Training Curriculum

Active echolocation for people with visual impairment

Methods for training and suggestions for exercises in perceiving and understanding the surroundings by means of self-produced sound.

The publication elaboration leaders:

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Preface

The special skills that blind people use to travel safely and to orientate themselves without using their vision are called orientation and mobility (O&M). O&M training includes the use of a long, white cane as the orientation assistive technology, but there is also training in using the other senses as a supplement to the information perceived through the cane.
Hearing is a key factor in orientation, both when you perceive sounds from the surroundings, e.g. noise from traffic, as well as when you emit sound from yourself and listen for the reflected sound echo from the surroundings. Visually impaired persons can learn to use the reflected sound from an emitted click of the tongue, clapping of the hands, whistling or the sound of the tip of the cane against the surface. Some blind people have developed particularly good abilities within perceiving and interpreting sound echoes from the surroundings.

This curriculum is meant as an inspiration for an O&M instructor in teaching active echolocation for visually impaired persons. Teaching active echolocation is an additional tool in O&M training for maintaining one's orientation and getting detailed information about the surrounding environment. The main aim is to equip O&M instructors with additional O&M skills in active echolocation, in order to be able to teach visually impaired persons to move around safely and independently, according to their needs. This methodology of teaching active echolocation assumes that the O&M instructor has the knowledge, skills and practice in teaching the general O&M techniques and strategies and has the knowledge about audiology in relation to general O&M practice.

During the EchoProVip project the necessity of describing a pedagogical starting point has become obvious to the authors. Teaching active echolocation is much more than just the theory behind echolocation and the related exercises. During the project it has become very clear that the theoretical pedagogical backgrounds of each participating country varies a lot. As a result of this realisation of differences, we have included a short section in the curriculum describing the authors' theoretical pedagogical background.

The curriculum of training active echolocation consists of four parts:

Part I

Includes basic theoretical information related to echolocation: Theory of audiology in relation to people with visual impairment, definitions of passive and active echolocation, assumptions of Daniel Kish's freedom formula, learning strategies and didactic reflections on active echolocation.

Part II

Includes basic exercises in using active echolocation inside buildings, locating the sound source, learning to produce tongue-click, locating objects in space (in front or at one side of you), hearing a doorway, wall, corner, identifying different rooms, etc. starting either standing or sitting and then on the move.

Part III

Includes the use of active echolocation in an outdoor environment. Many of these exercises are similar to the indoor exercises. Exercises concern e.g. practising walking along a wall, finding the opening or the end of the wall. How to estimate the distance to the wall, recognise and find eaves, cars, waste containers, etc. Walking in open spaces, finding bushes, trees and benches using echolocation.

Part IV

Focuses on the use of complex active echolocation skills, and the methods of on route problem solving and of using e.g. Google Street View in the preparation. It contains a part on using portfolio in the training and a part on didactic considerations working with different target groups.

The practical part provides suggestions for exercises related to different themes for training. The exercises are grouped according to the environment, they are practised in, and they show a slight progression in degree of difficulty in practising active echolocation. All exercises have been constructed according to the same scheme. They contain an introduction, information on the materials needed, and a description of execution and didactic considerations.
The exercises are not to be followed chronologically, but to be chosen from, according to the learner's' needs. Some exercises should be regarded as variations on the same skills.

The curriculum for O&M instructors planning to teach echolocation is written by O&M Instructors Lone Dyekjær, Kommunikationscentret Region Hovedstaden, Copenhagen and Gitte Thranum Haldbæk, the Institute for the Blind and Visually Impaired – IBOS, Denmark. It is based on and developed from a previous compendium about Echolocation written by Lone Dyekjær. In the present curriculum inputs from participants in the EU project EchoProVip and experience from the training in the EchoProVip seminars have been included.

The content is inspired by:
Kish, D. & Hook, J. (2017). *Echolocation and flash sonar*. APH. American Printing House for the Blind.

The echolocation exercises are inspired from:
Deel 2 Vaardigheden Echolokalisatie. Koninlijke Visio, Revalidatie en Advies, Expertisecentrum voor slechtziende en blinde mensen, Heerbaan 14-40, 4817NL Breda. Holland 2010.

The collected knowledge and practical issues can be useful for all professionals working with people with visual impairments, in particular for O&M teachers. This publication is the result of international cooperation within the framework of Project No. 2017-1-PL01-KA204-038557 - “Echolocation for people with visual impairment” – EchoProVip, implemented as part of the ERASMUS + Program, Action 2 Strategic Partnerships.

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PART I

BASIC THEORY AND INDOOR EXERCISES IN ACTIVE ECHOLOCATION

Audiology

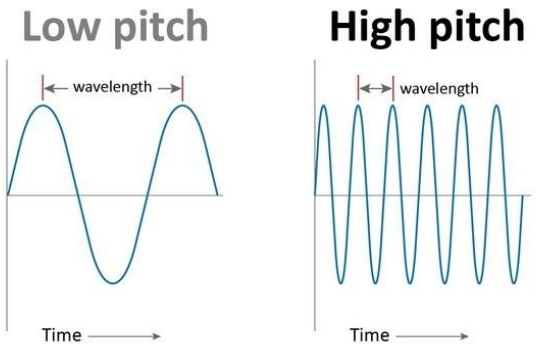
By Gitte Thranum Haldbæk

Hearing or audition plays an important role in helping people with visual impairments gain information about their surroundings. It can help a person to stay oriented or to move safely towards a target. "*Auditory cues can make it possible not only to determine and maintain one's position or orientation in the environment without vision, but also to move independently, even in a complex environment*" (Wiener, Welsh & Blash, 2010, p. 84).

Hearing, as sight, is a distance sense that gives information about an object without necessarily touching the object. Hearing can also provide you with detailed information about e.g. the size of a room, the material of an object or the shape of an object.

Auditory perception consists of multiple processes such as awareness, recognition, discrimination, figure-ground perception, sound localisation, closure and perceptual constancy. The understanding of how and what we hear is based on a complex coordination of a biological reaction combined with active cognitive processes in relation to the person's past and present experiences. Knowledge about audiology and targeted auditory training is a basic need for teaching echolocation to visually impaired people.

Sound can be characterised as waves of compressed or decompressed particles in an electric medium. Sound is measured in decibel (Db). We perceive sound as loudness, frequency and phase. These characteristics contribute to sound identification, discrimination, and localisation.



Source: https://www.quora.com/How-does-the-pitch-of-sound-depend-on-the-wavelength

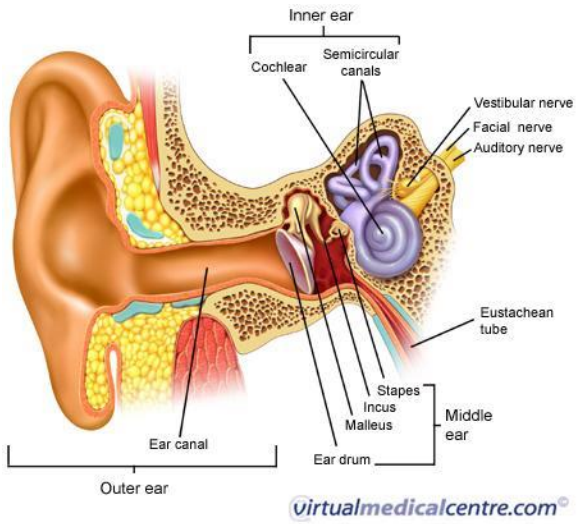
Hearing or audio refers to ”hear” and audiology means the study of hearing and balance (an important aspect of maintaining one’s balance is located in the inner ear). Audiology includes the ability to sense and analyse sounds and can be divided into the following three levels:

- Primary level – Background sounds -> I’m a part of the world;
- Signal level – Signals and warnings -> Sounds help me in everyday life;
- Communication level – conversation/communication -> I communicate with others.

The hearing sense can be used to give information about one’s orientation and direction.

We hear with our ears, but we perceive and understand with our brain.

The outlying auditory system involves the outer, the middle, the inner ear and the cranial nerve and centers in the brain that perceive and add meaning to the sound.



Source: nurseslabs.com/special-senses-anatomy-physiology

The outer ear consists of the pinna and ear canal and it collects and conducts airborne sound waves to the eardrum in the middle ear. Dysfunction in the outer ear results in conductive hearing loss.

The middle ear changes the airborne sound transmitted from the outer ear into a mechanical vibration and passes it on to the inner ear through the motion of the ossicles. Dysfunction in the middle ear results in conductive hearing loss.

The inner ear's primary function is to transform mechanical energy into electrochemical energy and to perform a frequency analysis of the incoming signal. Dysfunction in the inner ear results in sensorineural hearing loss.

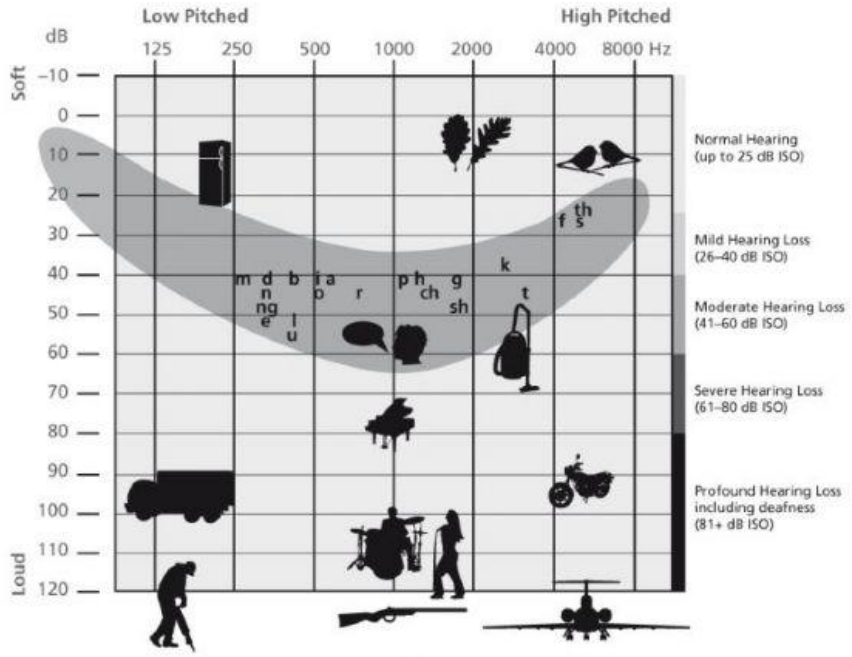
Hearing impairment

Individuals with conductive hearing losses usually have losses in the lower frequencies or have a more or less equal loss across the frequencies, while people with sensorineural loss usually have a loss in the upper frequencies. People with conductive loss often can be helped through medical management, while people with sensorineural loss must rely on hearing aids.

Identification of a hearing impairment:

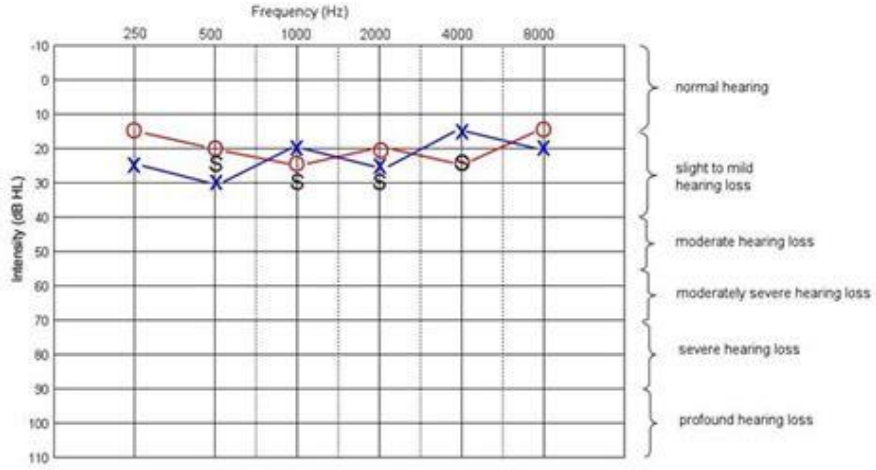
Hearing tests such as Pure-Tone Thresholds (the lowest level of a tone an individual can detect 50% of the time) is recorded in an audiogram.

- Normal hearing 0 – 20 dB;
- Slight/mild hearing loss 20 – 40 dB;
- Moderate hearing loss 40 – 60 dB;
- Moderate severe hearing loss 60 – 80 dB;
- Severe hearing loss 80 – 100 dB;
- Profound hearing loss 100 – 120 dB.



