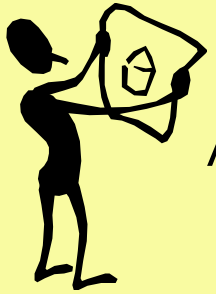
COMP 3220 Human-Computer Intearction

Human-Computer Intearction and Usability



Alexander Nikov

HCI and Usability

- Introduction: User test of a commercial software package
- Legal requirements within the European Union
- ISO 9241-10: The dialog principles
- ISO 13407 User-centred design methods
- User Interface Economics
- Presentation of information, user guidance, menue design
- User questionaires, user tests, inspections

Usability and the involved parties

Software manufacturer

- is under competition
- needs to meet market requirements
- needs to meet legal requirements (e.g. 90/270/EEC)
- **needs effective user centred quality procedures**

End user

- wants to get his job done!
- **needs usable product**

Software buyer (institution)

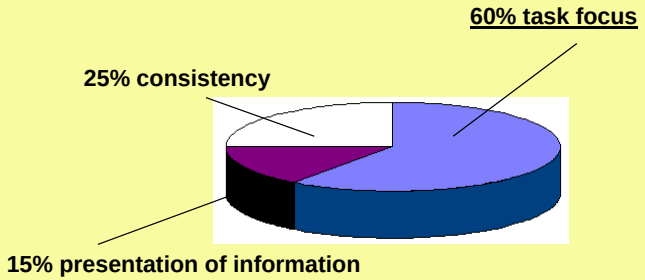
- intends to increase productivity
- needs to minimize purchase costs
- (forgets costs of use!)
- needs to meet legal requirements (e.g. 90/270/EEC)
- needs **certainty of usability of the purchased product**

Key issues

- How can software be designed for usability?
- Which design rules are there?
- How to apply the rules?
- How can usability be integrated with quality management?
- How can usability be measured?

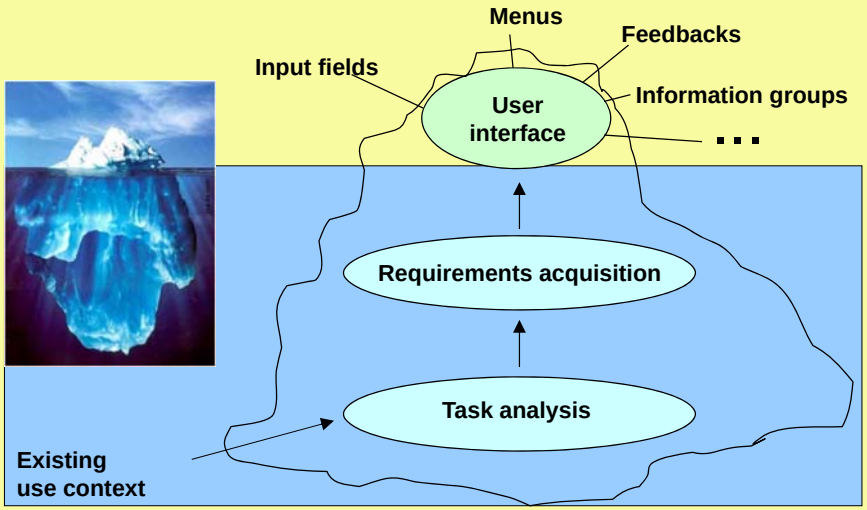
Usability is more than GUI manicure!

Factors determining the usability of software



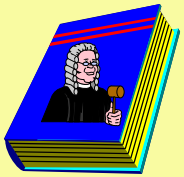
Source: System Concepts Ltd., 1997
http://www.system-concepts.com/articles/gui.html

