Certified Professional for Usability Engineering
Foundation Level

International Board for Usability Qualification

Revision History

Version	Date	Remark
1.0	18 Apr. 2011	Additional review
1.0 BETA	11 Feb. 2011	Additional changes, terms and references
0.9	07 Feb. 2011	Changes after extensive external review; terms added
0.8	19 Jan. 2011	Changes after first meeting with Prof. Dr. Karl-Werner Jaeger
0.7	12 Jan. 2010	Training period extended to 2.5 days
0.3	20 Dec. 2010	Changes incorporated as per IBUQ meeting
0.2	08 Oct. 2010	Changes after first review cycle
0.1	06 Aug. 2010	Prototype version

Introduction to this Syllabus

1) Purpose of this Document

This syllabus forms the basis (Foundation Level) of the International Board for Usability Qualification (IBUQ) certification program for a Usability Professional. The IBUQ provides this syllabus to accredited training providers who will derive examination questions in their local language and create any courseware required. The syllabus will help candidates in their preparation for the certification examination.

2) The IBUQ Usability Professional, Foundation Level

	Objectives
Obtain new key qualifications	Software products or websites must fulfill their intended objectives and tasks. Usability and User Experience as key competencies ensure that users or visitors are guided through the application and its contents according to their needs.
	Benefit
Increase your customers' satisfaction	Customer satisfaction is achieved when they experience the performance that meets their expectations. Improved usability of software and Internet applications minimizes any discrepancy between the expectations and the perception of performance, and also strengthens customer loyalty.
Minimize follow-up costs	Usability measures should be taken prior to the launch or relaunch of a website or the market launch of a software product. Earlier measures avoid damage to the image or loss of customers or visitors and reduce costs for future improvements or corrective actions.
Competitive advantage	Usability not only helps to win over desirable target groups, but also makes the provider's products and services stand out from those of the competition.
Build confidence	The users' needs are taken seriously making them feel more comfortable with the Internet or software solutions. This will strengthen their positive attitude towards the provider and the brand as well as improve customer loyalty.
	Focus
Human-machine interfaces	Understanding the process of perception; ergonomics; explaining the difference in online and offline behaviors

User-oriented design	Design principles for software products, GUI design, storyboard, paper mockups, prototyping, WireFrames, card sorting or personas
Standards, norms and legal regulations	Overview of the most important standards, norms and legal regulations
Usability Engineering Lifecycle	Process-oriented procedure to safeguard future usability of a system
Evaluation / techniques	Usability testing, techniques and procedures for usability data elicitation
Exercises	Planning and performing a usability test

The Foundation Level of the certification program for Usability Professionals addresses all persons and professional areas involved in the development of software or Internet applications including software designers, GUI programmers, project managers and personnel, organizers, supervisors, technical staff, IT auditors and quality assurance representatives.

The program assumes basic experience gathered in development projects. Holders of the Foundation Level Certificate will be able to go on to a higher-level Usability Professional certified qualification.

Usability projects can only be successful when all persons involved have access to common terminology and a common understanding of the key concepts. Associating the same terms with different concepts might otherwise lead to misunderstandings.

A knowledge base ensures that definitions and basic skills are obtained both about the human being (for example, through perception, mental models, faulty behavior) and about the techniques for developing interactive systems (for example, interaction styles, modeling techniques, dialog principles). Generally accepted standards are an essential part of the Foundation Level syllabus.

Focus is also put on the development process: The term *Usability Engineering* implies that ergonomic design does not emerge at a certain point or will be demonstrated only in the end, for example, with the aid of a user survey, but that a complete engineering process must be followed from requirements analysis through prototyping and specification to implementation, evaluation and testing.

3) Learning Objectives / Cognitive Levels of Knowledge

Each section of this syllabus has a cognitive level associated with it:

K1 Proficiency / Knowledge: Knowledge of precise details such as terms, definitions, facts, data, rules, principles, theories, characteristics, criteria, procedures; candidates are able to recall and express knowledge.

K2 Understanding: Candidates are able to explain or summarize facts in their own words, offer examples, understand contexts, interpret tasks. This includes being able to transfer the contents from one notation into another (for example, words into a diagram), to explain and summarize the contents, and finally to derive future developments from the contents.

Not part of the Foundation Level:

K3 Apply: Knowledge transfer for problem solution: Candidates can apply their knowledge in new situations and use abstractions or form their own abstractions. Ability to use the acquired knowledge in new specific situations, for example, by applying certain rules, laws or theories. For example, an IT student should be able to program different sorting algorithms in any assembler language or a math student must be able to reason mathematically according to the valid rules.

K4 Analysis: Candidates are able to partition a problem to understand how it is structured; they are able to discover inconsistencies, recognize correlations and derive conclusions, and distinguish facts and interpretations. This includes, for example, identification of the individual elements, determination of the relationships between the elements and recognition of the design principles. The Analysis level requires a higher knowledge level than Understanding and Apply, because it assumes that both the contents and the structure of the learning matter are well understood. For example, the learning activity of art history students discovering the elements of a painting that determine the style and assigning them to a specific epoch belongs on this level.

K5 Composition: Candidates are able to build a new structure or create a new meaning on the basis of several elements; they are able to suggest new approaches, design new schemas or conceptualize substantiated assumptions.

K6 Judgment: Candidates are able to assess the value of ideas and materials and use them to weigh alternatives against each another, select them, make decisions and give reasons for them, and to deliberately transfer knowledge to others, for example, by providing flow charts.

4) The Examination

The Foundation Level Certificate examination will be based on this syllabus. Answers to examination questions may require the use of material based on more than one section of this syllabus. All sections of the syllabus (chapters 1 to 5) may be included in the examination.

The format of the examination is multiple choice.

Exams may be taken as part of an accredited training course or taken independently (e.g. at an examination center). The training providers approved by the IBUQ are listed on the IBUQ website (www.ibuq.org).

5) Accreditation

Training providers whose course material follow this syllabus must be recognized and accredited by the IBUQ.

6) Level of Detail

This syllabus is intended to allow internationally consistent training and testing. This syllabus comprises the following components to reach this goal:

- General instructional objectives describing the intention of the Foundation Level
- A list of information to teach, including a description, and references to additional sources if required
- Learning objectives for each knowledge area describing the objective cognitive learning outcome of the course and the attitude that the participant is to achieve
- A list of terms that participants must be able to recall and understand
- A description of the key concepts to be taught, including sources such as accepted technical literature, norms or standards

The syllabus content is not a description of the entire "Usability" field of knowledge. It reflects the scope and level of detail to be covered in Foundation Level training courses.

7) How this Syllabus is Organized

There are four major chapters. The top-level heading for each chapter shows the learning objectives that are covered within the chapter and specifies the minimum amount of time that an accredited course must spend on the chapter.

For example:

2 Human-Machine Interface (K2) 390 minutes

This heading shows that Chapter 2 has learning objectives of K1 (higher learning objectives imply the learning objectives of lower levels) and K2 (but not K3), and 390 minutes are scheduled to teach the material in the chapter. Within each chapter there are a number of sections. Each section also has the learning objectives and the amount of time required. Subsections that do not have a time associated with them are included within the time for the section.