Source: https://www.hearinglink.org/wp-content/uploads/2016/02/speech-banana-800.jpg

Audiogram:

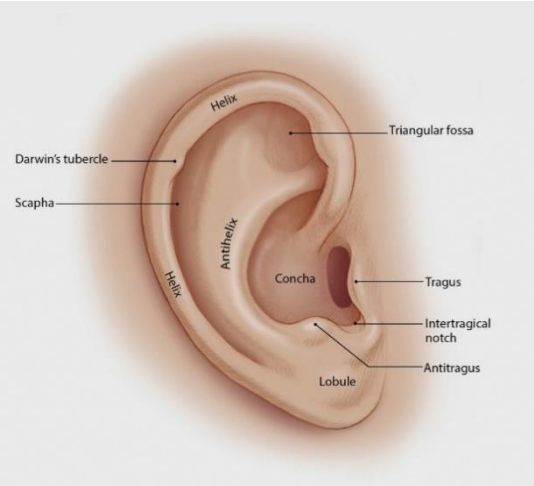


Source: https://canyouhearmenow1.wordpress.com/page/6/

Wind and temperature have an impact on one's ability to detect and localise sound. In the warm weather by 20 degrees sound travels with approximately 1 km in 3 sec. When colder (–12 degrees) sound travels more slowly 323 m/sec and faster when warmer. However, sound is louder by the ground level in the cold weather, this is because of different temperatures in the air layers, which reflects the sound downwards. This means that visually impaired often hear better

in the cold weather because of this combined with less reflection of snow and no leaves on the trees.

Direction and the Pinna Effect:



Source: https://www.hearsogood.com/wp-content/uploads/2015/06/Pinna.jpg

The outer ear: Pinna, leads the sound into the ear canal, and because of the shape of Pinna, it creates a high frequency comb-filtering effect, which is most efficient in the high frequency range at 2-8 kHz. Sound from behind is lowered by 3-4 dB.

Horizontally determination of direction is made by comparing sound input from the two ears regarding:

- Interaural time difference (ITD);
- Interaural phase difference (IPD);
- Interaural level difference (ILD).

How to make horizontal determination of direction:

- Low frequencies (<1500 Hz)/**Time** differences are predominant;
- High frequencies/**Strength** differences are predominant;
- Exact Horizontal Direction is only possible when the sound is heard loud and clearly in both ears.

How to make vertical determination of direction:

- Determined by cues from Pinna (the outer ear);
- Depending on the noise level, the frequency is affected when the sound hits the outer ear;
- Some frequencies are lowered, others reinforced;
- Vertical determination is more difficult to determine than the horizontal one

Why is determination of direction important?

It helps us determine the direction of a particular sound, locate another person's position, determine the direction, motion and speed of an audio source, e.g. in traffic, and it helps us quickly to locate an audio source and turn our attention towards it.

Hearing loss and the impact on determination of direction

First, the sound must be audible to be used for directional determination, at least 10 dB above the hearing level. Horizontal direction is affected by hearing loss in the low frequency range (<1500 Hz) and vertical direction is affected by hearing loss in the high frequency range (> 4000 Hz).

Unilateral Hearing Loss

When visually impaired people have a unilateral hearing loss, it affects their ability to orientate horizontally severely (if the sound is heard on the ‘good ear’). The ability to determine direction vertically is only slightly affected (the Pinna effect is intact) and the ability to determine direction at the front/back is intact (Wiener, Welsh & Blash, 2010).

Things to consider when teaching echolocation to visually impaired people with hearing aids:

To the beginner the sounds are different, and as an instructor, we must be aware of the right balance between the two ears. Hearing aids tend to lower powerful sounds, so it seems further away than it really is.

We need to have all this in mind when we teach echolocation.

Theory of learning and didactic considerations

By Gitte Thranum Haldbæk

During this EU-project it has come to the authors' minds that teaching active echolocation is so much more than the basic theory and exercises of active echolocation and audiology. The learning process is based on the general knowledge of O&M, but also on our understanding of disability, rehabilitation (the definition varies from country to country) and how we learn. Thus, didactic considerations are important to bear in mind. The following is a very short description of some important pedagogical considerations, in order to get a better understanding of the background for this curriculum and hopefully inspire the reader to search for more information.

Definition of rehabilitation

The Danish definition of rehabilitation:

"Rehabilitation is a goal oriented and corporative process involving an individual and his/her relatives and professionals over a certain period of time. The aim of this process is to ensure that the person in question, who has – or is at risk of having – seriously diminished physical, mental and/or social functioning can achieve independence and a meaningful life.

Rehabilitation takes into account the person's situation as a whole and the decisions he or she must make, and comprises coordinated, coherent and knowledge-based measures."

Source: www.rehabiliteringsforum.dk/in-english

(in Danish: Hvidbogen, 2004)
www.rehabiliteringsforum.dk/contentassets/519c219e42a3454da34db60a8454de58/hvidbog.pdf

This definition focuses on the overall life situation of citizens and their opportunities regarding participation in the society. The citizens' perspective and life experiences are central for the professional intervention. The goal of the rehabilitation process is set by the citizen and the professional jointly, the citizen being the expert of his or her own understanding and experiences of his/her life. The overall purpose of the rehabilitation process is to have a common understanding across sectors and educational background in order to create a coordinated coherent effort for the benefit of the citizen

Disability understanding

Denmark ratified The UN Convention on the Rights of Persons with Disabilities 2009. The purpose of the Convention is to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity. The overall goal of Danish disability policy is for all citizens to have equal opportunities, regardless of any disability, recognising that disability is an evolving concept and that disability results from the interactions between persons with impairments and the society's attitudinal and environmental barriers that hinder their full and effective participation in the society on an equal basis with others; an understanding of one's disability as an aspect between an individual person with disability and the surroundings.

The general principles of the Convention shall be:

1. Respect for inherent dignity, individual autonomy including the freedom to make one's own choices, and independence of persons;
2. Non-discrimination;
3. Full and effective participation and inclusion in the society;
4. Respect for differences and acceptance of persons with disabilities as part of human diversity and humanity;
5. Equality of opportunity;
6. Accessibility;
7. Equality between men and women;
8. Respect for the evolving capacities of children with disabilities and respect for the right of children with disabilities to preserve their identities (CRPD, 2006).

The Didactic Relationship Model by Hiim and Hippe

Learning through experience, understanding, and action (Hiim & Hippe, 2007) are the ground principles of learning. Asking how students learn the best way led to the illustration of the Relationship Star. The Star is made of the following six components: learning conditions, settings, learning goals, content, learning process and assessment. The six components affect each other, and it is not possible to affect one area of the model without affecting the other five components.

Learning conditions are changing as the learning process develops. Learning conditions need to look at the learners' interests and competencies in relation to the purpose of the teaching.

Settings are elements such as laws, regulations, cultural aspects, the local environment and school organisational means such as economics, management, teaching aids, equipment, professional plans, etc. The settings can be either limiting or making learning possible.

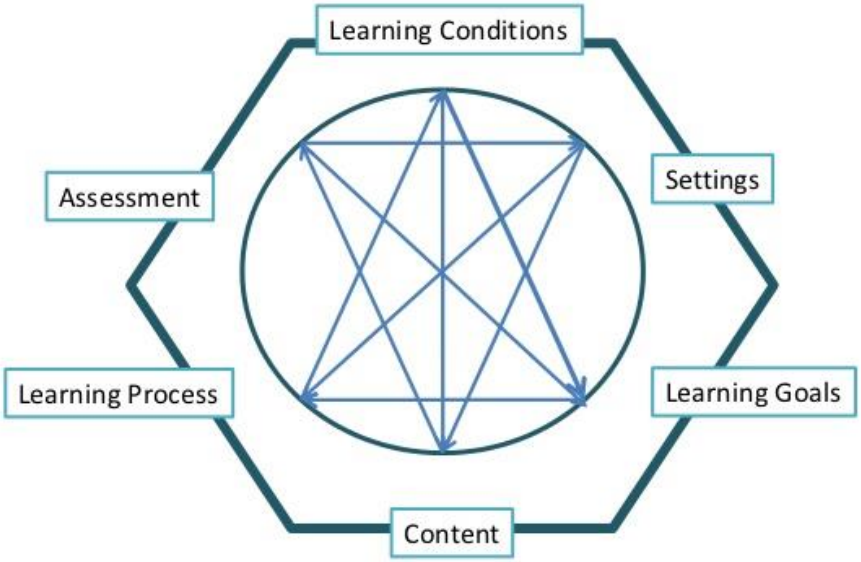
Learning goals help determine the teacher's intention in teaching, the direction in which the teaching process is conducted, and the purpose of learners' learning.

Content describes what the teaching is about, what role the various aspects play and how it is organised. The content of the teaching is shaped according to the learning goals. There are two kinds of content in the classroom, the hidden/latent and the open/manifested.

The learning process describes how learning itself should be conducted and who is organising the course. The learning process itself can be organised either by the teacher or by the teacher and the learners together. There are three different principles that contribute to a successful learning process; Participation (learners must, through cooperation and active participation in teaching, learn about democratic values), experience orientation (experience-oriented teaching allows learners to draw their own experience) and coherence between theory and practice (the learners' own experience is linked to the theory used in teaching).

The assessment/evaluation is both done during the teaching process itself and by the learners' learning.

The Didactic Relationship Model



The Didactical Relationship Model (Hiim & Hippe, 1998)

Source: https://www.slideshare.net/e_zazani/the-didacticrelationmodeldiscussion

Basic theory on active echolocation

By Lone Dyekjær

Echoidentification: Echolocation – Flash sonar – Bio sonar

Human echolocation, flash sonar, bio sonar, finding acoustic gaps/openings are all concepts for the same thing. You can find many concepts related to echolocation.

A mutual concept for them all could be ECHOIDENTIFICATION, as suggested by Sarah Elizabeth Baguhn, MA, and Dawn Anderson, PhD:

ECHOIDENTIFICATION – GETTING THE MOST BACK FROM SOUND.

What is echolocation?

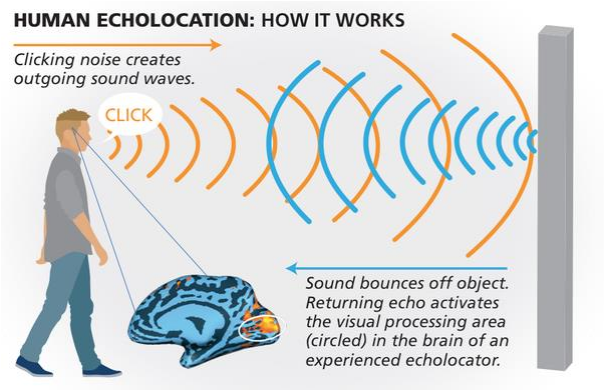
Sound is used by all mammals, by all vertebrates to actively orientate themselves in the same way as when people listen to their surroundings. Dolphins and harbour porpoises use clicking sounds to orientate themselves and to find prey. They have developed a navigation system that works in the same way as an echo sounder on a fishing boat. They emit brief sound pulses and listen for the echoes that are reflected from objects and from the surroundings (Surlykke, 2013). Bats, for example, emit calls with a very high frequency.

Humans can hear when a car is approaching. We can hear the difference in "sound landscapes". Most of us have a rather specific idea of various sound landscapes, e.g. the sounds from a day-care, steps, a church or a forest. We can hear a bird singing, and we can hear if someone is yelling to warn us that danger is approaching.

Echolocation is an orientation technique and a method to intentionally involve the senses, particularly the hearing, to perceive and gather exact information about the nature and structure of the surroundings to identify an object or a group of objects that are present in a given setting. Echolocation is a technique making use of the fact that the sound which a person emits will be reflected from the object, that the sound hits and comes back to the person's ears. Thus, it can be perceived by the ear and interpreted by the brain.

Echolocation cannot replace the use of a long cane but should be used in combination with the cane to complete and supplement the data sensed with the cane. Travelling in this way makes it possible for persons with visual impairments to gather maximum amounts of information about the world and the objects in the world surrounding them. Echolocation can help blind people to travel more freely, more safely and more independently in known as well as unknown surroundings.

There are two forms of echolocation: active echolocation and passive echolocation. Both involve the use of sounds to '*see*' the world and to form mental images through interpretation of the sound signals or echoes reflected from the surroundings.



