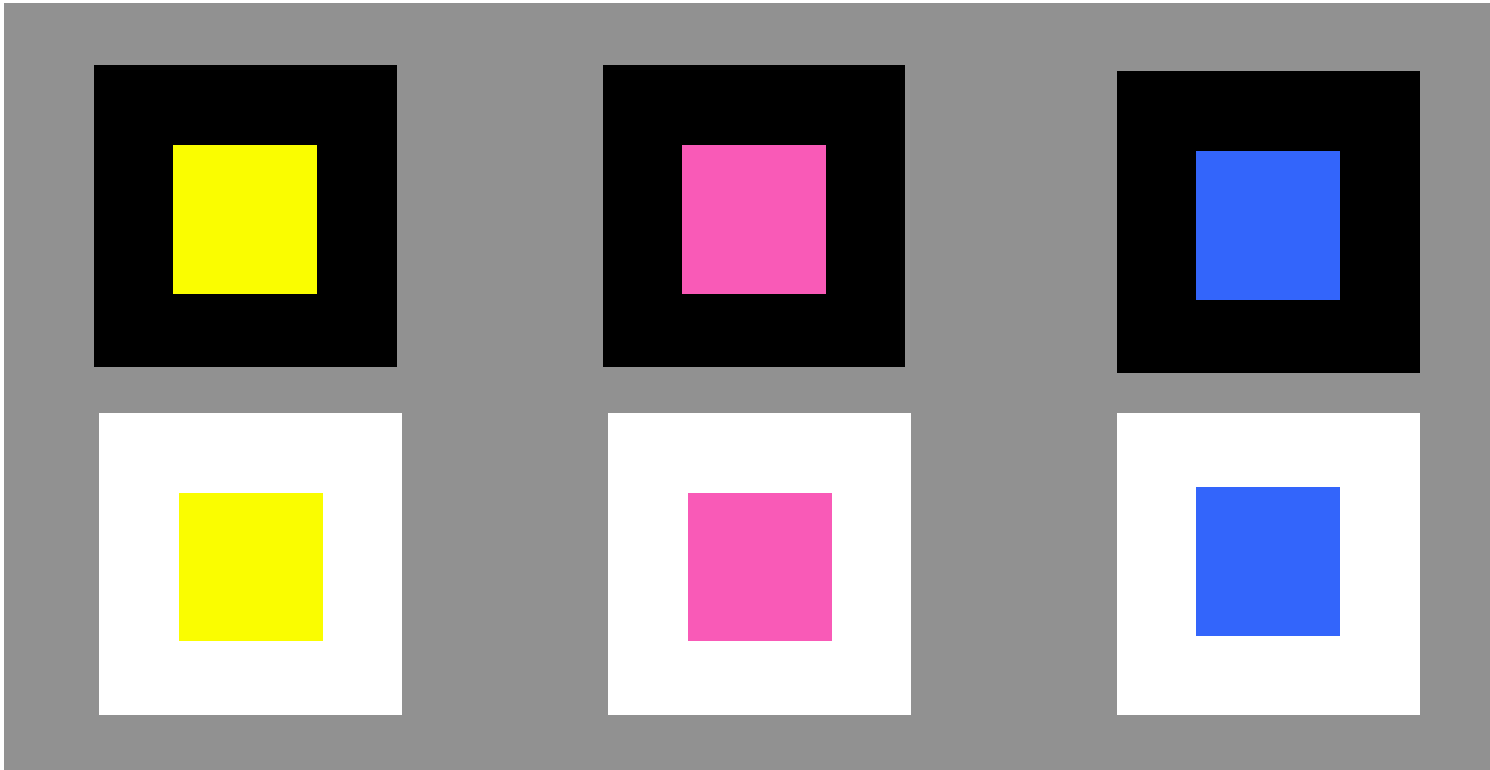


Jarke boje

Nežnije boje



Boje...



- Boje izgledaju tamnije i manje u odnosu na belu boju.
- Boje izgledaju svetlije i veće u odnosu na crnu pozadinu.

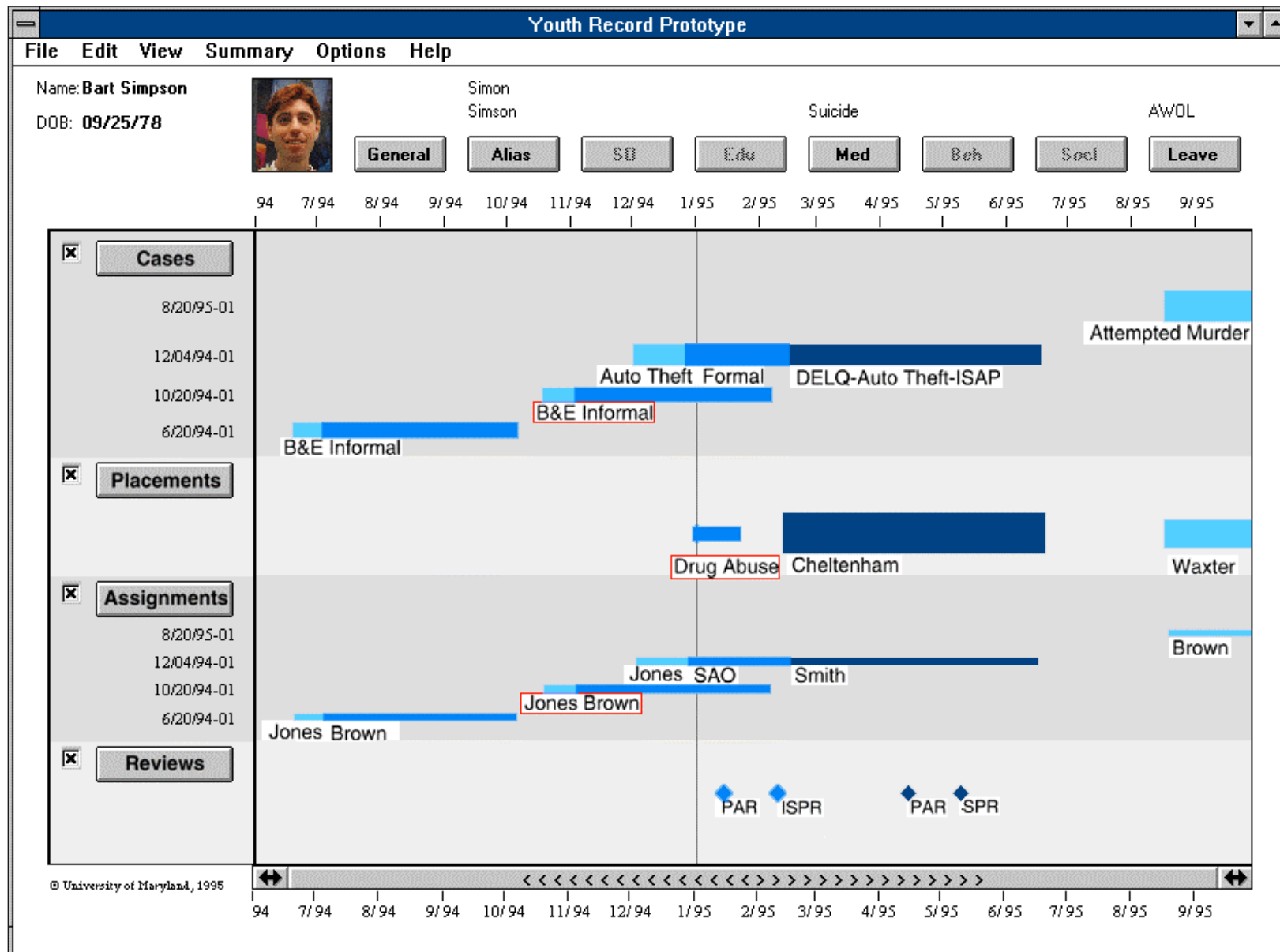
Boje...

