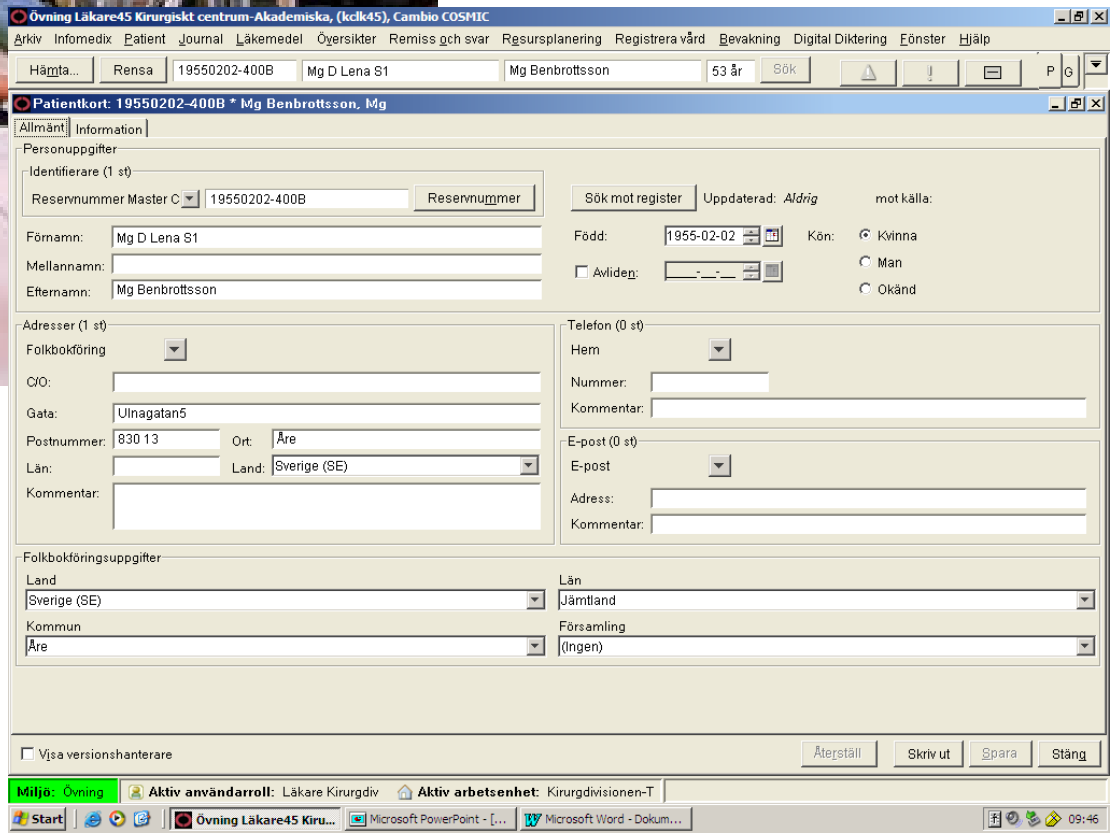
Human-Computer Interaction and usability in health care

Bengt Sandblad

http://www.it.uu.se/research/hci

IT is useful !?!?


Övning Läkare45 Kirurgiskt centrum-Akademiska, (kclk45), Cambio COSMIC
Arkiv Infomedix Patient Journal Läkemedel Översikter Remiss och svar Resursplanering Registrera vård Bevakning Digital Diktering Fönster Hjälp
Hämta... Rensa 19550202-400B Mg D Lena S1 Mg Benbrottsson 53 år Sök
Patientkort: 19550202-400B * Mg Benbrottsson, Mg
Allmänt Information
Personuppgifter
Identifierare (1 st)
Reservnummer Master C 19550202-400B Reservnummer
Sök mot register Uppdaterad: Aldrig mot källa:
Förnamn: Mg D Lena S1
Mellannamn:
Efternamn: Mg Benbrottsson
Född: 1955-02-02 Kön: Kvinna Man Okänd
Avliden:
Adresser (1 st)
Folkbokföring
C/O:
Gata: Ulnagatan5
Postnummer: 830 13 Ort: Åre
Län: Land: Sverige (SE)
Kommentar:
Telefon (0 st)
Hem
Nummer:
Kommentar:
E-post (0 st)
E-post
Adress:
Kommentar:
Folkbokföringsuppgifter
Land Sverige (SE)
Län Jämtland
Kommun Åre
Församling (Ingen)
Visa versionshanterare
Återställ Skriv ut Spara Stäng
Miljö: Övning Aktiv användarroll: Läkare Kirurgdiv Aktiv arbetsenhet: Kirurgdivisionen-T
Start Övning Läkare45 Kiru... Microsoft PowerPoint - [... Microsoft Word - Dokum... 09:46

ISO 9241:

Definition of usability:

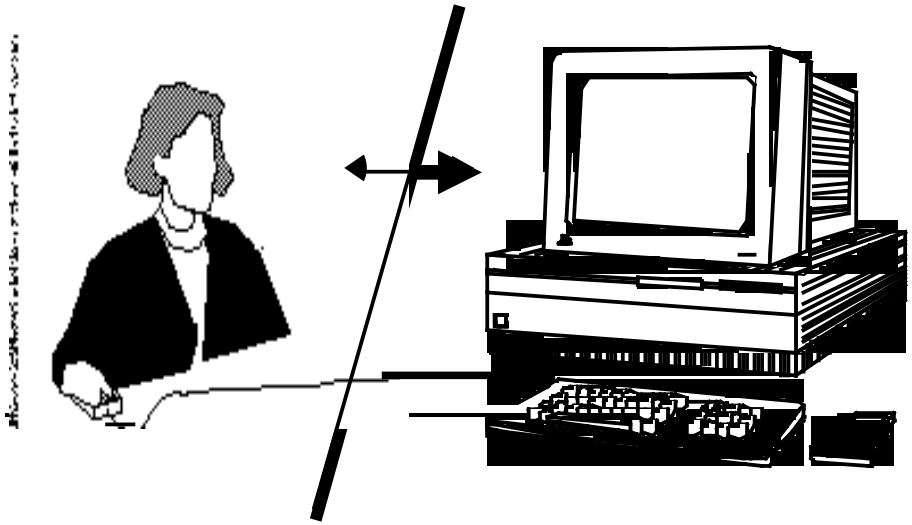
"The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use"

Humans in interaction with technology (HCI)

We must understand the nature of such interactions.

Requirements and needs in health care.

How can design of work processes and technology be based on such knowledge?



Human cognition

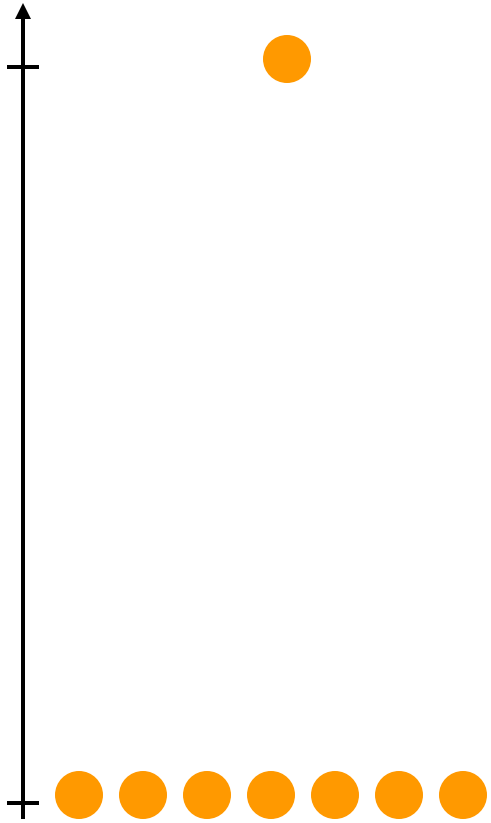
- Human cognition
  - Memory and short term memory (working memory)
  - Pattern recognition
  - Automated processes
- Human cognitive strengths and weaknesses must be considered when designing user interfaces.

Human memory

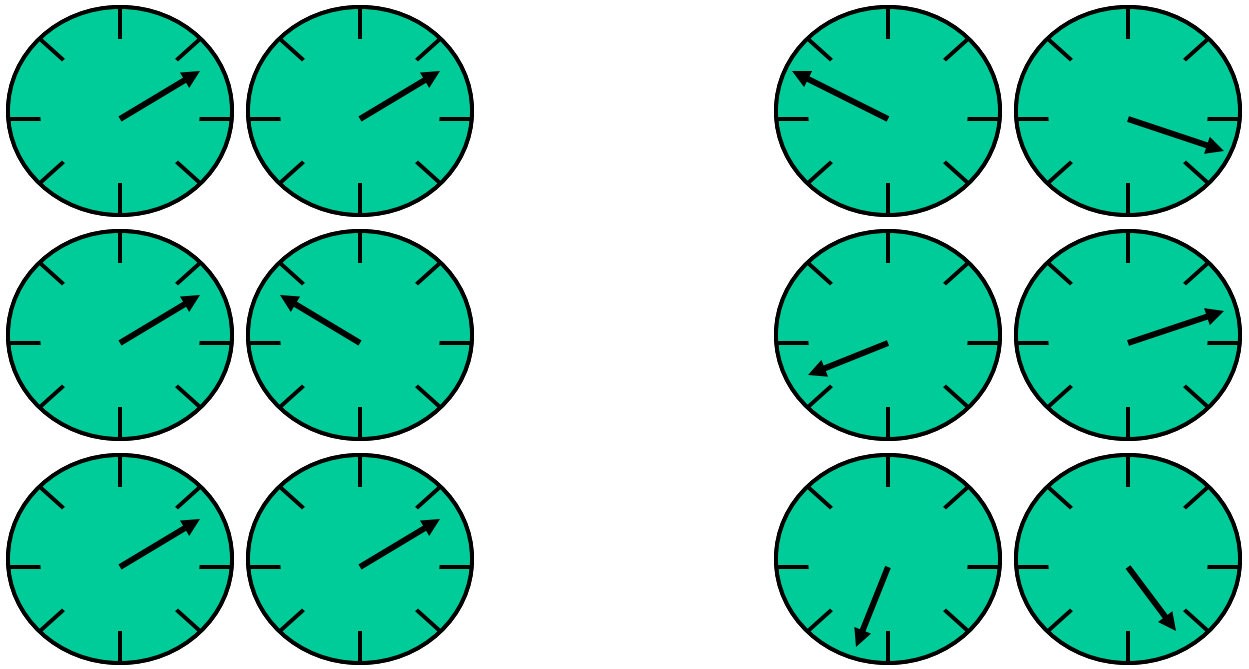
- Short term (working) memory
  - 5-8 ”chunks”
  - Declining time c:a 15 sec.
  - Sensitive to cognitive disturbances.
- Long term memory
  - Active “learning”
  - No information loss (“for life”)
  - Difficult to retrieve information (find “triggers”)