Source: https://sciencebehindsuperpowers.weebly.com/echolocation.html

Active echolocation

When you practise active echolocation, a person actively produces sounds, for example from tongue clicking, a clicker, a castanet, a cane, clapping and steps. Sharp, clicking tongue sounds are made by placing your tongue against the roof of your mouth. The clicking sound emitted from the mouth hits objects in front of the person and is reflected to the person in the form of echoes. When the clicking sound hits an object, it is modified by the characteristics of the object hit. The returned echoes provide the following information about the object.

Distance and location

Interpretation of the echo can tell where, how far away or how close the object is from the person emitting a sound by a tongue click or in other active ways. The echo brings information of the angle to the person emitting the sound and whether the object is placed to the right, the left or right in front of him/her. Thus, a blind person doing the echolocation can locate objects from a fair distance and can avoid bumping into things. It is also possible to state the distance to parked cars, holes between people standing and half-open and fully open doors.

Dimension

Through active echolocation, it is possible to learn the shape and size of objects,

e.g. whether they are tall, round objects (pillars and trees) or low, wide objects at the hip level. It is possible to follow guidelines, e.g. walls and fences, through active echolocation.

Density

Active echolocation contains information about the density of objects and the difference in the softness and hardness of objects. You can learn to distinguish between something soft (a soft pillow), something hard (steel) and distinguish between materials (a glass table and a wooden table).

Passive echolocation

Passive echolocation is the use of the sounds coming from the surroundings i.e. traffic noise, other people's steps, etc. By means of the sounds from the surroundings, it is possible to recognise a location and identify your position in an area. The sounds from the surroundings can be used as points of orientation to get around safely and wisely. For example, the sound from a church bell indicates the distance to the square/centre of the village. A constant sound of engines may indicate that you are approaching a motorway, etc.

Passive echolocation entails constant awareness of your body's position in relation to the sound, so that it is possible to perceive and recognise objects and avoid obstacles around you. It is possible to perceive changes in temperature and pressure when approaching the objects.

When following a concrete wall, for example, it is possible to tell the difference in pressure and temperature on the side of the cheek and ear turned to the wall and the cheek and ear turned away from the wall. Air, pressure and temperature stay relatively stable on the side that is close to the wall, while the air, pressure and temperature are relatively irregular on the side turned away from the wall, as there is no concrete wall to prevent free airflow.

Benefits of active echolocation

Daniel Kish is an American psychologist, O&M instructor, blind and main founder and CEO of 'Visioneers' or "World Access for the Blind', which is a non-profit organisation that works to provide blind people with the tools for an active life through counselling and training. The organisation's website has a link to comprehensive material about echolocation in the form of videos, articles and papers: https://visioneers.org or http://www.worldaccessfortheblind.org.

The following benefits of echolocation are cited from the book of Daniel Kish and Jo Hook (2017). *Echolocation and flash sonar*. APH American Printing House for the Blind. 2017:

- The use of active echolocation is growing in popularity as a perceptual mobility tool for the blind and visually impaired;
- As more scientific research is compiled, the skepticism around the skill is slowly fading away and making way for accelerated development and implementation of this unique tool;
- Echolocation is a fundamentally simple skill that many blind people use daily to navigate and understand their environment on a broad scale;
- With proper implementation, however, it can be used to identify precise distances, sizes, shapes, edges and even the density of surrounding objects;
- Sound waves like ripples in a pond reflect differently all objects and surfaces. This makes it possible for the trained ear to distinguish the shape, size, distance and material of our surroundings;
- Musicians will tell you that reverb causes each room or surface to have its own unique sound response. With sensitisation and applied practice

of this skill, it is possible for people with visual impairments all over the world to become increasingly independent, supplementing their existing forms of orientation and mobility with the intrinsic awareness that echolocation can provide;

- Echolocation requires no special equipment nor any special talent. The human body and mind are truly marvels of nature that grant us with capabilities you may never know you had. If you can hear, you can echolocate.

Freedom formula and self-directed discovery

Daniel Kish uses clicks, which he produces with his tongue. Others make their preferred sound – a clap, a whistle, they use the sound from their cane or some other self-emitted sound. That is all active echolocation or *flash sonar,* as Kish prefers to call it. It is key in Kish's approach that he focuses on possibilities rather than limitations in his echolocation training. In his personal life, that approach has contributed to enabling him to cycle, hike without a sighted companion and much more.

Kish has developed a way of thinking about development and learning, which he calls 'Freedom formula' (Kish, 2017). It contains training in what he calls self-directed discovery, self-initiated discovery of surroundings and the use of flash sonar. Related to Kish's 'Freedom formula', this curriculum focuses on the self-initiated discovery and the use of active echolocation/flash sonars as a tool.

Self-directed discovery means responsibility for your own discovery of your environments and travelling. A visually impaired person must learn to perceive the world in his/her own way and to personally experience the world and personally take initiative to do this. The self-initiated travelling will make sense to everyone, says Kish, and it will drive and motivate to a more independent

investigation and travelling. The self-initiated travelling sets an individual free, since the world can be perceived as full of useful information which the brain must be trained to perceive and use, e.g. to get around.

Active echolocation/flash sonar as a tool in O&M facilitates a VIP to use sound to get to know the surroundings. However, flash sonar cannot be learned without freedom of movement, neither if you cannot walk independently. The blind person must be able to walk age-appropriately but wanting to be able to do that is up to the individual. Therefore, the question for each person is:

How free do you want to be?
How freely would you like to be able to get around?
And for their relatives: How free would you like your child, your relative to be?

Kish links the self-initiated discovery of the surroundings to the plasticity and development of the brain and challenges our prevalent understanding of O&M. He believes that it is a matter of breaking away from 60 years of O&M training based on techniques and methods developed in the 50s, in the USA based on rehabilitation of veterans returning from WWII. According to Kish, these techniques have not developed much since then (Kish, 2017).

Kish discusses sequence learning in O&M, i.e. step-by-step methods, using tactile characteristics to a great extent and basing the learning of O&M skills on memory. He also discusses sighted guidance and calls this ‘catering and spoon feeding’. He believes using this learning approach gives too much non-self-initiated information about the surrounding world, because a sighted guide takes over the discovery process for a VIP. If the VIP is accompanied with a sighted guide, for example when going discovering the surroundings or going from a to b, the sighted guide should walk beside the blind person, so that the blind person will be able to discover himself or herself and feel speed, steps and posture.

Kish believes that visually impaired persons encounter a ‘danger theory’ in relation to travelling, meaning an understanding that travelling as a blind person is dangerous. However, the world is full of information, not dangers, says Kish (2017). Dangers depend on the choices each person makes based on his or her skill level. Most often sighted persons determine the danger risks. However, when you often say that something is dangerous, it affects each person’s motivation to travel. Travelling becomes dangerous.

Kish encourages ‘discouragement to tactile information’ (Kish, 2017) and urges to flow learning through discovery. It requires using the brain actively when discovering the surroundings, working independently and breaking away from being dependent on others. Doing this will create room for freedom of movement. Kish lists some fundamental principles of human development – the very building blocks of development and learning:

- *The thirst for freedom*;
- *Use it or lose it*;
- *Learning driven by need*;
- *What goes into development directly affects the product*;
- *Perception-based learning is most natural and effective; and*
- *Person-centred relationship with the environment promotes the most effective learning* (Kish, 2017, p. 273)

General didactic reflections when teaching active echolocation

The proposed exercises describe a progression in difficulty in exercises. The exercises should be a guideline and inspiration to an O&M instructor, from where he/she can make his or her teaching plan and choose exercises according to the learner’s prerequisites, age, motivation, possibilities and demands. According to Kish (2017) and Visio (2010), skills in active echolocation should not be taught in a sequenced way. The exercises should be presented matching the initial skills of the learner. Emphasis should be put on the learner’s learning style and need of learning

rather than on the teacher's own agenda or body of knowledge. The O&M instructor can plan for the learner to do structured and discovery-based echolocation exercises parallel.

Stimulus clarification: get the brain hooked

What amounts to stimulus hooks in the brain? The brain becomes occupied with a stimulus and is activated. What can activate a person's process towards free mobility? If a person is not interested in mobility, what can activate the mobility process? The answer is about motivation. The O&M instructor must try to motivate the VIP to move freely.

As preliminary training in active echolocation/flash sonar skills, you can warm up your brain and auditive system through simple hearing exercises, where you establish whether you can hear echoes by making stimulus sensitisation and stimulus clarification (Kish, 2017, pp. 296–297). You can start the process by answering the question: 'What can I hear, and what is it that I hear in my surroundings?', i.e. the traffic, the wind, steps, voices, etc.
When you start to practise active echolocation, you emit a directed signal into the surroundings. Tongue clicking can be used to ask questions to your surroundings: 'Where am I, and what do I hear?'. The sharper the click, the sharper the echo. Clicking requires focus on your tongue.

When practising active echolocation, you can compare various stimuli (stimulus comparison) such as sounds from trees, bushes, a sweater, a tray, etc. (see exercises later in the curriculum) (Kish, 2017, p. 298). Such exercises are about focusing the brain on something and preparing it to perceive and understand the surroundings. This directed reaching activates the images system of the brain. It is possible to manipulate stimuli and e.g. make a sound bigger, smaller, briefer or longer with various objects such as a tray/a panel and establish how accurate your echolocation skills are. With stimulus association you

conceptualise the stimulus comparison and draw upon your mental references. With experience you can build up a repertoire and understanding of acoustic imaging concepts (Kish, 2017, pp. 299–300).

It is important that the O&M instructor ask many questions to the learner. It is also important not to always give answers or say what is right and leave the answer to the learner.

Progression

On the beginners' level active echolocation exercises preferably should be practised in simple, calm, large, open, non-reverberant, fairly quiet environments in order to be able to distinguish the subtle differences in echo feedback and for the learner to gain successful experience and learning outcome. Going on to a more challenging level, locations can be more complex. Prerequisites to go on to more difficult levels are that the learner can produce a good consistent sound – a tongue click or his or her preferred sound, and that he or she can perceive the echo feedback from the surroundings either doing structured exercises and/or exploring the surroundings by doing discovery-based learning stimulated by the learner's motivation.

Learning themes in active echolocation

The skills to be learned in active echolocation are divided in themes and can also represent progression.

- Determination of a useful signal/sound; the learner's preferred sound;
- Awareness of echoes;
- Stimulation exercises;
- Basic skills inside;
- Basic skills in a corridor;
- Basic skills outside in different surroundings.

The options of a teaching plan

The learner can:

- Practise isolated skills;
- Detect echoes during exploration/discovery;
- Practise skills by playing i.e. game(s);
- Detect echoes while walking a route.

In terms of reflected sounds:

- Objects at the level of the head are easier to detect than below hips;
- Small objects in front of bigger objects are difficult to hear;
- Hard materials give louder echoes than soft ones;
- Solid objects give stronger reflection than non-solid objects;
- Nearly everywhere there is the echo;
- Understanding the richness of echolocation is motivating for the student.

PART II
BASIC INDOOR EXERCISES IN ACTIVE ECHOLOCATION

By Lone Dyekjær

Explanation to the structure of the practice exercises

In the following all active echolocation skills exercises, including the use of the tongue click, panel exercises[1] and other preliminary exercises in obtaining active echolocation skills are described in the surroundings/learning environment in which they take place. The exercises are inspired and rewritten from a Dutch teaching

[1] A panel could be a tray, a basket, a wall, etc.

material *Deel 2 Vaardigheden Echolokalisatie* by Koninlijke Visio, Oosterhoff den-Oudendammer, Mirjam et al. (2010).

The active echolocation skills exercises in the sections are intended for an O&M instructor who is preparing echolocation training for learners. The exercises are for inspiration and start with basic skills directing the focus of the brain to the reflection of sound and finishing with directions in ways how to use active echolocation skills for orientation in O&M.

Every active echolocation skill exercise includes didactic considerations. These considerations describe the performance of the exercise and provide directions in ways to do the training and describe the considerations which the O&M instructor (she) may have for the relevant learning environment.

There may be repetitions in the descriptions of the exercises. For instance, ‘walking towards a wall’ occurs inside as well as outside, and the description ‘observing objects and getting around objects’ also occurs inside as well as outside.

It is up to the O&M instructor to consider how to provide and arrange learning in active echolocation. The O&M instructor may choose to stimulate acquiring the skills by arranging targeted exercises, e.g. on a previously determined route or within a specific area preferably for most learners starting inside and then going outside. The O&M instructor and the VIP, in the following called the learner (he), can also explore active echolocation by discovering the surroundings and observing the echolocation options. This could be done while going out for a walk, when playing motion games (goalball, football), etc.