Usability under interface



European VDT Directive

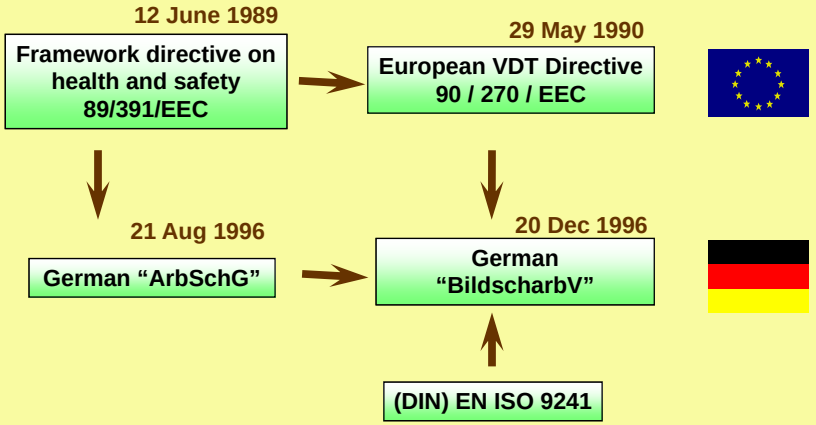
http://europa.eu.int/eur-lex/en/lif/dat/en_390L0270.html



"Council Directive of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment" (90/270/EEC)

5th individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC

European VDT Directive - Enforcement in Europe



European VDT Directive - The requirements

Minimum requirements on

- Hardware
  monitor, keyboard
  work desk work surface, work chair
- Environment
  space requirements, lighting,
  reflections and glare, noise, heat, radiation, humidity
- Software
  “Operator/Computer Interface”

European VDT Directive - Who is addressed?

- Employers in Europe who are operating computer work places
- Buyers of IT equipment within companies / organisations

Who is indirectly addressed?

- Manufacturers of Hardware equipment
- Manufacturers of software

European VDT Directive - Software requirements

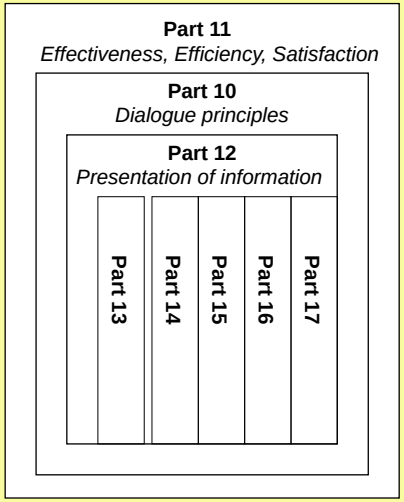
- Software must be suitable for the task
- Software must be easy to use and, where appropriate, adaptable to the operator‘s level of knowledge or experience
- systems must provide feedback to workers on their performance
- systems must display information in a format and at a pace which are adapted to operators

- the principles of human-computer interaction must be applied, in particular to human data processing

ISO 9241 “Ergonomic requirements for office work with visual display terminals”

Part 1: General Introduction
Part 2: Guidance on task requirements
Part 3: Visual display requirements
Part 4: Keyboard requirements
Part 5: Workstation layout and postural requirements
Part 6: Environmental requirements
Part 7: Display requirements with reflections
Part 8: Requirements for displayed colours
Part 9: Requirements for non-keyboard input devices
Part 10: Dialogue principles
Part 11: Guidance on usability
Part 12: Presentation of information
Part 13: User guidance
Part 14: Menu dialogues
Part 15: Command dialogues
Part 16: Direct manipulation dialogues
Part 17: Form filling dialogues

The structure of ISO 9241, parts 10 to 17



Legend:

Standard contains general design criteria

Standard contains general design criteria and specific recommendations

Standard contains specific recommendations

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."