Automated (cognitive) processes

- On a high cognitive level
  - Advanced performance (skills)
  - One thing at a time
- On a low cognitive level
  - High parallel capacity
  - ”Automatic” processing
  - Requires much training

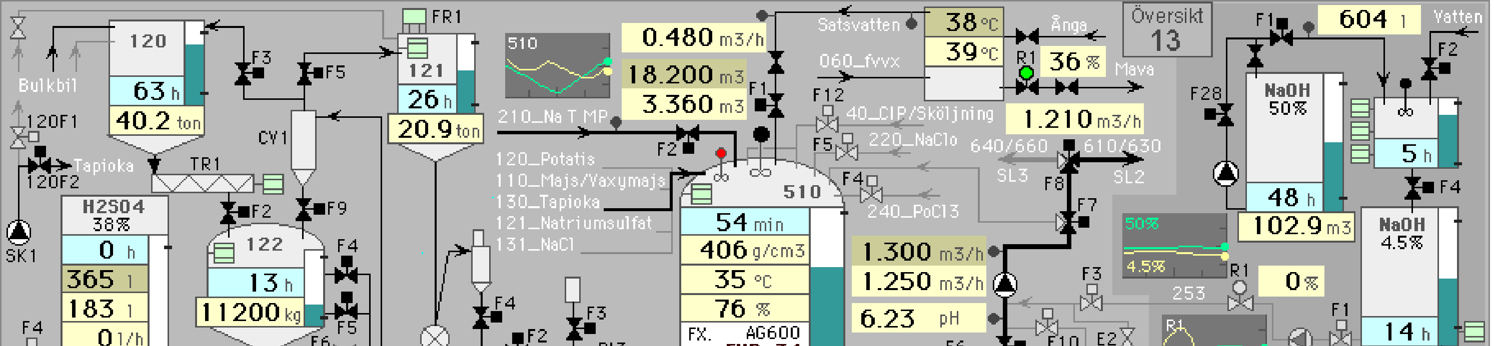


Pattern recognition



Conclusions

- A human user can overview *very* large sets of information, if relevant, well known and presented in a good way.
- Very small information sets can otherwise be totally confusing.
- We can not efficiently handle information we can’t see.
- “Information overload” is caused by too *little* information or bad design!
- A user must be focused on the work task, not on how to handle the information tool.



FR1
120
63 h
40.2 ton
121
26 h
20.9 ton
Bulkbil
120F1
120F2
Tapioka
TR1
CY1
F3
F5
F9
F2
H2SO4
38%
0 h
365 l
183 l
0 l/h
12 m3
SK1
122
13 h
11200 kg
510
0.480 m3/h
18.200 m3
3.360 m3
210_Na T MP
Satsvatten
060_fvvx
38 °C
39 °C
Ånga
36 %
Mava
Översikt
13
604 l
Vatten
40_CIP/Sköljning
1.210 m3/h
220_NaClo
640/660
610/630
SL3
SL2
120_Potatis
110_Majs/Vaxymajs
130_Tapioka
121_Natriumsulfat
131_NaCl
54 min
406 g/cm3
35 °C
76 %
240_PoCl3
1.300 m3/h
1.250 m3/h
6.23 pH
NaOH
50%
48 h
102.9 m3
5 h
NaOH
4.5%
14 h
0 %
253
31 °C
610
62 °C
73 %
PU2
R2
27 %
R1
11.6
29
57
51 Värme
61 Kyla
50 Värme
60 Kyla
H2SO4
820/830
640
6.10 pH
27 °C
93 %
PF. AC75
EYR 30
Steg 3

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松
屋
GAME
2F
1F

Example

Reading of a laboratory report in a health care unit

Question to physicians:

“How do you read this report?”