Background Color	Suggestions for Foreground Colors
Black	White Yellow Pink Green Blue Cyan Gray Red
Blue	White Yellow Green Red Cyan Gray DarkRed Pink
DarkBlue	White Yellow Pink Green Cyan Red Gray
Brown	White Black DarkBlue Cyan Green Blue DarkRed
Cyan	Black Blue DarkBlue Brown DarkPink Pink Red
DarkCyan	White Black Yellow DarkBlue Blue Cyan Red DarkRed
Gray	Black Blue DarkBlue Pink DarkPink DarkRed Red
DarkGray	White Black Yellow Green Cyan Red DarkRed
Green	White Black Blue DarkBlue DarkPink Red DarkRed
DarkGreen	White Black Yellow Cyan DarkBlue Red DarkRed
Pink	White Black Yellow DarkBlue Cyan DarkRed Green
DarkPink	White Black Yellow Cyan Gray Green
Red	White Black DarkBlue Blue Green Cyan
DarkRed	White Yellow Blue Cyan Green Gray
White	Black Blue DarkBlue Red DarkRed Pink DarkPink
Yellow	Black Blue DarkBlue DarkGreen Red DarkRed


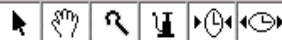










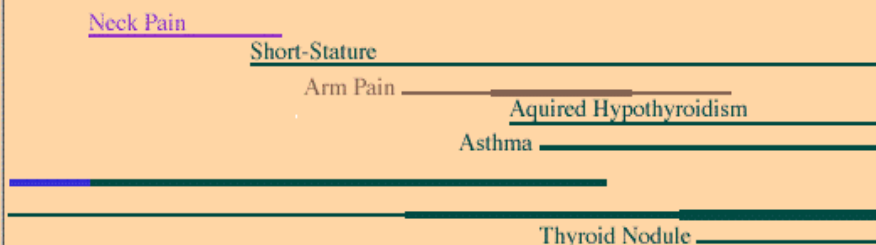





Kako izgleda ovaj radni ekran?

```
DWJMIC03  ISYS - INFORMATION SYSTEM FOR YOUTH SERVICES  10/27/94  15:04
INQCASE          CASE DETAIL INQUIRY                      WJUM03
-----
YOUTH NUMBER: 000123456          CASE NO: 09/14/93  - 01
NAME:FRST X00000          MID X000000          LST X0000          SUF
DOB: XX/XX/XX  VERIFIED (Y/N): N  RACE: X  SEX: X  COUNTY: 24
----- CASE -----
RECEIVED:          DATE 09/14/93  SOURCE POLC  REASON DELQ  OFFICE 71610
INTAKE DECISION: DATE 09/14/93  CODE  CCAI  AGENCY REF TO
INTAKE REASON:
APPEALED:  /  /  APPEAL DISP CODE:          APPEAL DISP DATE:  /  /
LEGAL COUNSEL:          JUDGE/MASTER:
COURT FINDING:          DISP DATE:  /  /  DISP CODE:
TERM/COND: WARN
TERMINATION:  FIXED  /  /  ACTUAL 09/19/93  LAST UPDT: 010/07/93  TEXT: N
CONSENT GIVEN (Y/N):  START DATE:  /  /  EXPDT DATE:  /  /  -----
ALLEGED OFFENSE: 01 DATE 09/14/93 CODE RNWY  CTY 16  POL CMLNT NO: 93045011
DESC/OFF RAN AWAY FROM MOM UPON RELEASE FROM CSC  ARREST DATE 09/14/93
LOCATION STREETS OF OXON HILL M.D.  ZIP 20745 0000  OTH INV (Y/N) Y
POLICE ID 1777          POLICE NAME NICODEMUS
ADJUDIC OFFENSE: 00 CODE          PETI          DISP CODE          DATE  /  /
-----
NEXT REQUEST: INQCASE  NEXT KEY:
DC900004  NO MORE DATA
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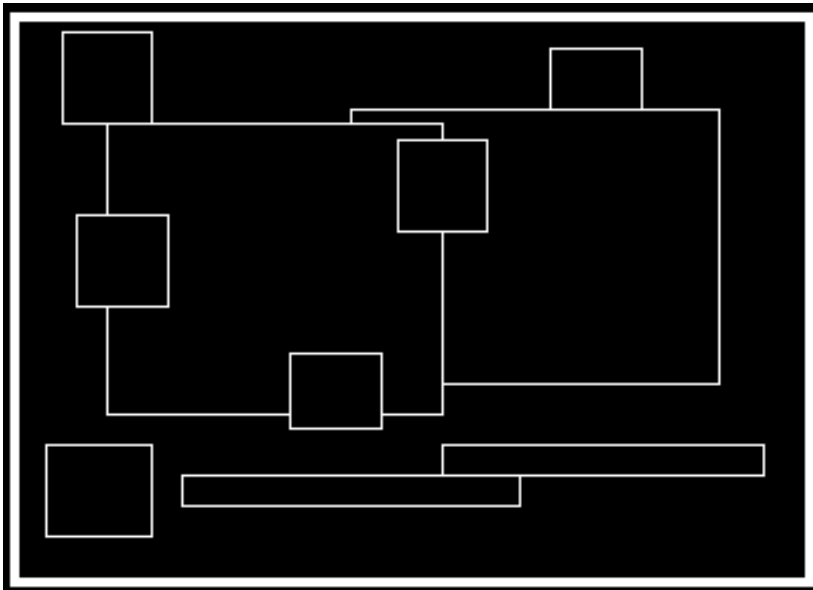

Kako izgleda ovaj radni ekran?



Kako izgleda ovaj radni ekran?

