



AUDIVA

Hearing and Moving

The basic information for hearing training

For therapists and doctors

For

auditory perception and processing dysfunction, attention deficit syndrome (ADS and ADHS), language and speech disorders, learning deficits, dyslexia, legasthenia, hyperacusia (noise sensitivity), hyper- and hypoactivity, aphasia, dysacusia (impairment of hearing).



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Dear Reader,

Since 1991 our organisation has been playing an active role in the improvement of auditory perception in children and adults. Over many years of communication with researchers, therapists and patients the AUDIVA procedures have been improving and growing. Sabine Minning runs a speech therapy practice on the same premises as AUDIVA, both located in Kandern-Holzen / Germany. She also works as a professional advisor for AUDIVA.) Our goal is the development and sale of therapy methods which train against different deficits in the perception. The focus is in the following areas:

- Auditory diagnosis
- Hearing perception training
- Functional training procedures

The theoretical basics of hearing deficits will be explained with this pamphlet, as well as diagnosis and hearing perception training.



Uwe Minning

What it is about:

Max is able to hear well, but rarely listens.

*Peter can read fluently, but can't understand the context.
Tina is frightened by every loud noise and shrieks.*

Steve is still getting confused with left and right at 9 years old. Additionally he will forget or swap letters while writing. At 6 years of age he went to see a therapist because he could not distinguish t and k very well.

Sandro can hear a sound but cannot connect it with a letter or word.

Martina is better at writing dictations at home than at school.

Claudia usually needs hours for her homework. She is day-dreaming and dawdles. It takes ages for her to learn a poem by heart. She can only rarely remember anything of the poem the next morning.

Marianne comes back from school aggressive and very tired. Everything is so noisy in school and the voice of the teacher is only as loud as the other background noises (disturbances in zhr basics of selective attention)

Andreas speaks very loudly. He has great problems in clapping a rhythmic sequence.

These deficits can be referred to as 'central hearing processing disorder'. It is an auditory processing- and perception disorder, which is often comorbid with attention deficit syndrome or attention deficit hyperactivity syndrome as well as with hyperacusia.

These deficits can co-occur. Often one or the other deficit is diagnosed to predominate but this depends on the examiner and the testing method used. We introduce you to a diagnosis, which will test for speech and non-speech performance. The case history (anamnesis) provides a connection with everyday life and is especially informative for ADS/ADHS and noise sensitivity.

Definition of auditory perception:

The current definition of auditory perception (according to the 2000 consensus-statement of the working group of German hearing therapists (led by Prof. Dr. M. Ptok)) is as follows:

The definition of auditory processing and perception deficits primarily lies on the hierarchical classification of afferent processing.... of nervous impulses and neuronal activities.... The inadequacy of this model, especially the negation to a large extent of the efferent directing or influencing of the afferences is consciously being neglected. Taking this negation into account, we define: Auditory perception deficits are then present when central processes of the hearing are ambivalent.

In this case the direction (afferent processing) of the auditory processing is being considered. According to our practical experiences this is not enough. Since especially the efferent (top-down ways) direct the perception like tolerance of disturbing noise, discrimination of tone pitch, selection etc....

Conscious perception is directed by emotions which are already present in a 3 month old embryo's limbic system. External stimuli can trigger emotions, which again direct behaviour.

Feelings under control?

There is something we would call „emotional intelligence“ which enables a human being to control their feelings before they can influence their behaviour.

Assumptions for the control of feelings are basic values- an inner codex for humans for morals and ethics. Adults model those ethical and moral values for their children or the children are imprinted by the morals of the external world.

In the book ‚emotional intelligence‘ Daniel Goleman (1996) writes about his experiences in the American society: „in our century the powers and possibilities of the hearing are just as important as the power of the head“ An example from the states shows how „clever can be dumb“. Jason's average mark was a clear first and he wanted to study medicine at Harvard. When his physics

teacher gave him a 2.1 he killed the teacher with a butcher's knife.

Today the neurosciences explicitly insist on taking emotionality seriously. For paediatricians, otolaryngologist (ear, nose, throat specialist), phoniatrist and audiologists the functional aspect of humans plays a bigger role. However the human brain is more than the sum of selected functions.

Performance or Ethics?