LABORATIONSLISTA 1

AKADEMISKA SJUKHUSET
UPPSALA

Klinik

Avd

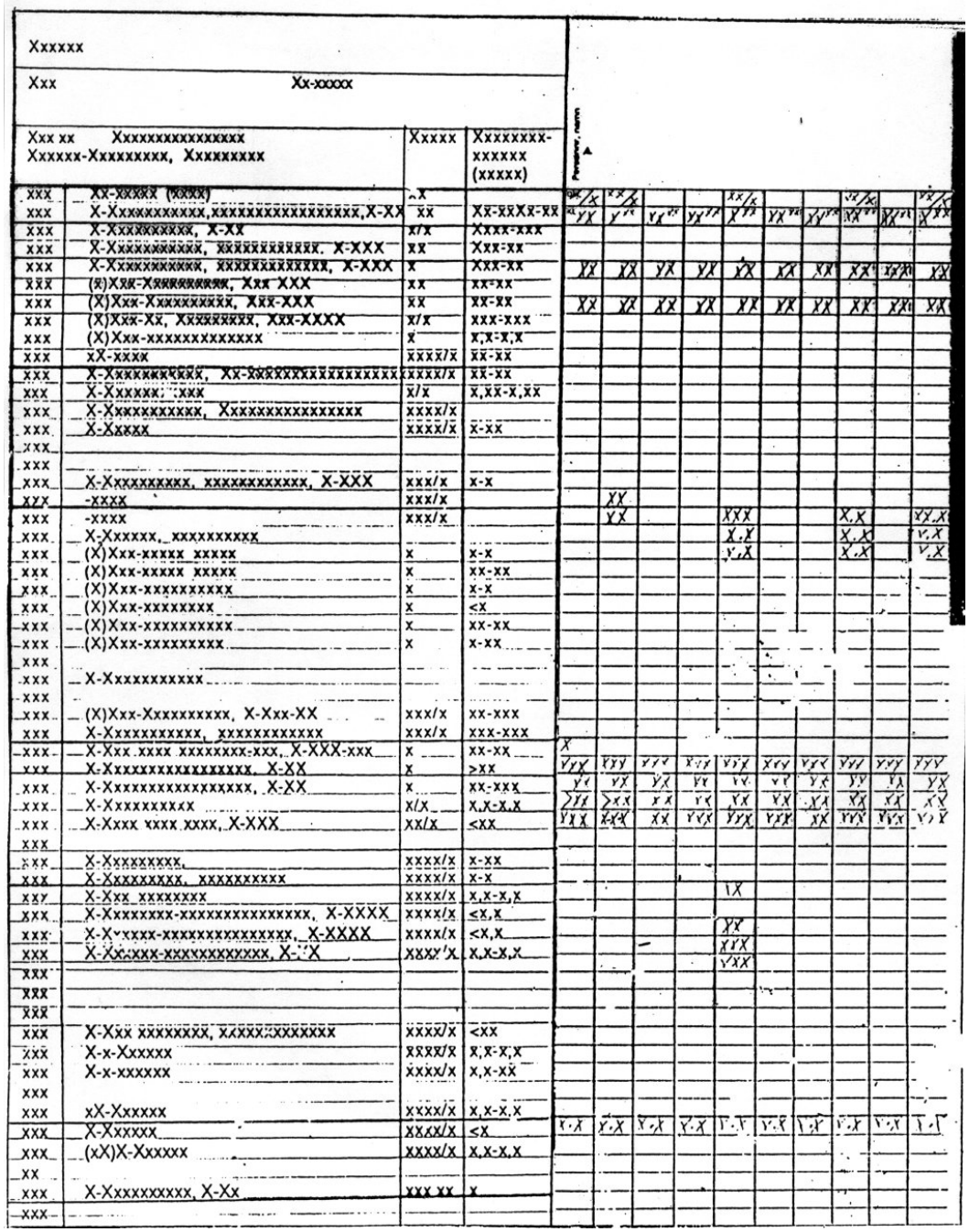
Pt-Längd m

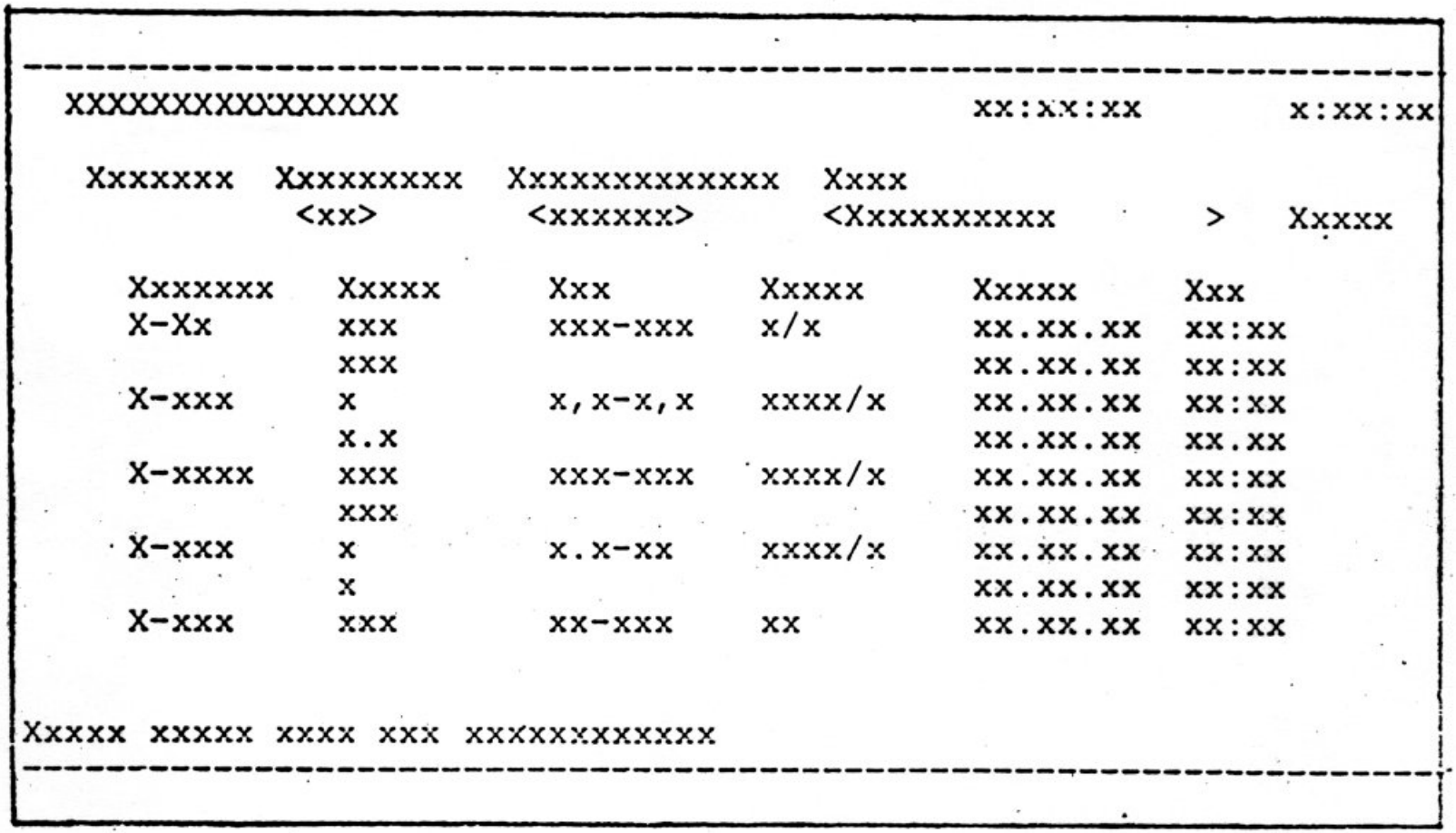
Personnr, namn

Rad nr	Analysbeteckning System-Komponent, Remissord	Enhet	Referens-område (vuxna)	Dat 9/11 Kl 23	10/11 7.40	19.55	23.15	11/11 8.00	19.45	23.00	12/11 8.00	23.00	13/11 [illegible]
101	Pt-Massa (vikt)	kg											
102	B-Erytrocyter, sänkreakt, B-SR	mm	K2-15M2-10										
103	B-Hemoglobin, B-Hb	g/l	K 113-139 M 134-166	96	99	93	96	98	98	98	96	100	99
104	B-Erytrocyter, partikelkonc, B-EPK	10^{12}/l	K 3,7-5,0 M 4,5-5,8										
105	B-Erytrocyter, volymfraktion, B-EVF	%	K 36-44 M 40-49	28	29	28	27	30	29	29	28	28	29
106	(B)Ery-Medelvolym, Ery-MCV	fl	76-96										
107	(B)Ery-Hemoglobin, Ery-MCH	pg	28-35										
108	(B)Ery-Hb, Massakonc, Ery-MCHC	g/l	320-360										
109	(B)Ery-Retikulocyter	%	0,2-2,0										
110	fS-Järn	µmol/l	11-35										
111	S-Transferrin, Fe-bindningskapacitet	µmol/l	45-72										
112	S-Haptoglobin	g/l	0,20-1,40										
113	S-Kobalaminer, Radioligandmetod	pmol/l											
114	S-Folat	nmol/l	7-34										
115													
116					7.7								
117	B-Leukocyter, partikelkonc, B-LPK	10^9/l	4-9		2.8			10.1			[illegible]		10.5
118	-poly	10^9/l						8.5			5.6		[illegible]
119	-mono	10^9/l						1.6			2.1		[illegible]
120	B-Celler, mikroskopi												
121	(B)Lkc-neutr stavk	%	2-5										