ISO 9241-11

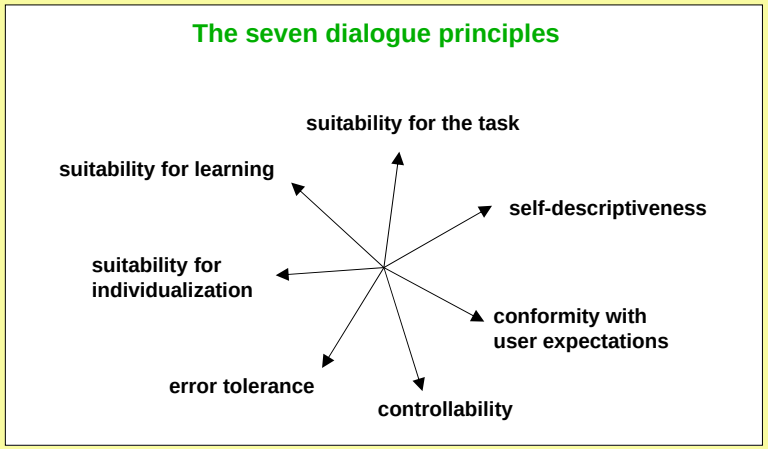
Effectiveness, Efficiency, Satisfaction

Effectiveness:	The accuracy and completeness with which users achieve specified goals.
Efficiency:	The resources expended in relation to the accuracy and completeness with which users achieve goals.
Satisfaction:	Freedom from discomfort, and positive attitudes to the use of the product.
Context of use:	The users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used.

6 Questions that a user should never need to ask himself!

- Where do I come from?
- How did I get here?
- Where am I?
- What can I do here?
- Where can I go from here?
- How do I get out of here?

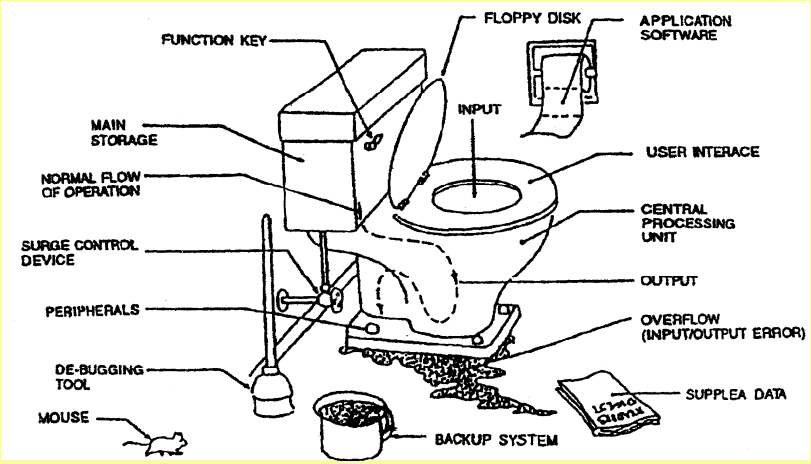
Principles of user interface design according to ISO 9241-10



Importance of Good User Interface Design

- Reduction in coding costs
- High costs of interface problems
- Serious life-threatening errors
- Good interfaces sell products
- Increased use of computers in the environment

Understanding Computer Technology



User Interface Code

In a modern graphics user interface program

- Estimated 40 to 90 percent of code concerned with user interface
- Most estimates around 70 percent
- If done wrong, has to be redone
- If not fixed, cost passed on to users

User Interface Economics

Good user interface may result in:

- Increased productivity
- Reduced training costs
- Preventable user errors
- Reduced employee turnover
- User satisfaction
- Higher quality products produced

Increased Productivity

X	500 menu selections per day
X	3 sec per selection
X	230 days per year
=	480 hours
	or 12 weeks

Reduce the menu selection time to 1 sec
8 extra weeks out of your best people

At $120K salary, that lost time will cost $21K

Reduced Training Costs

20 employees
X 2 systems/applications per year
X 2 1/2 days per application

=100 days
or 20 weeks

Training and support often more costly than hardware and software

Reduced error rate

250 users avoid
1 error per week (that is 0,2 error per day), thereby saving
2 minutes “recovery time” for every avoided error.
220 working days,
75 $ salary per hour.
250 x 0,2 x 220 x $ 2.5 / error = **$27,500 saved per year**

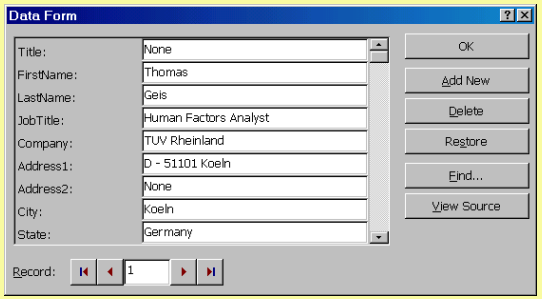
Reduced implementation costs

Given a usability defect, an early design change is then
about 1/4 cost of a late implementation change.
(This holds for an inhouse project.)