It is not enough to train children for performance and treat automation deficits. With the music phase (Phase A of our training plan) you can give ethically and morally valuable information contained in the structure of Baroque and Mozart music.

An example from England showed how Mozart and Bach could influence behaviour: they played their music in train stations and there were no longer any 'rowdies' left and the station was in peace.

Causes of auditory deficits:

Risk factors during pregnancy:

- Early contractions, contraction stoppers, Haemorrhage, diabetics
- Psychic stress (e.g. stress, work or family related conflicts, unplanned pregnancy, abortion trials)
- Nicotine, Alcohol, drugs, medication or infections

Perinatal risk factors during pregnancy:

- Premature delivery or transference,
- Umbilical cord winding, oxygen deficiency, low Apgar-values, strong hypoglycaemia,
- Powerless labour, caesarean, vacuum extractor or forceps delivery, multiple birth infections,
- Such as amniotic infection syndrome

Postnatal risk factors (after birth):

- Neonatal yellow jaundice,
- Strong infections such as sepsis, meningitis or encephalitis
- Eating problems with toxicities
- Relapsing middle ear inflammation or effusion
- Noise traumata (e.g. in the incubator, later called 'walkman-syndrome')
- Strong mental problems
- Cranial head trauma
- Ototoxic medication

These were the risk factors according to Dr. med, Renhard Schydlo: 'auditory perception and hearing training'. Ludwigsbuerg, 2000.

Indirect causes for behaviour- and perception problems (see also Hyperactivity and attention deficit disorder):

- Problem with diet (ready made meals, tinned food or anything not fresh) can result in (brain-) metabolic problems and immune system deficiency.
- Electric smog: basic studies in Vienna found an effect on DNA in living subjects from transmitter radiation. The question one is asking them is how sensitive an individual reacts to that.

- Family clan: familial circumstances can influence child development (stress, fights, separation)

Hearing: Quality and Quantity

Ocean murmur with a volume of 60 dB (e.g. on holiday) is perceived as relaxing, the same or less volume in form of street or plane noises make you stressed. Therefore noise is not so much characterized by volume (quantity) but rather by quality.

Increase your consciousness for qualitatively good acoustic surroundings:

Consumption of media at home:

Since the broad introduction of TVs and radios the self-induced noise exposure increased for these devices are turned on a lot of the time. For one person (e.g. the adult) it can be information, entertainment or exposure but for the other (e.g. the child) it can be disturbing noise.

Background-noise Computer:

The monotonous noise of the PC-airing system, and the memory can even be very stressful for adults. Ask for quiet computers with Decibel-levels below 30dBA or even better below 20dBA.

Electronic games:

Modern electronic games are often produced with piercing sounds, which are held right next to the child's ear.

What is Quality?

The quality of music and speech is embodied in humans from birth onwards.

According to new research by Koelsch our perception is especially built for the analysis of major and minor keys. Participants with or without musical experiences heard wrong keys put randomly in a melody and showed clear reactions on this wrong notes in EEG records.

Surprisingly it was in those areas that are used as well to precede speech.¹

Studies with neonates show that this ability is already present from birth, since they show reactions to changes in music heard already during pregnancy and they have an instinctive for harmonic music.²

Music Therapy:

A German-speaking author H.-G. Wieser (neurological university hospital Zurich) has dealt with the associations of music and speech in several of his publications.

He found confirmation that music used previous in therapy makes therapy for speech easier without asking for performances.

During the last years we regain the knowledge that humans are imprinted by the stimuli surrounding them. Therefore creative work is the expression of each epoch: modern

1. Koelsch, S. (u.a.); Brain indices of music-processing: "Nonmusicians" are musical; 1998 Max-Planck-Institute of Cognitive Neuroscience

2. Saffran, J.R. (u.a.); Infant memory for musical experiences; Cognition 77 (2000) • Perception of music by infants; M.R. Zentner, J. Kagan; Harvard-Uni.; in Nature Vol 383 1996

music mirrors the hectic of everyday life, narrowness of rooms and straightness of the streets.

Classical music (for our taste especially Baroque- and Mozart) creates the picture of quiet landscapes, endless rooms and winding rivers.