It is crucial to the effect in active echolocation that the learner can perceive deviations and changes in an echo such as the reflection of sound.

For targeted discovery, it is important that the learner focuses his echo signal

(e.g. the tongue click) in the direction where he wants to find/discover/perceive something.

Determination of useful active echolocation signals

An echo signal, which is emitted close to the ear, sends most of the information about the object it hits back the ear. This is because the sound is best reflected to the source of the sound, i.e. the mouth, hand, cane or feet. The tongue click is, therefore, the most effective echo signal, as the sound is produced close to the ear. There are other sounds that are produced by the mouth or other parts of the body which may be good preliminary exercises, if the most effective sound, the tongue click, is difficult for the learner at the beginning.

Tongue clicking: the blade pop sound

Execution: Practising tongue clicking. The learner:

- Place the middle of the tongue against the roof of the mouth (the English G might be helpful);
- Place the tip of the tongue right behind the teeth. May be practised with the letters T and D.

Didactic considerations: Use e.g. a spoon or a stick to make the learner conscious of the mouth. Find a room (hallway or hall) which also clearly reflects the learner's softest sounds and discover the effect of the tongue click and the reflection of the sound. The tongue click best reflects the sound to the ear, providing the best perception of an object.

The ch [tj], the tsk tsk, the cluck click, the giddy up, the sssh sound

Execution: The learner makes brief sounds with pauses to listen for the echo.

Didactic considerations: These sounds may be good alternatives if the tongue click causes problems.

Speech or singing

Execution: The learner makes brief sounds such as hé or ha with pauses to listen for the reflection of the sound.
Didactic considerations: Speech or singing may be useful, if the tongue click does not work. The advantage of speech is, that the sound that is used is already part of the brain function. The effect of your own voice is known.

Clapping hands/clicking fingers

Execution: The learner must make these sounds close to the face.
Didactic considerations: As with the tongue click, the signal comes central to the hearing. This provides the best information about the reflecting object.
When scanning and turning the head, the hands must follow and move close to the face.

Tapping a long cane

Execution: The learner does the tapping technique with a pendulum technique. Listen for the reflection of sound from the cane.
Didactic considerations: Changes in volume when tapping and the tapping frequency may be useful, especially in the case of anticipated obstacles.

Stomping or shuffling feet

Execution: The learner walks, stomps or shuffles and listens to the reflection of the sound.
Didactic considerations: If useful, the learner may make a longer or clearer sound to obtain variation in the volume.

Use of a clicker or castanet

A clicker is a tool often used for dog training.
Execution: The learner clicks a clicker and listens for the reflection of the sound. Pay attention to the effect of the double click. This may disturb the observation. Try to delay or reduce the sound of the second click by releasing the clicker slowly.
Didactic considerations: A clicker or castanet can make clicking sounds. It should be used outdoors to detect objects at a long distance. Do not use the clicker too close to the ear. The sound is very intense. The clicker may not be suitable for indoors use, as the signal may provide too much reflected sound from all the objects present.

Becoming aware of and perceiving echoes

This section contains exercises in observing the echo, which stimulates the perception of the difference between the presence or absence of objects. The absence of objects equals an open room. The exercises may take place as so-called panel exercises. A panel may be e.g. trays in varying sizes, a plate, a wall, a pan, etc. Reiterating the exercises regularly is important so that the perception of the echo is learned, especially at the beginning of a new echolocation skill. The exercises may be done with different sounds that the mouth can produce. Remember that the tongue click is the optimum sound which should be learned if possible.

Note:
It is important not to click too many times at a time but to click once around every 2 seconds. The learner needs time to process the information which is returned. The learner must deliberately listen for each echo.

Preliminary exercises inside

The following contains suggestions for initial exercises. The O&M instructor guides how to listen for echoes. The exercises can be executed in a classroom, gym or other similar location.

On the beginners' level active echolocation exercises should preferably be practised in calm, large, open, non-reverberant, fairly quiet environments in order to distinguish the subtle differences in echo feedback and for the learner to gain successful experience and learning outcome.

Materials:

Trays – wooden, plastic;

Breadboards – wooden, plastic;

Cork plates;

Cardboard different sizes – A6, A4, A5;

Bowls of different sizes, glass, metal, plastic;

Jars of different sizes, glass, clay.

Learning process:

Exercises go from easy to difficult. From stationary to moving. You may go quickly through or skip some exercises, if the learner is a quick learner.

Go for the AHA moment when the echo flashes back at you.

Your preferred sound:

Use your preferred sound. Try out at the start which sound works best for you. You can stick to that sound during exercises, and you can change your sound in order to hear and perceive the echo.

Sound associations: words describing the echo:

Solid, sparse, scattered, broad, tall, large, small, hollow, coarse, fine, juicy, mushy, sloppy, leafy

Find other words yourselves and write them down.

Source: private photos.

1. **<u>Demonstration of the echo with a panel</u>**

Execution: The learner stands at a distance from the instructor. The instructor holds a tray in front of her face and makes a sound, e.g. sshh. She removes the tray and makes the sshh sound again. The learner notices the difference.
Didactic considerations: The learner should preferably stand diagonally behind

the instructor, maybe behind the instructor, not opposite one another. Use a large plastic tray with a small edge.

2. **Demonstration of the echo at varying distances**

Execution: The learner is placed some distance from the instructor. The instructor holds the tray at her arm's length in front of the face and makes a sound, e.g. the sshh sound, while slowly moving the tray (panel) back and forth. The learner focuses on the difference in the sound.
Didactic considerations: The learner should preferably stand (diagonally) behind the instructor, maybe behind the instructor, not opposite one another. Use a large plastic tray with a small edge.

3. **Perceiving a panel in front**

Execution: The instructor holds the tray in front of the learner's face. The learner clicks, and the tray is removed. The learner clicks again and notices the difference.
Didactic considerations: Stand (diagonally) behind the learner or next to him. Use a large plastic tray with low edges.

4. **Perceiving a panel to the right and left**

Execution: The instructor holds the tray to the left or to the right of the learner's head. The learner clicks. Remove the tray. The learner clicks again and notices the difference. Alternatively, the learner clicks towards the open room and towards the tray (scanning).
Didactic considerations: Stand (diagonally) behind the learner, preferably not next to him. Use a large plastic tray with low edges.

5. **Finding a panel above**

Execution: The instructor holds the tray alternately to the left, to the right, next to or above the learner's head. The learner learns where the tray is by clicking in all directions.
Didactic considerations: Stand (diagonally) behind the learner. Start close to the head right in front of him or to the right or to the left. The exercises become more difficult by using various positions and increasing the distance. Use a large plastic tray with low edges.

6. **Finding small objects**

Execution: Use a small object, e.g. a credit card. The instructor stands (diagonally) behind the learner. Begin close to the head. Hold the card right in front of him, to the right or to the left.
Didactic considerations: The exercises become more difficult by using several positions and increasing the distance. Use flat, impenetrable objects such as a tray, but smaller in size.

7. **Standing still and observing a wall with the sshh sound**

Execution: The learner is standing in front of a bare wall, breathing in deeply. Let him turn his head slowly from the right to the left (scanning) while making the sshh sound. Listen for the difference in the echo while turning the head. The learner must determine when the face is facing the wall.
Didactic considerations: Padded walls provide a softer, subdued echo compared to a stone wall or a glass wall. A rough wall reflects a scattered echo quicker than a smooth wall.

8. Observing a wall with the sshh sound while walking

Execution: The learner stands at least 2 metres from a wall. Let him listen for the differences in the echo while approaching the wall. See if the learner can walk at a distance of 15 cm from the wall without touching it.

Didactic considerations: Take small steps. The instructor must make sure that the learner feels entirely comfortable and advances without effort. A hard and smooth wall provides the strongest reverberation. Padded walls provide a subdued sound. A rough wall provides a scattered reverberation.

Source: private photos.

Stimulation and comparison exercises

As with the previous exercises, the exercises in this section are intended to make the learner aware of small differences in sound and in reflected sound. The exercises may be used when the panel exercises either do not (yet) appeal to the learner or are too difficult to do. Most of these exercises should be done with tongue click but can be done with other self-produced sounds.

9. **Hearing small changes in sounds**

Execution: Fill up a bottle or a glass. The learner says when the water reaches the rim. Didactic considerations: Also, consider the difference between large and small coins dropping on a table. Rattle small cardboard tubes or tins with various content (rice, sand, sugar, etc.). Make little knocks on the surface with various materials.

10. **Perceiving the echo and comparing various sounds**

Execution: Make various sounds, e.g. with the voice, by clapping or with music. Make sounds by placing the sound next to or inside hollow objects, e.g. storage tins, vases, canisters or salvers or make sounds above or under the table, under the stairs or next to them.
Didactic considerations: Large, hollow objects make their very own reverberation. The learner can perceive this when the instructor makes the sound or when the learner makes the sound and experiences it through e.g. play. Depending on how (by whom) the sound is produced, these exercises are either passive or active echolocation.

11. **Perceiving whether a hollow shape is present/not present**

Execution: Hold a container, a bowl or a vase in front of the learner's face. The

learner clicks (or makes another brief sound). Take the object away. The learner clicks again and notices the difference.
Didactic considerations: Comparable with the panel exercises. Compare the sound (and the echo) inside and next to the hollow object. Also compare the bottom of the hollow object with the hollow space.

12. Comparing hollow shapes of varying sizes and materials

Execution: The learner clicks. First compare a large object (a tub) with a small object (a mug) made of the same material. Then compare hollow shapes of the same size but made of different materials. For example, a flowerpot of stone, wickerwork or plastic.

Didactic considerations: Stand (diagonally) behind the learner. Hollow objects provide a stronger echo. Gradually reduce the difference in size. When comparing materials, hard, soft, transparent and solid materials provide the biggest contrasts.

13. Finding a hollow shape

Execution: At random, hold a hollow shape in front of, to the left or to the right of the learner's head. The learner finds the shape by clicking in all three directions.
For children: Look for a hollow shape in a relatively empty room and crawl into it.
Didactic considerations: Stand (diagonally) behind the learner. The hollow shape provides bigger reverberation than a flat object (e.g., a wall or tray). The exercises become harder by letting the learner search vertically and/or by increasing the difference to the learner.
For children: Let a child start at a short distance so that he or she will hear the echo right away. Then make it harder by increasing the difference and changing directions.

General active echolocation skills indoors in a room, classroom, hall, etc.

This section contains descriptions of basic active echolocation skills which separately or combined may be used for orientation in a room, hallway, building. Establish with the learner which skills he needs and choose exercises. Establish which skills are useful in different kinds of rooms and which ones contribute to effective orientation.

Consider that for the adult learner these exercises could be less effective in home or work situations as the surroundings (rooms) are known.

Purpose of using active echolocation skills indoors

- By being able to observe open doors, the learner can find relevant door openings, e.g. his own office or bedroom;
- By being able to observe the end of a wall, the learner can find the coat rack;
- By being able to observe a lower ceiling, the learner can find a specific store, e.g. in a roofed shopping centre;
- By finding that spot where one material changes into another, the learner can find a door (which is closed and not placed in a niche).

Source: private photos.

14. Determining the kind of echo in various rooms

Execution: Join the learner in various rooms and let him experience the differences in echo sounds in different kinds of rooms: Large/small room, decorated or empty. Also, consider staircases. Also, use the difference between the outside and inside.

Didactic considerations: Possible echo signals are speech, clapping, clicking, etc. In the exercises, the learner names the typical sounds that the objects

reflect in the rooms in which they are practised – association exercises. A staircase is often tall, narrow and empty.
The transition to outdoor exercises is characterised by an initially longer or absent echo.

15. Perceiving differences in full/empty rooms

Execution: Discovery of different rooms. Are there many pieces of furniture or a few pieces of furniture?
Didactic considerations: There are many echoes when there are many hard objects at the head level. There are few echoes when there are many soft objects (at the head level). They sort of die. The learner might find it difficult to perceive low objects (below the head level). Check the skill in unknown rooms.

16. Detecting the difference between papered and not papered rooms

Execution: Discover various rooms with closed curtains and/or soft floors (rugs), bare walls and hard floors.
Didactic considerations: Hard materials/surfaces provide much reflection of sounds. If the reflection is good, the learner will automatically use a softer echo signal. In papered rooms, the echo signal nearly dies, and it is possible that the learner will have to use a harder echo signal. Check the skill in unknown rooms.

17. Detecting differences in sizes and shapes in a room

Execution: Discover the difference in sizes and shapes in the decoration of a room.

