

## Inženjerstvo upotrebljivosti



... iterativni proces za unapređenje upotrebljivosti sistema tokom njegovog razvoja.

*When the cook tastes the soup, that's formative assessment.  
When the guests taste the soup, that's summative assessment.*

**Robert E. Stake (PhD in Psychometrics), 1976**

## Usability - mera dobrog interfejsa



**USABILITY** (Part 11 of the **ISO 9241**, 1998) "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."  
"u kojoj meri se proizvod može koristiti od strane određenog korisnika da postigne specifične ciljeve u datom kontekstu upotrebe sa maksimalnom efektivnošću, efikasnošću i zadovoljstvom."

**EFFECTIVENESS** "is the accuracy and completeness with which specified users can achieve specified goals in particular environments."  
"je tačnost i potpunost sa kojima korisnici mogu da ostvare specifične ciljeve u određenom okruženju."

**EFFICIENCY** "the resources expended in relation to the accuracy and completeness of the goals achieved."  
"resursi za dostizanje ciljeva sa datom tačnošću i potpunosti."

**SATISFACTION** "the comfort and acceptability of the work system to its users and other people affected by its use."  
"komfor i prihvatljivost sistema u pogonu koje imaju njegovi korisnici i ostali na koje utiče rad tog sistema."

## Usability kao atribut prihvatljivosti sistema

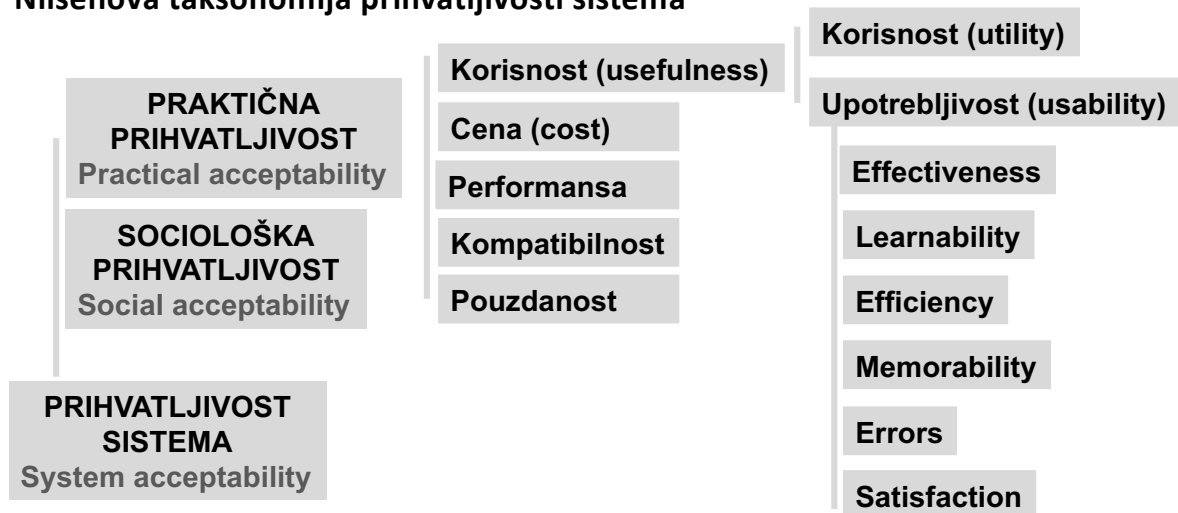
**NN/g** Nielsen **Norman** Group

Evidence-Based User Experience Research, Training, and Consulting

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2022/2023

## Nilsenova taksonomija prihvatljivosti sistema



## Kada se ne misli o nazivu proizvoda



Chevrolet Nova, 1962

Za Špansko govorno područje kao  
Chevrolet Shevy

No va -> ne ide



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## Metode za evaluaciju upotrebljivosti

Exploratory		Diary study, SW logging, Observational Study
Predictive	KLM-GOMS	
Formative	Heuristic Evaluation, Guideline Checking, Cognitive Walkthrough	Thinking aloud
Summative	Guideline Scoring	Questionnaires, Formal Experiment, A/B Testing
	Inspection <small>sprovode specijalisti/eksperti</small>	Testing <small>obavezno uključeni korisnici</small>

## KLM ...

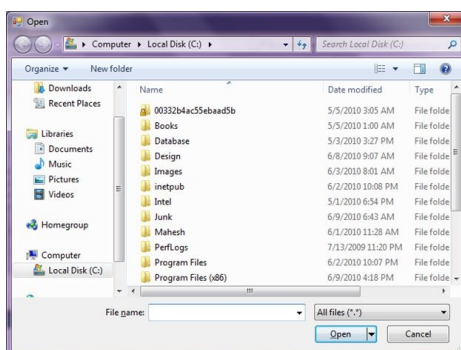
- prediktivne teorije/modeli kao kvantitativni ukazatelj na bolje rešenje!
- na nivou motorike – **Ke**ystroke **L**evel **M**odeling  
Card, Moran, & Newell, "The keystroke-level model for user performance time with interactive systems" July 1980.
- sračunava vreme potrebno za interakciju kao sumu elementarnih akcija koje je potrebno načiniti,
- pomoću narednih 5 operatora :
  - **K**eying - 0,12s dobar (90 r/m); 0,28 srednji (40 r/m) ili 1,20 početnik,
  - **B**utton press - 0,10s (tj. 0,20s),
  - **P**ointing – prosečno 1,10s, za tačno Fitts's law,
  - **H**oming - 0,36s,
  - **M**ental preparation- 1,35s (odnosno 1,2s da bi za repeated pao na 0,95s),
  - **R**esponding – vreme čekanja korisnika na reakciju sistema za neki unos,
- starosni multiplikatori ( 40–55 sa 1.4, 55–60 sa 1.7 i 65+ sa 2.2).

... KLM ...