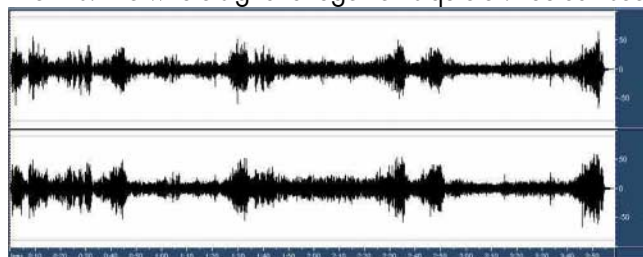
This picture shows us modern techno-music. With technical



tricks the volume-density can be held up permanently since the beginnings of the 90s (full response in the picture above). The general tendency in music- and advertisement production, in the radio, the TV and on sound carriers is to

create attention through volume. With this technique the risk of a hearing defect increases.

Baroque-music such as Vivaldi's concert of mandolins looks like this: The whole signal altogether is quieter. You can see



several pikes, which are very short. This creates more dynamics. The hearing perception follows this dynamic. The risk of a hearing deficit is in this case much smaller. In hearing training we work for 12 weeks with this kind of music.

Hearing and Perception

Hearing influences Emotions

The sense of hearing is from the 3rd month of pregnancy on the earliest active perception channel. Hearing stimuli can be memorized already long before birth in the limbic system of the brain.

We inherited the evolutionary basics of our association and feeling systems from our ancestors (those are used often in advertisements).

Especially children are open for these stimuli. Therefore we want to use for our goals universally regulating and positive influencing hearing sources. Especially compositions by Mozart and during the baroque epoch (Vivaldi, Handel, Bach...) are very useful for this purpose. The same result was found in studies for educational music. According to scientific studies even babies prefer music by Mozart.

Hearing influences speech

Hearing influences the speech development. Deaf babies cannot to speak without hearing devices. People who become deaf later on lose their speech melody and phonetic control.

Noise disturbs:

Constant exposure to music, TV, aircraft, street or train noises can result in less acoustic contrasts in perception in children during speech development. This results in a weak development of recognition patterns in speech.

Another factor are frequent middle ear inflammations or colds during childhood (1. -4. year of life), which can result in a hearing problem.

Both factors can lead to insufficient speech development. A child with those deficits can usually be found out between their 5. and 7. year of life due to their delayed speech development.

... Contrast rising can help

What do you do when the TV screen seems faded? You increase the contrast, raise the definition and use less energy for recognition.

Analogous to this the hearing training (HPT) leads to a contrast rise in the acoustic level, to bring attention on the special aspects of speech. Performing an intensive daily hearing training programme can help one catch up with maturational deficits easily.

Hearing influences movement

No one will start to dance in front of a beautiful picture but music awakens coordinated movements in our body. Already when locating sound head movements direct the useful sound events evenly to both ears. In this we can see an original connection between human development and motor activity. Auditory and motor problems often co-occur. Therefore the treatment of auditory functions is important in ergo therapy.

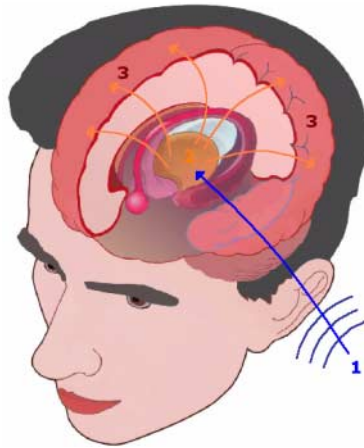
Hearing is always an active process

While seeing a picture the pupils physically focus, the brain only directs the eye muscle. When hearing the main neuronal areas for listening focus on the acoustic signal. Hearing is the only human sense to totally capture the three-dimensional room, it is very sensitive

Eyes have got a closing mechanism and can so effectively be protected against too much light. The sense of hearing can only partly regulate and delay sound through a function of the middle ear muscle. Therefore the hearing can be damaged easily by sounds which are too loud. After visits to the discotheque with usually over 100dB sound level a non-permanent dysacusia or tinnitus is often

the case. When this happens very often, it can lead to permanent hearing damages.

Distribution of Information



1 Speech, music and sounds

The sensory information comes via the ear to the limbic system.