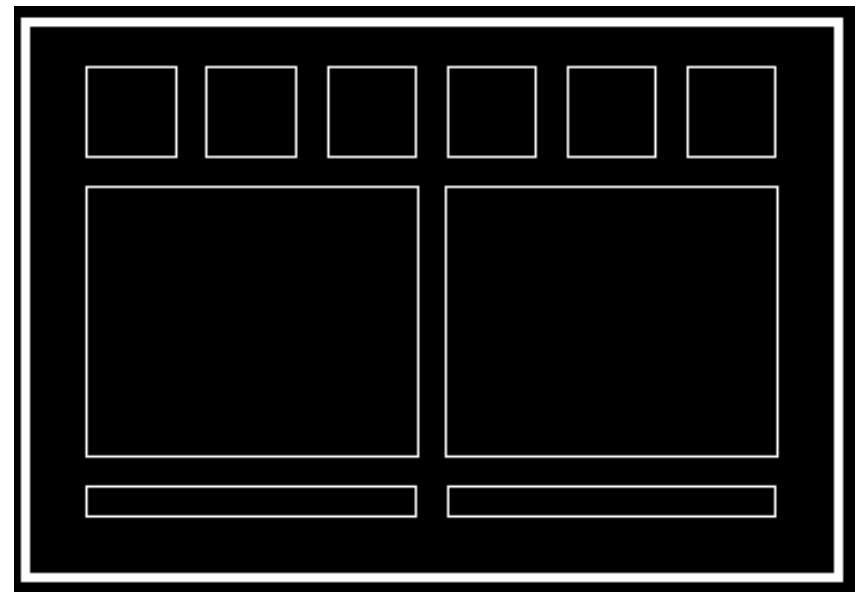
Medical Record Overview		2/07/94-Consultation with Dr. Samir Najjar at 15:58
Patient Name: Gold, Lea Date of Birth: 10-OCT-75 Sex: F Race: Q Insurance: Blue Cross Policy Number: 67-2323-34 	Alerts Allergies General Fam Hist Insurance Other Address: 34 Oak Street Melrose, NY 10101 Telephone Number: 8005551212 School: University of Maryland College Park, MD	Endocrine Clinic, Children's Memorial Hospital Diagnosis: Acute Lymphoid Leukemia Labs T4 10.7 ug/dL normal [5.5, 11.0] TSH 2.80 uU/mL FSH 3.5 IU/L LH 1.60 IU/L E2 68.0 pg/mL DS 139 ug/dL CA 8.8 MG/DL normal [8.4, 10.5] PHOS 4.2 MG/DL normal [2.7, 4.5] ALKP 106 U/L normal [30, 120] Clinical Measurements Diastolic BP 60 mmHg Heart Rate 80 Beats/Min Height 140 cm
	1/90 1/91 1/92 1/93 1/94 1/95	2/07/94-Letter by Dr. Najjar to Dr. Douglas Quinn  Douglas Quinn, MD RE: Lea Gold Dana-Farber Cancer Institute DOB: 10/10/75 44 Binney Street Boston, MA 02115 Dear Dr. Quinn: We had the pleasure of seeing Lea in the Endocrine Program on 2/7/94 for follow up post treatment of all. History: About a year ago she tripped in school and hit her back on the edge of a metallic table. Since then
▼ Consultations ▼ Endocrine Clinic <i>Dr. Samir Najjar</i> <i>Dr. Michael Millis</i> ▼ Internists <i>Dr. Horatio Wood</i> <i>Dr. Alan Leichtner</i>	   Lymphoid Leukemia  Lack Norm Phys Devel  Acute Lymphoid  Limb Deformities  Enter Endocrine clinic  Esophagitis	3/04/93-Consultation with Dr. Michael Millis at 10:56  Endocrine Clinic, Children's Memorial Hospital Diagnosis: Oth Acq Limb Deformities Observations Skin: Cold extremities, not mottled. HEENT: Alopecia, estropia OD, fundi normal Neck: Thyroid not enlarged. Heart: Normal. Chest: Tenderness over most of the upper ribs. Abdomen: Soft, no masses, no hepatosplenomegaly. Neurological: DTR 2+ Cranial, nerved II-XII: normal Clinical Measurements Height 139.4 cm
▼ Conditions Neck Pain Short-Stature Arm Pain Aquired Hypothyroidism Asthma Secondary Amenorrhea Lymphoblastic Leukemia Thyroid Nodule		
▼ Misc Documents ▶ Letters ▶ Orders	 To: Dr. Samir Najjar  To: Dr. Strangelove  To: Dr. Quinn	
▼ Hospitalizations ▼ Children's Memorial Hosp. <i>Orthopedic Clinic</i> <i>Endocrinology Clinic</i> ▶ Boston General Hosp.		
▼ Medications Acetaminophen Prednisone Doxycycline	Acetaminophen — 50 mg TID Doxycycline — 100 mg BID Acetaminophen — 100 mg TID Prednisone — 50 mg QID — 75 mg	
Date Span:		

Kako treba da izgleda struktura korisničkog interfejsa?

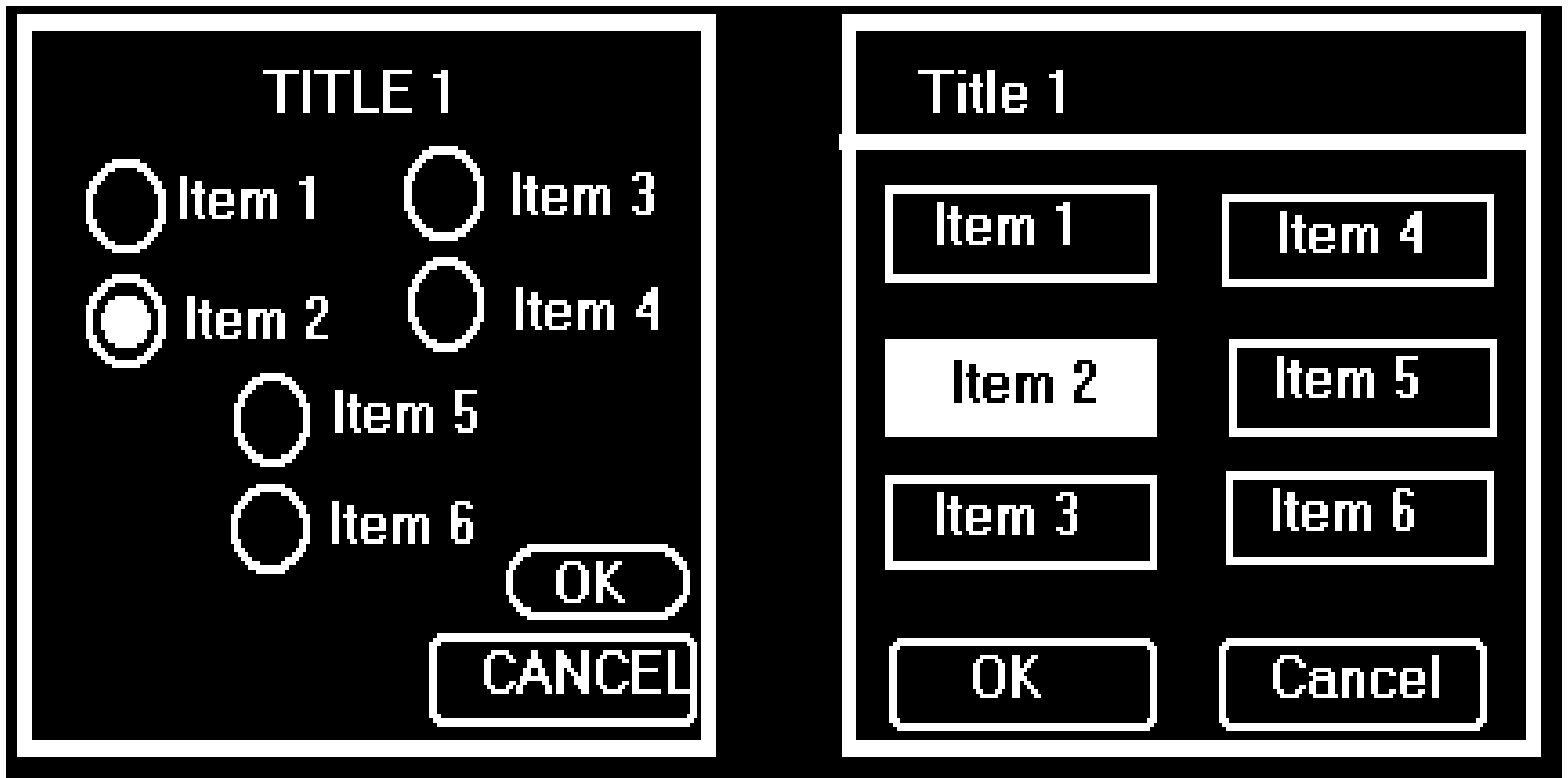


Ovako?

Ili ovako?