Didactic considerations: It is possible that it is easier in a relatively empty room with primarily hard materials. Papered walls and other soft objects may give an impression of a small room. Therefore, also compare rooms where the characteristics are comparable (e.g. large/small bedroom, large/small office). Check the skill in unknown rooms.

18. Identifying rooms including staircases

Execution: Discover acoustics in various rooms and ask the learner to state where he is (in known rooms) or where he thinks he is (in unknown rooms). Spend a lot of time on recognising acoustics in staircases.
Didactic considerations: Consider talking to the learner about the noticeable characteristics: bare/papered, large/small, full/empty. Stairs are a potentially dangerous obstacle. Recognising staircases is, therefore, very useful. Upstairs can be detected by the echo, while stairs going down cannot! Detecting stairs going up requires practice because they do not have a big surface to provide the echo. Practice the difference between an empty room with stairs going up inside the room and a room with stairs going down by a wall.

19. Detecting a door opening

Execution: Listen for the difference between a wall and a door opening with a quiet room behind it. The exercises can be done by standing still, scanning and clicking and taking some steps to the side or by passing by with a targeted clicking sound.
Didactic considerations: A hard wall provides a strong echo. The (open) area behind the door opening provides a late echo or an entirely absent echo. The nature of the room behind the door opening (small/large, papered/bare) has some influence on the observation. The learner sometimes does not notice the door opening, until he has passed it and does not notice the difference between the opening and the wall until then.

20. Preliminary panel exercise in approaching or walking by a wall

Execution: Hold a panel at various distances to the learner. The learner clicks to detect the different echoes.
Didactic considerations: For confirmation, the learner can feel the distance to the panel. Take the surroundings and the distance to the wall, etc., into account. Reiteration of the exercise is useful.

21. Approaching a wall

Execution: Stand at least 2 metres from a wall. Walk to the wall/door while clicking and get as close to the wall as possible (15 cm) without touching it.
Didactic considerations: The exercise is easier in a large and empty room, where the echo signal provides the least resonance from walls/objects. Hard and bare walls provide the strongest resonance. Make the learner take small steps. The learner must know that it is safe to come closer with as little effort as possible. Also, do the exercise from a longer distance and by walking towards it diagonally. Reiteration of the exercise is useful.

22. Observing the distance to a wall while walking alongside it

Execution: The learner walks alongside the wall while clicking and keeping the same distance to the wall based on the distance perception of the reflecting sound. The learner clicks towards the wall as well as towards the open room by turning the head (scanning).
Didactic considerations: Observe how comfortable the learner feels when following the wall. Does he keep a constant distance? If he does not, the reason may be the characteristics of the wall: uneven/rough/many recesses/papered. The reason may also be the learner's ability in the skill/his experience with it. Reiteration of the exercise is useful.

23. Finding the middle between two walls

Execution: Stand between walls in a hallway or a space and determine when the distance to both or all the walls is equally large.
Didactic considerations: The exercise is the easiest with walls of the same material. Hard, bare walls provide a stronger echo than papered walls. Check the skill in unknown surroundings.

24. Detecting a corner

Execution: The learner should be placed in a corner at an equal distance from

both walls. Ask him to click to both sides and to state whether the walls are equally far away or whether one of the walls is further away/closer. Change the distance to both walls.
Didactic considerations: The exercise is the easiest with walls of the same material. Hard, bare walls provide a stronger echo than papered walls.

25. Finding a corner

Execution: Place the learner one metre from the corner. Make the learner confused by turning him around, and let the learner point out the corner. Then increase the distance.
Didactic considerations: Also, consider the characteristics of the wall: neven/rough/many recesses/papered.

26. Walking to a corner

Execution: Let the learner locate a corner from the middle of a room and walk over to it.
Didactic considerations: A corner provides an increased echo, and therefore, provides support for orientation within a room. Doors are often located near a corner. Consider the influence that the material of the walls has on the observation.

27. Walking diagonally from corner to corner

Execution: Enter a room, preferably with no obstacles from the one (start) corner to the other (end) corner. Begin at the start corner and locate the end corner diagonally opposite. Walk to the end corner and keep track of the location of the end corner along the way.
Didactic considerations: If the learner cannot hear the destination right away, he should walk to the middle of the room while clicking or clapping to find the end corner. The material of the walls and the corners may influence the observation, hard/soft, smooth/rough. Also, do the exercise with one or two objects to be avoided.

28. Perceiving objects while standing still: 1

Execution: Place or hold a large and tall object (at least the head level) in an open room. The learner is next to the object and clicks towards the object and then into the open room. Discover the difference.
Didactic considerations: Distinguishing the object becomes harder depending on how small the room is and how many objects (walls) there are. The closer you get to a wall or another object, the more difficult it gets to make the distinction. A movable object can be placed anywhere in the room, close to a wall, or at various angles to the learner. This makes it possible to increase the degree of difficulty.

29. Perceiving objects while standing still: 2 with 4 executions

Execution 1: Place or hold a tall and small object (an oar, at least the head level) in an open room. The learner stands next to the object and clicks towards the object and then into the open room. Discover the difference.
Didactic considerations: An object may be smaller in the one end. This makes it possible to make different exercise situations with an object. Scanning may help to observe and locate a small object.

Execution 2: Place a low and large object (a bench) in an open room. The learner stands next to the object and clicks towards the object and then into the open room. Discover the difference.
Didactic considerations: Direct the click lower towards a low object.

Execution 3: Place a low and small object (a chair, a small cupboard) in an open room. The learner stands next to the object and clicks towards the object and then into the open room. Discover the difference.
Didactic considerations: Direct the click lower towards a low object.

Execution 4: Place a table. The learner stands next to the object and clicks towards the object and then into the open room. Discover the difference.
Didactic considerations: The exercise is more difficult because there is an open space under the table. Horizontal and vertical scanning is important. The tabletop can provide a recognisable echo just as the hollow space under it can.

30. Perceiving an object while approaching it

Execution: Use the same objects as in the previous exercise but explore and perceive while approaching the object – in motion.
Didactic considerations: Use the same didactic considerations as in the skill: Perception of objects while standing still. The sound of the echo changes because you move around. This may make it easier to notice and locate the echo. Large objects may hide small objects.

31. Avoiding obstacles

Execution: Observe an obstacle. Establish its boundaries and walk by the obstacle without touching it.
Didactic considerations: Use the same didactic considerations as in the skill: Perception of objects while standing still. The learner is challenged through walking and turning his head/scanning while also establishing as accurately as possible where the boundaries of the obstacle are located. The learner then walks around the object and continues following the route (way).

Purpose of using active echolocation skills when orientating indoors

- The learner knows that he is in the hall when he notices a small room;
- The learner recognises the living room when he notices the papered room;
- From random positions in a room, the learner can find the exit that is the closest to a corner by noticing the corner;

- By identifying a staircase, the learner knows that he must be aware of bumps or drops and avoid running into them or falling down.

General active echolocation skills in a hallway/passage

This section describes basic active echolocation skills which separately or combined may be used for orientation in a building.
Establish together with the learner which skills he needs, and which active echolocation skills might be useful and may contribute to the learner's effective orientation in a room.


Source: private photos.

32. Perceiving differences in floor-to-ceiling heights

Execution: The learner walks in a hallway while clicking and observing varying echoes, as there are changes in the floor-to-ceiling height.
Didactic considerations: You might want to direct the echo signal upwards. The most important thing is to observe the change in the reflection of the sound in the case of transitions in the floor-to-ceiling height and to observe the significance of the direction of the echo signal in the room. Changes in material may give help in the perception of changes in the floor-to-ceiling height.

33. Perceiving the end of a wall at a crossroad

Execution: The learner walks while clicking alongside a wall and notices the varying echoes when the wall ends. The learner clicks towards the wall to be followed and straight ahead. He scans.
Didactic considerations: Observe the time/distance that the learner needs in order to detect the change. If the reaction is late, the reason might be the material of the wall. The echo gets stronger depending on how hard and smooth the wall is and on the characteristics of the room. After having passed a wall at a crossroad, it is often not only the biggest distance to the wall/object that is detected. There are corners at a crossroad, and therefore, acoustics change entirely. This can also happen when there are changes in materials, e.g. hard/papered. The learner may need a lot of practice in walking over to a wall and following a wall.

34. Observing differences in widths, e.g. in a hallway

Execution: The learner walks in a hallway while clicking and observing the varying echoes when the width of the hallway changes.
Didactic considerations: Click straight ahead and at both sides (scanning). Observing changes in the echo is important. It is of significance to the learner's perception of his position in the room. Observe the time/distance that the learner needs to detect changes. If the reaction is late, the reason might be the material of the wall. The echo gets stronger depending on how hard and smooth the wall is and on the characteristics of the surroundings, e.g. when it gets wider/narrower. Also, see the section 'perceiving the end of a wall'. The learner may need a lot of practice in distinguishing the difference in width.

35. Perceiving a door opening

Execution: Listen for the difference between a door opening (with a quiet area behind it) and the wall next to it.
Didactic considerations: A hard wall provides a stronger echo. The area (room) behind the door opening entails a late or absent echo. The characteristics

behind the door opening determine the strength of the echo – small/large papered/bare – and influence the observation. You can do the exercises while standing still and scanning, standing still and taking a few steps to the side along the hallway or purposefully passing by while clicking. The learner sometimes does not detect the door opening until he has passed it and then perceives the difference between the opening and the wall.

36. **Approaching a wall/door**

Execution: Stand at least 2 metres from a wall/door. Walk towards a wall/door while clicking and get as close to it as possible without touching it.
Didactic considerations: Hard, bare walls provide the strongest echo. The learner must take small steps. The learner must feel confident and walk without effort. If possible, also do exercises at longer distances by walking diagonally and getting closer.

37. **Observing a door in a niche (a closed door pulled back a little from the wall)**

Execution: Listen for the difference between the wall and the niche with the closed door.
Didactic considerations: A hard and smooth wall provides a strong and constant echo. A mix of echoes will occur at the niche due to the closed door and the edges of the niche. This may be perceived as a stronger echo. You can do the exercises while standing still and scanning, standing still and taking a few steps to the side along the hallway or passing by while clicking. The learner sometimes does not detect the niche until he has passed it and then perceives the transition from the niche to the wall.

38. **Preliminary panel exercises in walking alongside a wall**

Execution: Hold a panel up at various distances to the learner in a larger room. The learner clicks to detect the echo at various distances.
Didactic considerations: For confirmation, the learner can feel the distance to

the panel. Take into account the surroundings, e.g. the distance to the wall, etc.

39. Determining the distance to a wall while walking alongside it

Execution: Walk alongside a wall while clicking and keeping an equally large distance to it.
Didactic considerations: The learner clicks towards the wall as well as towards the open room while turning his head, scanning. Note how comfortable the learner feels when following the wall. Does he keep an equally large distance? If not, the reason may be the characteristics of the wall – uneven/rough/many indentations/papered. The learner's skills/experience/abilities. Reiterations may be useful.

40. Walking between two walls

Execution: Stand between two walls. Establish when the difference is equally large and keep that distance while walking. That way the learner can walk in the middle of a hallway.
Didactic considerations: Scanning is important to the ability of listening to both sides all the time. This is easier when there are two walls of the same material. There probably is a risk of ending up walking closer to one wall when that wall is made of a softer material or is papered. Reiterating these many times is useful. Check by tapping the cane.

41. Observing an obstacle

Execution: Observe an obstacle. Establish its boundaries and walk by the obstacle without touching it.
Didactic considerations: Use the same didactic considerations as in the skill: Perception of objects while standing still and in motion. The learner is challenged through walking and turning his head/scanning while also establishing as accurately as possible where the boundaries of the obstacle are located.

42. Finding changes in the material

Execution: Walk in a hallway, click against the walls and observe by means of the echo signal where the material changes, e.g. when stone turns into wood. Search purposefully for the boundaries between two different materials. Didactic considerations: The bigger the contrast is in hard/soft, smooth/rough materials, the easier it is to determine the change in the material.

PART III
ACTIVE ECHOLOCATION EXERCISES OUTDOORS

By Lone Dyekjær

General active echolocation skills outdoors

This section describes basic active echolocation skills outdoors, which separately or combined may be used for orientation. The exercises can be executed structured in quiet, non-reverberant surroundings and/or on routes. An O&M instructor establishes together with the learner which skills the learner needs, and which skills then would be useful on a given route and contribute to the learner's orientation. The practice can be executed in an outdoor location with buildings (e.g. a schoolyard), in a town or a village centre. The transition to outdoor exercises is characterised by an initially longer or absent echo. Shifting location from an open yard to practising at pavements in a town represents the progression in difficulty.