2 In the Limbic system

(centre of feelings) information is connected to feelings. The limbic system consists of the so-called Hippocampus (and many others), which plays an important role in storing

information in the short-term memory. It is also responsible for the distribution of information on the cortex.

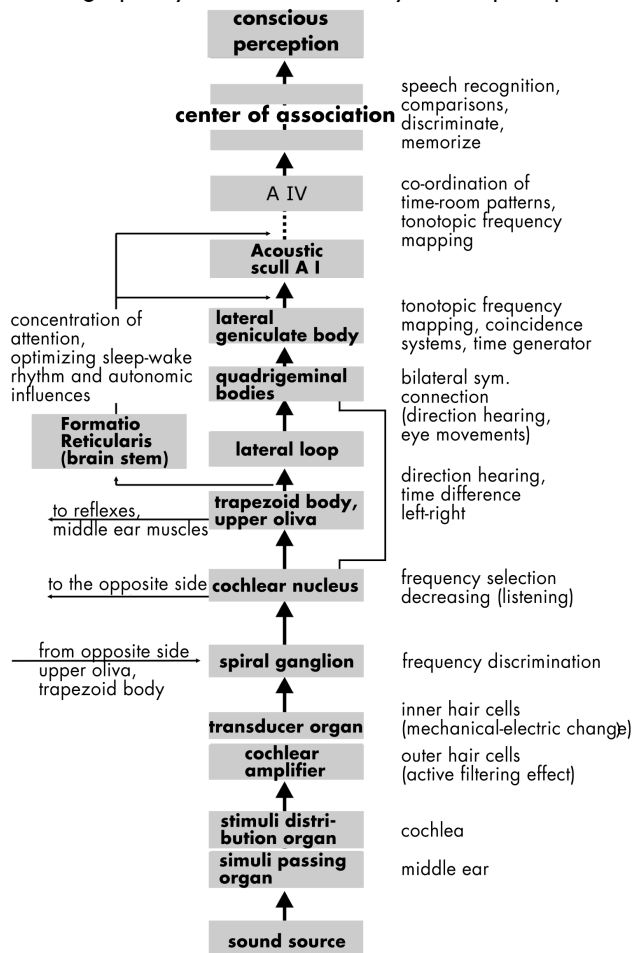
3 Neocortex

The neocortex is divided into functionally different areas, such as speech area, motor area etc.

auditory pathway

From sound to conscious perception

From this graphic you can see the way sound perception



occurs from the sound source (lowest picture) to the conscious perception of it (top).

Emotional Components of Hearing:

Through the combination of the brain stem (formation reticularis) the vegetative system (sleep- wake rhythm, breathing-frequency, pulse...) is being influenced. In the limbic system auditory stimuli results in emotions. The limbic system is steering the short-term memory and results in a sensible distribution of the incoming information to the according parts of the neo cortex. With this auditory information will be lead along or inhibited. These processes explain the positive influences of music on memory and learning abilities.

In hearing training it is therefore important to influence the emotional area via harmonic and light Mozart- or Baroque-music, so that a passing on into conscious perception happens and possible psychological hindrances can be dissolved.

There are some children who already show progress in behaviour or even language in the hearing-training phase A, in which the task is ,only' listening to music.

Altogether the training-process means a pleasant therapy, which will be mainly stress free and usually patients enjoy doing it.

Functional components of Hearing:

In the graphic you can see in the middle boxes the function for direction hearing, frequency-selective fading (fade out noise), time-place summation, and for dissolving the space structure of auditory things.

Already in the central hearing line there are two crossovers of hearing signals that exist, so that hearing lateralisation is less a function of the hemispheres but takes place already in the sub cortical hearing.

For the development of human communication the newborn child is already born with many abilities.

Neuronal detectors filter the

- Volume (envelope)
- Vocal frequencies
- Gaps
- Sound of a consonant

Conscious perception only takes place after a learning process. The limbic system recognises new (not yet integrated) knowledge and this is passed on to the cortex for storing. With rewards and confirmation those learning contents are rewarded: already winking, smiling, gesticulating or facial expressions.... can be seen as reward, as long as they occur within 1 second after the process.

To provide enough information of those neuronal detectors, the auditory environment of the neonate, one should provides many active vocal rewards for echoing back a word-children with middle-ear infection or hearing over sensitivity have problems with this.

