Old Exam Question Collection

(A1.4) To respectfully (was: "(politically) correctly") communicate with and about people with disabilities also means to avoid discriminating terms. (Give Examples)

Don't generalize. Don't patronize. Ask how people want to be referred to. Don't talk about or say substantiations/categorizing terms like "the disabled" and avoid stereotyped thinking. Do not use any descriptive terms like "disabled/behindert" as a slur. Do not use derogative terms like "retard", "mongoloid". Use the correct medical terms, e.g., Trisomy 21. Try, instead of looking at the definition of shortage and the deviation from norm, to put the strengths of the person and the person in the foreground. Know and correctly use your vocabulary, like impairment vs. disability vs. handicap. All of this counteracts preconceptions and reduces social barriers.

(A1.4) What is proposed by the "People First" language/principle? Give 2 examples!

- *Proposed*: paradigm change; from model looking at the definition of shortage and the deviation from norm to one looking at strengths and the person in the foreground.
- *Example 1*: "differently abled" instead of "disabled"
- *Example 2*: "person on the autism spectrum" instead of "autist"

(A2.4) What is the definition of the Visus and how is it measured?

- *Definition*: Visus (V) is a measure for the visual acuity respectively for the resolution of the eye. V is the reciprocal of the smallest angle $\alpha_{\min}$ (in arcminutes), under which two points can be perceived as separated: $V = 1/\alpha_{\min}$.
- *Measurement*: Using an eye chart (chart with optotypes of different sizes). The smallest symbols that can be reliably identified at a fixed distance is the person's visual acuity. Example: Snellen charts, Landolt rings.

(A2.5) What are important differences of tactile sense and visual sense?

- *Bandwidth* (how much information can be encoded/decoded within how much time/space): Vision has a much larger bandwidth (10^6 bit/s) than tactile sense (10^2 bit/s).
- Eyes have good spatial performance (0.5-1') and a relatively low frequency (max. 80 Hz). Tactile sense has medium spatial performance (and frequency?) compared to vision.
- Visual sense has shadows, and (changing) perspective and occultation, whereas tactile sense is invariant to positional change.

(A2.6) Audible threshold audiogram (Tonschwellenaudiometrie)

It is a subjective audiometry showing the differences in air conduction (via earphone, marked **x**) and bone conduction (via vibrator behind the ear, marked **]**). The input signal is pure sine, as opposed to speech audiometry. It can help to find the source/cause for hearing loss (i.e., ear structure or nerves).

(A2.6) What is speech audiometry?

It is a subjective audiometry determining speech understanding: numbers, monosyllabic words, and sentences are applied with different volume via earphones (input signal is speech, not pure sine).

(A2.10) How and where are vowels / consonants created when speaking (difference)

- *Vowels*: arise from oscillations of the vocal cords. Different vowels do not differ in the base frequency but in the formant frequencies.
- *Consonants (voiceless sounds)*: are noises produced by audible eddies of the air flow due to narrowing of the articulatory tract (vocal cords do not oscillate).

(A2.10) Which body parts are involved in voice formation (phonation)? (at least 3)

- Respiratory system (lungs & airways)
- Larynx (with vocal cords)
- Articulatory system (pharynx, oral cavity, nasal cavity, tongue, palate, jaw, lips)
- Motoric speech area in cortex
- Hearing (for feedback)

(A2.10) List important principles languages can be based on.

As of WS2022 this was not directly mentioned/discussed in the lecture.

Syntax and phonology, if you mean “principles” according to Chomsky (biological/congenital part of languages)

(A3.2) Cataract, Macular Degeneration and Glaucoma cause impairments of different parts of an organ. Describe the effect(s).

- *Organ affected*: Eye
- *Effects*:
  - *Cataract*: lens becomes clouded; caused by injury, diabetes, infection in pregnancy, radiation, or simply by age. Solution: remove/replace lens.
  - *Macular Degeneration*: degeneration of the macula (yellow spot) causes “inverse tunnel vision”. Caused by age, Morbus Stargardt or Morbus Best.
  - *Glaucoma*: tunnel vision; too high pressure of intraocular liquid damages the optic nerve. Solution: reduce pressure (if damage is not irreversible yet).

(A3.2) Retinitis pigmentosa:

- *Effect*: tunnel vision, night blindness
- *Causes*: Enzyme disorder; Mostly hereditary, but also caused by infection or intoxication
- *Affected part of organ*: degeneration of rods (in the retina of the eyes)

(A3.4) Explanation of Conductive hearing loss diagram

Air conduction (**x**) lies below bone conduction (**]**) = „air-bone-gap". Issue exists in the transportation of the sound stimuli within the ear, cannot get through the outer and middle ear.

(A3.7) Signal vs. Message in Communication.

As of WS2022 this was not directly mentioned/discussed in the lecture.

Message is the information you want to convey, signal is how you convey the message (e.g., sound for speaking to someone).