20 changes made during design,
8 hours needed per change,
150 $ salary per hour.

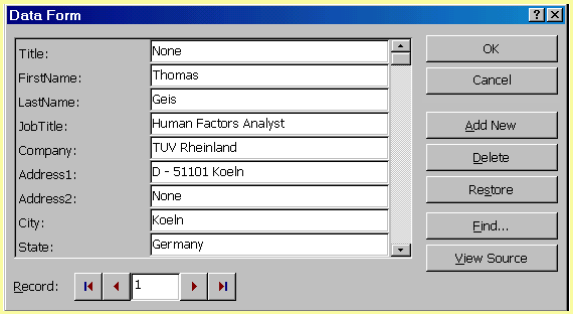
Design change costs: 20 x 8 x $150 = $24,000
Implementation change costs: 4 x design costs = $96,000
Total cost savings: 96,000 – 24,000 = $72,000

Negative example
Not self-descriptive dialog
(Source: Microsoft Word)



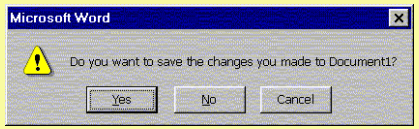
Problem:
The dialog can only be aborted through the window menue or the escape key.
The button “Cancel” is missing.
For novice users who do not know the window menue, the dialog is not even controllable.

Self-descriptive Dialog
(Source: TÜV Rheinland)

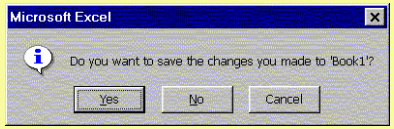


The dialog has an additional “Cancel”-Button.

Negative example
Dialog does not conform with user expectations!
(Source: MS Office)



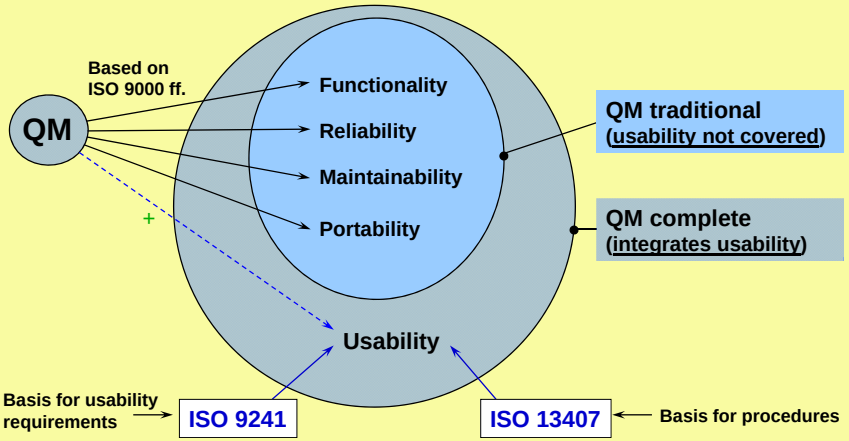
Close message of MS Word for Windows



Close message of MS Excel for Windows

The style is inconsistent

Quality Management (QM) and Usability



Human-centred design processes for interactive systems

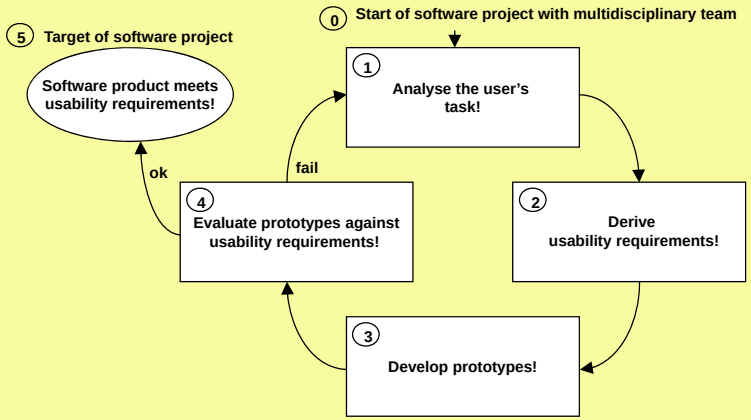
ISO 13407

Human-centred software projects include:

- Multidisciplinary Designteams
- Analysis of the context of use (users, tasks, environment)
- Validation of the analysis with users
- Specification of usability requirements
- Development of prototypes
- Evaluation of prototypes against specified usability requirements with users

ISO 13407

"User centred design processes for interactive systems"



ISO 9241-12 Presentation of information

- General guidance
- how to organize information
- Use of coding techniques

Summary

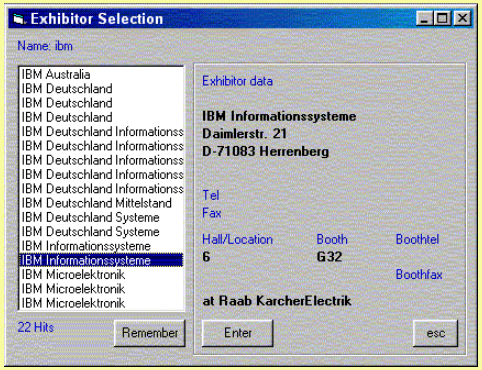
- Display only task related information
- The task requirements determine the screen layout
- Spare usage of attributes (underline, blinking, colour etc.)

ISO 9241-12 Principles for presenting information

- **Clarity** (the information content is conveyed quickly and accurately)
- **Discriminability** (the displayed information can be distinguished accurately)
- **Conciseness** (users are given (only) the information necessary to accomplish the task)
- **Consistency** (the same information is presented in the same way throughout the application, according to the user's expectation)
- **Detectability** (user's attention is directed towards information required)
- **Legibility** (information is easy to read)
- **Comprehensibility** (meaning is clearly understandable, unambiguous, interpretable, and recognizable).

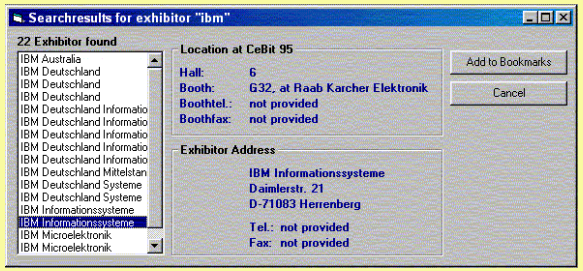
Negative Example 1

Unclearly arranged window



Problems: no appropriate grouping of information
push buttons vary in size
push buttons are labelled poorly

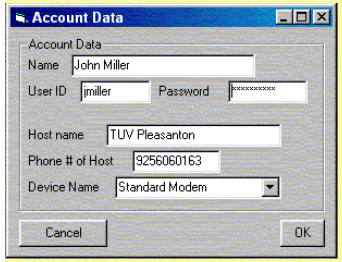
Clearly arranged window



- Task related information has been grouped
- Push buttons have been placed and labelled decently

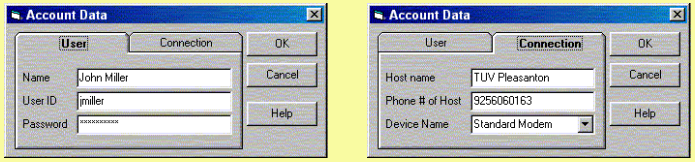
Negative Example 2

Unclearly arranged dialog box



- Bad continuation of dialog elements
- The group box is not needed, since the window itself is the group
- The dialog box has a minimze and maximize button
- The push buttons vary in size

Clearly arranged dialog box



The dialog box employs property sheets to group information.