How the Syllabus is Organized

Total training time: 2.5 days, 1200 min. (20 hours)

Day 1 (480 minutes)

1 Principles of Usability (K2) — 90 minutes

1.1 Necessity and benefits of Usability (K1, 4 LO, 90 min.)

2 Human-Machine Interface (K2) - Part 1 (K2) — 390 minutes

2.1 Software ergonomics and design philosophies (K1, 3 LO, 60 min.)

2.2 Human information processing (K2, 7 LO, 90 min.)

2.3 Standards and style guides (K2, 11 LO, 240 min.)

Day 2 (480 minutes)

2 Human-Machine Interface (K2) - Part 2 (K2) — 90 minutes

2.4 Accessibility (K2, 11 LO, 90 min.)

3 Usability Engineering – Part 1 (K2) — 390 minutes

3.1 Principles of Usability Engineering (K1, 5 LO, 120 min.)

3.2 Analysis and concept phase (K2, 5 LO, 60 min.)

3.3 Design phase (K2, 5 LO, 60 min.)

3.4 Prototyping phase (K2, 5 LO, 120 min.)

3.5 Evaluation phase introduction (K2, 5 LO, 30 min.)

Day 3 (240 minutes)

4 Usability Engineering – Part 2 (K2) 240 minutes

4.1 Usability testing and evaluation (K2, 5 LO, 240 min.)

Syllabus

1. Principles

1	Principles of Usability (K2)	90 minutes

1.1. Necessity and benefits of Usability (K2) – 5 LO (90 minutes)

LO-1.1.1	Classify and define Usability (K1)
LO-1.1.2	Show the benefit for the user as well as the economic benefit of Usability for providers (K2)
LO-1.1.3	Use examples to describe the problems involved with insufficient Usability (K2)
LO-1.1.4	Define User Experience (UX) (K1)

1.1	Necessity of Usability (K2)	90 minutes

1.1.1	Classify and define Usability (K1)	30 minutes

Terms
Usability, serviceability, learnability, efficiency, memorability, error, satisfaction

Usability ensures that products and applications are usable. It should be easy to learn, understand and use any functions included.

Today Usability is a major factor in the development and design of software and Internet applications. Functionalities are often integrated in systems, however they cannot be used or used correctly by the user because they are complicated to use or because they cannot be found.

The International Organization for Standardization (ISO) describes Usability as "the extent to which a product can be used by certain users to reach specific objectives within a specific context of use with effectiveness, efficiency and satisfaction" [TA08, page 4]. The serviceability and the suitability of a system in a user context are thus put in a specific user context.

Jakob Nielsen defines the following target variables as benchmark for the quality of user interaction with a system:

- **Learnability:** It should be easy to learn the system in order to manage the tasks as quickly as possible.
- **Efficiency**: It should be possible to use the system within a reasonable period of time and the system should be highly productive.

- **Memorability**: It should be easy to remember how to operate the system and use it without repeated training even after a longer break.
- **Errors**: The system's error rate should be low.
- **Satisfaction**: The user should enjoy using the system and be satisfied with it.

Despite all these requirements, the design should not be neglected. For example, the user decides within the first 50 milliseconds whether or not he/she likes a website. If users exit a website for this reason, all usability measures will serve no purpose. Furthermore the aesthetics of a website contribute to its usability, because it makes the user feel more comfortable and he/she is thus more satisfied.

Eventually the creator of a website or a software application determines the purpose of the product. For example, websites used for marketing purposes show a preference for design over functionality. Usability always has to take the relevant context of impact into consideration in order to reach its objectives.

A high degree of usability in development is achieved with an iterative process, the Usability Lifecycle. Repeated and continually improved analysis and involvement of the target group in usability tests and their evaluation generate products with increased user-friendliness. New technologies continuously being added, such as mobile devices and services, account for perpetual review and extension of the methods employed in the development of usable products.

Reference
Nielsen [1]

1.1.2	Show the benefit for the user as well as the economic benefit of Usability for providers (K2)	30 minutes

Terms
Increase in productivity, competitive advantages, cost reduction

Today's applications must meet the customers' expectations; must be simple and intuitive to use; and easy to understand.

In general, usability is an extremely effective tool for cost reduction. Usability helps the designers to create less complex products. Less complex products can be sold more easily and are easier for the customer to operate.

Basically usability tests are an effective way to save time in the development and implementation of software websites and to reduce the stress on the design team. The test determines in advance the criteria that are important to the user and those that are less important. Furthermore the test helps to find weak points and errors at an early stage that could have a tremendous impact if found in a later development phase. The earlier an error is detected, the smaller the effort required to resolve it is.

Usability Engineering, an iterative process for improving the usability of products, causes many monetary and non-monetary usability benefits. They can be quantified for three basic areas:

- Increase in productivity
- Reduction of incurred costs
- Improved competitiveness

Reduction in costs and resources in the development process are made possible through:

- Target group-oriented development from the beginning; saves future "touching up".
- Avoiding unnecessary design iterations.
- Avoiding the development of unnecessary functions.
- Allowing the design to be clarified and communicated with the customer at an early stage.

Furthermore:

- Your own staff members are sensitized and receive additional training.
- The training costs for your own staff members are reduced, for example, by using uncomplicated operational systems within the organization.
- Usability test results help to make the right decision which enables uncomplicated strategic decision-making for the organization.

Reduced costs and resources in practice are possible when:

- The solution is efficient.
- The training effort is reduced and the solutions are easy to use.
- The support and call center effort for easily usable solutions is reduced.
- User errors are avoided and the effort to perform troubleshooting is reduced due to user-friendly solutions.

Quality is improved by:

- Optimal mapping of the workflows, tasks and systems.
- Meeting the actual user requirements (and not only the buyers' expectations).
- Transparency of the services and contents based on user-oriented information architecture.
- Ensuring internal and external consistency of the user interfaces.
- Integrating cutting-edge usability know-how from science and practical experience.
- Integrating the relevant industrial standards.

Increased potential for innovation and marketing is made possible by:

- Developing target-oriented, innovative solutions based on the knowledge of real user needs.
- Using multidisciplinary knowledge and methods.
- Integrating experience and know-how from other domains.
- Techniques for increasing the potential of innovations by involving the users or on the basis of expert knowledge.

1.1.3	Use examples to describe the problems involved with insufficient Usability (K2)	15 minutes

Terms
Target group relevance

Unfortunately usability is often prone to being deleted from the project budget. Similar to documentation or quality assurance, usability is regarded as a nice-to-have factor of the development process and is therefore given a lower priority by the management.

However, usability may directly lead to the success or failure of a software application or website. Particularly in online trade it has a direct impact on the sales figures of the stores. Not being able to find central store functionalities, such as the shopping cart or the checkout path, or insufficiently described or hidden products within the product line may lead to loss of sales.

Usability problems can be more dangerous for example, in medical devices, because incorrect setup may harm the patients' health. Switches and buttons in airplane cockpits must be easily accessible and operable even in stressful situations; status indicators must be quickly and directly comprehendible.

1.1.4	Define User Experience (UX) (K1)	15 minutes

Terms
User Experience (UX), Joy of Use

User Experience, in addition to Usability, not only represents the user's experience with the product itself, but a holistic approach including all experiences related to this product in any context.

All experiences and the feelings involved are evaluated, from the desire to own this product to its last use. In addition to the actual serviceability of a product, factors such as reliability, emotion or aesthetics are considered. Using the product should trigger a "Joy of Use" feeling. The meaning of User Experience therefore includes the emotional appeal of the software.