- operator R (> 0,1s zahteva feedback, 0,25s korisnik će ponoviti unos, >1s?),
- operator M izazovan za umetanje, pravila:
  1. Postavi M pre svakog K i svakog P (samo za pointiranje na komandu, ali ne i njene parametre),
  2. Izbriši M ako je anticipirano u prethodnom operatoru (PMK → PK),
  3. Izbriši M unutar kognitivne jedinice ( "Dragan↵" → MKKKKKK MK),
  4. Izbriši M pre uzastopnih terminatora ( "Dr↵ ↵" → MKK MK K),
  5. Izbriši M koji je terminira komandu ( "del↵" → MKK K),
  6. Izbriši preklapajuće M (R MK → R K),

... KLM ...

**PRIMER:** Otvoriti fajl pomoću aktivnog Open dijaloga, tekst kursor u polju za unos naziva fajla. **Koliko traje (kada su ruke na tastaturi, odnosno na mišu) zavisno od dužine naziva fajla?**



tastatura

$$M+n*K+K=1,2+n*0,28+0,28=1,48+n*0,28s$$

miš i OpenBtn

$$M+P+2*B+M+P+2*B=2(1,2+1,1+0,2)=5s$$

Dvoklik mišem

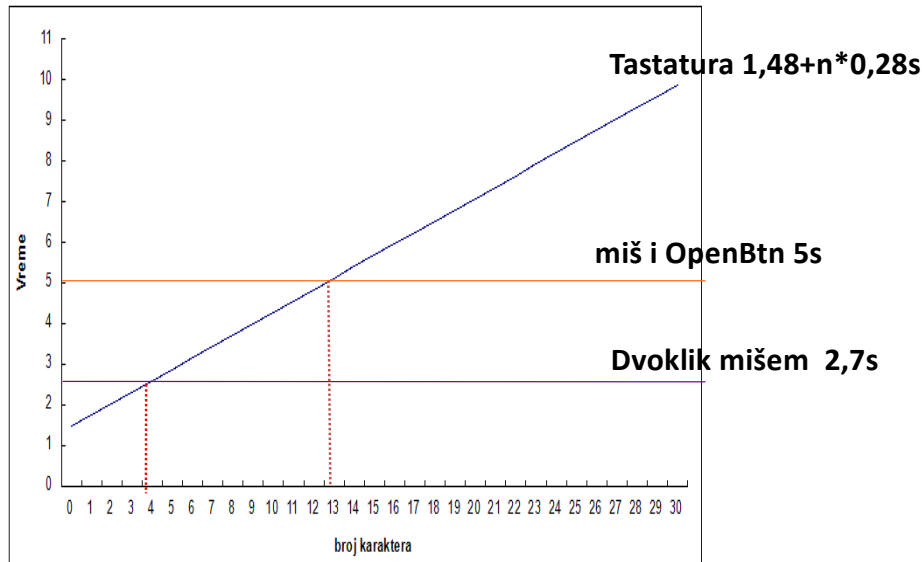
$$M+P+2*B+2*B=1,2+1,1+0,2+0,2=2,7s$$

Naziv tastaturom i klik na OpenBtn? ....

Potreban skrol na naziv fajla?

... KLM

Predikcija efikasnosti otvaranja fajla zavisno od dužine naziva.



GOMS ...

- prediktivna/eksplanatorna teorija iz 1983. od Stuart Card, Thomas Moran i Allen Newell (CMN-GOMS)

**G**oals – korisnikov cilj, šta namerava da obavi, ali i podcilj,

**O**perators – akcije koje se sprovode do (pod)cilja, mogu biti izražene na:  
 konceptualnom nivou – mentalni model i slike,  
 semantičkom nivou – nivo komandi (uneti PIN, ukucati PIN ili ...),  
 sintaksnom nivou – kada se prepozna struktura komande  
 (imenica-glagol, glagol-imenica, objekt-op...)  
 leksičkom nivou – nivo samog uređaja i korisnika, GOMS-KLM.

**M**ethods – sekvenca operacija koje treba obaviti do cilja, moguće da postoji više metoda koje vode istom cilju (kako zatvoriti prozor),

**S**election\_rules – (ako je potrebno) definišu koju metodu koristiti da se u datom slučaju stigne do (pod)cilja,

## ... GOMS ...

## KLM-GOMS primer za brisanje nekog fajla,

## GOAL: DELETE-FILE

- . GOAL: SELECT-FILE
- . . [select#: GOAL: KEYBOARD-TAB-METHOD
- . . GOAL: MOUSE-METHOD]
- . . VERIFY-SELECTION
- . GOAL: ISSUE-DELETE-COMMAND
- . . [select\*: GOAL: KEYBOARD-DELETE-METHOD
- . . PRESS-DELETE
- . . GOAL: CONFIRM-DELETE
- . . GOAL: DROP-DOWN-MENU-METHOD
- . . MOVE-MOUSE-OVER-FILE-ICON
- . . CLICK-RIGHT-MOUSE-BUTTON
- . . LOCATE-DELETE-COMMAND
- . . MOVE-MOUSE-TO-DELETE-COMMAND
- . . CLICK-LEFT-MOUSE-BUTTON
- . . GOAL: CONFIRM-DELETE
- . . GOAL: DRAG-AND-DROP-METHOD

#Selection rule for GOAL:  
SELECT-FILE

If hands are on keyboard,  
use KEYBOARD-TAB-METHOD,  
else use MOUSE-METHOD

\*Selection rule for GOAL:  
ISSUE-DELETE-COMMAND

If hands are on keyboard,  
use KEYBOARD-DELETE-METHOD,  
else if Recycle bin is  
visible,  
use DRAG-AND-DROP-METHOD,  
else use DROP-DOWN-MENU-  
METHOD.