Hearing training can train perception by influencing frequency and impressions of direction of the provided music and speech. As sportive activities (e.g. riding a bike, weight training) can result in muscle building, hearing training leads to improvements in auditory perception weaknesses and central hearing disabilities.

INDICATION

Previous anamnestic and diagnostics (after calculations and correlation comparisons) will provide a certain picture of the patient.

According to this information, one can decide whether hearing training is the right form of treatment:

Anamnesis:	
Indication yes, when:	Block of questions no.:
• Middle Ear problems	1 > 2 points
• Hearing over sensitivity	2 > 2 points
• Speech development	3 > 2 points
<i>Also consider the relation between blocks of questions and the counter indication..</i>	
Diagnostic phase:	
If at least 2 of the following diagnostic points are considered delayed (only if diagnosis can be conducted)	
<i>For patients with high attention deficit a principal training with HPT Phase A is often necessary after looking at anamnestic data before one is able to do a diagnosis.</i>	
• Audiogram: shows falls in high pitch areas in comparison to low pitch areas (below 1000 Hz)	
• Order threshold: according to age?	
• Direction hearing: are all tested directions OK?	
• Memory abilities: unusual in 1 min. test device?	
• Differentiation (WTT): unusual in 1 min substest or sound sensitivity?	
• Dichotic hearing: according to age?	
<i>Note: The Anamnesis and Diagnostic material we have developed, are actually only available in german language. Speak to us, if you can maintain a translation or knowing about appropriate's in english.</i>	

Symptoms and causal deficits:

- Attention deficit syndrome (ADS)
- Concentration problems
- Learning disorders
- Hypo- and hyperactivity
- Coordination problems
- Speech and language problems, mutism
- Voice-problems
- Speech flow problems
- Partial deficit disorders
- legasthenia
- Dyscalculia
- Aphasia
- Hyperacusia
- Hearing problems
- Tinnitus
- Sudden deafness

A pill, injection or suppository works on a chemical level and only has a certain spectrum, and as it degrades it often has uncomfortable side effects for our bodies.

Since we are working with sensory things, the results are due to bodily reactions. Therefore the effects are usually without side effects and have got a development-improving or adjusting nature.

Summary:

With the hearing training you can improve the emotional assumptions, attention and motivational factors (unspecific factors) as well as the functional speech factors (specific factors). Therefore the hearing perception training programme with music (Phase A) and speech (Phase B) are preferable to an isolated functional training. The functional training can be used additionally or in isolation if problems are independent of basal auditory perception deficits.

Characteristics of auditory perception deficits:

- Isolated problematic phonemes and sounds can be done- but not in school
- Dictation in a quiet surrounding is possible- but not in the class-room
- Peripheral hearing, audiologist tests are good- but there are still problems of understanding
- Information misunderstood
- What was heard can only be put in action with lots of effort
- Not understanding what was read
- Unsound singing
- Left-right problems
- Light to middle hearing deafness
- Sound sensitivity
- Easily distracted
- Restless
- Forgetful
- Low perseverance

Auditory attention:

Attention Deficit and concentration problems and learning problems:

Attention deficit syndrome in itself is only then diagnosed when the attention is low not only in one specific task but in various situations.

Attention can be decreased by noises. See noise sensitivity and performance decrease from side sounds.

Expl: working at home is successful, but not in school.

Learning deficits can have several causes and part learning deficits and hyperactivity can have a connection with this. Usually a learning deficit is diagnosed with a lower IQ. At this point we critically want to point out that many IQ tests depend on perception and parts of different

modalities for solving the problem. Therefore you should question IQ tests and check the diagnostic system whether auditory deficits could be part of the symptom. If so you can make a lot of progress with the here described training method.

Hyperactivity and Attention deficit Syndrome:

ADD, ADS, ADS and ADHD

According to the perspective, the main problem of the child is motor restlessness and one is talking of the 'hyperkinetic syndrome'.

Learning theory explains another part of the symptom- the strong attention deficit: ADD.

Both diagnoses together are ADHD: attention deficit hyperactivity syndrome.

Secondary disorders and diagnosis:

In hard cases social contacts (fellow students, parents teacher) are limited. On the other hand this can also be the result of a global perception- and learning deficit.