2 Human-Machine Interface (K2) - Part 1 (K2) 390 minutes

2.1 Software ergonomics (K2) – 3 LO (60 minutes)

LO-2.1.1	Describe the procedure and areas of application of software ergonomics (K2)
LO-2.1.2	Describe universal design (K2)
LO-2.1.3	Know the Weimar Declaration from the Universal Design Expert Conference (K1)

2.2 Human information processing (K2) – 7 LO (105 minutes)

LO-2.2.1	Describe the biological principles of visual perception (K1)
LO-2.2.2	Distinguish dynamic and static vision (K1)
LO-2.2.3	Explain the anatomic-physiological restrictions of human perception (K1)
LO-2.2.4	Estimate color associations and color effects (K1)
LO-2.2.5	Describe color vision defects (K2)
LO-2.2.6	Describe the environmental impact on Usability (K1)
LO-2.2.7	Provide an overview of the Gestalt laws and some examples (K1)

2.3 Standards, norms and and style guides (K2) - 5 LO (225 minutes)

LO-2.3.1	Rank the significance of standards (K1)
LO-2.3.2	Provide an overview of DIN EN ISO 9241 (K1)
LO-2.3.3	Provide an overview of DIN EN ISO 9241-110 ("Dialog principles") (K2)
LO-2.3.4	Provide an overview of organization-related industrial standards (style guides) from providers such as Apple, IBM, Microsoft, SAP, SUN Microsystems (K1)
LO-2.3.5	Provide an overview of W3C activities and describe the differences between W3C standards and other standards (K2)

2 Human-Machine Interface (K2) - Part 2 (K2) 90 minutes

2.4 Accessibility (K2, 4 LO, 90 min.)

LO-2.4.1	Provide an overview of the "E-Government Guide – Quality Criteria for a Public, User-Friendly and Secure Website" (K1)
LO-2.4.2	Know the Equality Act for the protection of disabled people (BGG 2002) and the regulation to create accessible information technology according to the Equality Act (BITV 2002) (K1)
LO-2.4.3	Demonstrate the international differences in handling accessibility using examples (K1)
LO-2.4.4	Provide an overview of various computer utilities for blind and visually impaired people (K1)

2.1 Software ergonomics (K2) 60 minutes

2.1.1.	Describe the procedure and areas of application of software ergonomics (K2)	30 minutes

Terms
HMI, HCI, software ergonomics, hardware ergonomics, user interface

With regard to software ergonomics, human-machine interaction (HMI) can be narrowed down to human-computer interaction (HCI). In Englishspeaking countries the latter is also referred to as software ergonomics. In the end, HCI includes both software and hardware ergonomics.

Hardware ergonomics adapt the tools (input and output devices) for human-computer interaction to the physiological characteristics of humans, while software ergonomics has the goal of adapting to the cognitive capabilities or ability to process human information.

Both focus on the user interface, which as per Herczek include the following components and characteristics:

- User interface including the input options for the users and output options of the computer system
- Rules for input and output processes on the user interface
- Systems to support human computer communication

With regard to software ergonomics, input and output processes are not related to using technical devices such as a mouse or keyboard, but to dialog operations within the software such as menus, command dialogs or input

forms. This enables interaction or a mutual influence between humans and the computer. Software ergonomics provide guidelines for a user-oriented design of software and interactive systems.

The following interdisciplinary approaches must be included in the field of software ergonomics:

- **Biology**
  Biological principles such as visual color and sensory perception, auditive perception of sounds or haptic perception, which is the active sensing of an object by integrating all tactile senses of the skin as well as bathyesthesia
- **Psychology**
  Applying the theories of cognitive processes, design psychology and empirical analysis of user behavior
- **Sociology and anthropology**
  Interaction between technology, work and organization
- **Computer sciences**
  Application design and development of human machine interfaces
- **Design**
  Design of the appearance of interactive applications

Formal guidelines for software ergonomics are defined in the Regulation for Computer Workplaces (applicable law in Germany since 1996) as well as in standard DIN EN ISO 9241.

Reference
Michael Herczeg [2]

LO-2.1.2	Describe universal design (K2)	15 minutes

Terms
Universal Design

Universal Design (also known as Universal Usability) aims to design products and services in a way that they can be used by all people regardless of their age, capabilities and usage scenario.

As needed, "Universal Design" includes support for certain groups of people with disabilities.

LO-2.1.3	Know the Weimar Declaration from the Universal Design Expert Conference (K1)	15 minutes

Terms
Weimar Declaration

In twelve theses the so-called Weimar Declaration summarizes the results from a national expert conference for universal design and describes the challenges for politics, business, service providers, architects and designers with regard to the demographic change in Germany and in other industrial nations worldwide:

- Universal design puts the human being in the focus.
- Universal design is not only a matter of design.
- Universal design is an interdisciplinary task.
- Universal design is open for all users.
- Universal design creates service systems.
- Universal design is a process, not a standard.
- Universal design creates social integration.
- Universal design asks questions about the future.
- Universal design is an attitude and responsibility.
- Universal design must be embedded permanently in training at an early stage.
- Universal design has to enlighten politics and business.
- Universal design consolidates and promotes economic growth.

Reference
Weimarer Erklärung [3]

2.2 Human information processing (K2) 105 minutes

LO-2.2.1	Describe the biological principles of visual perception (K1)	15 minutes

Terms
Primary colors, cones

Visual perception is not only determined by the physical condition of the eyes. Moreover, the strongest impact is caused by processing through the executive system of the brain. Habits as well as psychological facts play a major role in this.

Anatomy and primary colors
The main field of vision is approximately 30° around the optical axis.
The residual area (up to 110°) is peripheral.

The eyesight is formed by:
- Rods for gray tones (brightness).
- Cones for color tones.

Cones need a certain light intensity in order to function correctly.
- 3 cone types
- 3 primary (fundamental) colors
- (Almost) any choice of primary colors; mixed all visible colors from the signals of the 3 cone types

Reference
S. Schubert & C. Eibl, Universität Siegen, Didaktik der Informatik und E-Learning [4]

LO-2.2.2	Distinguish dynamic and static vision (K1)	15 minutes

Terms
Static vision, dynamic vision

Distinguished between:
- Static vision
- Dynamic vision

Static vision:
- Focusing on one object

- Clear vision
- Nuances of brightness and color are seen clearly

Dynamic vision:
- Mostly peripheral field of vision.
- Even the smallest movements are visible.
- Details not so important: the "danger" must be perceived.
- Tightly linked to attentiveness.

Reference
S. Schubert & C. Eibl, Universität Siegen, Didaktik der Informatik und E-Learning [4]

LO-2.2.3	Explain the anatomic-physiological restrictions of human perception (K1)	15 minutes

Terms
Optical limitations, visual illusions, receptors

Limitations on perception cause humans not to apprehend their environment as it is.

- Perception of individual images as a continual process
  - Cartoon
  - Flip book
  - TV
- 22 Hz are enough for the perception of movement
- But: the eye "gets used" to the current image
- Integrating the use of half images to perceive more changes
- Sensitivity to movements is much higher in the peripheral area (edge) of the field of vision
- Movements of prey or predators
- Rapid movements are perceived as flickering
- 50 Hz of the TV/monitor can be perceived as flickering
- Flashing elements, for example, on websites immediately grab attention
- Preprocessing of images in the retina (which has a filtering function to relieve the brain) (data reduction)
- Crosslinks between receptors do not allow for obvious effects in natural images, but they can be triggered by artificial images ("visual illusion")
- Different gray tones within gray boxes
- Wrong perception of contrast with different comparison values
- Linking of receptor cells causes mutual influence

Additional examples for limitations/illusions:

- "Lateral inhibition"
- Herman grid illusion

Reference
S. Schubert & C. Eibl, Universität Siegen, Didaktik der Informatik und E-Learning [4]

LO-2.2.4	Estimate color associations and color effects (K1)	15 minutes

Terms
Color associations, color effects

Colors are not only relevant for design and highlighting; they excite associations and create emotional and psychological effects. Colors can make messages look more important, but can also confuse the recipient. Depending on the context, colors can have a positive or negative effect.