(A3.7) When two people communicate, what are (some) purposes of this action?

As of WS2022 this was not directly mentioned/discussed in the lecture.

Passing on of information; understanding; negotiation and emerging of knowledge, stances, opinions, theories, …; food; reproduction; trade; need for social interaction

(A3.7) Which principal methods can be tried to overcome a communication handicap of a communication partner?

As of WS2022 this was not directly mentioned/discussed in the lecture.

Depends on the handicap: find first what the issues are; be mindful & patient. As the non-disabled person: adapt to the disabled communication partner's speed/mode of communication.

(A3.11) Why may older persons have issues distinguishing colors?

Because cones (for color perception; especially blue and green) degenerate over time, and because the lenses of their eyes can become yellowish.

(A4.2) Estimate roughly the amount of disabled people in the population. Why is it often difficult to compare national statistics on disability from different countries?

- *Percentage (%) of total population*: 10-15%
- *Difficulties comparing statistics*: perspectives, definitions, classifications, and counting methods vary.

(B1.1) Which possibilities exist to support hearing with hearing aids?

Lots, and mostly depends on what the cause for the hearing loss is. E.g., augmentative vs. insertive aid: former will help with conductive hearing loss (e.g., amplify sounds), latter with sensorineural hearing loss (e.g., cochlea implant).

(B1.1) Name 3 different types of Assistive Aids + examples

According to operation principle:

- *Augmentative aid*: amplify stimulus or action; e.g., certain hearing aids, spectacles
- *Inserting aids*: forward the stimulus or action to the original organ or nerve; e.g., Cochlea implant
- *Substituting aids*: redirect a stimulus to another sense/organ; e.g., translating black print to Braille; lip reading or sign language instead of hearing

According to vicariate:

- *Sensor vicariate*: replace sensory organ; e.g., white cane
- *Actuator vicariate*: support body function; e.g., feeding robot
- *Mental vicariate*: aid for "thinking"; e.g., day/night clock

(B1.2) List human sensor systems (senses) and compare their characteristic properties

- *Vision (eye)*: 10^6 bit/s information bandwidth; good spatial performance, relatively low frequency; light
- *Hearing (ear)*: 10^4 bit/s information bandwidth; low spatial resolution, higher frequencies; air vibration
- *Tactile (skin)*: 10^2 bit/s information bandwidth; largest sensory organ; touch, pressure, vibration, heat & cold, pain & itching.
- *Smelling (nose)*: < 10^1 bit/s information bandwidth; receptors are "primary" sensory cells; chemical „distant range" sense; high adaptation (longer lasting stimuli are no longer perceived after some time)
- *Tasting (tongue)*: < 10^1 bit/s information bandwidth; chemical "close range" sense; high adaptation (longer lasting stimuli are no longer perceived after some time)

(B1.2) What is a sensor vicariate?

A replacement of a defaulting sensory organ by another, e.g., visual stimuli cannot be perceived with the eyes, so a tactile or haptic interface is used instead.

(B1.4) Name 4 of the 7 Universal Design Principles with explanation

- *Equitable Use*. The design is useful and marketable to people with diverse abilities.
- *Flexibility in Use*. The design accommodates a wide range of individual preferences and abilities.
- *Simple and Intuitive Use*. Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

- *Perceptible Information*. The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- *Tolerance for Error*. The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- *Low Physical Effort*. The design can be used efficiently and comfortably and with a minimum of fatigue.
- *Size and Space for Approach and Use*. Appropriate size and space are provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

(B2.1) Name replacements for manual writing.

As of WS2022 this was not directly mentioned/discussed in the lecture.

Typing; speech to text; speech; sign language; Lormen/Lorm-alphabet; magnified overhead projection; symbols/images.

(B2.1) Give 4 examples of typical accessibility features today's operating systems (Windows, Android, MacOS, iOS etc.) and briefly describe the benefit for certain user groups.

- *Keyboard settings*:
  - sticky keys (for single hand operation)
  - sounds for toggle keys (for visual impairment)
  - auto-repeat setting
- *Mouse settings*:
  - keyboard mouse (for head/mouth stick)
  - sticky click
  - near-miss-function
  - mouse cursor size (for visual impairment)
- *Screen settings*:
  - Color, contrast, and font settings (for visual impairment)
  - magnification (for visual impairment)
- *Audio output*:
  - screen reader (for visual impairment/blindness)
  - visualization of sounds (for auditive impairment)

(B2.2) List advantages of Semantic Compaction in AAC (Augmentative and Alternative Communication)?

As of WS2022 this was not part of the lecture.

- Method using pictorial language to formulate sentences.
- Only a small number of icons to be learned (40 – 80)
- Icons on the display stay in a fixed location (yay muscle memory)
- Patterns applied to say a word can be used when learning to say new words

(B2.2) List examples of smart phone apps dedicated to blind users or to deaf users and briefly outline the principles the apps are based on.