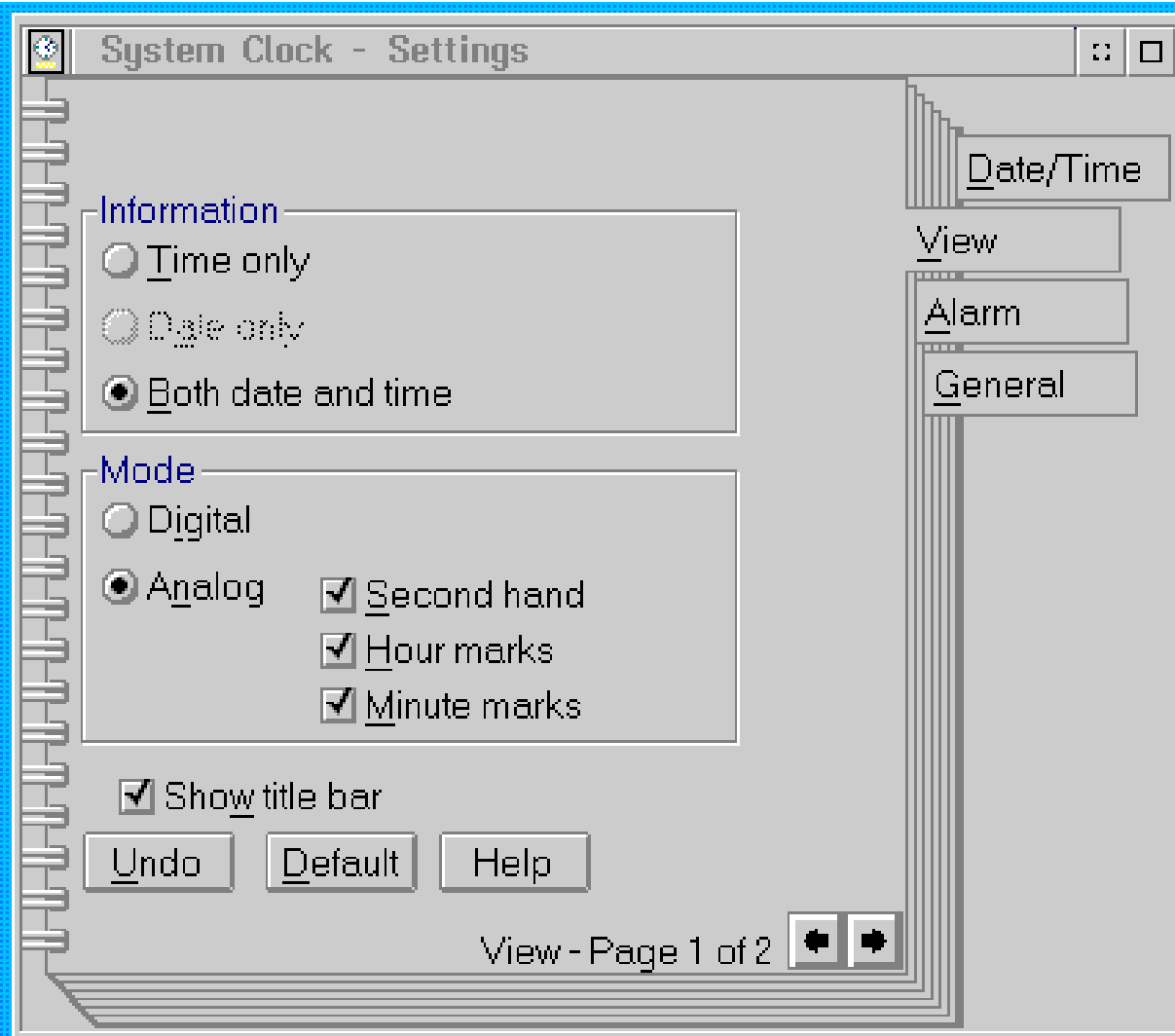
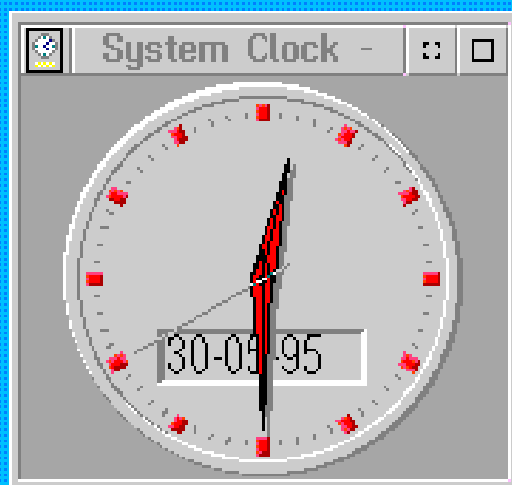
Struktura korisničkog interfejsa?



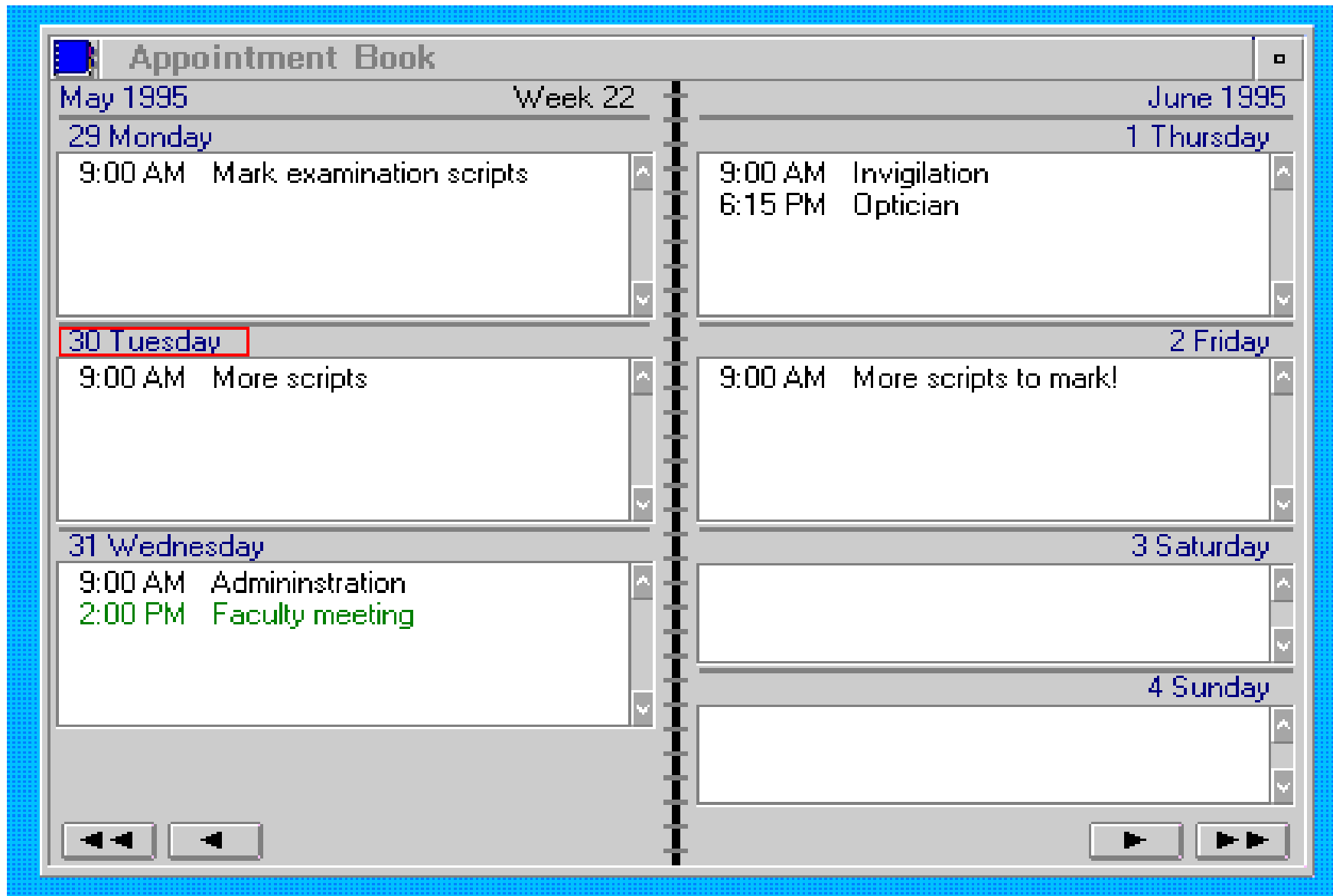
“Dobra” slika sistema - interfejsa

- **Sistem treba da bude “blizak” korisniku:**
 - Prikazuje način kako “razmišlja”
 - Koristi konkretne stvari i ne zahteva mnogo razmišljanja
 - Omogućava dvosmerne informacije