Red: love, fire, energy, passion, blood, stop, danger, heat, drive
Green: acid, nausea, nature, hope, life, pacification, OK, poison
Blue: dynamic, nobility, competence, coolness (calmness vs. alienation)
Purple: extravagance, clergy, power, rigidness, decadence, sin, vanity
Yellow: sun, vitality, warmth, versatility, envy, death
Pink: cute, sweet, tender, naïve, soft
Orange: modern, funny, young, enjoyment, extroverted
Brown: warmth, decay, cozy, fascism, patina, rotten, aromatic, old-fashioned
White: pure, bright, complete, sterile, neutral, bride, empty, innocence
Black: death, night, elegance, mourning, neutral, difficult, threat, nothingness, misfortune, seriousness
Gray: pale, fog, neutral, boring, theory, poor, covert, unfriendly

Light
Cyan: passive, concentrated, conscientious
Turquoise: expectant, defending
Magenta: idealistic, transcendent, theoretical
Brown: reclusive, cozy
Gray: indifferent, hidden, uninvolved
White: illusionary, escapist
Black: pessimistic, hopeless, constrained

However, intercultural differences in the effect of colors must be considered. For example, in China the color white represents mourning or death.

Psychological color effects

Colors can be interpreted emotionally, too. These effects are partly based on the use of colors as a classification or safety system.
Today it is regarded as proven that certain colors can have an impact on physical reactions.

Reference

S. Schubert & C. Eibl, Universität Siegen, Didaktik der Informatik und E-Learning [4]

LO-2.2.5	Describe color vision defects (K2)	15 minutes

Terms

Color vision defects, trichromats, dichromats, monochromats, protanopes, deuteranopes, tritanopes

Compared to normal trichromats we distinguish the following congenital color vision defects:

a) Abnormal trichromats:

Seeing three colors, but in a different way than with normal three-color vision. It is a three-dimensional color vision, but the composition is different compared to normal color vision, meaning that the normal color triangle does not apply here.

b) Dichromats:

Dichromats can distinguish only two colors, because they lack the color sensitiveness of one receptor type. The color space is perceived two-dimensionally. All compositions in which the malfunctioning color tones appear are seen differently or achromatically compared to people with normal eyesight.

c) Monochromats:

Monochromats can only distinguish between bright and dark. They completely lack any color sensation and suffer from total color blindness. In rare cases it is a color blindness of the cones (rod monochromatics); in most cases the cones are missing completely (cone monochromatics).

We can distinguish:
Protanomaly = red weakness
Deuteranomaly = green weakness
Tritanomaly = blue weakness

a) Protanopes (cannot see achromatic images):
The receptor for 570nm is missing, which shortens the red color spectrum. All wavelengths above 570 nm seem to be the same; only colors from yellow through green to blue can be distinguished. On the anomaloscope, the protanope and the deuteronope perceive all compositions alike. Protanopes see 494nm as white.

b) Deuteranopes:
The receptor for 535nm is missing. Thus, all wavelengths above 530nm appear to be the same. Like protanopes they can only distinguish colors in the short-wave spectrum. The achromatic point lies at 499nm.

c) Tritanopes:
The receptor for 440nm is missing. Therefore wavelengths below 480nm cannot be distinguished. The achromatic point lies at 400nm and at 568nm.

A color vision defect occurs in about 8% of all men (mostly blue weakness) and 0.5% of all women.

Reference
Franz Docekal [5]

LO-2.2.6	Describe the environmental impact on Usability (K1)	15 minutes

Terms
Physical environmental influences, organizational environmental influences, social environmental influences

Environmental influences comprise various factors which influence human activities. Environmental influences can be classified in three different types:

- Physical environmental influences
- Organizational environmental influences
- Social environmental influences

Environmental influences can diminish human efficiency, sometimes significantly.

Examples:

- **Cold:** limited movement abilities/impaired motor skills, big hands (gloves)

- **Dark:** loss of color vision, blindness
- **Sunlight, brightness:** screens are hardly readable, low contrasts are invisible in glare
- **Stress:** limited intellectual power, reduced creativity
- **Loud environment:** quiet sounds are no longer perceived.
- **Alcohol:** limited intellectual power, lower capacity to react, poor ability to concentrate, impaired motor skills
- **Amphetamines:** limited intellectual power, poor ability to concentrate, impaired motor skills
- **Fatigue, exhaustion:** limited intellectual power, poor ability to concentrate, impaired motor skills

Reference
Dr. rer. nat. Dirk Struve [6]

LO-2.2.7	Provide an overview of the Gestalt laws and some examples (K1)	15 minutes

Terms
Gestalt laws

The Gestalt Psychology or Gestaltism was founded in the 1920s and investigates human perception. The Gestalt laws reveal the principles in the creation of entities.

A network of properties in the brain is used to create visual stimuli. An object is examined and classified using this network. Nine types of properties help to distinguish objects:

- Shape, color, brightness
- Size, direction, texture
- Arrangement, depth, movement

As per Zimbardo the Gestalt laws can be classified in various categories:

- Classification into properties
- Distinction between figure and background
- Closure and grouping
- Principle of “good design” and principles of grouping
- Integration in reference frames

The so-called Gestalt Psychology or Gestaltism investigates how human beings experience and perceive entities.

References
Butz, Schmid [7], Zimbardo [8]

2.3 Standards, norms and style guides (K2) 255 minutes

LO-2.3.1	Rank the significance of standards (K1)	30 minutes

Terms
Standards, DIN, EN, ISO

The *Deutsche Institut für Normung e.V.* (German Institute for Standardization, DIN) compiles standards based on a contract with the Federal Republic of Germany. As the national organization of standardization it is represented in the relevant European and international institutions.

The whole purpose of standards is a national and international alignment of products, promotion of rationalization, quality assurance and safety at work. They normalize test methods and facilitate communication in business and technology. Standardization and the resulting compatibility may cause competition and a corresponding pressure for innovation and on the price. They form the basis for legal certainty and play a major role in actions for breach of warranty, liability suits and actions for damages. However, they also restrict markets by excluding products which do not meet the standards.

Standards can be classified in the following areas:
- Safety standards
- Usability standards
- Quality standards
- Measurement standards
- Testing standards

DIN standards are checked for validity every five years at the latest.
DIN EN standards are standards comprised by the European standardization organization CEN which were accepted in the German standards. ISO standards are developed by the *International Standardization Organization* (ISO) and are often accepted at the European and national level.

LO-2.3.2 Provide an overview of DIN EN ISO 9241 (K1) 30 minutes

Terms
DIN EN ISO 9241

As per DIN EN ISO 9241 ergonomics of human-system interaction is the central element of the framework of standards for user interfaces in interactive systems.

DIN EN ISO 9241 describes quality guidelines to ensure the ergonomics of interactive systems. At first, the International Standards Organisation (ISO) named it "Ergonomic requirements for office work with visual display terminals". In 2006 the title was changed to "Ergonomics of human-system interaction" so as to no longer be limited to office work.