As of WS2022 this was not thoroughly discussed in the lecture.

- *Blind users*:
  - "be my eyes" – contact a seeing person and ask them to describe whatever you're showing them
  - text-to-speech
- *Deaf users*:
  - "Greta" – audio description or subtitles for cinemas
  - "DEC 112" – contact emergency numbers via text message
  - speech to text

(B2.2) Cell phones, smartphones and tablets have opened many new opportunities for people with disabilities. Select 3 types of disability and give an example of a particular functionality of a modern device or app and explain how it helps in the telecommunications field.

As of WS2022 this was not thoroughly discussed in the lecture.

- *Blind people*: "be my eyes" app, text-to-speech
- *People with language/speech disabilities*: text to speech
- *People with auditive impairment*: telephone hearing amplifier
- *Deaf users*: speech to text, written communication in general, video calls
- *People with tetraplegia*: "click2phone" software to use a single switch (e.g., for forehead) to write text via scanning. "HouseMate Home Control" e.g., to initiate phone calls.
- (non-telecommunication):
  - *People with dementia*: navigation apps as assistive aid for orientation

(B2.2) Which simple measures can increase the communication rate when using "scanning" (communication with single switches and characters on an on-screen keyboard) – except "predictive typing"? Give short descriptions.

- Choose a fitting scanning method: linear scanning, group scanning, partial area scanning.
- Optimize the arrangement of characters on the display: Sort by character frequency or probability of occurrence, put frequent letters at the beginning.
- Continuous adaption of scan time using current average position of selection time within scan time, using error rate, or when target is often missed.

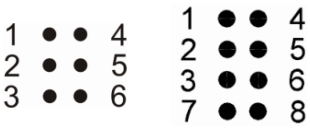
(B2.4) Difference between tactile and haptic

- Tactile relates only to touch, e.g., to read Braille.

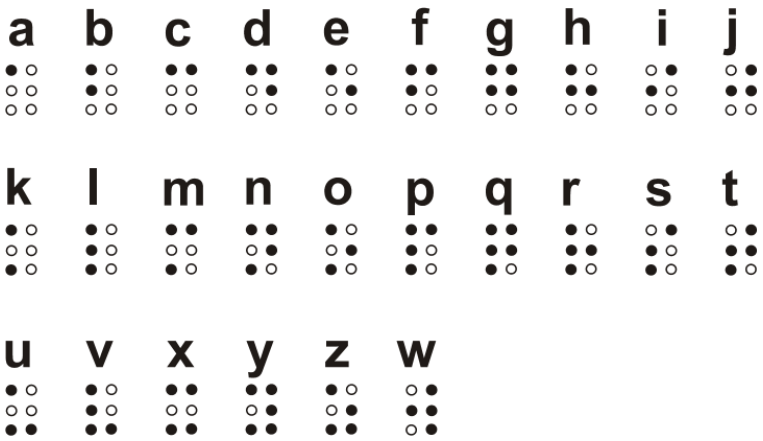
- Haptic includes proprioception, e.g., a 3D-print of an image or sculpture to get a more spatial impression of it.

(B2.4) Describe and/or sketch the dot (Braille) script (system, characters, dimensions)

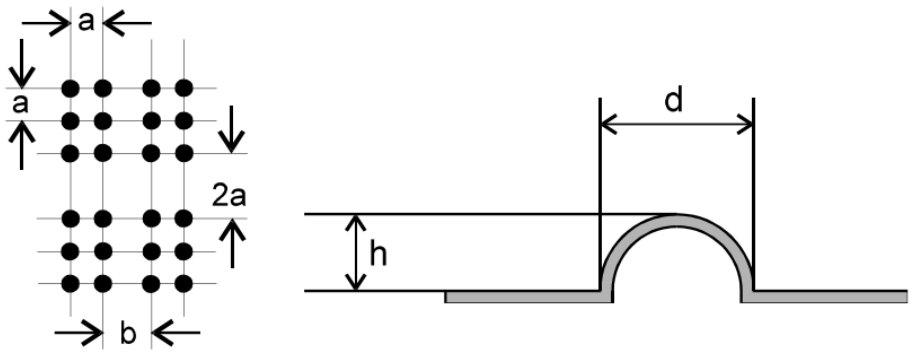
2 rows with 3 dots (or, extended for computer use, 4) each (= 6-point or 8-point Braille).



Allows for encoding of 64 (= 2^6, extended 256 = 2^8) characters (including space). Encoding of first 10 letters, repeating with added dots in 3rd row, W added later.



Fits size and sensitivity of finger pulp. a = 2.5 mm, b = 3.5 mm, d = 1.5 mm, h = 0.4-0.8 mm.



(B2.4) Which types of tactile displays are NOT used?