## ... GOMS ...

- . . GOAL: DRAG-AND-DROP-METHOD
- . . MOVE-MOUSE-OVER-FILE-ICON
- . . PRESS-LEFT-MOUSE-BUTTON
- . . LOCATE-RECYCLING-BIN
- . . MOVE-MOUSE-TO-RECYCLING-BIN
- . . RELEASE-LEFT-MOUSE-BUTTON]

$$\text{KLM}_{\text{DRAG-AND-DROP-METHOD}} = \text{M} + \text{P} + \text{B} + \text{M} + \text{P} + \text{B} = 1,35 + 1,1 + 0,1 + 1,35 + 1,1 + 0,1 = 5,1 \text{ s}$$

$$\begin{aligned} \text{KLM}_{\text{DROP-DOWN-MENU-METHOD}} &= \text{M} + \text{P} + \text{B} + \text{B} + \text{M} + \text{P} + \text{B} + \text{B} + \text{M} + \text{P} + \text{B} + \text{B} = \\ &= 1,35 + 1,1 + 0,2 + 1,35 + 1,1 + 0,2 + 1,35 + 1,1 + 0,2 = \\ &= 7,95 \text{ s (6,6s)} \end{aligned}$$

$$\text{KLM}_{\text{KEYBOARD-DELETE-METHOD}} = \text{M} + \text{K} + \text{M} + \text{K} = 1,35 + 0,2 + 1,35 + 0,2 = 3,1 \text{ s}$$

Rbr	GOMS opis	KLM op	Vreme op	Vreme 1	Vreme 2	Vreme 3
0	GOAL: DELETE-FILE					
1	GOAL: SELECT-FILE					
1.1	GOAL: KEYBOARD-TAB-METHOD		3,5	3,5		
1.2	GOAL: MOUSE-METHOD		4,8		4,8	
1	VERIFY-SELECTION	M	1,35			
	<b>Ukupno 1</b>			<b>4,85</b>	<b>6,15</b>	
2	GOAL: ISSUE-DELETE-COMMAND					
2.1	GOAL: KEYBOARD-DELETE-METHOD PRESS-DELETE	M+K	1,55	3,1		
	GOAL: CONFIRM-DELETE	M+K	1,55			
2.2	GOAL: DROP-DOWN-MENU-METHOD MOVE-MOUSE-OVER-FILE-ICON CLICK-RIGHT-MOUSE-BUTTON LOCATE-DELETE-COMMAND MOVE-MOUSE-TO-DELETE-COMMAND CLICK-LEFT-MOUSE-BUTTON GOAL: CONFIRM-DELETE	M+P B M P B+B MP2B	2,45 0,1 1,35 1,1 0,2 2,65		7,95	
2.3	GOAL: DRAG-AND-DROP-METHOD MOVE-MOUSE-OVER-FILE-ICON PRESS-LEFT-MOUSE-BUTTON LOCATE-RECYCLING-BIN MOVE-MOUSE-TO-RECYCLING-BIN RELEASE-LEFT-MOUSE-BUTTON	M+P B M P B	2,45 0,1 1,35 1,1 0,1			5,1
	<b>Ukupno sa 1.1</b>			<b>7,95</b>	<b>12,8</b>	<b>9,95</b>
	<b>Ukupno sa 1.2</b>			<b>9,25</b>	<b>14,1</b>	<b>11,25</b>

## Evaluacija po heuristikama ...

### EVALUACIJA PO HEURISTIKAMA (usability inspection)

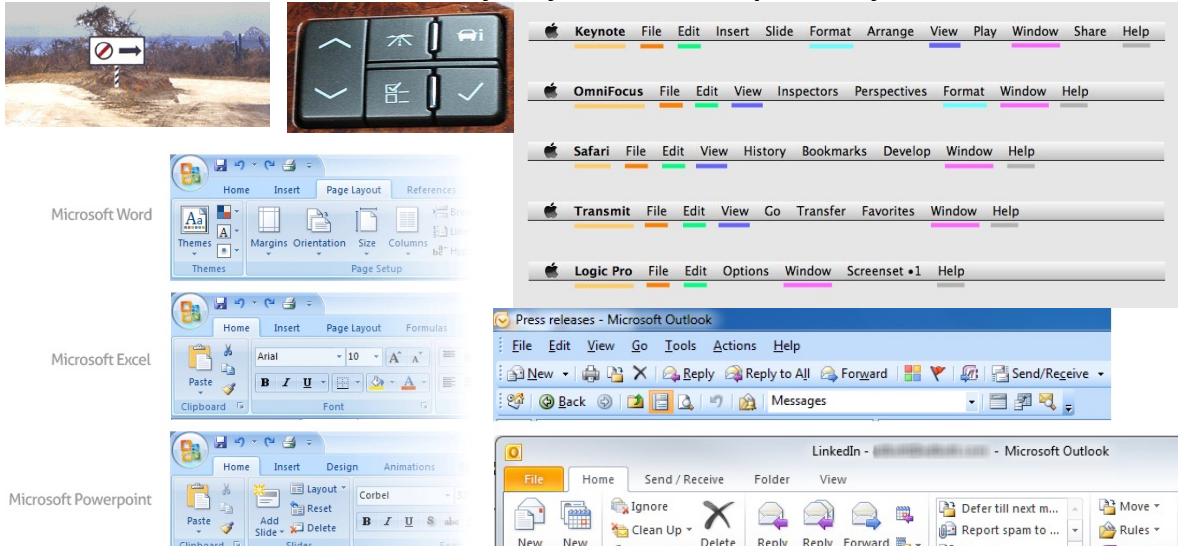
- odrediti slaganje sa listom projektantskih heuristika (npr. 8 zlatnih pravila) verbalnog ili papirnog modela rešenja, prototipa ili gotovog rešenja,
  - tim od 3-5 članova, jedan član otkrije do 35% a 5 članova i do 75%,
  - upoznati evaluatore sa potrebnim domenskim znanjem,
  - interfejs se istražuje u dva prolaza - prvo da se upozna s tokom, a drugi da posmatra detalje i beleži slaganja/neslaganja,
  - za jednostavan interfejs oko 1h,
  - zatim lične liste opažanja integrisati u jednu listu.