- **Podržava i omogućava lagano učenje**
- **Uklanja tehničke podatke o modelu sistema koje korisnik ne mora da zna**
- **Reflektuje tekući status – promene moraju da se verifikuju**
- **Podrška je uvek aktivna**
- **Smanjuje potrebe za obukom ili treningom**

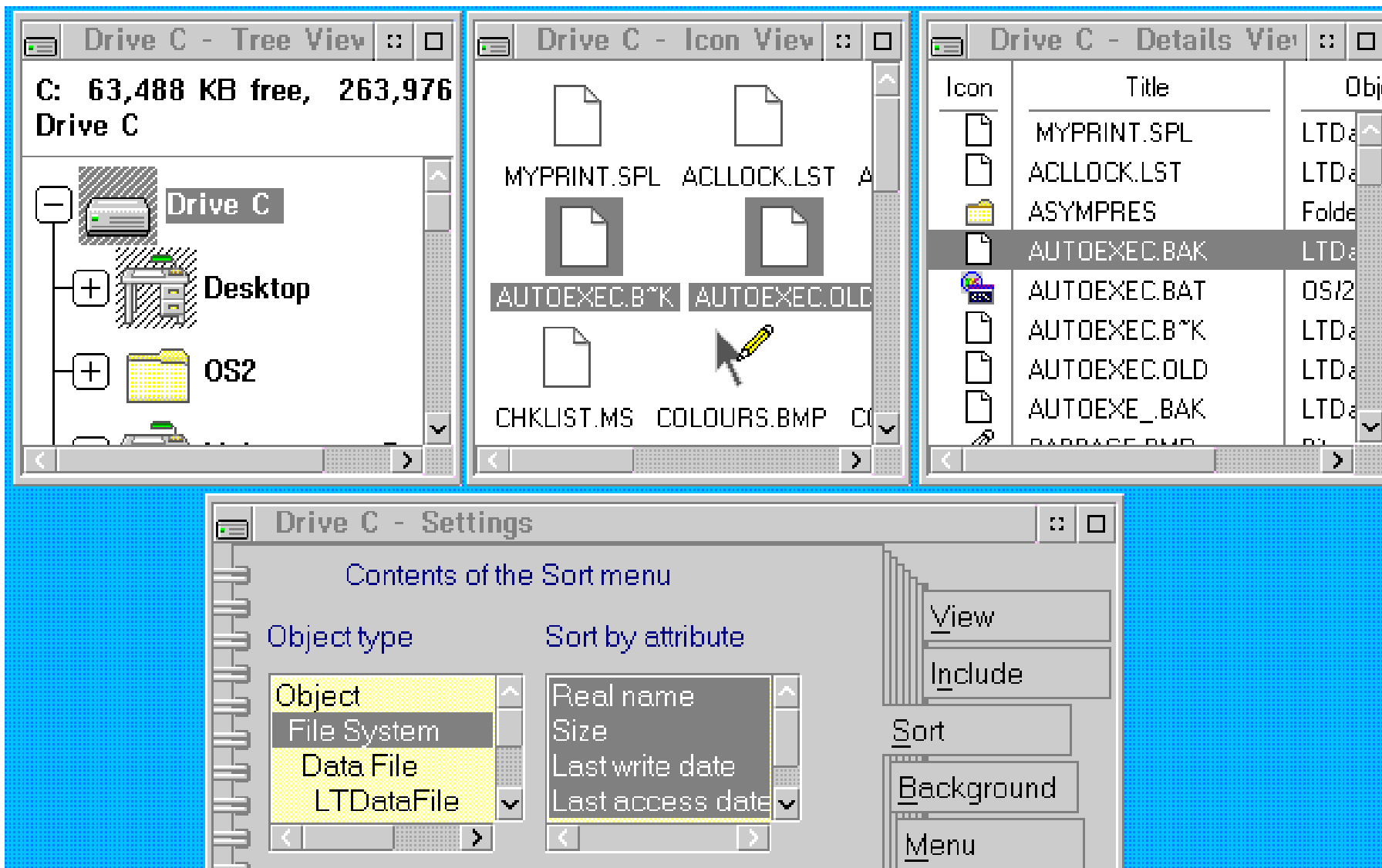
Podešavanje sata !?



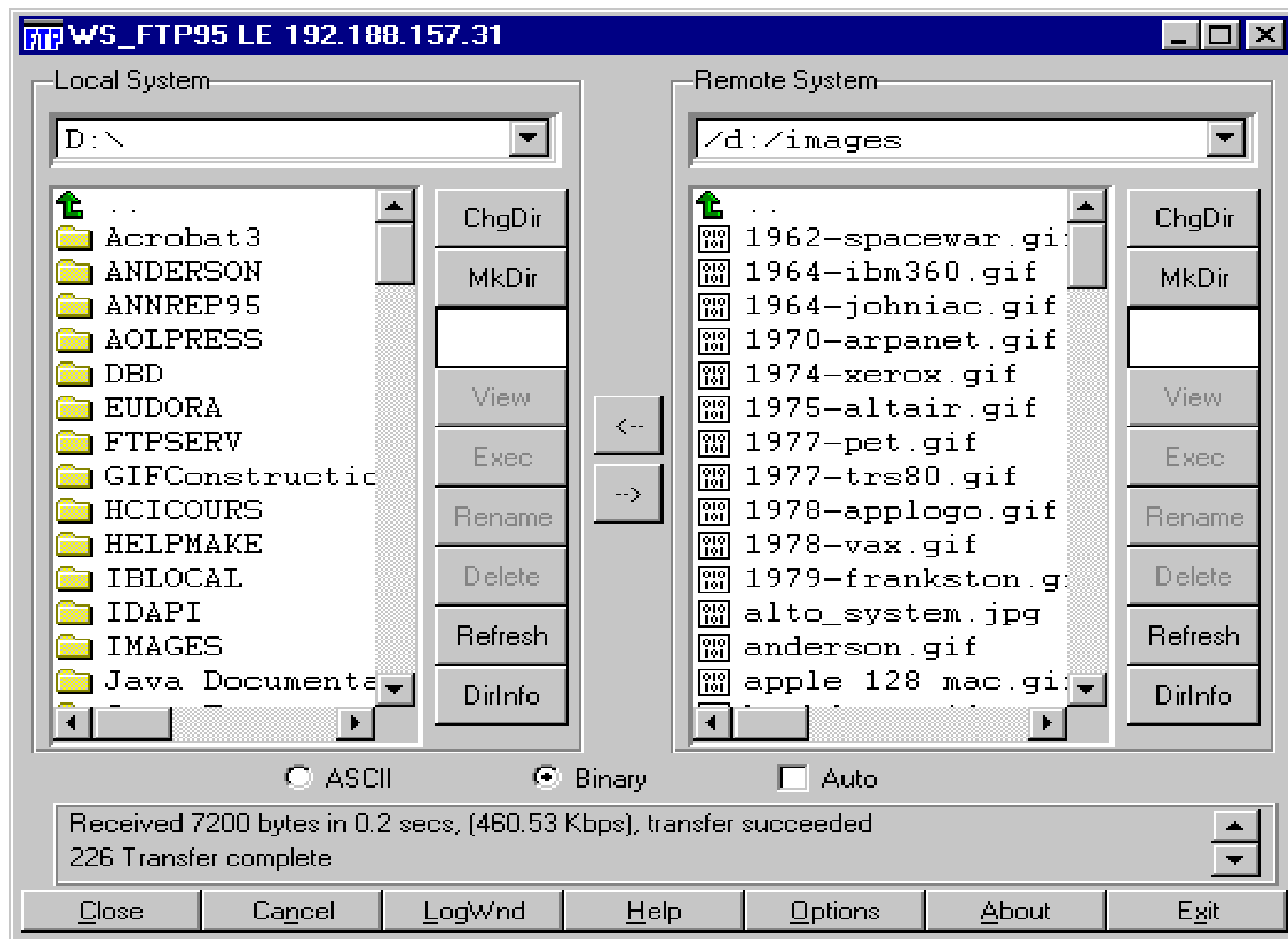
Rokovnik!?