ISO standard 9241 is structured in 17 sections:

1. General introduction
2. Requirements for work tasks – Principles
3. Requirements for visual displays
4. Requirements for keyboards
5. Requirements for workplace design and posture
6. Requirements for the workplace environment
7. Requirements for visual displays regarding reflections
8. Requirements for color displays
9. Requirements for input devices except keyboards
10. Principles of dialog design
11. Requirements for usability – Principles
12. Presentation of information
13. User guidance
14. Dialog control using menus
15. Dialog control using command languages
16. Dialog control using direct manipulation
17. Dialog control using on-screen forms

References
DIN EN ISO 9241[9], Wolfgang Schneider [10]

LO-2.3.3	Provide an overview of DIN EN ISO 9241-110 ("Dialog principles") (K2)	30 minutes

Terms
Regulation for Computer Workplaces, design principles, suitability to tasks, self-descriptiveness, controllability, compliance with expectations, error tolerance, customization, conduciveness to learning

The Regulation for Computer Workplaces requires that software follow ergonomic principles.

BildschArbV (Regulation for Computer Workplaces, regulation on health and safety protections for work with computer monitors)

Appendix – on the requirements for computer workstations
Interaction between humans and work equipment

20. The principles of ergonomics are to be applied in particular for information processing by humans.

21. For the development, selection, purchase and change of software as well as any arrangements of computer activities the employer is to consider the following principles particularly with regard to user-friendliness:

21.1 The software must be adapted to the task to be carried out.

21.2 The systems must provide users with information about the various dialog procedures either directly or after being prompted.

21.3 The systems must enable the users to influence the various dialog procedures as well as describe possible handling errors and allow their elimination with minimal effort.

21.4 It must be possible to adapt the software according to the users' knowledge and experience and in view of the task to be executed.

22. Using a mechanism to monitor quality or quantity control without informing the user is not permissible.

These principles for software ergonomics are listed in standard DIN EN ISO 9241-110 (previously sect. 10) which is valid for German-speaking countries. Modern graphical database applications and web pages must meet these requirements as soon as they fall under the scope of this regulation.

Design principles according to DIN EN ISO 9241 section 110

Suitability to tasks

"A dialog is appropriate for a task when it supports users in executing their work task effectively and efficiently."

Suitability to a task occurs when an interactive system supports the user in executing the intended work task, meaning that functionalities and dialogs are not adapted to the execution of a task by the technology in use, but to the characteristic properties of the human work task.

Example: Specification of reasonable standard values in input fields

Self-descriptiveness

"A dialog is self-descriptive when the individual dialog steps are directly understood due to the feedback of the dialog system or when they are explained to the user after being prompted."

Self-descriptive dialogs mean that users are always able to trace and determine their current location among the dialogs and within them. The users clearly know what actions to take and how to carry them out.

Example: Status changes in the system are displayed and the user is informed about what input is expected and what the next step to be done is.

Compliance with expectations

"A dialog conforms to the expectations when it is consistent and corresponds to the characteristics of the user, for example, the skills required for the field of activity, the user's experience as well as commonly accepted conventions."

A dialog conforms to the expectations when it meets the predictable and context-dependent user requirements as well as commonly accepted procedures and conventions. Predictability of a dialog can be increased by a corresponding consistency in the design of the task.

Example: The same keyboard layout for all menus and masks

Controllability

"A dialog can be controlled when the user is able to start the dialog procedure as well as influence its direction and speed until the goal has been fulfilled."

Controllability is achieved, for example, when it is possible to switch media on or off, when the home page can be reached at any time, or when there are several exit options.

Example: Ability to undo the last input in input fields

Error tolerance

"A dialog is error tolerant when despite an obviously incorrect input the intended work result can be achieved with no or minimal correction effort by the user."

Error tolerance of a system should be improved through error avoidance, for example, by carefully planning structures and the navigation in advance. Users should be provided with clear and simple ways to perform any corrections themselves.

Example: Validation of forms prior to/after sending without losing the input entered

Customization

"A dialog can be customized when the dialog system allows adaptation to the requirements of the work task as well as individual preferences of the users and user capabilities."

Customization of a dialog is achieved when users can change human-machine interactions and the representation of information and adapt it to their individual abilities and needs.

Example: Ability to change the font sizes in the browser.

Conduciveness to learning

"A dialog is conducive to learning when it supports users in learning the functions of the dialog system and provides instructions."

Dialogs conducive to learning provide inexperienced users with help functions.

Example: FAQs and help pages

New features in ISO 9241-110

A resolution of the International Organization for Standardization (ISO) extended the graphical user interfaces in traditional office environments (previous title: "Ergonomic requirements for office work with visual display terminals") to user interfaces in other operating areas (current title: "Ergonomics of human-system interaction"). Therefore the standard also applies to other systems such as ticket machines or complex displays and the user interfaces of interactive information systems.

Revision of the definitions caused a clearer formulation of the seven principles of dialog design.

References
BildschArbV [11], DIN EN ISO 9241[9]

LO-2.3.4	Provide an overview of organization-related industrial standards (style guides) from providers such as Apple, IBM, Microsoft, SAP, SUN Microsystems (K1)	30 minutes

Terms
Style guides, corporate design

Style guides are based on the corporate design and specify clear guidelines for designing the printed material and web designs of an organization.

The specifications often include the definition of colors, templates for certain wordings in correspondence, and regulations for source codes of programs and web pages.

This guarantees a uniform appearance of all the products relevant for an organization.

LO-2.3.5	Provide a brief overview of W3C activities and describe the differences between W3C standards and norms (K2)	30 minutes

Terms
W3C, WAI

The W3C (World Wide Web Consortium) was founded in October 1994 to fully develop the World Wide Web. Uniform protocols are developed that are to advance the progress of the Internet and to ensure interoperability.

The Internet provides social value by enabling interpersonal communication, business environments and opportunities for the exchange of knowledge. One of the main goals of W3C is to make these advantages available for all people, independent of their hardware, software, network infrastructure, native language, geographic position, and physical or mental abilities.

The activities of W3C are mainly structured in groups: Work groups (for technical developments), interest groups (for more general tasks), and coordination groups (for the communication between related groups). These groups are comprised of participants from the member organizations, the team and the experts invited by W3C; they produce the major portion of the W3C results: Technical reports, open source software and services (for

example, the validation service). These groups also ensure coordination with other standardization committees and technical associations.

Architecture

- DOM
- Internationalization
- URI
- Web services
- XML

Interaction

- Combined document formats
- Device independence
- Graphics
- HTML
- Math
- Multimodal interaction
- Style
- Synchronized multimedia
- Language-based browser
- XForms

Technology and society

- Patent policy
- Data protection
- Semantic web
- XML key management

Web Content Accessibility Initiative (WAI)

- WAI International Program Office
- Technical WAI working group

Quality assurance (QA) working group

- QA

Reference
World Wide Web Consortium (W3C) [12]

2.4 Accessibility (K2) — 90 minutes

LO-2.4.1	Provide an overview of the "E-Government Guide – Quality Criteria for a Public, User-Friendly and Secure Website" (K1)	15 minutes

Terms
E-Government Guide

The World Wide Web is a suitable platform for providing information and services for customers by the public authorities. In contrast to the online offers of private enterprises, demand patterns for offers from public authorities cannot be regarded as a quality criterion, because there is no competition. Those responsible in public authorities must therefore watch the quality of their offers themselves and must take the measures required for a citizen-friendly website when they set up the concept.