122	(B)Lkc-neutr segmk	%	40-70										
123	(B)Lkc-eosinofila	%	1-6										
124	(B)Lkc-basofila	%	< 1										
125	(B)Lkc-lymfocyter	%	20-45										
126	(B)Lkc-monocyter	%	2-10										
127													
128	B-Erytrocyter												
129													
130	(B)-Lkc-Eosinofila, B-Eos-PK	10^6/l	40-440										
131	B-Trombocyter, partikelkonc	10^9/l	150-400	139	114	135	149	158	190	208	[illegible]	337	379
132	P-Akt part trombopl-tid, P-APT-tid	s	25-39	29	28	27	29	26	25	29	27	27	[illegible]
133	B-Protrombinkomplex, B-TT	%	> 55	>70	>70	>70	>70	>70	66	66	56	52	62
134	B-Protrombinkomplex, B-NT	%	70-130	125	115	95	105	115	115	82	115	130	115
135	P-Fibrinogen	g/l	2,0-4,0										
136	S-Fibr degr prod, S-FDP	mg/l	< 10										
137													
138	S-Bilirubin	µmol/l	4-21					8.3					
139	S-Bilirubin, konjugerat	µmol/l	0-4										
140	S-Alk fosfatas	µkat/l	0,8-4,8					1.6					
141	S-Aspartat-aminotransferas, S-ASAT	µkat/l	< 0,6					0.50					
142	S-Alanin-aminotransferas, S-ALAT	µkat/l	< 0,6					[illegible]					
143	S-Laktat-dehydrogenas, S-LD	µkat/l	3,8-6,7										
144													
145													
146													
147	S-Sur fosfatas, tartrathämbar	nkat/l	< 58										
148	S-α-Amylas	µkat/l	1,4-5,0										
149	U-α-Amylas	µkat/l	2,2-28										
150													
151	fB-Glukos	mmol/l	3,3-5,7	6.9	8.2	6.3	7.6	6.3	6.4	6.0	6.2	[illegible]	[illegible]
152	U-Glukos	mmol/d	< 3										
153	(aB)P-Laktat	mmol/l	0,7-1,8										
154													
155	F-Hemoglobin, F-Hb	arb enh	0										
156													

What does this report contain?

How can it be perceived and analysed by a professional user?

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And this?

Different types of users in different contexts

- Different professionals
  - Physicians, nurses, assistants, secretaries, physiotherapists etc.
  - Technicians etc.
  - Administrative personal
- Different work contexts
  - Read/write patient records
  - Order lab investigations and receive reports
  - Patient administration
  - Medical technology….
  - Laboratory work
  - Primary care units
  - Home care
  - Communication structures

ISO 9241:

Definition of usability:

"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"

Human-Computer Interaction is especially important in health care

Design of user interfaces must be based on analysis of e.g.:

- Which information?
- Used by who?
- In which way and form?
- Where?
- When?
- In which context?
- Of which purpose?
- Integration of systems
- Communication and collaboration?

User interface design

- Design metaphor: Room and work-spaces
- Use e.g. design heuristics to design usable interfaces

- See course in basic HCI (or advanced interaction design) for more about interface design!!!!

Design heuristics (main parts)