No.	Problem	Novice	Regular	Double
<b>Major Usability Problems</b>				
1.	Error message appears too late.	68%	84%	100%
2.	Do not require dollar amount to be entered in cents.	68%	74%	79%
3.	The error message is not precise.	55%	63%	64%
4.	The error message is not constructive.	6%	11%	21%
5.	Replace term "primary account" with "checking account".	10%	47%	43%
6.	Let users choose account from a menu.	16%	32%	43%
7.	Only require a # where it is necessary.	3%	32%	71%
8.	Give feedback as name of chosen account.	6%	26%	64%
<b>Average for major problems</b>		<b>29%</b>	<b>46%</b>	<b>61%</b>
<b>Minor Usability Problems</b>				
9.	Read menu item description before action number.	3%	11%	71%
10.	Avoid gap in menu numbers between 1 and 3.	42%	42%	79%
11.	Provide earlier feedback.	42%	63%	71%
12.	Replace use of 1 and 0 for accept and reject with # and *.	6%	21%	43%
13.	Remove the field label "number" when no number is given.	10%	32%	36%
14.	Change prompt "account" to "account number".	6%	37%	36%



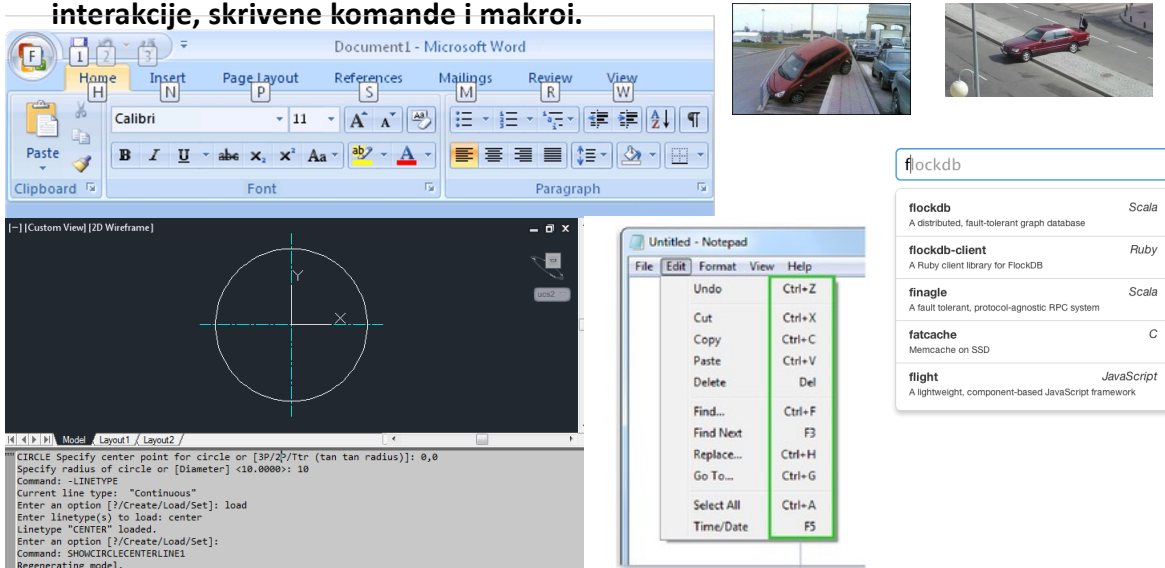
## Shneiderman-ovih osam zlatnih pravila ...

### 1. TEŽITI KONZISTENTOSTI – najčešće prekršeno, identična terminologija u svim elementima UI, konzistentne boje, lejeri, fontovi, kapitalizacija...