With regard to Usability the guide provides instructions in the following sections:

Access
Customers must be able to access the website easily and without any problems. This requirement, on the one hand, includes implementation of measures to easily find any web content (see the module "Making web content easy to find"). On the other hand, it includes the accessibility of the web pages (see the module "Accessible E-Government"). Finally contents that are easily understood and a design that is software-ergonomically optimized should be taken into account.

Quality of content and function
The information offered must be presented in a way that fulfills the information requirements of the customers. Guidance information about the public authority as well as the description of tasks and services must be complete, comprehensible, correct, reliable and available. The communication options (such as email, newsletters and discussion forums) must have a functional and target group-oriented design. The highest level in the functional implementation of business procedures between the administration and the customers on the Internet is achieved with complete transaction offers.

The traditional procedure of a contact between the citizen and the public authority is handled completely online. The quality of an offer like that is determined particularly by its integration into the total offer, the effort involved, lack of media interruptions, platform independence and the way in which it is used.

Data protection

Data protection refers particularly to the protection of users against impermissible access to their privacy. In general and area-specific laws (such as the German Data Protection Act and the Tele Services Data Protection Act) requirements such as the "transparency of the data saving location", the "substantive legality of the data processing" and "data economy" are defined that can also be understood as quality criteria for the website.

Responsibility for contents

Against the background of judgments of the regional courts and higher regional courts, it is important for the public authority (as is the case for any other Internet provider) to clearly and comprehensibly delimit responsibility for the contents that is presents from that of others. In order to minimize liability risks, contents that they created and integrated themselves must be reviewed for illegality and youth endangerment. Notes on regular reviews of the contents as well as explanations on the protection of minors can be placed on the web pages of the public authority in the form of text templates.

References

E-Government-Handbuch „Qualitätskriterien für einen bürgerfreundlichen und sicheren Web-Auftritt“ [13]

LO-2.4.2	Know the Equality Act for the protection of disabled people (BGG 2002) and the regulation to create accessible information technology according to the Equality Act (BITV 2002) (K1)	30 minutes

Terms
Equality Act for People with Disabilities, accessibility

In Germany the Equality Act (Behindertengleichstellungsgesetz, BGG) for the protection of disabled people and the respective amendment of other laws came into effect on 1 May 2002.

The law aims to eliminate and avoid the discrimination of disabled people, guaranteeing them equal rights to participate in society and enabling them to lead a self-determined life. Special needs in particular are taken into consideration.

The following paragraph is particularly important in view of Usability of software and interactive applications:

§ 11 Accessible information technology

(1) Public authority agencies in the spirit of § 7 sect. 1 sent. 1 technically design the websites and Internet offers as well as the graphical user interfaces, which they make accessible and that are presented using information technologies, as stipulated in the regulation to be enacted according to sentence 2 such that they can always be used by disabled people without any restrictions. The German Federal Ministry of Labor and Social Affairs determines by decree the following without the need of approval by the *Bundesrat* (German Federal Council) and according to the technical, financial and administrative possibilities:

1. The groups of disabled people to be included in the scope of the decree
2. The applicable technical standards as well as the deadline for their mandatory use
3. The areas and types of official information to be designed.

(2) The German Federal Government uses its influence to make commercial providers of websites and graphical user interfaces design their products that are represented using information technologies in line with § 5 and according to the technical standards specified in section 1 using target agreements.

References
Behindertengleichstellungsgesetz - BGG"(2002) [14], BITV (2002) [15]

LO-2.4.3	Demonstrate the international differences in handling accessibility using examples (K1)	30 minutes

Terms
Accessible information technology

In other countries accessibility in information technology is implemented in various ways.

Some countries pursue a policy of equalization in areas such as education, medical rehabilitation, employment and information technology (for example, in Germany and the UK). Other countries such as Denmark and Canada are focused on the employees and their individual needs at their workstations. Information technology is recognized as an important part of the work process.

Almost all countries in the world use the WCAG1 (W3C Web Content Accessibility Guidelines 1.0) as the basis for accessibility in information technology. The United States of America and New Zealand are exceptions, because they have set up their own guidelines. With their individual regulations on accessible information technology some of the legal specifications go into the requirements in detail (for example, Germany or Australia). Other countries only postulate a basic accessibility for people with disabilities without explaining the requirements in detail (for example, India). Again other countries (for example, Argentina) do not dwell on the issues of accessibility for disabled people at all, but specify accessibility for all people.

The following table shows a selection of countries which have integrated accessibility elements into their legislation for information technology.

Country	Regulation for accessible information technology
Argentina	argentin@internet.todos (basis for accessible information technology), 1998
Australia	Obligation to design information technology based on accessibility (1992); since 2000 proof of compliance with W3C has been required in addition.
Denmark	IT Action Plan (1995)
UK	Anti-Discrimination Law (1996)
Japan	e-Japan Priority Policy Program (2001)
Canada	Equality Act (1999)
Portugal	Initiative for people with disabilities in new media (1999)
Thailand	Prohibition of discrimination

References

Jan Eric Hellbusch [16]

LO-2.4.4	Provide an overview of various computer tools for blind and visually impaired people (K1)	15 minutes

Terms

Computer tools, Braille

The following support is provided for blind and visually impaired people:

- Selected screens
- Screen readers
- Braille printers
- Braille displays
- DAISY players
- Dictaphones/recorders
- Selected ebook readers
- Electronic magnifiers
- Uppercase keyboards
- Navigation and orientation systems
- Selected notebooks
- Organizers

- Screen readers
- Voice output
- Voice recognition software
- Telephones/mobile phones
- Magnification software
- Text-to-speech systems

Various factors must be considered in deciding about the tools to be used:

- What are the requirements (e.g. work, education, self-determined life)?
- What are the difficulties involved in executing these activities?
- Are these activities always executed at the same location or is the location frequently changed?
- How much space is available for the placement of a tool?
- Must the tools comply or be networked with other products/tools?

The German project *Informationspool Computerhilfsmittel für Blinde und Sehbehinderte* (INCOBS, information pool of computer tools for blind and visually impaired people) is sponsored by the German Federal Ministry for Labor and Social Affairs and carried out by the company DIAS GmbH supported by the German Association of Blind and Visually Impaired People (DVBS). The project provides information about workstation technologies for people with visual impairments, creates market overviews, runs product tests and publishes checklists for the selection of appropriate tools. It supports the setup of computer workstations for blind and visually impaired people in Germany.