- *Electrical irritation of the skin (electro-cutaneous stimulation)* – still being researched
- *Surface texture* – still being researched
- *Heat (thermal irritation)* – too inaccurate, too slow

(B2.4) Describe the operating principle of a piezo-electric Braille display and an advantage and a disadvantage.

2 strips of piezo ceramic glued together, working principle like bimetal. Elongation and shrinkage of each, and thus bending of the two-layer-sandwich, depending on the polarity.

- *Pros*: needs less energy than electromagnetic versions

- *Cons*: high costs, large size, sensitive (e.g., to dust and dirt), multi-line displays are difficult

(B2.4) Describe the operating principle of an electromagnetic Braille display and an advantage and a disadvantage.

Each pin is moved up and down by combination of electromagnet and spring. Systems with locking mechanism (bistable e/m Braille display) exist (improvement of power consumption).

- *Pros*: dynamically changeable/refreshable Braille display
- *Cons*: needs a lot of space; high energy consumption; warms up considerably

(B2.4) Describe two ways (devices, procedures etc.) to put Braille on paper?

As of WS2022 putting Braille on paper was not part of the lecture, but Braille keyboards were.

- *Stylus and slate* are written *in mirror* and *from behind* onto the document.
- *Braille typewriter* is operated using 3 fingers of each hand.

(B2.4) Writing Braille with slate & stylus and using a Braille typewriter (e.g., Perkins Brailler) are two methods of putting Braille on paper. Describe important differences.

As of WS2022 putting Braille on paper was not part of the lecture, but Braille keyboards were.

- Stylus and slate are written *in mirror* and *from behind* onto the document.
- Brailler is operated using 3 fingers of each hand.

Braille keyboards can have different layouts, e.g., with three fingers per hand to input the six dots, or one hand is used to input all six dots.

(B2.4) What is the function of a screen reader and for which users?

Alternative representation of visual content can be used to display screen contents and to create an alternative interface to the computer (usually called “Screen Reader”) that can be used by blind people. The main task of a screen reader is to intercept all information that is sent from the computer to the screen without influencing the display screen, and to use it for the Braille display or for the speech synthesizer.

(B2.4) Speech output aids: Which technical requirements for a) blind people b) people with speech impairment?

a) *For blind people*: pure information source/relay. Synthesizer speaks information to “print disabled” persons; natural voice is nice-to-have, but not necessary.

Unlimited vocabulary, high speed of speaking, adjustable voice pitch, fast reaction to commands, and speaks punctuation, capitalization, and formatting

b) *For people with speech impairment*: Synthesizer speaks "for" the disabled person to another person.

Good understandability for non-trained listeners required, prosody (natural human sound), and cosmetic aspects (gendered voice, voice character, age, dialect, ...)

(B3.1) List advantages each of dot (Braille) script and relief (Moon) script

As of WS2022 Moon script was not part of the lecture, but normal relief labelling is.

- *Braille*: Braille can be read AND written by blind people (Moon must be embossed into wet paper), can be read fast (dots are easier to recognize and distinguish compared to relief shapes/lines)
- *Moon*: Symbols similar to Latin characters (easier to learn for late blind persons)
- *Relief labelling*: Symbols are protruding Latin characters → easy to read (most people can read Latin characters, whereas only ~10% of blind or severely vision impaired people can read Braille)

(B3.1) Name different common dot (Braille) script codings for German and describe the essential differences (no details needed).

As of WS2022 this was not part of the lecture.

Base, full, shorthand, stenography. Various levels of compression/shortening. Shorthand allows for ~ 30% savings.

(B3.1) What are main reasons why Braille is now used by fewer blind persons?

As of WS2022 this was not directly mentioned/discussed in the lecture.

Because it takes a lot of time to learn; documents are often not available in Braille; and: modern devices (especially smartphones) provide accessibility without having to use Braille.

(B3.1) What are the environmental/design requirements for blind people?

Space requirements for persons using a white cane:

- path width ≥ 70 cm
- Free standing obstacles' base height ≤ 30 cm
- Obstacles above head ≥ 220 cm

Tactile labelling for visually impaired and blind people:

- Relief labelling (raised letters, high contrast)
- Braille labelling

(B3.1) Which problems can obstacle mounting heights cause for users of white canes?

- *Problems*: stumbling over, walking into, or brushing obstacles, as well as missing drop-offs
- *Problematic range*: anything higher than 30 cm above ground in a width range of 40-70cm, depending on the exact technique the cane user applies, and the cane used.

(B3.1) What environment/design requirements do persons in wheelchair have?

- *Turning circle*: radius ≥ 75cm
  - *90° turn*: ≥ 150x150cm
  - *180° turn*: ≥ 150x170cm
- *Grasping range*:
  - arm range: 61-76cm; shoulder ~53cm above seat
  - sideways: 40-130cm from floor (depends on arm range, height of the wheelchair, size of the person, …)
- *Placement of control elements*: 85cm height, distance from corners ≥ 40-50cm, pedestals ≤ 10cm

Keep in mind that operation is from below, so objects below a control element can block accessibility.