## ... Shneiderman-ovih osam zlatnih pravila ...

### 2. OMOGUĆITI FREKVETNIJIM KORISNICIMA UPOTREBU PREČICA – veća brzina interakcije, skrivene komande i makroi.

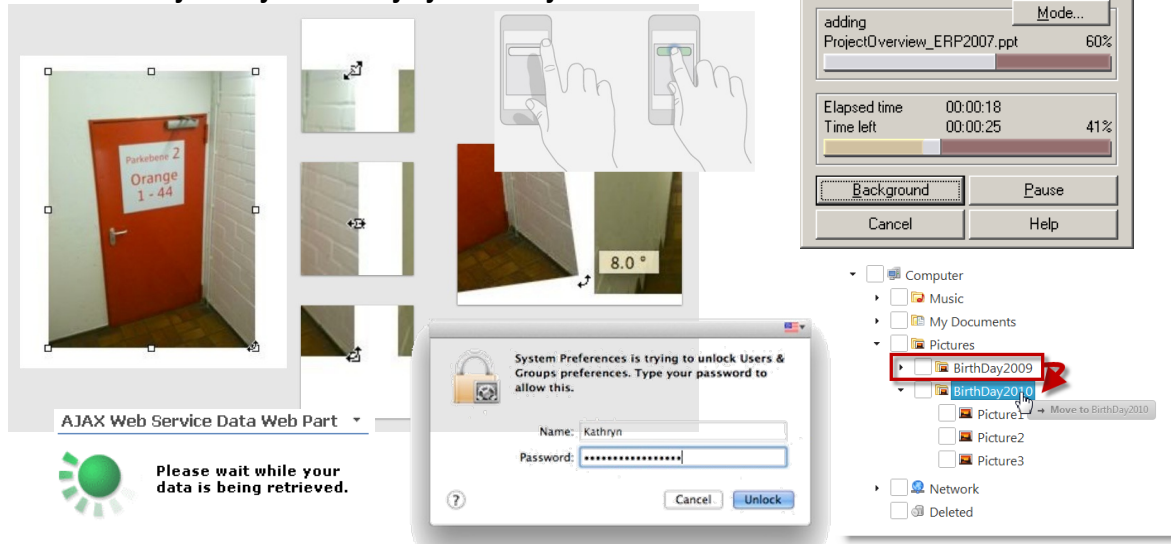




## ... Shneiderman-ovih osam zlatnih pravila ...

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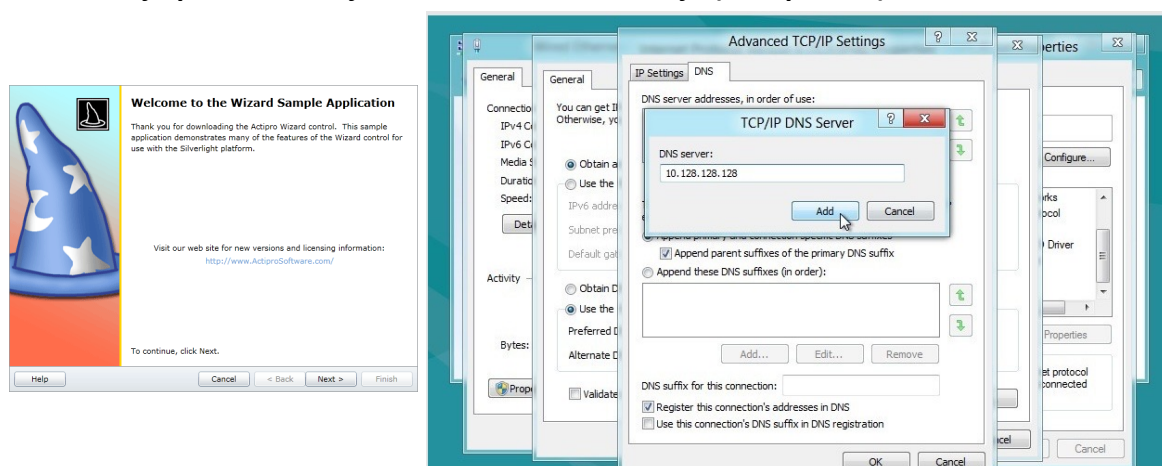
## 3. DAVATI INFORMATIVNI FEEDBACK – za svaku akciju dati feedback, skromniji za frekventije akcije a značajniji za manje frekventne.



## ... Shneiderman-ovih osam zlatnih pravila ...

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## 4. PROJEKTOVATI DIJALOGE NAGLAŠENE ZATVORENOSTI – sekvence akcija grupisati da imaju početak i kraj, kao i sve korake do kraja (@kupovina).



amazon.com.

SIGN IN

SHIPPING & PAYMENT

GIFT-WRAP

PLACE ORDER

## ... Shneiderman-ovih osam zlatnih pravila ...

### 5. PONUDITI PREVENCIJU I RUKOVANJE GREŠKOM – input line guard, ako pogreši tada jednostavna korekcija (samo što je loše a ne sve).

**Realtime Masking**

Phone: ( ) - -

Fax: ( ) -

Date of birth: mm/dd/yyyy

Credit Card: #####

Credit Card 2: nnnn-nnnn-nnnn-nnnn

Postal Code: A#A #A#

Password strength: **strong**

Go to all templates

Edit this template

The page cannot be found

The page you are looking for might have been removed, had its name changed, or is temporarily unavailable.

Please try the following:

- If you typed the page address in the Address bar, make sure that it is spelled correctly.
- Open the [localhost](#) home page, and then look for links to the information you want.
- Click the [Back](#) button to try another link.

HTTP 404 - File not found  
Internet Information Services

Form1

Unhandled exception has occurred in your application. If you click Continue, the application will ignore this error and attempt to continue. If you click Quit, the application will close immediately.

Operation is not valid due to the current state of the object.

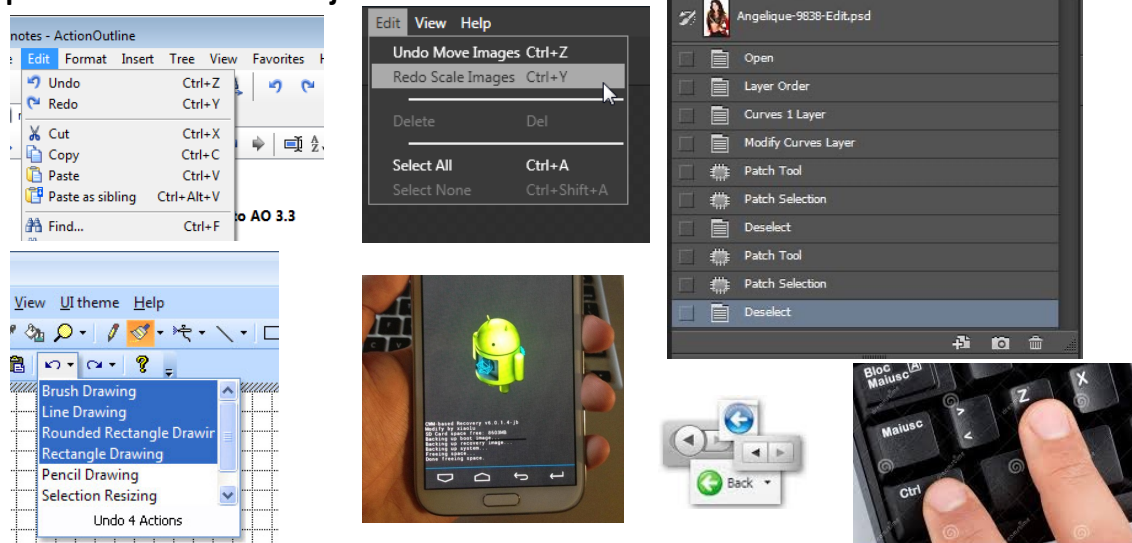
Details Continue Quit

Password must:


- Have at least one letter
- Have at least one capital letter
- Have at least one number
- Not contain multiple identical consecutive characters
- Not be the same as the account name
- Be at least 8 characters
- Not be a common password
- Not be used in past year