Purpose of using active echolocation skills when orientating outdoors

- Observation of a building on the other side of the street may be a directive to cross it;

- By hearing the third flower bowl in a street, the learner knows that his friend's house is right on the other side. Because of the special acoustics of an object above the learner's head and because of angles in walls directed outwards or inwards, the learner can find the entrance to a (large) building, even from a certain distance;
- By noticing the transition of the material, the learner can find the door to a store.



Source: private photos.

43. Preliminary panel exercise in walking alongside a wall

Execution: The instructor holds (outdoors) a panel, e.g. a tray, up at various distances from the learner. The learner clicks to detect the echo at various distances.
Didactic considerations: For confirmation, the learner can feel the distance to the panel. Keep enough distance to walls and other large objects. If necessary, place the learner with his back against the wall.

44. Approaching a wall

Execution: The learner stands at least two metres from a wall. Walk towards the wall while clicking and get as close to it (15 cm) as possible without touching the wall.
Didactic considerations: A hard, bare wall provides the clearest echo. The learner must take small steps. The learner must know that he is safe and can come closer with as little effort as possible. Also, do the exercises from an increased distance and by walking towards it diagonally. At a large distance, a harder echo is necessary which will gradually decrease as you get closer.

45. Determining the distance to a wall while walking alongside it

Execution: The learner walks alongside a wall while clicking and keeps a constant distance to the wall based on echo signals.
Didactic considerations: The learner clicks towards the wall as well as towards the open space and turns his head (scanning). Observe how comfortable the learner feels when following the wall. Does he keep a constant distance? If not, the reason may be the characteristics of the wall – uneven/rough/many niches or the learner's skills/experience. Reiteration of the exercises is useful.

46. Perceiving a weather porch

Execution: The learner walks alongside a wall and observes a change of the weather porch – see the photo. Click especially towards the wall, later also in

other directions.
Didactic considerations: Many weather porches provide a stronger echo. A weather porch is a relatively small, hollow room where various surfaces can reflect the echo. Especially a late echo is observed in some weather porches, as is the case in a door opening (see later). The characteristics of the weather porch – large/small and the materials used – influence the perception. Practise while standing still at the boundary between the wall and the weather porch if necessary.

47. Perceiving objects above the learner's head (eaves/sunshades)

Execution: The learner walks while clicking from an open space towards the transition to and under e.g. the eaves and observes changes in the echo above. Direct the echo signal particularly upwards.
Didactic considerations: The closer you are to the object and the harder the material, the easier it is. If necessary, practise while standing still by the boundary between the eaves and the open space.



Source: private photos.

48. Perceiving an open door to a store

Execution: The learner walks alongside a wall while clicking. Observe the change in the echo. Direct the echo signal particularly towards the wall, later also in other directions.

Didactic considerations: The room behind the door opening causes a late echo or an absent echo. The characteristics of the room behind the door opening –

small/large, papered/bare – influence the perception. If necessary, practise while standing still by the boundary between the wall and the door opening. The learner sometimes does not detect the door opening until he has passed it and notices the difference between the opening and the wall.

49. Perceiving the end of or an opening in a wall

Execution: The learner walks alongside a wall while clicking. Observe the change in the echo at the end of the wall. Direct the echo signal particularly towards the wall, later also in other directions.
Didactic considerations: A lacking echo also provides information. Observe how much time/distance the learner needs to perceive the changes. If this takes some time, the reason may be the characteristics of the wall, many indentations, the learner's skills and experience. Reiteration of the above exercises is useful.

50. Perceiving a wall directed outwards or inwards

Execution: The learner walks alongside a wall while clicking. Observe the change in the echo at a wall directed outwards and at an obstacle. Avoid the obstacle and continue along the route without touching the diverging wall. Listen for a late echo and continue the route straight ahead. Avoid walking closer to the divergent wall. Click a minimum towards the wall you follow and straight ahead. Clicking in all directions is better.
Didactic considerations: With the experience from the panel exercises and the skill: getting closer to a wall, the exercise is relatively easy. Continuing on the route is an additional challenge.
Depending on the distance to the wall, it may be difficult to observe a divergent wall. If necessary, practise while standing still at the boundary to the wall alongside the divergent wall. Reiterate the exercise while passing. When the learner knows or assumes to hear that e.g. a wall directed outwards comes after the divergent wall, walking closer to the divergent wall is not meaningful. The difficult part is to follow the original line. Changes in the material in the wall you follow, and the wall directed outwards or inwards may influence the observation.

51. Perceiving inner angles (corners)

Execution: There are corners outdoors as well which are comparable to corners in a room. You can do similar exercises as with the skill: detecting a corner, finding a corner, walking to a corner.
Didactic considerations: These exercises are easier when there are walls with comparable characteristics. A corner (an angle) provides a stronger echo, and therefore, supports the orientation in the room.

52. Observing objects, the size of a van/car (not lower than the head level)

Execution: while clicking, listen for the difference between the echoes from a relevant object and the lack of the echo in the open space. Compare the observations with the observations from the panel exercises.
Didactic considerations: Practise while standing still and standing close by and then vary the distance and positions in relation to the object. Take nearby objects into consideration. To begin with, the object must be placed in the open space as much as possible. Later, the exercise can be made more difficult by placing/choosing the object near other large objects.


Source: private photos.

53. Perceiving objects, the size of a rubbish bin/container (below the head level)

Execution: Listen for the difference between the echo from an object (e.g. a rubbish bin) and the absent echo in the open space. Comparable with the panel exercises.
Didactic considerations: See the above section.

54. Perceiving tall, narrow objects (streetlights) (not lower than the head level)

Execution: Stand in front of a tall and narrow object. Click towards the object and into open space. Listen for the difference. Practise close to the object first. Then vary the distance.
Didactic considerations: The size, material and shape of the object influence the observation. Hard and smooth surfaces provide a clearer echo than soft and uneven surfaces. A tall, round post carries a small chance that the echo will hit it, and the possibility of perceiving the echo signal is, therefore, also little. Scanning is important here.

55. Perceiving objects while approaching (first objects at the head level, then objects that are lower)

Execution: Walk and click towards an object from approx. 10 metres. State when the object is observed.
Didactic considerations: Begin with an object in a fairly empty open room. Approach from the direction with the biggest possibility of hitting – large, vertical surface such as the side of a van. A van/car can be observed from approx. 4.5 metres. Vary the distance and the angle from which you approach later. Make the exercise more difficult by selecting surroundings with several objects (large objects hide small objects). Note that objects may be easier to observe while approaching than when standing still. When you approach, the echo changes.

Approaching may increase perception.

56. Avoiding solid/firm obstacles (cars/posts/small posts/pillars)

Execution: Observe an obstacle. Search for its boundaries and pass by the obstacle without touching it.
Didactic considerations: Give the learner a challenge, while he is scanning and walking. Ask him to state the boundaries as accurately as possible, to walk around and past the obstacle, and to continue on the route. The characteristics of the obstacle and the characteristics of the surroundings, e.g. whether there are objects in the surroundings, influence the observation.

57. Avoiding small and compact obstacles (not a dense surface, e.g. a sofa or a bicycle)

Execution: Observe an obstacle. Search for its boundaries and pass it without touching it.
Didactic considerations: Comment to avoid walking into compact obstacles. If there are problems avoiding small, compact obstacles, it may be useful to practise while standing still and to approach purposefully (see above). The exercises may be easier in motion than when standing still.

58. Perceiving kerbs while approaching

Execution: While crossing a street, search for the kerb on the other side by clicking.
Didactic considerations: This is an exercise for practised learners. A kerb can be heard at a distance of approx. 1 metre. If you get closer, you can no longer hear it! Begin on a quiet street with no buildings on the other side. Practise later on in busier streets and with buildings on the other side.

59. Perceiving changes in facade materials

Execution: Follow a facade and observe the transition in the material from one kind of material to the other, e.g. stone and glass. State the boundary as accurately as possible.
Didactic considerations: Click towards the facade you are following. If necessary, let the learner turn towards the facade to accurately state the boundary between one and the other material.

Complex exercises in active echolocation outdoors

This section contains descriptions of complex active echolocation skills, which separately or combined may be used for orientation outdoors. Establish together with the learner which skills he needs and choose exercises. Establish which skills are useful in different kinds of environments and can contribute to effective orientation for the learner.

Open, outdoor areas (squares, lawns, car parks)

60. Observing a building close by

Execution: Stand still and click in all directions. Determine where a building is located and walk over to it.
Didactic considerations: For a building in the open space, 10 metres is close.

61. Observing several buildings at various distances

Execution: Search for buildings in the surroundings while standing still. State which building is the closest and which building is further away. Click in all directions. Turning is permissible.
Didactic considerations: The material of the building influences the observation. The echo from soft materials, e.g. wood, is not as strong. It may, therefore,

seem that the buildings are further away. Other large buildings nearby may seem confusing.

62. Observing large objects up to the eye level (cars, vans, containers)

Execution: Walk around and examine the surroundings to determine whether there are large objects in the surroundings. State the location as accurately as possible and state the characteristics of the objects (what is characteristic). Determine what it could be.
Didactic considerations: Being able to scan in all directions is important. One kind of material might provide a clearer echo than the other. Large objects may hide small objects. Also, practise avoiding objects. Therefore, first determine the boundary of the objects and where there is open space. If possible, while walking.
As a game: From the starting point, e.g. the exit from a building, determine three large objects in open space. Go back to the starting point and lead the learner along the three objects. This can be done with more or fewer objects.

63. Perceiving hedges, fences, bushes

Perceiving the difference between solid and penetrable sound and following these as a guideline.
Execution: Search for the boundaries in the open space. Name and point out the characteristics of the objects/obstacles. Are they firm/penetrable, tall/short? Follow the objects without touching them at a constant distance.
Didactic considerations: Bushes and fences are called penetrable as part of the echo signal goes through these objects. This means that only part of the sound is reflected. These echoes are often more difficult to observe than the echo from solid objects such as walls. If this is difficult for the learner, practise while standing still. Compare the open space and the penetrable objects. Compare solid and penetrable objects by their boundaries. Just as it can be useful to follow

a wall, it can be useful to follow a hedge or a row of bushes – a natural guideline. The taller and denser an object is, the easier it is to follow.

64. Perceiving narrow objects at the head level (e.g. street lights or tree trunks)

Execution: Look for small, tall obstacles in the surroundings. State the location and characteristics. Say what it could be.
Didactic considerations: Large objects may hide small ones. Hard materials and large surfaces provide a clearer echo than soft materials and small surfaces. For a round object, the possibility of the echo signal hitting and of perceiving the echo is quite small. Being able to scan is important. Practise avoiding and walking around the object.

Source: private photos.

65. Perceiving low objects (e.g. small posts, flower bowls, benches)

Execution: Search for low objects in the open space. State the location and characteristics. Say what it could be.
Didactic considerations: Direct the click downwards. Take into consideration any influence from the material of various objects and objects in the surroundings, e.g. the fact that large objects hide small objects. Practise avoiding and walking around the object.

66. Perceiving trees while walking under them

Execution: Walk and click on a path or in the open space and observe changes above. Direct the click upwards. Observe branches, high and low.
Didactic considerations: Observe the situations in which the learner perceives something and when he does not. Thick or thin branches, density of the leaves. In clearly difficult situations, it might be helpful to practise while standing still and compare the reflection of the sound to the open space.

67. Perceiving tree trunks while passing by or approaching them

Execution: Search for trunks (trees) in the surroundings. State where they are. Do not click too much upwards (branches and leaves). Focus on the trunks.
Didactic considerations: Thick trunks are easier to hear than thin ones. If necessary, practise the difference between thick and thin and the difference between the open space and thin trunks while standing still.

68. Perceiving an open space (clearing)

Execution: Establish where there an open area is and where the nearest boundary is. Click in several directions.
Didactic considerations: Lead the learner close to the boundary of the open space. Let him click in several directions. Supplementary exercises: Crossing the open space and searching for more boundaries.

69. Perceiving bushes

Execution: Search for a bush or a row of bushes in the surroundings.
Didactic considerations: Direct the click lower. If necessary, listen for the difference between bushes and the open space and between bushes and trees while standing still.