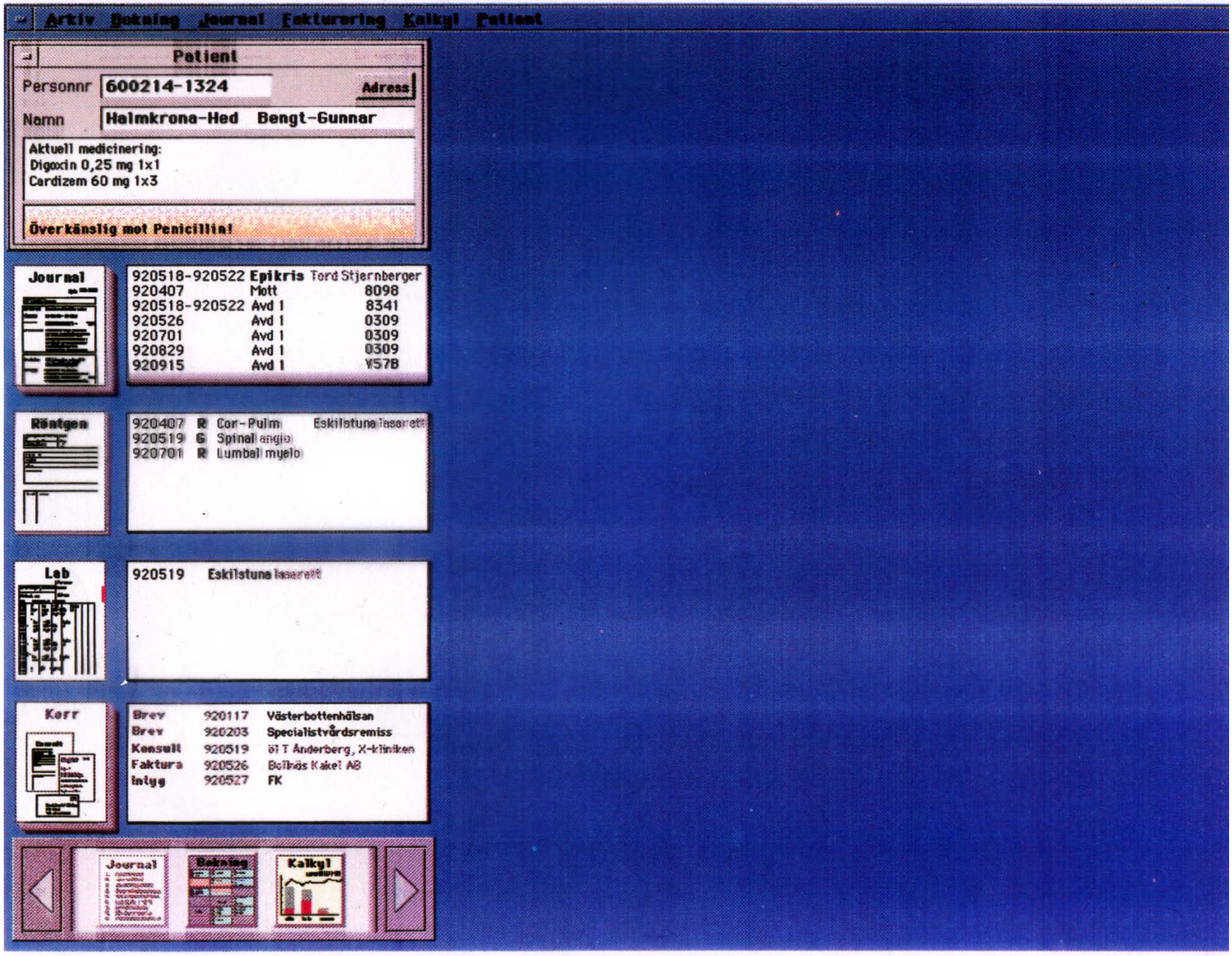
- Design for skilled users
- Let humans ”be in full control”
- Support the user’s understanding of the process, reduce complexity and support efficient visualisation of information
- Do the design ”complete”
- *Management by awareness* vs. *Management by exception*
- Disposition of the screen area
  - Show overview and details simultaneously
  - Fixed and logic spatial visualisation
- Use colours in an efficient way
- Avoid scrolling of text.
- Etc. (See course in HCI and user interface design)