## ... Shneiderman-ovih osam zlatnih pravila ...

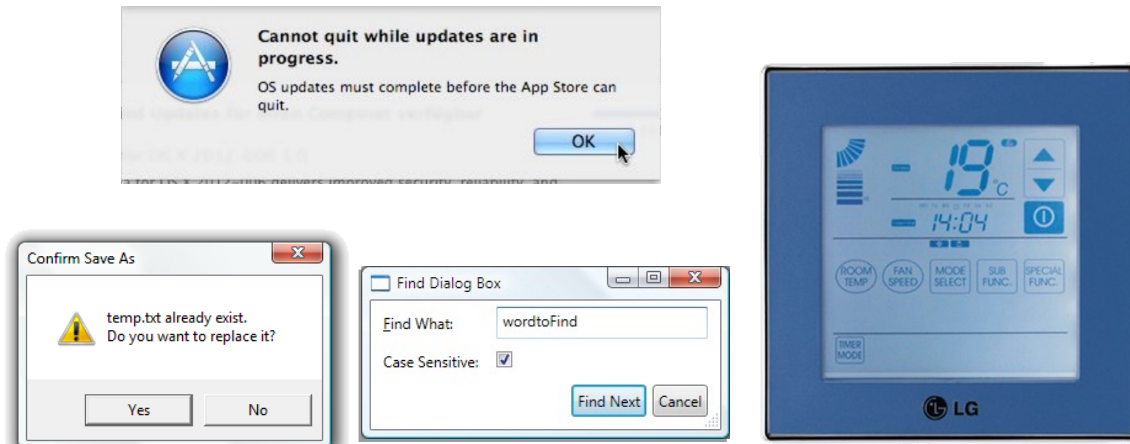
### 6. DOZVOLITI PONIŠTAVANJE EFEKATA AKCIJE (UNDO) – veliko olakšanje kod početnika – sami istražuju.



### ... Shneiderman-ovih osam zlatnih pravila ...

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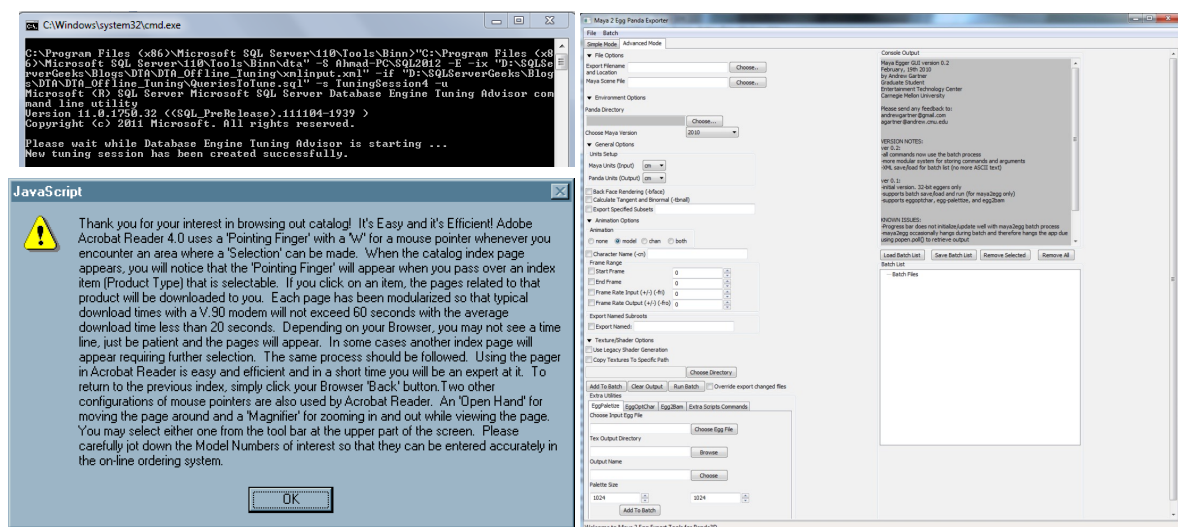
#### 7. INTERNO PODRŽAVATI KONTROLU – frekventni korisnici vole da imaju osećaj pune kontrole sistema, bez iznenađujućih akcija sistema, kreirati UI tako da se korisnici osećaju kao inicijatori aktivnosti a ne da ih slede...



### ... Shneiderman-ovih osam zlatnih pravila ...

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#### 8. REDUKOVATI OPTEREĆENJE RADNE MEMORIJE – $7 \pm 2$ , jednostavan prikaz, konsolidovati višeprozorske prikaze, uvoditi skraćenice.



**Nilsenovi principi ...**<http://www.nngroup.com>

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1. **NALIKOVATI STVARNOSTI** – koristiti uobičajenu terminologiju, koncepte i fraze za korisnika, informacije u prirodnom i logičkom redosledu.



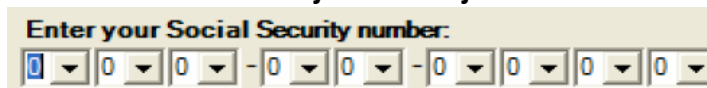
2. **KONZISTENTNOST I STANDARDI** – Least Surprise princip – slične stvari izgledaju i delaju isto na interfejsu, imenica-glagol / glagol-imenica sintaksa interakcije, slediti standard platforme.
3. **HELP i DOKUMENTACIJA** – on / off line, zadatak-orijentisani help.
4. **KORISNIKOVA KONTROLA I SLOBODA** – obezbediti undo, dugačke operacije moraju biti prekidive (sa/bez nastavka), dijalog i cancel dugme.
5. **VIDLJIV STATUS SISTEMA** – korisnik uvek svestan stanja sistema (promena kursora, selekcija objekta, status bar...), **BEZ PRETERIVANJA**, vreme odgovora (<0.1s, .1s – 1s, 1s – 10s sa ⌚, a za > 10s progress bar).

**... Nilsenovi principi ...**

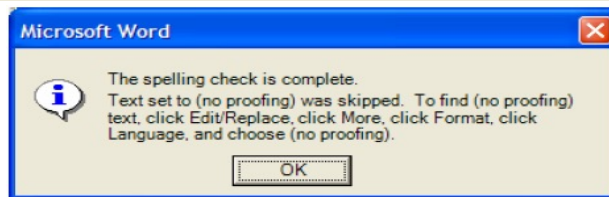
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6. **FLEKSIBILNOST i EFIKASNOST** – kratice i ostala ubrzanja interakcije.