The diagnosis of hyperactivity disorder is until today a subjective one. There is no solid classification and it is very situation dependent. See also the according questions in the anamnesis section.

Hyperactivity can also be the result of allergies and nutritional problems, as well as environmental factors (electro-smog) and inherited metabolism problems. Inheritance seems to play a bigger part in boys than in girls (6-10:1). Several findings from studies in brain metabolism suggest that hyperactive children have a deficit between the stimulation and inhibition in the limbic system. Emotions and weakness are regulated there. (This is why the positive influence of music in training phase A can work here).

Medication can only support the therapy and make the child quiet and attentive, but medication alone cannot be a sufficient treatment.

Dependence on metabolism problems (nourishment) and sensitiveness of environmental factors (electro-smog), emotional blocking, as well as hyperacusis is a main cause should be carefully checked (this is often forgotten when Ritalin is given).

Hypoactivity

It was shown that with the HPT muscle tonus could be built up. Observing students who had regular hearing perception training with music could show, that the body posture improved (more straight while sitting) without being verbally told to do so. Additionally the children often became more active and open.

Problems of coordination

A dyslexic child or part-underachiever often has difficulties with tapping a rhythm with the fingers of both hands, if both hands should be used in turns. When both hands can

tap at the same time, they are much better (Wolff, 1990)- see also diagnosis: synchrony.

Additionally they often have problems with complex finger functions (Berninger, 1992). See also diagnosis: finger tapping (motor functioning).

Rosenkötter, H: 'neuropsychological treatment of dyslexia', 1997.

Remark on training functions:

Do the hearing perception training with music (phase A) together with (light-)motor exercises. You could choose games, which stimulate the light motor. Within this the neuronal stimulation of the HPT is directed on the motor control.

With older children, juggling can be an additional activity to train coordination.

The coordination of the motor left-right movement combined with the timed perception capability can be trained with the order threshold training (OL/ Os) and together with rhythmic with synchrony training.

See also functional training methods.

Speech- and Speaking- disorders

(Dyslalia, Dysgrammatism, word-finding problems and lalognosis problems)

Especially patients with speech and speaking disorders can profit from training of the auditory perception with the hearing perception training. For children with a strong SES the treatment duration can be shortened significantly through the neuronal activation techniques, treatment is qualitatively improved (general therapy influences) and perhaps treatment may even prevent legasthenia later on.

Multiple Dyslalia:

Sound construction can be made easier by introducing microphones and headphones (via the HPT home/practice or the SPT home), since the articulatory control system (so to say the hearing of differences between phonemes) enables the transformation in an according motor articulatory pattern. This is directly controllable with the speech-colour picture-transformation, which is available in the form of software and aims to assign a colour to the speech frequencies, so that the correct articulation can be recognized with ease.

Dysgrammatism (Dysphasia):

Children with a limited short or long term memory (under-achievers) often speak dis-grammatically. With the hearing perception training sentences get longer, more structured and show correct grammar. This can be explained with auditory improvement of memory processes (see also tests for short-and long term memory).

Lalognosis (speech understanding):

Due to low memory and long processing this deficit can also be improved through the auditory training.

Voice disorders:

If frequencies or groups of frequencies cannot be heard properly, this has an influence on the voice. Especially with hyper- and hypo- and psychogenic voice disorders stimulation of auditory perception for improvements of self-hearing and self-control are very important. Especially self-control can be improved by using microphones and headphones (via the HPT home/practice or the SPT home).

In addition several experiences of Tomatis show that a high pitch filter can help singers train back their missing voice frequencies.

Concluding from these findings: voice can only produce what the ear hears or perceives. A high pitch filter can be found in the hearing perception trainer HPT home/practice as well as the speech perception trainer SPT home.

Word-finding problems:

With an increased memory ability the word-memory is made more accessible.

Mutism:

For a psychological or emotional conditioned speech disorder introductory hearing perception training with music (phase A) can increase motivation and harmonisation. Generally children become more speech motivated with the excitation of their hearing and the balancing influences of the music.

Disorder in flow of words

Problems with the flow of words can be comorbid with perception problems (see diagnosis).