User Interface Styleguides

The Windows Interface Guidelines for Software-Design
Microsoft Corporation, ISBN: 3-86063-226-4
(HTML-Version on the Web: www.microsoft.com/win32dev/uiguide/)

Macintosh Human Interface Guidelines
Apple Computer, Inc., Addison Wesley Publishing Company, 1992
ISBN: 0-201-62216-5

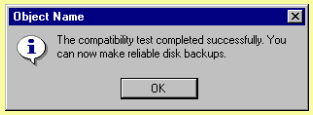
Object-Oriented Interface Design, IBM Common User Access Guidelines (CUA),
IBM Corporation, published by Que Corporation, 11711 N. College Avenue, Carmel, IN 46032, 1992, ISBN: 1-56529-170-0

Mobile visitors to retail sites overtake desktop visitors in the U.K.

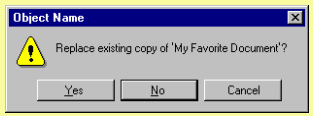
- 52% of retail site traffic now originates on tablets or smartphones, and transactions from those devices account for more than a third of U.K. web sales.
- U.K. consumers in Q2 2014 more often turned to their mobile devices than their computers to connect with retailers, with 52% of traffic to retail web sites coming from smartphones and tablet computers.
- It was the first time U.K. retailers received more web traffic from mobile than from the desktop web
- More than a third, 36%, of U.K. online sales took place on mobile devices in the May to July quarter, according to the report. Of those, 82% of those took place on tablets and 18% on smartphones.
- The report estimates web sales across all devices, including desktop and laptop, for the quarter were 24.2 billion pounds ($39.9 billion), with mobile devices accounting for 8.7 billion ($14.4 billion) of the total.
- In 2014, mobile sales will reach 21% of total web sales for the leading 500 retailers in mobile commerce worldwide, according to data in the newly published 2015 Internet Retailer Mobile 500.
- Mobile sales by the world's 500 leading retailers in mobile commerce should reach $84 billion in 2014, **up 80%** from $47 billion in 2013, according to the 2015 Internet Retailer Mobile 500

Source: http://www.internetretailer.com/2014/09/02/mobile-visitors-overtake-desktop-visitors-rthe-uk, September 2, 2014

Message box types



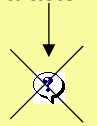
Informative character



Warning character

Critical Character

Confusing character



Example for incorrect classification of a message box

Incorrect, because “no mail” is not a warning

Correct, because message is simply informative

Rules for use of Colors

- as few colors as possible, as many colors as necessary
- never use color as only means for information coding
- never use more than 7 colors at once
- use pastel colors
- never use saturated colors (e.g. intensive red, intensive blue)

This is the worst color combination

NEVER USE
intensive red on intensive blue
or
intensive blue on intensive red

Madrid

Suitable Color Combinations

Background Color \ Foreground Color	black	white	magenta	blue	cyan	green	yellow	red
black		+	+	-	+	+	+	-
white	+		-	-	-	-	-	+
magenta	+	+		-	-	-	-	-
blue	-	+	-		+	-	+	-
cyan	+	-	-	+		-	-	-
green	+	-	-	+	-		-	-
yellow	+	-	+	+	-	-		+
red	-	+	-	-	-	-	+	

Legend

\+ Color combination suitable, bright background colors are only suitable for displays where no flicker is visible

\- Color combination NOT suitable, either the color differences are to small, thin lines not visible or the focus capabilities of the human eye are stressed

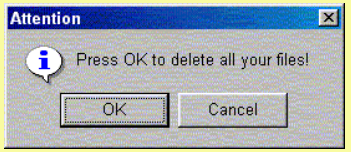
User Guidance - ISO 9241-13

- User guidance as defined in ISO 9241-13 is additional information beyond the regular user-computer-dialogue that is provided to the user on request or is automatically provided by the system

ISO 9241-13 covers:

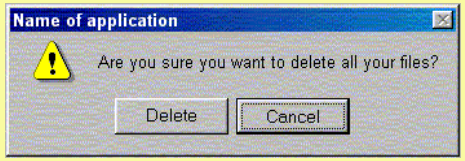
- common guidance recommendations (see clause 5)
- prompts (see clause 6)
- feedback (see clause 7)
- status (see clause 8)
- error management (see clause 9)
- on-line help (see clause 10)