(B3.2) Which problems can interfaces of technical devices cause for persons with epilepsy?

- *Problem*: flicker can provoke seizures of photosensitive epileptics, even with eyes closed.
- *Problematic range*: 3 Hz to 80 Hz, peak at 20 Hz

(C1.3) (Vinyl) records were previously used as media for audiobooks (or "talking books"). What more modern media are there today? What are the advantages?

As of WS2022 this was not directly mentioned/discussed in the lecture.

Digital audio books – if done according to DAISY standards, there will be chapter marks etc. so that the book can be properly navigated. Needs less space (smartphone, laptop, …), no dedicated device necessary, can be bought & downloaded via internet (way faster than ordering, sending, ...).

(C3.2) Examples for mobile and stationary robots

- *Mobile service robots*: mounted grasping robots (MANUS/iARM), autonomous help (Care-O-Bot)
- *Stationary service robots*: dining robots (Robot Handy, iEAT, Obi), workstation robots (RAID)

(A3.4/C4.1?) What is the Lormen or Lorm-Alphabet used for? Describe the method.

As of WS2022 this was not part of the lecture.

- *Usage*: letter-wise tactile signing to communicate with a deaf-blind person.
- *Method*: encodes letters on the listener's hand by tapping or stroking different parts of the hand.

(A3.4/C4.2?) Mark the important elements conveying meaning for visual communication (X).

As of WS2022 this was not part of the lecture.

	Visemes	**Phonemes**	**Characters**	**Words**
Lip Reading	X			
Finger Alphabet			X	
Cued Speech		X		
Manually Coded Language				X

- *Visemes*: smallest segment distinguishable at the lip image
- *Phonemes*: smallest meaningful sounding segment of a language

(C4.4) Which (undesirable) effects does the use of text prediction often imply (e.g., regarding additional effort related to time and cognition)? Name and describe briefly.

As of WS2022 this was not directly mentioned/discussed in the lecture.

- Cognitive load: extra time for making the right decision; necessary to keep in mind the word(s) that still are in the queue to be written (rest of the sentence/message).
- Additional problem space: in some languages, one stem may be shared by many words (forsch-: er, erin, ende, en, end, …).

(C4.4) What is "Keystroke Saving Rate"?

As of WS2022 this was not part of the lecture.

Number of stops necessary with conventional input vs. Number of stops with predictive input.

(C4.5) What is "Active / Ambient Assisted Living"?

As of WS2022 this was not directly mentioned/discussed in the lecture.

- *Target user group*: older people (+ care persons)
- *Aim*: Supplement / support in everyday life through technology

(C4.5) How is “AAL” motivated by the Demographic Change?

People are getting older, less young people “coming after”. AAL allowing older people to stay in their „usual” surroundings for longer or needing less assistance.

Previous Exams

S1: 19-17 U2: 16,5-14,5 B3: 14-12 G4: 11,5-10 N5: 9,5-0

26.01.2023 [Group A]

1. What causes a Down-Syndrome? What are characteristic symptoms? (2 pt.)

Cause: Chromosomal disorder, a third extra chromosome 21 at insemination or proliferation

Symptoms: Tissue malformation, muscle hypotonia, speech disorder, mental impairment

2. Advantage of an intelligent emergency call system over traditional senior alarms? (1.5 pt.)

Advantage: In traditional systems, the user as result of the incident is unable to act or underestimates the situation. Intelligent systems can then automatically trigger alarms.

Method 1: Monitoring activity of the person (behavior, detection of falls)

Method 2: Monitoring vital parameters (pulse, ECG, temperature, SpO_2, blood sugar)

3. List human sensor systems (senses) and compare their characteristic properties. (3 pt.)

a) Vision (eyes): light detection, 10^6 bit/s information bandwidth, good spatial performance, relatively low frequency

b) Hearing (ears): air vibration detection, 10^4 bit/s information bandwidth, low spatial performance, high frequency

c) Tactile (skin): touch, pressure, vibration, temperature, and pain and itching detection, 10^2 bit/s information bandwidth, medium spatial performance; largest sensory organ

4. What environment/design requirements do blind persons have and why? (2 pt.)

a) Free standing obstacles' base height ≤ 30 cm to be able to detect them early enough with a white cane.

b) Obstacles above the head at ≥ 220 cm to be able to freely walk below them without brushing the object or even hitting the head.

c) Path width (≥ 40 cm for the person or) ≥ 70 cm for the unrestricted usage of a white cane.

d) Tactile labelling: relief labelling with raised letters and if possible additional Braille labelling.