70. Perceiving a building at a distance (e.g. an open space or the edge of a park)

Execution: Search for a building in the surroundings at a certain distance.
Didactic considerations: Begin with a building fairly close by (10 metres) and increase the distance (approx. 60 metres is the limit). Low bushes and thin trees will hardly prevent the observation. High and dense objects may cause some confusion. However, by scanning and listening for characteristics, it should be possible to distinguish between these objects and the building. Discuss with the learner whether he hears something and what that might be.

71. Perceiving objects (benches, picnic tables, play equipment)

Execution: Walk on a path and explore or walk in the open space and observe the objects while clicking. See if you can avoid them by searching for their boundaries.
Didactic considerations: The material and the size of objects will influence perception. Listen to objects close by and further away. If necessary, listen for the difference between the object and the open space or for objects close to each other while standing still.

72. Following a natural guideline in the form of trees, bushes, hedges, etc.

Execution: Walk along a path while clicking. According to the situation, direct the click to the left and/or to the right and keep an equal distance to the natural guideline.
Didactic considerations: You often follow a row of trees or lines of bushes or hedges. These are more difficult to follow than a wall because it is easier for sound to penetrate them. The taller and denser an object is, the easier it is to follow. If necessary, listen for the difference between the open space and the natural guideline while standing still.

73. Perceiving a path in a woodland

Execution: Click in the direction in which you expect a path and notice the difference.
Didactic considerations: Find an opening in a row of trees, bushes or a hedge/fence. In this situation, the contrast between a path and the surroundings with penetrable objects or openings between the objects are often very little. Practise at the boundaries between the opening, if necessary while standing still, and reiterate the exercise afterwards while walking.

Purpose of using complex active echolocation skills when orientating outdoors

- By observing rows of trees, bushes or hedges, the learner can, e.g. in a park or forest, follow a natural guideline by using the hearing without being bothered by (wet) branches or shifts in the guideline;
- By observing a large opening in the trees in the forest, the learner can find a path in the forest;
- By observing a transition from a penetrable material in a natural guideline to a solid material, the learner knows that he has arrived at a building;
- By noticing an open space, the learner knows that he is close to e.g. a picnic table and can, therefore, search for it purposefully.

PART IV
TARGET GROUPS, COMPLEX ROUTE LEARNING, O&M ASSESSMENT, PORTFOLIO

By Lone Dyekjær

Part 4 focuses on:

- Different target groups and didactic considerations in relation to these;
- Complex route learning:
    - when an O&M instructor uses e.g. Google StreetView Map or another equivalent app as a tool in the O&M instructor's teaching preparation;
    - when a learner uses active echolocation skills in complex and busy city streets/railway station;
- The O&M instructor using an interview guide in the assessment of a VIP's O&M needs;

- The O&M instructor and the learner use a portfolio as a working tool.

Different target groups and didactic considerations

Beginners and experienced VIP travellers should be offered active echolocation training as a tool in O&M in addition to other tools in O&M according to their needs. Active echolocation can be learned in a structured learning programme, including only structured exercises and/or self-directed discovery learning in active echolocation, or it can be integrated in a person's general O&M training.

Whether to choose one learning approach or another depends on an individual person, who is going to learn active echolocation and regards his personal prerequisites, physical habitat, preferred learning style, motivation, age, abilities, etc.

The choice of the learning approach is also dependent on e.g. different cultural traditions for teaching in a country, and the frames for organising learning environments within a learning institution.

It is very important for the learning outcome of the VIP that the learning approach and the chosen methods can be changed according to the VIP's needs. How the learner best learns must be assessed successively during the learning process.

How can the teacher then plan an O&M course containing learning active echolocation skills, and how can she assess the learner's O&M needs?

The O&M instructor's reflections on planning a course could regard questions like:

- How can you plan progress and a course in active echolocation with tongue clicking for a VIP when:
    - echolocation is to be introduced to an experienced traveller as an additional tool to navigate your surroundings;

- echolocation is part of a general O&M course for a new traveler?
- the traveller is blind, has low vision, is newly blinded, is a child, is an adult, is a cane user, is a dog guide user, has a mental disorder, has a hearing loss or other limits in function?

There are no fixed answers to the above, as each learner is unique and has his own prerequisites. Whether active echolocation is introduced to an experienced O&M traveller or to a new traveller in O&M, the skills to achieve will be different from person to person. The contents in an active echolocation course will thus depend on the goal-setting for each individual. When starting to practise active echolocation all learners need to get the brain hooked for listening – i.e. stimulus sensitisation and clarification and to choose their preferred echolocation sound. Initially basic skills must be trained.

When planning training in active echolocation, the O&M instructor might consider the following brief didactic considerations regarding different target groups (Kish, 2017).

Teaching children

- Start clicking early;
- Be aware of the position and height of the child – the feedback will be different in a lower position than from an adult position. Listen to the clicks from the same perspective as the child;
- Discovering is highly motivating and developing for the child;
- Think about variations;
- Offer various types of listening games/auditory games involving the hearing;
- Involve the parents/siblings to stimulate the child every day;
- Kinds of games could be search and hide games.

Teaching adults

- Explain the advantages of an effective and active self-produced sound;
- Explain the advantages of active echolocation as a navigation tool;
- Be aware of the position and height of the wheelchair user – the feedback will be different in a lower position than from an upright position. Listen to the clicks from the same perspective as the wheelchair user.

Teaching people with low vision

- Find a balance using residual vision and active echolocation;
- Use of blindfolds, dark sunglasses may be of big help at the beginning of practising active echolocation;
- Use of earplugs can be helpful to be able to differentiate between what you see and what you hear.

Teaching people with hearing impairment

- The use of active echo signals increases echo detection, especially under noisy conditions. *"Much hearing loss occurs in the high frequency range and it is the low frequency sounds that may be sufficient to enable somebody to walk parallel to a wall, find corners, or to locate an opening in a corridor"* (Kish, 2017, p. 327);
- Age-related hearing loss of high frequencies limits the detailed observation of echoes;
- With one-sided/monaural hearing it is very difficult to determine and hear from where the sound comes;
- Hearing aid must be in the ear, not behind the ear;
- Settings of the hearing aid must focus environmental sound and not for communication.

Teaching people with mental impairment/learning disabilities

- It is motivating to go discovering;
- Preferably practising should be conducted in familiar surroundings;
- Using preferred sound is motivating.

Teaching guidedog users

- Active echolocation complements and facilitates working with a guidedog. The dog can guide the team easily through the environment and maintain the user's safety without having tactile encounters, but the guidedog then deprives the user from knowing the structure of the environment. Active echolocation skills may reestablish the connection to the environment.

Planning a structured route exercise in a complex environment

An O&M instructor might plan a structured route with Google StreetView or an equivalent app. This gives the O&M instructor an idea of what you will meet in an unfamiliar area when you are going to practise the route live. The O&M instructor will need preferably a tablet (easier to watch) or a smartphone with apps like Google StreetView Map and Google maps. The route could be executed e.g. along a busy city street or a railway station.

The O&M instructor investigates and looks on Google StreetView Map for good spots to make structured active echolocation exercises. She considers which active echolocation exercises will be good for the learner to practise according to his needs, prerequisites, skills and goals.

Good spots could be openings and closings i.e. doors, gateways, high/low walls, roofs, awnings, trees, bushes, parked cars. More advanced could be benches, flower boxes, poles, road signs, garbage cans, staircases, etc.

The O&M instructor might not know if the map shows what you will see in reality, but you will get an idea. Out on the route you will have to improvise according to reality. As preparation, the O&M instructor and the learner might talk about the route details beforehand.

When investigating a route, start looking at the map with street view:

- Watch the total route;
- What are the possibilities for doing echolocation on that route?
- Determine and identify where you can find echoes;
- Determine where echoes are essential to orientate yourself on the route
- Choose some echolocation skills that you might need;
- Which skills do you wish to practise?
- How will you teach the different skills?
- How can you make exercises easier or more difficult?
- What would you do differently with children, adults, etc.?
- Which skill will you start with?

Remember:

- Objects at the level of the head are easier to detect than objects below hips;
- Small objects in front of bigger objects are difficult to hear and detect;
- Hard materials give a louder echo than soft ones;
- Solid objects give a stronger reflection than non-solid objects;
- Nearly everywhere there is the echo.

Active echolocation exercise in an advanced environment

As an opportunity to try out the learner's O&M skills and his echolocation skills in combination, he can try out an exercise at the local railway station. The learner has prepared himself by investigating either a tactile map and/or has been talking to

somebody/the O&M instructor for necessary information of the route. If he is motivated and has the skills to do so, he could go on self-directed discovery, or the O&M instructor could plan a structured route with different exercises in active echolocation.

The exercise requires that the learner can make differentiations in clicking skills, i.e. going from quiet to loud when needed according to the size and distance from the objects. The exercise requires that the learner can make interpretation of the feedback from echoes and can answer what the echoes represent and still keep track of where he has been walking (way finding).
The exercise is complex, as the learner may not have been at the station before, and therefore, is not prepared for what to expect. The exercise does require advanced skills in O&M and in active echolocation. The learner walks a certain route from A to B.

Some questions to reflect upon after executing the exercise could be:

- Where did you hear echoes?
- When and where did you differentiate your echoes?
- When did you get clear echoes?
- How did you interpret them?
- Where did you meet challenges?



Source: private photos.

Source: private photos.



Source: private photos.

Interview guide in O&M assessment

An interview guide could be of inspiration and serve as a guideline to the O&M instructor when assessing the learner's O&M needs and for her to draw up the objectives for the learner's outcome of an O&M programme (for the full scheme see Enclosure 1).

Portfolio as a working tool for the O&M instructor

A portfolio is a tool for managing, learning and evaluating the process of learning to actively echolocate the surroundings (Lund, 2013). Working with the portfolio concerns both the O&M instructor and the learner, who are going to learn to actively echolocate. Both create their own work portfolio.

A portfolio is a (Lund, 2013):

- working tool and a way of working pedagogically;
- briefcase, a folder, a collection which could be physical and/or electronic;
- systematic collection, selection and reflection on products/materials which document the working process of the learner;
- place where the learner collects his papers, notes, learning materials, didactic reflections, film clips etc.;
- managing tool, which manages the learner's learning process in a way that keeps the learner on track of his learning goals, the purpose of the project/study, the reflections in and over practice;
- practice-oriented way of working, involving reflections on interaction between the theory of echolocation and working with echolocation in practice;
- managing tool for the learner, showing his choices of using available knowledge, efforts, progress and presentations within his chosen areas of working with echolocation;
- managing tool to show competencies of the learner.

Work portfolio

The learner:

A work portfolio is a collection of all the materials the learner has been working with, which have produced during a course/progress. A work portfolio is private. Contents in a work portfolio could be:

- Notes the learner makes to learning materials in echolocation during class and working in practice in the field;
- Notes from discussions and group work;
- Notes from the learner's reading of echolocation in accessible literature;
- Notes from a logbook the learner keeps on his own self-practice to learn active echolocation.

The O&M instructor also works with a work portfolio. The work portfolio for the O&M instructor could contain:

- Notes from a logbook the O&M instructor keeps when she teaches could contain:
    - Reflections in and on her planning, when she teaches active echolocation to a learner – who, when, where and why did she teach echolocation to this person?
    - Reflections on the methodology;
    - Work papers regarding her choices of exercises;
    - Her observations when teaching in practice;
    - Photos and film clips she makes during her own self practice and/or with learners, describing/showing/illustrating – when, where and how she practiced;

- Discussions and sparring with her colleagues.

Documentation portfolio

The documentation portfolio could be for both the O&M instructor and the learner. The documentation portfolio is:

- to be presented, shared and evaluated with peers/colleagues;
- is the material of the O&M instructor or the learner presenting and giving reasons for their systematically selected materials from her work portfolio to be presented to someone;
- there is a requirement of reflection in the documentation portfolio;
- it trains the O&M instructor's and the learner's documentation competencies and support their learning and meta learning – i.e. their careful considerations on their own learning;
- a systematic collection of work;
- it shows the development as a learner – i.e. in active echolocation;
- it claims the participation of the learner;
- it shows the learner's reflections on the subject, i.e. echolocation;
- it evokes the learner's attitude towards the subject.

When the O&M instructor digs deeper into the understanding the concept of a documentation portfolio, the O&M instructor finds that:

- It is a systematic collection – it could be thematic or chronological:
    - Showing what, why and how you have been engaged in the subject you study – i.e. echolocation;
    - It shows one's development as a learner;
    - Starting from the very first notes on how you practise echolocation to end up with you fulfilling your goals for travelling

practising active echolocation.