Reference

Incobs - Informationspool Computerhilfsmittel für Blinde und Sehbehinderte [17]

3 Usability Engineering (K2) 390 minutes

3.1. Principles of Usability Engineering (K1) – 4 LO (120 minutes)

LO-3.1.1	Know the concepts of User-Centered Design (UCD) (K1)
LO-3.1.2	Provide the definition and explain the use of Usability Engineering (K1)
LO-3.1.3	Describe the Usability Engineering Lifecycle (K1)
LO-3.1.4	Provide an overview of the contents of the Usability guide of the *Deutsche Akkreditierungsstelle* (DAkkS, German accreditation agency) (K1)

3.2. Analysis and concept phase (K2) – 2 LO (60 minutes)

LO-3.2.1	Describe the difference between the quality and quantity targets of Usability (K1)
LO-3.2.2	Know the principles for building user scenarios and the different views of use cases (K1)

3.3. Design phase (K2) – 2 LO (60 minutes)

LO-3.3.1	Enumerate various design processes (K1)
LO-3.3.2	Know the scope and components of wireframes (K2)

3.4. Prototyping phase (K2) – 1 LO (120 minutes)

LO-3.4.1	Enumerate various lo-fi prototypes (paper prototype) and hi-fi prototypes and their areas of application (K2)

3.5. Evaluation phase - introduction (K2) – 2 LO (30 minutes)

LO-3.5.1	Understand the spirit and purpose of evaluation (K2)

4 Usability Engineering – Part 2 (K2) 240 minutes

4.1 Usability testing and evaluation (K2, 5 LO, 240 min.)

LO-4.1.1	Know different testing methods and provide examples for their preferred use (K2)
LO-4.1.2	Know the basic contents of an evaluation report (K2)

3.1 Principles of Usability Engineering (K2) 120 minutes

LO-3.1.1	Know the concepts of User-Centered Design (UCD) (K1)	30 minutes

Terms
User-centered design, product lifecycle

Guidelines for user-oriented design activities within the entire product lifecycle of computer-aided interactive systems were formulated in standard DIN EN ISO 13407.

A user-oriented design of interactive systems provides numerous advantages. This way the total cost of a product lifecycle including its concept, design, implementation, upkeep and maintenance can be reduced considerably.

A user-oriented, fit-to-use design of systems contributes to the following aspects:

- Systems are easier to understand and to use, which reduces extra training and incidental product expenses.
- Users are more satisfied, which reduces discomfort and stress.
- User productivity and thus the organization's efficiency are increased.
- Product quality is improved. Users are more interested, which may result in a competitive advantage.

LO-3.1.2	Provide the definition and explain the use of Usability Engineering (K1)	15 minutes

Terms
Usability Engineering process

The process of Usability Engineering runs in parallel with the software development process and ensures the future usability of a software application. Goals are defined in iterative steps in line with the target groups' needs and are tested using prototypes. In the case of any deviations from the intended state, project steps are repeated and improved.

Delivery of a product or putting it online for the market, however, does not terminate the process of Usability Engineering. It is a continuous process which also deals with continual optimization, sensitization of the people involved and even with identification of the right time for a relaunch.

LO-3.1.3	Describe the Usability Engineering Lifecycle (K1)	30 minutes

Terms
Usability Engineering Lifecycle

Usability Engineering is not a variety of incoherent individual methods, but is integrated in a higher-level "lifecycle". The activities in this lifecycle commence prior to the development of the human-machine interface.

For a so-called Usability Engineering Lifecycle this results in the following phases, which are to be repeated as often as required for the product to meet the user requirements:

1. Analysis and concept phase
2. Design and prototyping phase
3. Evaluation phase

In the meantime there are numerous variations of such lifecycle models, which mainly differ with regard to their integration in existing development processes.

Additional models of Usability Engineering Lifecycles are, for example, the Delta Method, the Contextual Design, the scenario-based development, the usage-centered design or the waterfall model that has had the aspect of usability added to it.

LO-3.1.4	Provide an overview of the contents of the Usability guide of the *Deutsche Akkreditierungsstelle* (DAkkS, German accreditation agency) (K1)	45 minutes

Terms
Guide, fit-to-use product design, test procedure based on EN ISO

In the beginning of 2008 the Deutsche Akkreditierungsstelle (Dakks, German accreditation agency), previously known as DATech, published an extensive guide for a fit-to-use product design.

This guide includes the following sections:
1. Framework for the Usability Engineering process
2. Testing procedure for the Usability Engineering process on the basis of EN ISO 13407
3. Procedure for the conformance test of interactive products on the basis of EN ISO 9241, sections 11 and 110

Reference
Deutsche Akkreditierungsstelle (DAkkS)

3.2 Analysis and concept phase (K2) 30 minutes

LO-3.2.1	Describe the difference between the quality and quantity targets of Usability and the basis of requirements analysis (K1)	15 minutes

Terms
Quality targets for Usability, quantity targets for Usability

Why Usability targets?

Quality and quantity targets for Usability provide the guideline for the design of interactive user interfaces and create acceptance criteria for the evaluation of the design process. They facilitate the decision whether or not to repeat a design cycle or to transfer/transition to the development of the user interface.

For this purpose, a mutual and valid view of the user groups (derived from the user profiles) and a corresponding and valid model of the work and work environment (from task analysis) must be created first to focus the design process more precisely.

Quality targets for Usability
Quality targets help to control the interface design particularly in the starting phase. They are derived from the requirements in the user profiles as well as from the context-related task analysis.

Examples:
- The system shall not require any knowledge about the basic technologies.
- During transition to new releases, changes irrelevant to the users' tasks shall not be visible.
- The system is to support teamwork.

Quantity targets for Usability
It is often difficult to define how quality targets are to be achieved. In contrast, additionally specified quantity targets are more objective and can be measured more accurately.

Examples:
- Definition of specific or permissible maximum execution time
- Execution times are specified for a certain level of user experience:

Expert: ease of use
New user: ease of learning

- Absolute targets use absolute, quantitative units such as processing time (in minutes, seconds), number of errors, etc.
- Relative targets refer to the experience of the users with a certain product/interface relative to the experiences with another product/interface
- Clear preference of one of various alternatives
- Level of satisfaction with a certain interface (5-level scale: unsatisfied to completely satisfied)
- Performance targets quantify the current performance of a user when executing a certain task. Common: time to execute the task or to learn how to execute it; number and type of errors.

Reference
Prof. Dr. rer. pol. Thomas Urban [20]

LO-3.2.2	Know the principles for building user scenarios and the different views of use cases (K1)	15 minutes

Terms
Test schedule, persona, user scenario, use case

An extensive test schedule must be set up prior to executing the test. Test schedules normally include the following components:

- Goals of the test?
- Test duration?
- Date, time and location of the test?
- Required infrastructure?
- Development status of the system at the time of execution?
- Person responsible for testing?
- Amount and composition of the test budget?
- Test procedure?

Persona

For setting up test series some virtual persons ("personas") are conceived, who are to represent the majority of the future real users. The team of designers and developers later refers to the needs of these virtual persons and runs through the corresponding different user scenarios. Setup of such profiles is more than just a tabular list of characteristics. Photos and names as well as data such as age, gender, education, preferences, hobbies and finally characteristics and backgrounds make the personas come alive. This

way, personas not only help to meet the actual software-ergonomic requirements in the design process, but also to consider the desired user experience for the target group.

Using the setup of these types of persons avoids having designers act on the assumption of non-existent average users, but also makes them consider and fulfill specific user requirements.

User scenarios

User scenarios show how users manage tasks in a specific context. They provide examples for the differing use of devices and applications, and form a basis for subsequent usability tests. For these scenarios, tasks, targets and motivations of a user must be determined.

User scenarios can have different levels of detail. Target or task-controlled user scenarios only define what a user wants to achieve. Extensive scenarios observe the user's background and task. They provide an in-depth understanding of the user's motivation and behavior for the completion of the task.

Basically user scenarios should cover a wide variety of situations. The design and development team must be certain that they consider not only the obvious cases or the cases they are interested in. They should also consider the situations which challenge the concept of the system as such.

By contrast, the usage is described in use cases from the point of view of the application. These make it possible to address actual procedures, which describe the steps a user performs for a specific task of an application as well as how the application reacts to the user's actions. Use cases serve to describe the interaction procedures and evaluate them in the order of their priority. As with user scenarios, it is important for use cases that user data are available and as precise as possible.