Negative example: Feedback 1



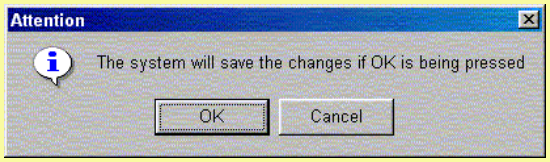
- The user action is described before the consequence
- The user is tempted to perform the action without considering the consequences

Better:



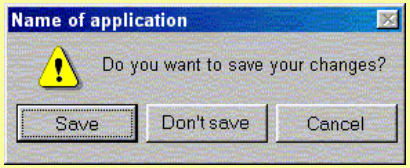
- The consequences are described before the required action

Negative example: Feedback 2



- The message does not actively address the user

Better:

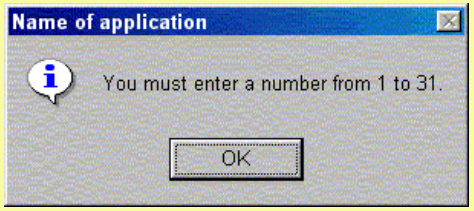


- User is addressed actively
- The user control is enhanced

Negative example: Feedback 3

- No hint towards the cause of the error
- No hint towards the correct entry

Better:

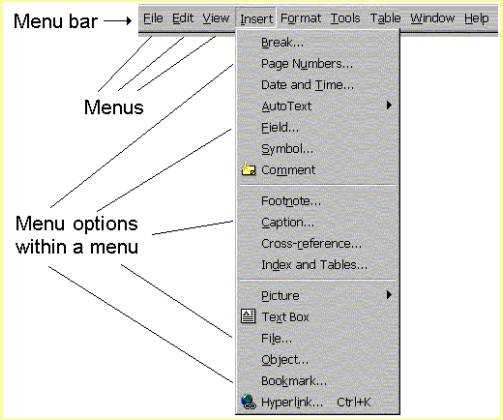


- Correct hint towards the expected entry

Menu Dialogues - ISO 9241-14

- The menu allows to select one item out of a group of known items.
- The user gets an overview about the type and extent of possible actions and options.
- Menus prevent the user from repeated leaning and active repetition of many codes and commands.

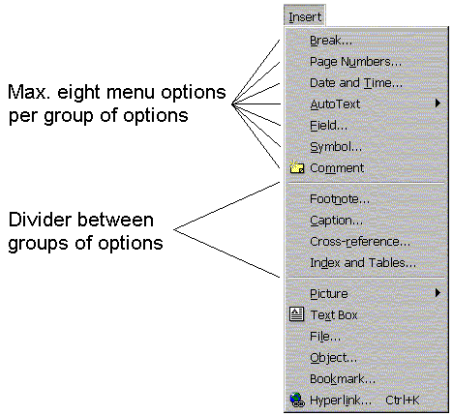
Menu Design within the Menu Bar



Esspecialy untrained and ocasional users of an application prefer menu bars because of their textual presentation.

On the other hand trained and frequent user usually go around the menu bar to save steps e.g. using shortcuts and tool bars

Grouping of Menu Options



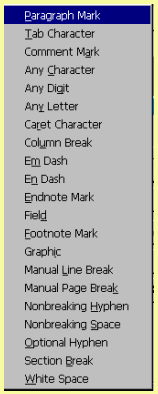
Conventional order
or
logical order
or
logical order of use
or
frequency

Choose clear titles:

- represent objects by noun
- represent actions by verbs

Negative Example: Unsorted Menu

(Source: Microsoft Word)

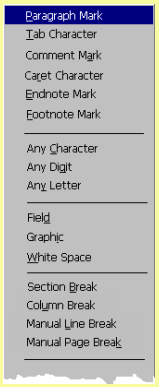


Disadvantage:

- no grouping of options
- no structured search possible
- long search time

Sorted menu in accordance with ISO 9241-14

(Source: TÜV Rheinland)



- Options are grouped
- maximum of 8 options per group of options
- most frequent used options are positioned at the start of the option group

Advantage:

- Grouping supports faster identification of searched objects
- minimized search time