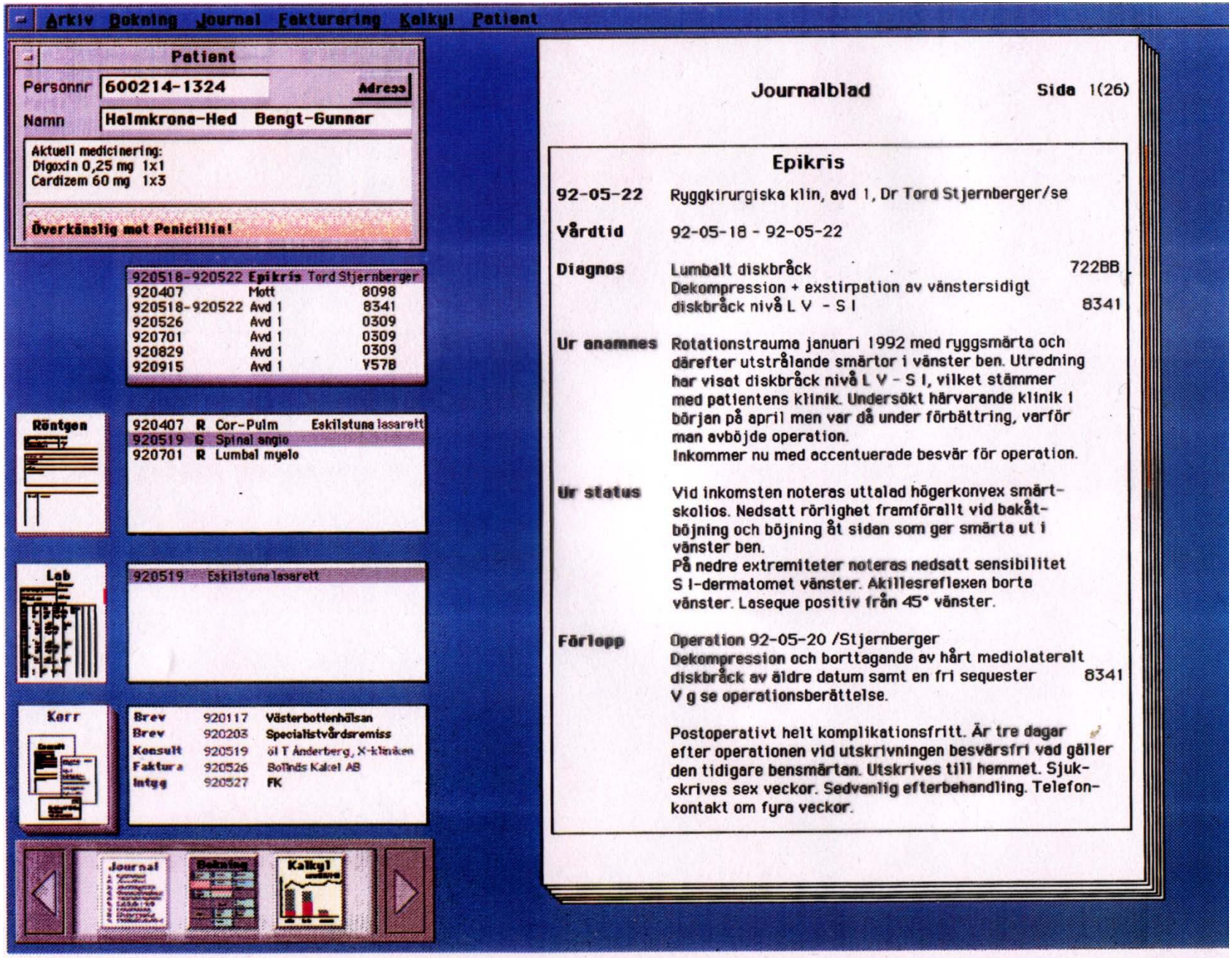
An example of interface design

- One task – one work space
- The interface should be ready for immediate use
- See details and overview simultaneously
- Emphasize important information
- Simple and obvious navigation
- Support identification of important relations
- Support pattern recognition
- Support speed for skilled users
- Allow users to jump between tasks
- Support communication and cooperation
- Etc.

Example

Select ”record room” and patient ID


Arkiv Bokning Journal Fakturering Kalkyl Patient
Patient
Personnr 600214-1324
Adress
Namn Halmkrona-Hed Bengt-Gunnar
Aktuell medicinering:
Digoxin 0,25 mg 1x1
Cardizem 60 mg 1x3
Överkänslig mot Penicillin!
Journal
920518-920522 Epikris Tord Stjernberger
920407 Mott 8098
920518-920522 Avd 1 8341
920526 Avd 1 0309
920701 Avd 1 0309
920829 Avd 1 0309
920915 Avd 1 V57B
Röntgen
920407 R Cor-Pulm Eskilstuna lasarett
920519 G Spinal angio
920701 R Lumbal myelo
Lab
920519 Eskilstuna lasarett
Korr
Brev 920117 Västerbottenhälsan
Brev 920203 Specialistvårdsremiss
Konsult 920519 ol T Änderberg, X-kliniken
Faktura 920526 Bollnäs Kakel AB
Intyg 920527 FK
Journal
Bokning
Kalkyl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920829 Avd 1 0309
920915 Avd 1 Y57B
Röntgen
920407 R Cor-Pulm Eskilstuna lasarett
920519 G Spinal angio
920701 R Lumbal myelo
Lab
920519 Eskilstuna lasarett
Korr
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Brev 920203 Specialistvårdsremiss
Konsult 920519 öl T Anderberg, X-kliniken
Faktura 920526 Bolinds Kakel AB
Intyg 920527 FK
Journal
Bokning
Kalkyl
Journalblad Sida 1(26)
Epikris
92-05-22 Ryggkirurgiska klin, avd 1, Dr Tord Stjernberger/se
Vårdtid 92-05-18 - 92-05-22
Diagnos Lumbalt diskbråck 722BB
Dekompression + exstirpation av vänstersidigt diskbråck nivå L V - S I 8341
Ur anamnes Rotationstrauma januari 1992 med ryggsmärta och därefter utstrålande smärtor i vänster ben. Utredning har visat diskbråck nivå L V - S I, vilket stämmer med patientens klinik. Undersökt härvarande klinik i början på april men var då under förbättring, varför man avböjde operation.
Inkommer nu med accentuerade besvär för operation.
Ur status Vid inkomsten noteras uttalad högerkonvex smärtskolios. Nedsatt rörlighet framförallt vid bakåtböjning och böjning åt sidan som ger smärta ut i vänster ben.
På nedre extremiteter noteras nedsatt sensibilitet S I-dermatomet vänster. Akillesreflexen borta vänster. Laseque positiv från 45° vänster.
Förlopp Operation 92-05-20 /Stjernberger
Dekompression och borttagande av hårt mediolateralt diskbråck av äldre datum samt en fri sequester 8341
V g se operationsberättelse.
Postoperativt helt komplikationsfritt. Är tre dagar efter operationen vid utskrivningen besvärsfri vad gäller den tidigare bensmärtan. Utskrives till hemmet. Sjukskrives sex veckor. Sedvanlig efterbehandling. Telefonkontakt om fyra veckor.