5. What is the difference in methods between speech audiometry and audiogram? (2 pt.)

Speech audiometry: subjective; input signal: speech (numbers, monosyllabic words, sentences) in different volumes; speech understanding measured

Audiogram: subjective; input signal: pure sine; differences in air conduction and bone conduction measured

6. What are advantages of using mainstream devices instead of assistive devices? (2 pt.)

a) Reduced costs / better availability / easier repair.

b) Reduced stigmatization associated to use of device.

c) One smart phone with several apps can provide many functionalities.

d) Higher chance to receive help from sighted people

7. What important changes did the ICF implement over ICIDH? (2 pt.)

Paradigm change: better suited model of disability. Person and body as a reason for disability fade into background, environment is put into foreground as cause for disability.

8. For Braille displays theoretically several simulation principles are possible. Which of them have gained (until now) NO practical importance? (1 pt.)

Check with „X" **the NOT** important ones	**X**	Heat (thermal stimulus)
		Pressure (static)
	X	Electrical irrigation (electrocutaneous stimulation)
		Vibration (variable/dynamic pressure)
	X	Surface texture

9. List the 3 goals of Rehabilitation Engineering. (1.5 pt.)

1: Restoration or improvement of a function affected by a disability.

2: Overcoming the effects of a disability without restoring the function.

3: Removal of barriers.

10. Which aids for using money do you know for blind persons? List two of them! (2 pt.)

a) "CashTest" using the size of the banknotes to detect their value.

b) "Cash Reader" app to identify banknotes via camera and an AI.

10.06.2022

1. Which **aids for using money** do you know for blind persons? List two of them! (2 pt.)

a) → 26.01.2023 – 10.

b)

2. **Accessibility features** for augmented input & output are integrated in today's operating systems (Windows, Android, MacOS, iOS, etc.). Give 4 examples of typical accessibility features and briefly describe the benefit for certain user groups. (4 pt.)

a) Keyboard setting: sticky keys – beneficial for single hand operation.

b) Mouse setting: keyboard mouse – for head/mouth stick users.

c) Audio setting: screen reader – for visually impaired and blind users.

d) Screen setting: magnification glass – for visually impaired users.

3. Estimate roughly the **amount of disabled people** in the population. Why is it often difficult to compare national statistics on disability from different countries? (2 pt.)

Percentage (%) of total population: 10-15%

Difficulties comparing statistics: Perspectives, definitions, classifications, methods vary.

4. **Cataract**, **Macular Degeneration** and **Glaucoma** cause impairments of different parts of an organ. Name the organ and describe the effect(s). (2 pt.)

Organ affected: Eye

Effect(s) of a Cataract: Lens becomes **clouded** due to injury, diabetes, age, radiation, …

Effect(s) of Macular Degeneration: degeneration of macular causes **inverse tunnel vision**

Effect(s) of a Glaucoma: high intraocular pressure damaging optic nerve causes **tunnel vision**

5. What important changes did the **ICF** implement over **ICIDH**? (1 pt.)

→ 26.01.2023 – 7.

6. Describe the **operating principle** of an electro-magnetic **Braille display** and an advantage and a disadvantage. (2 pt.)

Each pin is moved up and down by a combination of electromagnet and spring. Systems with locking mechanism (bistable e/m Braille display) for improved power consumption exist.

Pros: dynamically changeable/refreshable Braille display

Cons: needs a lot of space; high energy consumption; warms up considerably

7. What environment/design **requirements do blind persons have** and why? (2 pt.)

a) → 26.01.2023 – 4.

b)

c)

d)

8. List principles of Universal Design with short description. (2 pt.)

a) Flexibility in Use. The design accommodates a wide range of individual preferences and abilities.

b) Simple and Intuitive Use. Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

c) Perceptible Information. The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

d) Low Physical Effort. The design can be used efficiently and comfortably and with a minimum of fatigue.

9. The technical requirements on speech output are different for blind persons (as users) vs. speech impaired persons (as users). Which requirements exist and why? (2 pt.)

a) Requirements for blind people: pure information relay. Synthesizer speaks information to "print disabled" persons → unlimited vocabulary, high speaking speed, adjustable pitch, fast reaction to commands, speaks punctuation, capitalization, and formatting

b) Requirements for speech impaired people: Synthesizer speaks "for" the disabled person → Good understandability for non-trained listeners, prosody (natural human sound), cosmetic aspects (gendered voice, voice character, age, dialect, ...)

07.10.2021

1. Which problems can obstacle **mounting heights** cause for users of **white canes**? (2 pt.)

Problems: stumbling over, walking into, or brushing obstacles

Problematic range: ≥ 30 cm above ground, ≤ 220 cm above ground

2. **Cataract**, **Macular Degeneration** and **Glaucoma** cause impairments of different parts of an organ. Name the organ and describe the effect(s). (2 pt.)

Organ affected: → 10.06.2022 – 4.

Effect(s) of a Cataract:

Effect(s) of Macular Degeneration:

Effect(s) of a Glaucoma:

3. Describe the **operating principle** of a piezo-electric **Braille display** and an advantage and a disadvantage. (2 pt.)