In contrast to conventional software applications, the usage context of web applications is characterized by special properties. Conventional software applications are mostly based on defined user groups, task and organization contexts, while public web pages often address a wide user spectrum with sometimes quite different interests and information requirements. In the design of world-wide-web user interfaces it is consequently even more important to know the basic design decisions and strategies and to consider them in the course of the development process.

3.3 Design phase (K2) 30 minutes

LO-3.3.1 Enumerate various design processes (K1) 15 minutes

Terms
Parallel design, participatory design (cooperative design), iterative design

In a beginning phase, initial concepts with pre-drafts and wireframes are created that function as the basis for prototype development.

The design phase includes:

- Selection of the style guides.
- Definition of the standards and norms to be used.
- Initial design walkthroughs.

Parallel design:
- Begin the design as a parallel design with several designers involved; develop different design alternatives and use them for testing the various intended usability goals.
- Draft design solutions.
- Put the design solutions into concrete forms using simulations, models, life size models, etc.

Participatory design (cooperative design):
- Directly involve the users in the design process.
- Develop the design proposals with a multidisciplinary approach using existing knowledge.
- Present the design solutions to the users and have them execute test tasks (or simulated tasks).
- Multidisciplinary design.

Problems that occurred in the evaluation phase are eliminated and improved in design and development in iterative steps.

Iterative design:
- Determine the basic principles of design.
- Continually evaluate new designs.
- Change the design solutions according to user feedback.

Reference
Universität Linz, Institut für Wirtschaftsinformatik Prof. Dr. Christian Stary, Hannes Gotthartsleitner, Ing. Mag. Peter Eberle [21]

LO-3.3.2	Know the scope and components of wireframes (K2)	15 minutes

Terms
Wireframe

A wireframe is a schematic representation of a web page. The wireframe serves to illustrate and plan elements that are to be present on a web page. Although the basic elements of a page are represented, it has nothing to do with the design of a web page.

Wireframes are to direct the concept creators' attention to the major elements.

For the Niehaus wireframes (named after the designer Sandra Niehaus) ideally four gray scales are used in which each gray scale stands for a different value of attention "triggered" in the user:

- **Light gray:** All basically required elements such as the logo, the meta navigation, important content, but also some of the main navigation.
- **Medium gray:** Tertiary focus. This may include the main navigation, input fields, contact data, trust signals, etc.
- **Dark gray:** These areas represent the secondary focus. This gray scale is assigned to all elements that shall either lead to the primary focus, or that make another important contribution which justifies this value of attention.
- **Black:** Primary focus. The direct call-to-action (CTA).

References
Sandra Niehaus [22]

3.4 Prototyping phase (K2) — 120 minutes

LO-3.4.1	**Enumerate various lo-fi prototypes (paper prototype) and hi-fi prototypes and their areas of application (K2)**	120 minutes

Terms
Vertical prototype, horizontal prototype, scenario prototype, paper prototype, lo-fi prototype, hi-fi prototype

Prototypes help to make design and procedures comprehensible and serve to map an early stage of the future application. They are used at a very early stage of the development process. They help to identify and remove potential dangers or problems in advance. They support discussions and help to avoid misunderstandings in the development process.

Prototypes frequently only map the part of the scope of functions to be tested and thus allow testing of various concepts. When a prototype serves to explore not yet understood usage requirements, the process is called explorative prototyping or usability prototyping.

The following different types of simulations with prototypes are distinguished:

- Vertical prototypes: reduction to a few individual, but detailed functions.
- Horizontal prototypes: as many functions integrated as possible, but not functional (mostly serve for user interface testing).
- Scenario prototype: all functions are simulated for a specific task using a combination of vertical and horizontal prototypes.

Depending of the purpose of use, the creation of prototypes in different forms and variations is used. Basically we distinguish low fidelity (lo-fi) prototypes (low similarity with the end product; review the idea's benefit) and high fidelity (hi-fi) prototypes (high similarity; review of details and exact functions). Hybrid forms – for example, interactive simulations using HTML or PowerPoint – are referred to as the low-high fidelity (lo-hi-fi) prototypes.

Low fidelity prototypes

- **Verbal prototype**
  A person describes how he/she wants to interact with the system, while another person describes the reaction and condition of the system.

- **GUI prototypes**
  Screen masks or task steps are represented on large file cards. A person "plays" the card deck supported by a moderator.

- **Storyboards**
  Storyboards are illustrations that visually map the chained processes of an interaction with a system. This form of prototyping goes back to movie production and is mostly used in the context of user scenarios.

- **Paper prototypes**
  The representation on paper imitates the basic form of user interfaces.

High fidelity (hi-fi) prototypes

- **Wizard-of-Oz prototype**
  In this form of prototyping, the user believes that he/she interacts with the computer. However it is a designer or test director who reacts or simulates the system behavior in the background.

- **Programmed prototypes**
  These digital and interactive prototypes are quite similar to the form and function of the final end product. However, take care to avoid giving the impression that the program is finished, because in this case the prototype might be confused with the target system.

3.5 Evaluation phase – Introduction (K2) — 30 Minuten

LO-3.5.1	Comprehend the whole purpose of the evaluation phase (K2)	30 Minuten

Begriffe
User participation, cyclical process

The process of Usability Engineering runs in a cyclic prototyping process. Evaluation and improvements are done by having the future product users and target groups participate in the process.

User participation during the evaluation phase guarantees a reality check-up during the development cycle. This way the risks not developing tailored to particular needs and user behavior is clearly reduced.

4.1 Usability testing and evaluation (K2) — 240 minutes

LO-4.1.1	Know different testing techniques and provide examples for their preferred use (K2)	225 minutes

Terms
Heuristics, eye tracking, focus group, video evaluation, usability lab

Evaluations must be performed in the form of usability tests to ensure that the intended goals for designing a user-friendly interface have been achieved. Selected test groups and/or future users, themselves or in groups, test developed prototypes and products, evaluate them and enter them in a new improvement cycle.

Numerous different methods exist for performing such evaluations, for example:

- Cognitive walkthrough
- Constructive interaction
- Eye tracking
- EVADIS
- Evaluation checklist
- FIT system
- Focus group
- Heuristic evaluation
- IsoMetrics-L & IsoNorm
- ErgoNorm
- Thinking aloud
- Log files
- Eye tracking per mouse
- SUMI & QUIS & CUSQ;
- Teach back
- Video analysis
- Video confrontation

For many of these methods the appropriate locations or technical equipment must be used to perform, observe and analyze valid usability tests.

Temporary usability labs with their temporary setup of technical systems enable the performance of smaller test scenarios on one's own and with comparatively little effort. They are particularly suited for gaining one's own direct impression of the users and drawing one's own conclusions from their behavior. However, mobile usability labs can be used in any location.

LO-4.1.2	Know the basic contents of an evaluation report (K2)	15 minutes

Terms
Summative evaluation, formative evaluation

Evaluation is the assessment of a test result in a usability test with regard to its impact on the user tasks, the user's attitude or the usage result. The requirements for evaluation are defined on the basis of evaluation dimensions from the analysis and concept phase.

Evaluation can be performed as a summative or formative evaluation. "Summative" means an evaluation is performed in the end, while "formative" represents an evaluation performed in the course of the development process in order to contribute to an improvement of the product quality.
A process can be evaluated as well, for example, the Usability Engineering process of a provider.

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