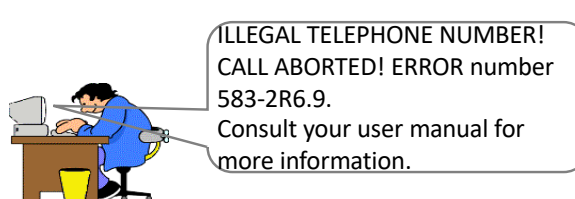
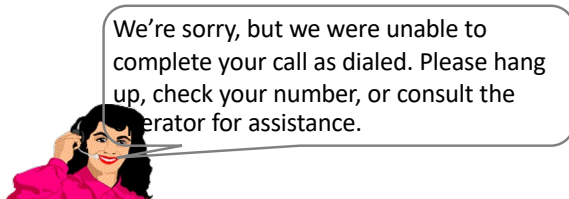
7. **PREVENCIJA GREŠAKA**,  
bez preterivanja.



8. **PREPOZNAJ, NE DA SE PAMTI** –  
štednja radne memorije korisnika.



9. **PRIJAVA GREŠKE, DIJAGNOSTIKA, OPORAVAK** – biti precizan, konstruktivan, ljubazan, bez blamiranja i tehničkih detalja.



## ... Nilsenovi principi

### 10. ESTETIČAN I MINIMALISTIČKI DIZAJN – manje je više.



## Weinschenk-Barker klasifikacija

1. **User Control:** heuristics that check whether the user has enough control of the interface.
2. **Human Limitations:** the design takes into account human limitations, cognitive and sensorial, to avoid overloading them.
3. **Modal Integrity:** the interface uses the most suitable modality for each task: auditory, visual, or motor/kinesthetic.
4. **Accommodation:** the design is adequate to fulfill the needs and behaviour of each targeted user group.
5. **Linguistic Clarity:** the language used to communicate is efficient and adequate to the audience.
6. **Aesthetic Integrity:** the design is visually attractive and tailored to appeal to the target population.
7. **Simplicity:** the design will not use unnecessary complexity.
8. **Predictability:** users will be able to form a mental model of how the system will behave in response to actions.
9. **Interpretation:** there are codified rules that try to guess the user intentions and anticipate the actions needed.
10. **Accuracy:** There are no errors, i.e. the result of user actions correspond to their goals.
11. **Technical Clarity:** the concepts represented in the interface have the highest possible correspondence to the domain they are modeling.
12. **Flexibility:** the design can be adjusted to the needs and behaviour of each particular user.
13. **Fulfillment:** the user experience is adequate.
14. **Cultural Propriety:** user's cultural and social expectations are met.
15. **Suitable Tempo:** the pace at which users work with the system is adequate.
16. **Consistency:** different parts of the system have the same style, so that there are no different ways to represent the same information or behavior.
17. **User Support:** the design will support learning and provide the required assistance to usage.
18. **Precision:** the steps and results of a task will be what the user wants.
19. **Forgiveness:** the user will be able to recover to an adequate state after an error.
20. **Responsiveness:** the interface provides enough feedback information about the system status and the task completion.



## Smernice

smernice platformi na različitim nivoima:

**Microsoft User Interface Design Guidelines**

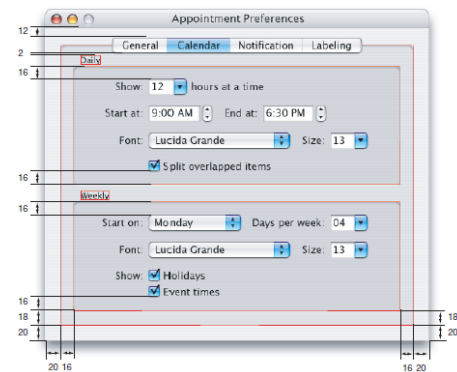
<https://learn.microsoft.com/en-us/windows/win32/uxguide/guidelines>

**Apple OS X Human Interface Guidelines**

<https://developer.apple.com/design/human-interface-guidelines/guidelines/overview/>

**Adroid UI Overview**

<https://developer.android.com/design>



## Guideline checking

- evaluator proverava interfejs u odnosu na detaljnu listu smernica,
- pravi listu odstupanja od smernica,
- automatizovan pomoću različitih aplikacija, npr. <https://testpad.com>,
- jeftin, intuitivan, primenljiv u prvim fazama razvoja,
- zamara, zahteva vremena.

Desktop Testing		number	1	2	3
		tester	Sally	Harry	Patrick
		browser	Chrome	IE11	Firefox
		build	10123	10123	10123
0001	Signup		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0007	Login		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0016	Forgotten Password		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0021	Help menu		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0029	Script name and description		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0047	Script case lock		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0058	Script release lock		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0073	Case editing, initial		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0077	Case editing, general		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0100	Case links		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0104	Import		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0112	Export		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0124	Multiple selections		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>
0149	Drag and drop		<div><div></div></div>	<div><div></div></div>	<div><div></div></div>

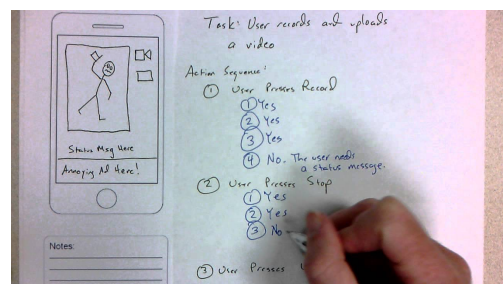
## Guideline Scoring

- Interfejs se boduje u skladu sa njegovom usklađenošću u odnosu na ponderisanu listu odabranih smernica.
- dobijeni ukupni rezultat predstavlja stepen do kojeg interfejs prati smernice.
- jeftino, intuitivno,
- formiranje korektnih pondera i u skladu sa domenom.