Evaluation of usability

Practically three methods available:

1. Expert evaluation (asking usability expert)
2. User test (testing with users)
3. User interview (asking users)

1. Expert evaluation

Prerequisites:

- Knowledge about the user group and their tasks
- Familiarity with the evaluated software

Description:

The software is evaluated by a usability expert against agreed recommendations using guidelines and checklists

Goals:

Rough analysis for non-compliances with agreed recommendations (such as ISO 9241)

2. User test (Usability test)

Prerequisites:

Access to representative end user and their tasks

Description:

Typical end user perform typical tasks with the software while they are observed and recorded (e.g. Video)

Goals:

Identification of hurdles during task completion

3. User Interview

Prerequisite:

Sufficient amount of **experienced** users of the software are available

Description:

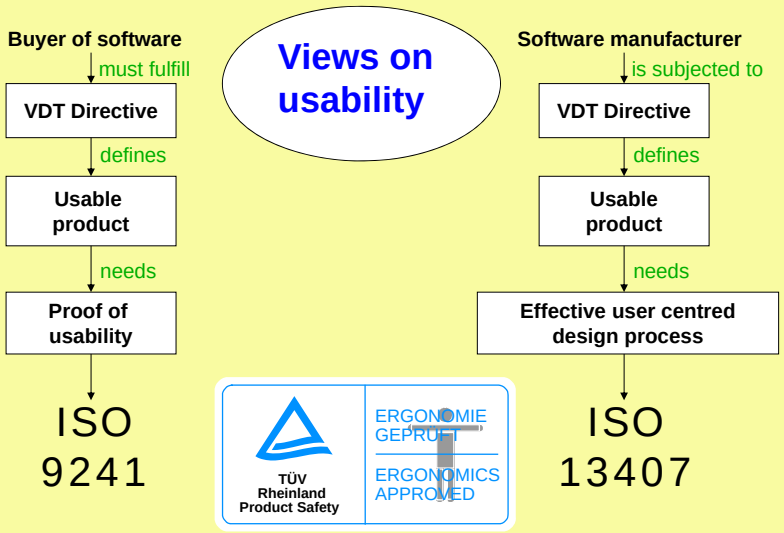
Experienced user of the software answer standardized questionaire, e.g ISONORM or SUMI

Goals:

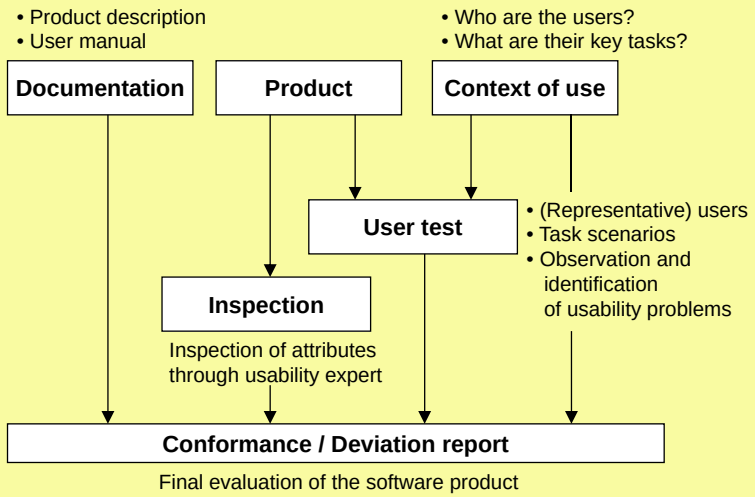
Rough determination of user satisfaction

Example for User interview using standardized questionaire (ISONORM)

Controllability								
Can you as a user influence the way you work with the software?								
The software …	---	--	-	+/-	+	++	+++	The software …
requires to follow a unnecessary strict order of operational steps								does not require to follow a unnecessary strict order of operational steps
…								…



Test procedure for software products



Product evaluation vs. process evaluation

Problem:

Straightforward product testing is not practicable for complex software products (many different tasks, user groups and environments)

Solution:

VDT Directive „the principles of User Interface Design/Human-Computer Interaction must be applied“

User-centred design process