2 strips of piezo ceramic glued together, working principle like bimetal: Elongation and shrinkage of strips, and thus bending of the two-layer-sandwich, depending on the polarity.

Pros: needs less energy than electromagnetic versions

Cons: high costs, large size, sensitive (e.g., to dust and dirt), multi-line displays are difficult

4. What environment/design **requirements do persons in wheelchair have** and why? (2 pt.)

a) Turning circle radius ≥ 75 cm; 150x170 cm space for 180° turn

b) Grasping radius frontal 61-76 cm from the shoulder, which is ~53 cm above seat
Grasping range sideways 40-130 cm from floor

c) Path width ≥ 90 cm for single wheelchair, ≥ 150 cm for wheelchair + person, ≥ 180 cm for two wheelchairs

d) Placement of control elements at 85 cm height and ≥ 40-50 cm away from corners

5. List human sensor systems (senses) and compare their characteristic properties. (3 pt.)

a) → 26.01.2023 – 3.

b)

c)

6. What is the definition of the **Visus** and how is it measured? (2 pt.)

Definition: Visus (V) is a measure for the visual acuity of the eye. V is the reciprocal of the smallest angle $a_{\min}$ (in arcminutes), under which two points can be separated: $V = 1/a_{\min}$.

Measurement: Using an eye chart (chart with optotypes of different sizes), like Snellen charts or Landolt rings. Smallest identifiable symbols at a fixed distance give visual acuity.

7. Accessibility features for augmented input & output are integrated in today's operating systems (Windows, Android, MacOS, iOS, etc.). Give 4 examples of **typical accessibility features** and briefly describe the **benefit** for certain user groups. (3 pt.)

a) → 10.06.2022 – 2.

b)

c)

d)

8. Which problems can interfaces of technical devices cause for persons with **epilepsy**? (1 pt.)

Problem: Flicker can provoke seizures of photosensitive epileptics, even with eyes closed.

Problematic range: 3 Hz to 80 Hz, peak at 20 Hz

9. Estimate roughly the **amount of disabled people** in the population. Why is it often difficult to compare national statistics on disability from different countries? (1 pt.)

Percentage (%) of total population: → 10.06.2022 – 3.

Difficulties comparing statistics:

10. Give one **application example** each for a stationary and a mobile **assistive robot**. (1 pt.)

Stationary: iEAT robot for assistive dining

Mobile: iARM as a mounted grasping and fetching robot

28.01.2021

1. Advantages of intelligent emergency calls

→ 26.01.2023 – 2.

2. Cataract disease

→ 10.06.2022 – 4.

Clouding of the lens caused by injury, diabetes, infection during pregnancies, radiation, and age. The lens is surgically removed or replaced by a plastic lens.

3. Service robot examples

→ 07.10.2021 – 10.

Stationary: Robot Handy 1 (dining), iEAT (dining), Obi (dining), RAID (workstation)

Mobile: MANUS/iARM (fetch and carry, dining), Care-O-Bot (service)

4. Human Sensory system

→ 26.01.2023 – 3.

5. Design requirements for wheelchair

→ 07.10.2021 – 4.

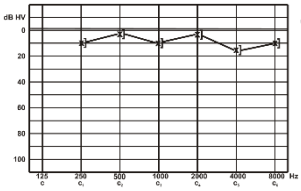
6. Speech audiometry

→ 26.01.2023 – 5.

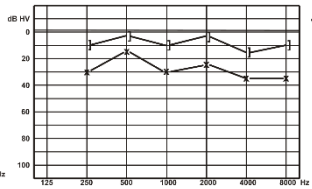
Speech audiometry subjectively measures speech understanding. A speech input signal (numbers, monosyllabic words, sentences) is applied at different volumes via earphones.

7. Audiogram impairments

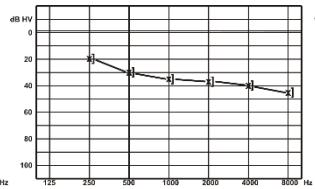
→ 26.01.2023 – 5.



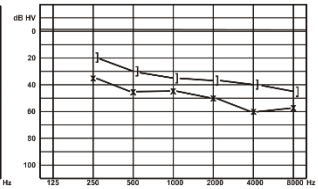
No hearing loss (hl)



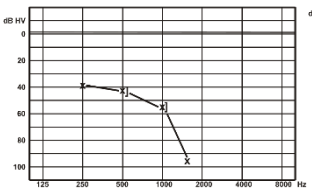
Conductive hl



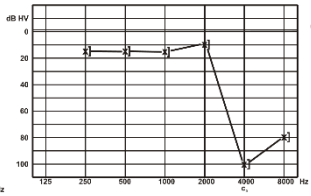
Sensorineural (SN) hl



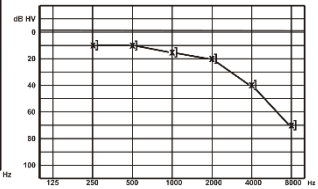
Combined Con&SN hl



Sudden hl / ototoxic



Noise induced hl



Age induced hl (presbyacusia)