Sadržaj diska i njegovo podešavanje!?



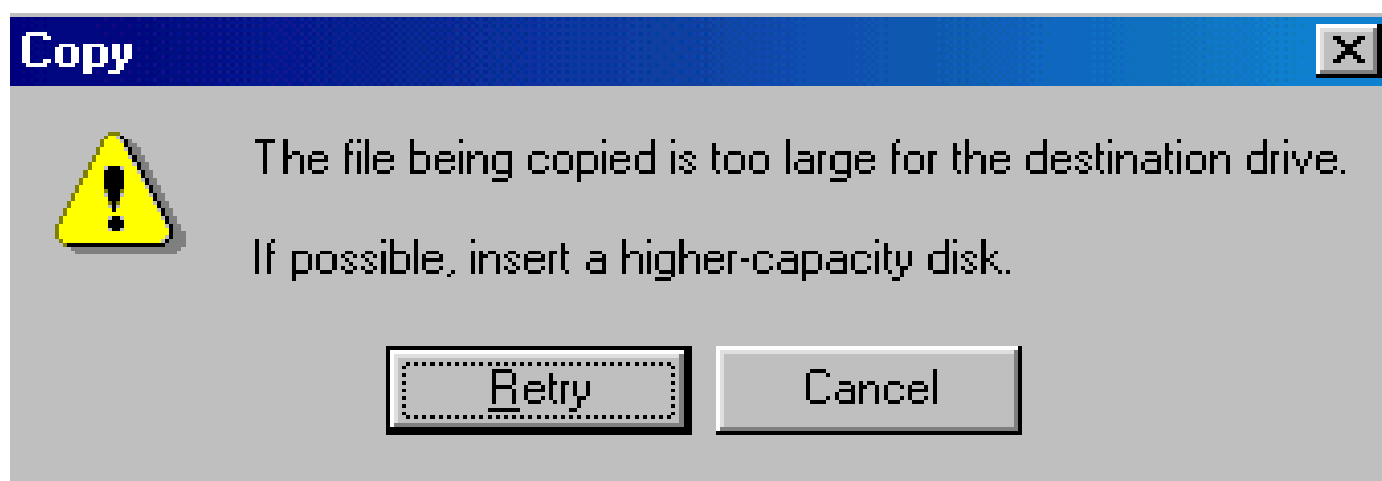
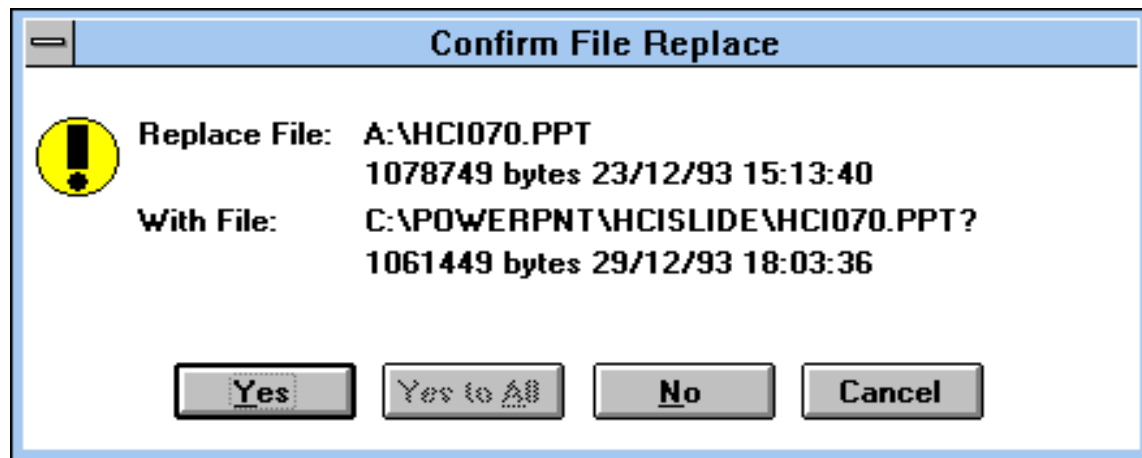
Sadržaj particije diska!?



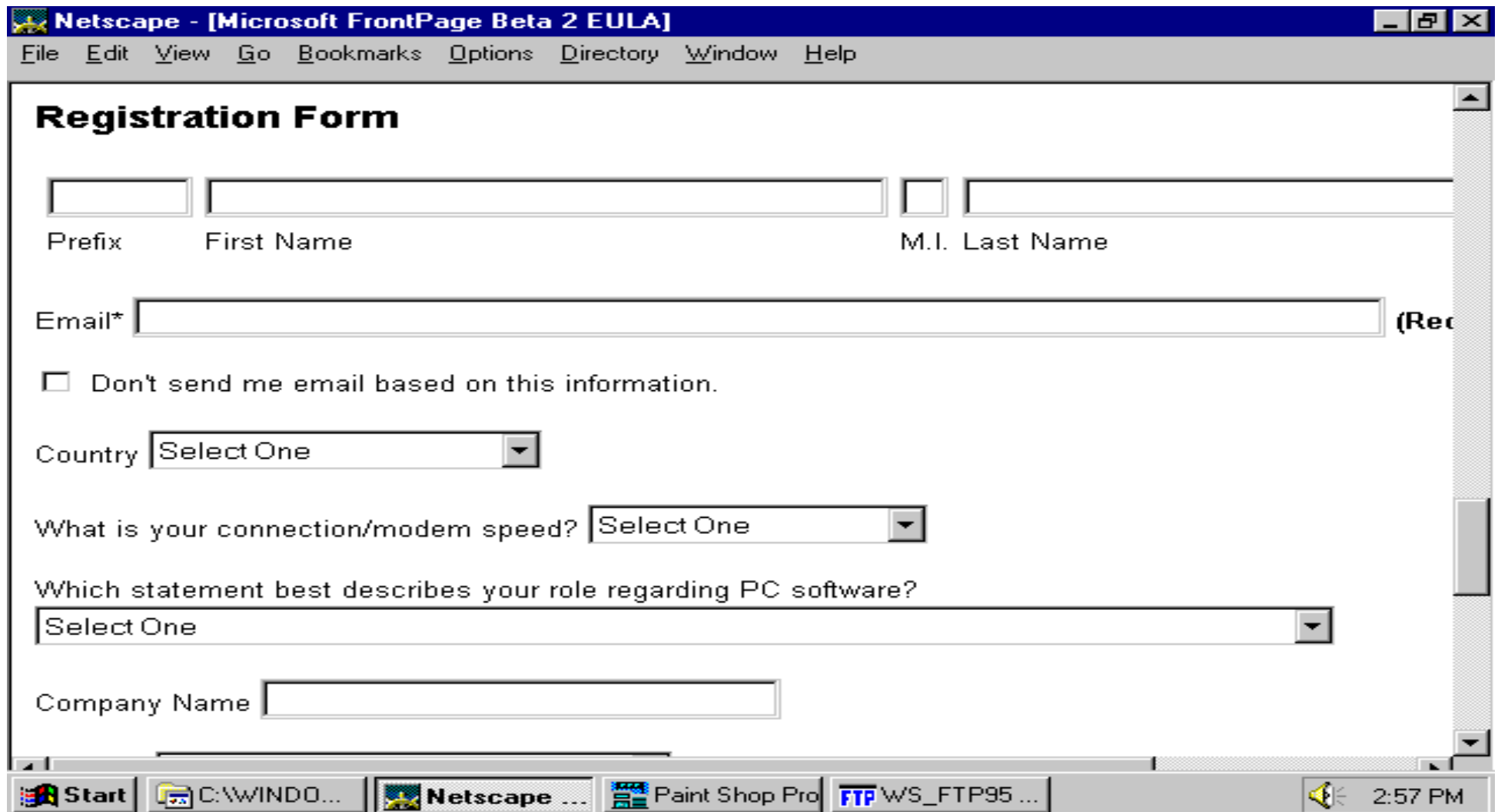
Šta je sa porukama o greškama?