Nr	Topic	Recommended Design	Strength	Points	You
1	Download time	50 kB (<10 sec for your customer)	***	3	
2	Window title	Start with Company Name	***	3	
3	Title tag line	What about, Slogan	***	3	
4	Readable URL	Hackable URL, URL is a UI part	**	2	
5	Error page	Catch errors/dead links, to search	**	2	
6	Meta tags	For search engines (trafficattack.de)	***	3	
7	Alt Information	Images, accessibility, Lynx	**	2	
8	Page width	770 pixel (620-1024)	**	2	
9	• Liquid vs. frozen layout	Liquid is better	**	2	
10	• Page length	<2 pages (1000-1600 px)	**	2	
11	Frames	No, Don't use (search, bookmarks)	***	3	
12	Logo placement	Upper left	***	3	
13	• Logo size	Around 80x68 Pixel	**	2	
14	Search	Yes, in a box, always	***	3	
15	• Search placement	Upper part, right or left corner	**	2	
16	• Search box color	White	***	3	
17	• Search button	Call it "Search" or "Go"	**	2	

## Cognitive Walkthrough

- eksperti kao korisnici u tipičnom (ali i kritičnom) zadatku,
- the day in the life of the user,
- samostalni explore walkthrough,
- kasnije i javni sa ostalim ekspertima, projektantima i korisnicima radi projekcije novih walkthroughs ali i provociranja reakcije.





## Diary study

- longitudinalna istraživačka metoda,
- prikupljanje kvalitativnih podataka,
- učesnici vode dnevnik kako bi zabeležili svoje misli, osećanja i ponašanje, dok koriste proizvod,
- sprovodi se u sledećim fazama:
  - Planiranje i priprema,
  - Predstudijski brifing,
  - Loginig podataka, in-situ ili snippet,
  - Poststudijski interjui,
  - Analiza podataka.

Date	Where does it come from	How often?	how many people asked for it	What page(s)	What task were you trying to accomplish?	Feedback // What prevented you from doing your task? (missing content, wrong content, something not working, etc?) feel free to add screenshots if needed	How might we make this better in the future?	Type (usability issue, improvement, new feature, bug)	Gravity (trivial/minor/moderate/major/critical)	UXD comment	story	status	tag

## Softverski logging

- instrumentirana verzija softvera beleži sve interakcije korisnika,
- korisnici moraju dati svoju saglasnost,
- veći uzorak korisnika testa (20–50+),
- prikupiti i integrisati različite datoteke logova,
- statistički analizirati dobijene podatke,
- softver od interesa mora biti instrumentiran,
- (ne)moguće zaključiti namere i motivaciju korisnika?

3/2/2022, 5:33 AM	https://ns.adobe.com/identity/mixins/278fd060aeece90c4c24d40f0728380564619db99e48540d	Field Group	Update
3/1/2022, 1:16 PM	Test profile dataset for identity namespace - CORE	Dataset	Enable For Profile
3/1/2022, 1:16 PM	Test profile dataset for identity namespace - CORE	Dataset	Create
3/1/2022, 1:16 PM	Schema for test Profiles with identity namespace - CORE	Schema	Create
3/1/2022, 1:16 PM	A mixin that contains the use case instance id	Field Group	Create
2/28/2022, 7:51 AM	https://ns.adobe.com/identity/schemas/6d8c51b9c03d505b2be030eeba0a17ae89304d21c8046d5b	Schema	Update
2/28/2022, 7:51 AM	https://ns.adobe.com/identity/mixins/278fd060aeece90c4c24d40f0728380564619db99e48540d	Field Group	Update
2/23/2022, 1:18 PM	Test	Dataset	Create
2/8/2022, 8:48 AM	Test	Dataset	Create
2/4/2022, 3:59 PM	Test-JC	Dataset	Create

## Opservacione studije

INTERAKCIJA  
ČOVEK RAČUNAR   
Prof. dr Dragan Ivetić  
2022./2023

- snimiti jedan ili više tipičnih dana korišćenja, pa ponovo za nekoliko dana,
- obavezna saglasnost,
- analizirati/notirati snimke pa statistički analizirati dobijene podatke.
- korisnici često nerado učestvuju u studiji upotrebe,
  - razgovarati, dati garancije, sve objasniti,
- objektivna analiza upotrebe (ne samoprijavljivanje),
- teško pronaći voljne korisnike, obrada video sadržaja.



## Razmišljanje naglas

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- korisnici verbaliziraju svoje misli dok obavljaju zadatke,
- pripremiti korisnika (i sistem) zamolite da kažu:
  - šta pokušavaju da urade, stvari koje čitaju, pitanja koja se pojavljuju u njihovom umu, stvari koje smatraju zbunjujućim, odluke koje donose...,
- ako korisnik prestane da govori naglas, ohrabriti ga: „Možete li reći više?“, „Ne čujem šta govoriš“...,
- nikako konkretna pitanjima kao: "Zašto si to uradio?", „Zašto nisi kliknuo ovde?“, „Između čega pokušavate da se odlučite?“...,
- pronalazi mnoge probleme upotrebljivosti i zašto se javljaju,
- mali broj test korisnika (3 do 5),
- potreba za razmišljanjem naglas može promeniti korisnikovo rešavanje problema,
- ne može da pruži podatke o učinku.



## A/B testiranje

- kontrolisani eksperiment na veb lokaciji (ili app) sa korisnicima,
- postoje dve verzije rešenja (web, app) sa izbalansiranim razlikama: ključne a da ih ne bude previše jer se neće znati šta je prevagnulo kod korisnika,
- % posetilaca je nasumično dodijeljena varijanta (B) veb stranice (app), ostali vide standardno rešenje (A, kontrolna grupa),
- za veb se dodeljuje kolačić, tako da korisnici uvek vide istu varijantu,
- beleži se stopa učestalosti klikova za svakog korisnika,
- ispituje se statistička značajnost,
- multivarijantno (multinomijalno) testiranje je slično (A/B/N, A/B/Z), ali može testirati više od dve verzije u isto vreme.