Conductive: sound conduction problem in outer or middle ear

Sensorineural: problem with inner ear or hearing nerve

Sudden: acute circulatory disorder, or no apparent reason; ototoxic: hearing loss due to medicine/toxic substance

Noise induced: destruction of hair cells due to loud noise

Age induced: maybe due to changes in the inner ear and auditory nerve

8. Önorm B1600

B 1600: Barrier-free construction – general principles for planning

B 1601: Special buildings for disabled and old people – principles for planning

B 1602: School buildings

B 1603: Planning principles for barrier-free tourism and leisure sites

B 1610: Barrier-free buildings and sites – requirements for assessment of barrier-freeness

9. Down Syndrome explanation

→ 26.01.2023 – 1.

10. Money handling tools for blind people

→ 26.01.2023 – 10.

--.11.2020

1. Types of assistive aids (+examples)

Augmentative aid: amplify stimulus or action; e.g., certain hearing aids, spectacles

Inserting aids: forward the stimulus or action to the original organ or nerve; e.g., Cochlea implant

Substituting aids: redirect a stimulus to another sense/organ; e.g., translating black print to Braille; lip reading or sign language instead of hearing

2. Retinitis pigmentosa

Effect: tunnel vision, night blindness

Causes: Enzyme disorder; Mostly hereditary, but also caused by infection or intoxication

Affected part of organ: degeneration of rods (in the retina of the eyes)

3. Principles of universal design with short description

→ 10.06.2022 – 8.

4. 3 Input methods for a person with tetraplegia (+description)

A sip-puff switch can be used in combination with a joystick for mouse input.

A head/mouth stick can be used in combination with a path optimized keyboard and a keyguard for keyboard input.

A head switch can be used in combination with scanning to input text (keyboard input) or select fields (mouse input).

5. Speech output: requirements for blind people and for speech impaired people

→ 10.06.2022 – 9.

6. What is measured by speech audiometry and how is it measured?

→ 26.01.2023 – 5.

→ 28.01.2021 – 6.

7. Which impairment can you derive from this audiogram?

→ 28.01.2021 – 7.

8. Which problems can interfaces of technical devices cause for persons with epilepsy?

→ 07.10.2021 – 8.

9. What causes a down-syndrome? What are characteristic symptoms?

→ 26.01.2023 – 1.

10. For Braille displays theoretically several stimulation principles are possible. Which of them have gained (until now) NO practical importance?

→ 26.01.2023 – 8.

12.03.2019

1. 3 different types of Assistive Aids + examples

→ --.11.2020 – 1.

2. Retinitis pigmentosa: Effect, Cause, Affected part of organ

→ --.11.2020 – 2.

3. 4 of the 7 Universal Design Principles with explanation

→ 10.06.2022 – 8.

4. Explanation of Conductive hearing loss diagram.

Air conduction (**x**) lies below bone conduction (**]**) = „air-bone-gap". Issue exists in the transportation of the sound stimuli within the ear, cannot get through the outer and middle ear.

5. Speech output aids: Which technical requirements for a) blind people b) people with speech impairment?

→ 10.06.2022 – 9.

6. Which electronic types of tactile displays are NOT used? (heat, ..., ...) [5 types, multiple choice]

→ 26.01.2023 – 8.

7. What is speech audiometry?

→ 28.01.2021 – 6.

27.09.2018

1. Unterschied Taktile und Haptische Hilfsmittel mit Beispielen

Tactile relates only to touch, e.g., to read Braille. For example: refreshable Braille displays, tactile graphics displays

Haptic includes proprioception, e.g., a 3D-print of an image or sculpture to get a more spatial impression of it. For example: Pantobraille

2. Was ist ein Glaukom, welche Ursachen und welche Auswirkungen hat es?

Glaucoma (most common cause of blindness) happens due to too high intraocular pressure damaging the optic papilla. The result is tunnel vision.

3. Beispiel für mobile und nicht-mobile Roboter

→ 07.10.2021 – 10.

→ 28.01.2021 – 3.

4. Tonschwellenaudiogramm mit Luftleitung und Knochenleitung wurde gezeigt und man musste sagen, an welche Krankheit sie erinnert und wodurch diese Krankheit auftritt.

→ 28.01.2021 – 7.

5. Warum alte Personen Farben nicht mehr so gut unterschieden können (oder so ähnlich).

Because cones (for color perception; especially blue and green) degenerate over time, and because the lenses of their eyes can become yellowish.

6. Was ist ein Sensorisches Vikariat?

A sensor vicariate is a replacement of a defaulting sensory organ by another. E.g., visual stimuli cannot be perceived with the eyes, so a tactile or haptic interface is used instead.