- Kako bi se korisnik osećao kada bi naišao na ovakav komentar prilikom korišćenja računara?
 - Fatal compiler error!! [Sledi jezivi zvuk SIRENE!!!!!!!]
 - You did something bad. Restart your computer.
 - You pressed the wrong button, stupid!
 - Syntax error. Error number 435760.
 - Out of RAM. Try again.

Poruke koja traži odgovor od korisnika i on odgovor daje aktiviranjem odgovarajućeg tastera



Forme – primer 1



The image shows a Netscape browser window with the title bar "Netscape - [Microsoft FrontPage Beta 2 EULA]". The menu bar includes "File", "Edit", "View", "Go", "Bookmarks", "Options", "Directory", "Window", and "Help". The main content area is titled "Registration Form" and contains the following fields and controls:

- Prefix:
- First Name:
- M.I.:
- Last Name:
- Email*: (Required)
- Don't send me email based on this information.
- Country:
- What is your connection/modem speed?:
- Which statement best describes your role regarding PC software?:
- Company Name:

The Windows taskbar at the bottom shows the Start button, several open applications (C:\WINDO..., Netscape ..., Paint Shop Pro, FTP WS_FTP95 ...), and the system clock showing 2:57 PM.

Forme – primer 2

Congregation

Title	Christian Name	Initials	Surname	Listing No.	Household No:	Year joined:
Mr	Bugs	B	Bunny	1	33	

Address: The Hole
Near Hollywood, CA

District No.: 3

FWD: 51
Contributor:
Covenanted:
Anon:

Phone No.: (0232
Sex: M
Marital Status: Single
DOB:

Communicant:
Voter:

Session:
Committee:
Visitor (Focus):
Bus driver:

Senior citizen:
Core list:
Date Widowed:

Tuesday circle:
OPH/Nursing Home:

Sunday school:
C E:
B B:
G B:
Scouts:
Youth group:

Choir:
Worship group:
Music group:
P W A:
A C E:
House group:

Prebyterian Herald:
Christian Irishman:
Annual report:

Tennis:
Bowls:
Badminton:

Record: 51

Forme – primer 3

Asgard TicketBase [Window Title Bar]

File Edit Record Modules Help [Menu Bar]

Navigation icons: Home, Back, Forward, Stop, Search, Print, Refresh, Home, Help

Patrons Performers Contacts All [Tabs]

Household: [Text Field]

Select individual: [Dropdown]

Title: First Name: Initials: [Text Fields]

Last Name: Quick Sale [Text Field]

Position: [Text Field]

Salutation: [Text Field]

Select address: [Dropdown]

Address 1: [Text Field]

[Town:] [Text Field]

City/Country: [Text Field]

Postcode: [Text Field] Country: [Text Field]

Select Telephone/Fax: [Dropdown]

Area Code: [Text Field]

Tel No: [Text Field]

Ext: [Text Field]

Cordial Mailing list? Selected? [Checkboxes]

Unique ID: -1 [Text Field]

Field 1 [Dropdown] Field 5 [Dropdown] Field 11 [Text Field]

Field 2 [Dropdown] Field 6 [Dropdown] 00/00/00 [Text Field]

Field 3 [Dropdown] Field 7 [Dropdown] Field 9 [Text Field]

Field 4 [Dropdown] Field 8 [Dropdown] Field 10 [Text Field]

Classifications Notes Tickets Bookings Reminders [Tabs]

Ready [Status Bar] SOS 01/01/00 - SV - 01/01/00 [Text]

Nestandardni meniji

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FAQ Index

Products

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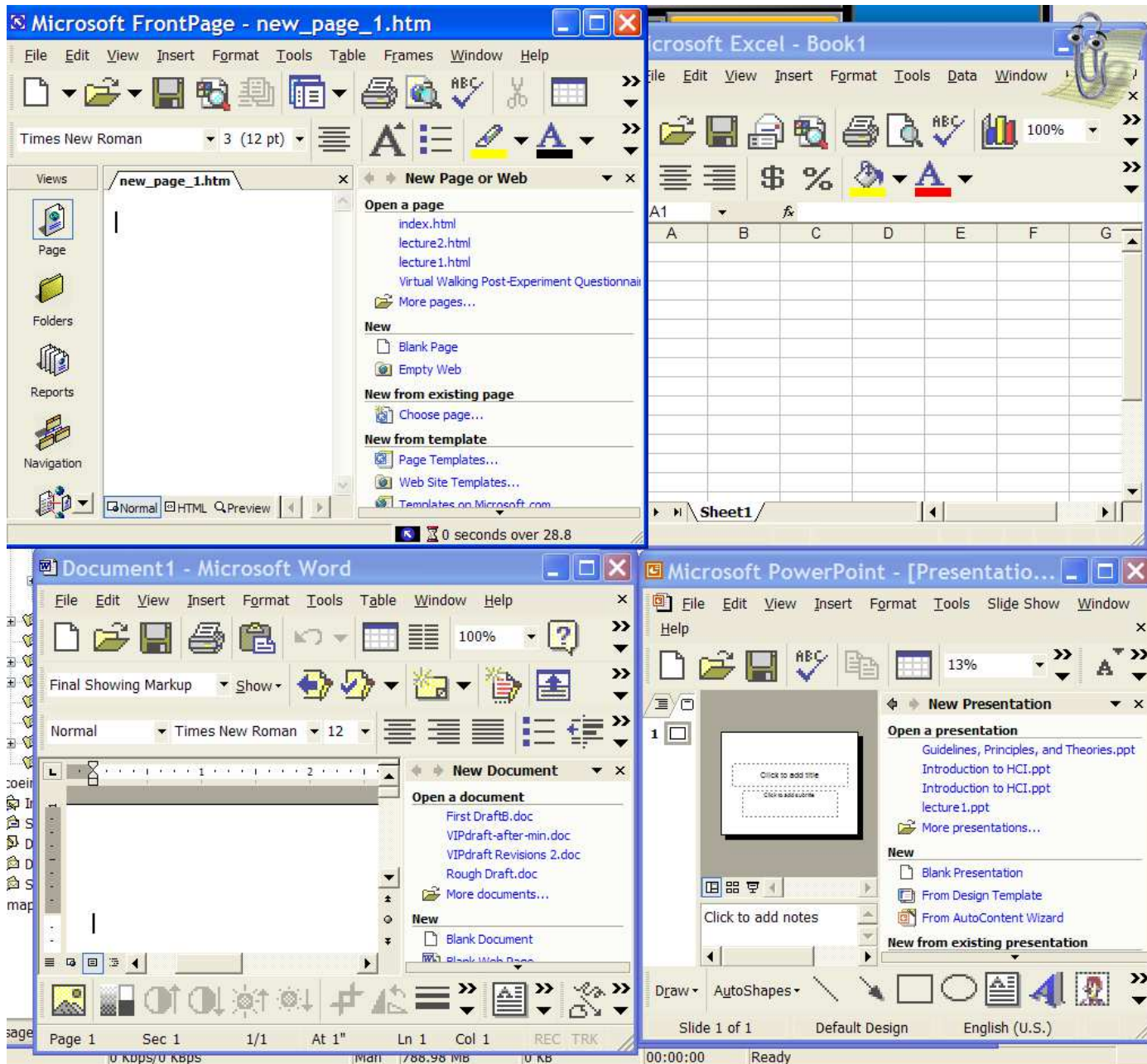
Books

APIs

JavaWorld



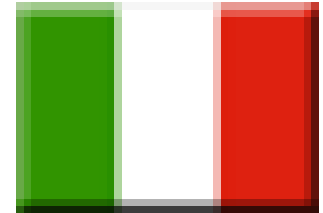
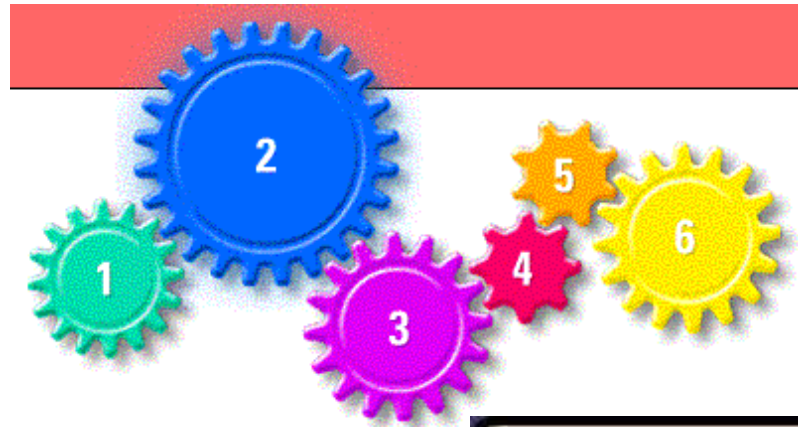
Microsoft aplikacije



Primeri za Web



Primeri za Web (2)



Roll over an area for more information

Understand	The focus of this stage is concept generation. The team conceives future directions through brainstorming, storyboards, drawings, and models.