- It claims participation of the learner:
    - The learner should present when, with whom, where, why and how they have worked with echolocation;
    - It shows the learner's reflections on the subject – i.e. echolocation;
    - The learner presents his reflections on what he finds valuable and essential, meaningful and coherent when learning and teaching echolocation.
- It evokes the learner's attitude toward the subject:
    - When working with portfolios, the learner creates his own narrative about learning and realisation and through his reflection on this, i.e. his meta reflection, he establishes a helicopter perspective on his learning process.
- Working with portfolios as a pedagogical tool in a teaching process, which is offered here and which can work for trainers.
- The tool can be transferred and used as a tool for the learners that you are going to teach echolocation to.

For the VIP learner working with portfolios means:

- Learners are conscious about their own learning;
- Focus is shifted from product to process in the learning;
- Learners work within 3 main areas:
    - Goal setting;
    - Documentation;
    - Planning/reflection/evaluation;
- Learners set their own goals. The teacher helps them to draw attention to the learning process and to understand the goals in the curriculum so that the learner understands them and can set his own goals;
- The documentation helps make the learning and development visible.

The learner dates and keeps his work in his portfolio. The contents reflect the learning and the individual progress over a period of time;

- All that is kept must be followed up by reflections:
  Why did I work with this subject/echolocation?
  What have I learned through this work?

Thus, the learner learns about which strategies work. The learner learns through both successes and failures.

Setting up a scheme and leading a logbook could be of help in collecting reflections for the portfolio. Below is an example of a scheme:

Enclosure 1: Interview guide for O&M-assessment

Name of the learner: _____ Date: _____

Try with your own words to describe the function of your vision (field acuity, reading acuity, colour vision, sensitivity to light, sensitivity to contrast)

Did you receive training/instruction before considering your travelling/your mobility?

Do you travel on your own? Where do you travel? Try to describe your experience of travelling

Do you use any aids for mobility? (cane, binocular, glasses, sunglasses, badge, sunscreen/cap/hat, torch, iPhone, iPad, other) If so, how does it work?

Do you use any arrangement for transport from your community?

Do you have community-based arrangements, such as to get sighted guidance when needed? If so, how do you use this?

How do you manage to travel indoors? (In your own home and other relevant places):

How do you manage *doors (revolving doors/sliding doors):* *stairs (moving staircase):* *crossing of streets (traffic lights):* *differences in levels (curbs, holes, bumps, irregularities etc.):* *reading signs:*

How do you manage to find your way on familiar and unfamiliar routes? (do you use tactile, visual, audible guidelines, landmarks, other):

How does different lightning affect your travelling? (darkness, sunshine, fog, backlighting)

How do you manage to avoid bumping into obstacles?

(Tendency to bump into things/people?):

How do you recognise people you meet in the street?

How do you feel about asking for help?

Do you use public transport (bus/train, etc.)? How do you manage it?

How do you experience reactions from your surroundings when you travel?

Do you have a need for sighted guidance? If so, how does it work?

How is your hearing, sense of touch, smelling?

Do you have other important information (illness, medicine taken or other)?

What is the most important for you to be able to manage right now?

Which places do you need to be able to find your way to?

What do you know about echolocation – passive and active echolocation?

Suggestions for goal setting:

Enclosure 2: Sound associations – words describing the echo:

Solid

Sparse

Scattered

Broad

Tall

Large

Small

Hollow

Coarse

Fine

Juicy

Mushy

Sloppy

Leafy

Find other words yourselves and write them down

Enclosure 3: Practical example of a teaching plan

– teaching 12 adults (from EchoProVip training in Copenhagen)

Basic exercises in active echolocation – 3.5h

Bring along: a notebook, pencil, blindfolds, bottle of water

On the beginners' level echolocation exercises should preferably be practised in calm, large, open, non-reverberant, fairly quiet environments in order to distinguish the subtle differences in echo feedback and for the learner to gain successful experience and learning outcome.

At this course there are 2 teachers and 12 learners (O&M instructors) with very different learning backgrounds and qualifications. This makes it necessary to plan the logistics. We will, therefore, work in groups and pairs, and the learners will be teaching each other after a short teacher demonstration. The teachers will give feedback on the learners' teaching and exercise performance. The teachers will be circulating around to 3 working locations as consultants and guiding during exercises.

Practical information:

- 30minutes: Teachers' demonstration of basic active echolocation exercises.

- 3 hours: Students will work in 3 groups with 4 persons in each. Within one group you work in pairs 2x2 persons.

3 pairs work 50 minutes : Pairs shift roles after 25 minutes.

3 pairs are observers for 50 minutes. They are silent during the exercises. They observe the other pair in the group exercising. With closed eyes, they also listen to the echoes produced by the echolocator during the exercises. Observers

consider didactics – what works well, ok, not so well, not at all. Consider progression, order, give suggestions and take written notes for later tips. Observers watch the time and get the group on time through exercises.

Pairs change their roles.

Materials:

Trays – wooden, plastic;

Breadboards – wooden, plastic;

Cork plates;

Cardboard different sizes – A6, A4, A5;

Bowls of different sizes, glass, metal, plastic;

Jars of different sizes, glass, clay.

Learning process:

Exercises go from easy to difficult. From stationary to moving. You may go quickly through or skip some exercises, if the learner is a quick learner.

Go for the AHA moment when the echo flashes at you.

Your preferred sound:

Use your preferred sound. Try out at the start which sound works best for you. You can stick to that sound during exercises, and you can change your sound in order to hear and perceive the echo.

Sound associations – words describing the echo:

Solid, sparse, scattered, broad, tall, large, small, hollow, coarse, fine, juicy, mushy, sloppy, leafy.

Find other words yourselves and write them down.

Exercises:

With panels: jars/bowls/trays – flat/round/hollow – try if possible, a tray, a breadboard, a cardboard. You may start with jars or bowls.

Exercises no. 1–8, pp. 17–18.

Exercises no. 19,21–31, pp. 21–23.

Enclosure 4: Practising active echolocation – Daniel Kish's first school day

The following narrative is Daniel Kish's description of his first school day. The description gives a good idea of the use of the senses when travelling.

"On my first day of first grade, the bell rang, and I heard the crash and clink of chairs against desks. The muffled thud of seemingly countless pairs of shoes pounded on the carpet as all my classmates scampered out of the classroom, their excited voices gleefully ringing. I ambled after them, occasionally clicking my tongue quietly in order to listen for my proximity to the wall on my left, and so I could avoid chairs left askew along the way. Directing myself toward the shrill symphony of kids at play, I clicked again to centre myself as I passed through the open doorway. The silence of the empty classroom closed in behind me as I entered the new playground beyond.

After taking a few steps, I dimly felt where the smooth cement turned to somewhat rougher pavement. Under my feet, I could feel a crack that I discerned ran parallel to the long building whispering behind me. I knew by experience that this crack was an important feature to remember, and I wished my feet were not encased in hard-soled shoes.

I paused to consider the strange, chaotic scene stretching out in all directions before me. Clicking and turning my head from side to side, I scanned the expanse, straining to penetrate the heavy curtain of commotion. The world suddenly seemed bigger than anything I had ever encountered, and noisier, too—teeming with flocks of darting voices, swarms of bouncing balls, and battalions of scuffling shoes, all darting and swirling in mesmerizing threads of motion.

This playground, and this extent of activity and commotion, was completely new to me. Prior to starting first grade, I had only been oriented to the primary

students' building, taught to trail the wall of smooth bricks with my hand from my first-grade classroom five doors down to the resource room where I would learn Braille. I didn't need to trail the wall with my hand in order to follow it, for I could hear its presence just as easily, but my vision teacher insisted upon my touching the wall and counting the doors. I had no cane; mobility training wasn't provided to children my age in 1972. Although this practice has changed in the U.S., it remains this way in most countries. A short introduction had been given to my class that morning about a blind child among them, but we did not have aides looking after special education children in those days, so as I entered the playground, I stood near the building all alone. I wasn't scared though. I generally preferred to be alone, and in all my time in school since I was two years old, I had thought little about being guided or helped along. I had been clicking my tongue to get myself around for as long as I could remember. I did not even have to think about my clicking, for it came as naturally to me as breathing. To this day, I have always enjoyed figuring things out and finding my way around new spaces: What is around me? How do I get there?

What do I do when I find it? How do I get back? New places have always been like intriguing puzzles to me.

At first, I found the noise on my new playground oppressive, threatening to swallow me up. But curiosity won out over mild apprehension. I stepped gingerly forward, clicking quickly and loudly to cut through the cacophony while turning my head left and right to hear where my clicks came back to me as echoes. Clicking and listening allowed me to find the clear spaces, and I walked easily through the playground, passing between clusters of bodies—undulating blips on my "radar." Keeping my distance from the boinging thud of bouncing balls and the repetitive clack of twirling ropes, I moved cautiously at first, but gained speed as I found my "fit" into these busy surroundings. From time to time I clicked back over my shoulder. As long as I could hear the hard surfaces of the building call back to me through the crowd, I knew I could find my classroom again.

The storm of noise went on in all directions, and the building was fading fast through the bedlam fog. I hesitated, wondering if I should return to the building while I still knew I could, but the skittering of a ball behind me followed by shoes pelting lightly after it spurred me onward. I knew there must be quiet fields of grass somewhere; softer open spaces like there had been on my kindergarten playground. As the pavement sloped slightly downward, I realized that if I could get back to the slope, I would be able to follow it up toward the building.

Eventually, the pressing din gave way to a softer hue, taking on a slightly muffled quality, while my clicking inquiries found no reply. With relief I sped up, eager to find the open quietude of the large field of grass that I knew lay shortly before me. Despite the hard-soled school shoes I was required to wear, I felt my feet hit grass. Stimulated by the promise of great adventure, I broke into a run, quickly clicking to ensure that nothing stood in my way. Finally emerging from the heavy fog of noise, I felt as freed as a bird taking joyful flight.

Then, suddenly, something whispered back to me from the open expanse, and I jolted to a stop.” HI", I ventured in a bell-like treble. There was no reply. As I scanned, clicking more softly, the something quietly told me about itself-- it was taller than me, and too thin to be a person. As I reached out to touch it, I knew already that it was a pole. I was glad I found it with my tongue and not my head. A small metal cap adorned the top of the pole. I clicked around me, and barely heard something else whispering back. Leaving the pole, I moved toward this next thing as it called to me with a similar voice, telling me that it was also a pole. I detected yet another one, and another-- nine poles in a straight line. Later I learned that this was a slalom course. In time I practiced biking by slaloming rows of trees while clicking madly.

A strident buzzer abruptly sliced the air. I was not startled, but I froze and raised my hands to my ears. When it finally ceased, I lowered my hands to hear buildings from far away calling back to me from several directions surrounding the immense grass field. I detested the buzzer, but the distant voices echoing back to it sounded like wistful music, now conveying to me just how big this field

was. I was amazed. I had never been in anything this vast. I scanned around me, clicking, but I couldn't hear the building over the great distance and bedlam of kids. I clapped my hands with a sharp report, and something large called back through the tangle of piping voices and scurrying shoes. I moved in that direction. The grass gave way to pavement, and as I stepped quickly up the slope, clicking and clapping, I heard the unmistakably broad, clear voice of a wall drawing nearer.

As I approached the building, I caught the exchange of other kids talking about me:

-- “How does he know where he’s going if he can’t see?”

-- “He’s got some kind of radar.”

-- “Like a cop?”

-- “No silly, like a bat.”

The crowd noise organized itself and became not quite so assaultive. I heard kids in lines facing the wall. I didn't know why they were lining up or what I was supposed to do, and I couldn't tell where my classroom was. The wall sounded completely featureless, offering no information. I asked someone where the B-9 classroom was, and someone pointed me in the right direction. I started to walk along the crack parallel to the wall, but kids were standing on it. I moved in toward the wall, clicking and walking between it and the fronts of the lines until someone called my name. I found the right line and, turning away from the building, I started to click my way along the line, now all quiet as directed by the teacher. The teacher told me that I can just stand in the front of the line until we're ready to go in, so I positioned myself there, clicking behind me to make sure that I was in front of whoever was there. I was glad I got to be in the front of the line. I was the last one to leave, but I got to be the first one inside...

As we entered the room, once again I clicked and scanned to avoid kids as they shuffled into their chairs. I clicked along the wall to my right until I neared a corner. Sensing the distance from the wall in front of me, I knew I had arrived at

my desk at the end of my row. I reached to my left and found a desk with a Braillewriter

on it. I took my seat, wondering how exciting the new playground would be, and if it would have a slide. I wriggled with anticipation to find out more about it next recess" (Kish, 2014).

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