Observe	
Visualize	
Evaluate and Refine	
Implement	

Understand Visualize

Observe

Evaluate/Refine

Implement

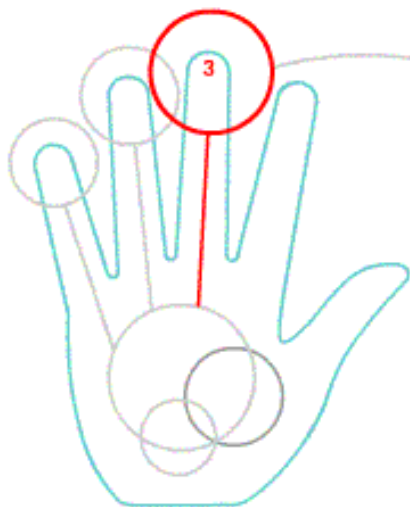
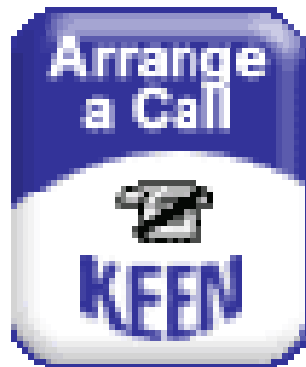


DAHILIA SCHWEITZER

Project Manager

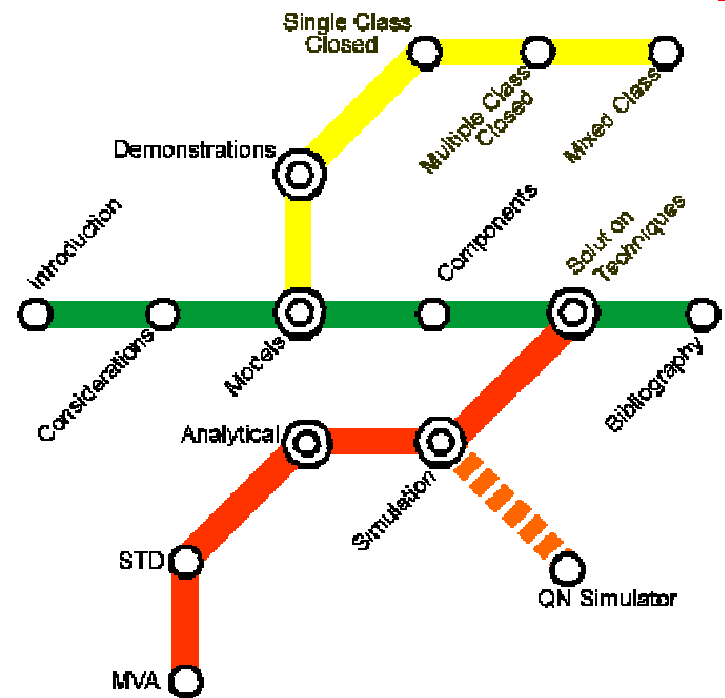
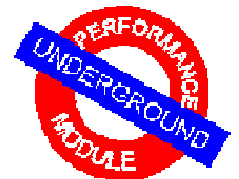
After graduating from Wesleyan University, Dahlia Schweitzer moved to Manhattan to immerse herself in the world of computer art. She worked as the Associate Curator of Digital Media at the Museum of the Moving Image and as Account Manager for the L'Oreal website before finding her way to Templar. In her spare time, she plays bass guitar and sings in Galvanized, a local punk band—having taught herself the instrument without the help of any boys—and edits Ruckerzine, an online magazine targeted at female musicians, and tries to stay out of trouble.

Primeri za Web (3)



Future concepts are generated through creative brainstorming sessions, scenario generation exercises, sketching and models. The best ideas are developed and optimized using input from you, your customers and the creative power of a design leader.

Navigating the Performance Module



- Introduction
- Solution Techniques
- Demonstrations
- Future Work
- Transfer Station

GUI Istorija

- 1973 Pioneered at the Xerox Palo Alto Research Center.
-First to pull together all the elements of the modern GUI.
- 1981 First commercial marketing as the Xerox STAR.
-Widely introduced pointing, selection, and mouse.
- 1983 Apple introduces the Lisa.
-Features pull-down menus and menu bars.
- 1984A pple introduces the Macintosh.
-Macintosh is the first successful mass-marketed system.
- 1985 Microsoft Windows 1.0 released.
Commodore introduces the Amiga 1000.
- 1987X Window System becomes widely available.
IBM's System Application Architecture released.
-Including Common User Access (CUA).
IBM's Presentation Manager released.
-Intended as graphics operating system replacement for DOS.
Apple introduces the Macintosh II.
- The first color Macintosh.

GUI Istorija

- 1988 NeXT's NeXTStep released.
 - First to simulate three-dimensional screen.
- 1989 UNIX-based GUIs released.
 - Open Look by AT&T and Sun Microsystems.
 - Innovative appearance to avoid legal challenges.
 - Motif, for the Open Software Foundation by DEC and Hewlett-Packard.
 - Appearance and behavior based on Presentation Manager.
- Microsoft Windows 3.0 released.
- 1992 OS/2 Workplace Shell released.
Microsoft Windows 3.1 released.
- 1993 Microsoft Windows NT released.
- 1995 Microsoft Windows 95 released.
- 1996 IBM releases OS/2 Warp 4.
Microsoft introduces NT 4.0.
- 1997 Apple releases the Mac OS 8.
- 1998 Microsoft introduces Windows 98.
- 1999 Apple releases Mac OS X Server.
 - A UNIX-based OS.
- 2000 Microsoft Windows 2000 released.
Microsoft Windows ME released
- 2001 Microsoft Windows XP released