Stuttering:

Besides the auditory stimulation of the hearing the vegetative nervous system and so the breathing rhythm are influenced with music and sound as well as the self-consciousness via the emotional duct. Work with secondary symptoms is done in parallel.

Rumbling:

Auditory perception is prepared again with hearing perception training. Especially with the speech training with microphone and headphones the patient becomes more conscious of his own speech flow and self-control is increased. With the slow level learning-to-read material the rumbling patient is shown how to speak slower.

Iven, C.: 'Rumbling: up-to date findings....' Sprache, Stimme, Gehör, 22-1998.

Rumbling is often comorbid with attention and hearing memory Disorder, speech developmental delay, monotonous speech melody, problems of pronunciation etc...

Iven (1998) claims that rumbling is connected to disordered auditory processing and attention. She cites research findings of Molt:

- Lowered amplitudes (less strong reactions to acoustic stimuli) in EEG with acoustic potentials

- Lower than average performance in dichotic hearing tests

Partial Deficits like:

Legasthenia, Dyslexia, Dyskalkulia

Legasthenia can be regarded as a disorder in itself or a combination of partial deficits. Therefore the general diagnosis of legsthenia is not sufficient for decisions on training methods. We recommend diagnosing partial deficits as described in the diagnostic section.

Partial deficits are genetic up to 60% and concern primarily boys (boys: girls=6:1). Most common are speech development disorders and disorders in light and visual motoric coordination. The prevalence is about 10-15% in school children¹.

Auditory area:

One should always test whether the auditory functions of the child work perfectly. If the child has found some supply strategies, to make up for auditory problems, e.g. a visual compensation strategy, the deficit may become obvious when additionally to auditory problems visual and graphomotoric problems appear in the progress phase. If there are auditory problems, hearing perception training with music (phase A) is suggested first and speech work (phase B) should be conducted in an accordingly intensive way.

Visual Area:

Depending on anamnestic data one should control for visual problems with the child:

First of all the visual acuity is determined, followed by the binocular fusion. Those are responsible for spatial seeing in near and far areas. In binocular fusion the focus points of both pupils differ, so that two pictures are recognized as displaced.

The sufferer inwardly closes one eye to prevent seeing double pictures. This inactivity of one eye becomes habitually and spatial seeing of children is disabled. Children with this kind of problem often write lop-sided and hold the head inclined. (Anamnestic details)

Corrections can be done with prism glasses and/ or with a seeing training. We offer visual lateral training for reading (see blinding glasses).

Aphasia:

In rehabilitation the flexibility of the brain is being used to reactivate or rebuild lost brain functions. The training process starts with speech development. Therefore the described training method enables effective strengthening training, which can also be used with fatigue symptoms during listening (e.g. Cocktail Party effect).

Especially interesting is a combination of oxygen therapy with hearing perception training. More oxygen in the blood flow increases the brain metabolism and together

1. Rosenkötter, H.: „Neuropsychologische Behandlung der Legasthenie“, 1997

with vitamins and trace elements gives important basic elements (Manfred von Ardenne). The HPT directs the metabolism via sensors to the brain areas of speech and music perception.

Finally modern techniques can display oxygen in the brain. Areas with increased oxygen levels have greater activity. With the contents (music and speech) in the HPT and the speech-concerning exercises in phase B you can direct which areas in the brain are activated most strongly.

If you do a lot of work with Aphasia patients we would be interested in a case study of yours.

Noise Sensitivity (Hyperacusia)

Hyperacusia can be seen more frequently. It is often comorbid with behaviour problems in children (e.g. in group situations).

Even deafness can sometimes be accompanied by an over sensitivity towards certain frequencies or Tinnitus.

Hyperacusia in children:

Hyperacusia often appears in connection with middle ear problems as well as in autistic and spastic children. In those cases hearing perception training with music has shown to be very effective. In these cases the volume is turned much lower than in ordinary hearing children. When choosing Baroque music one should try to take a selection of soft instruments (harp, mandolin, zither)¹.

Hard of Hearing/ partial deafness

Generally previous to diagnostic and therapy an actual audiogram should be made. Mark the diagram as suggested in the diagnostic section.

Apart from central auditory connections, which follow from this, here are some recommendations for training of mild to middle partial deafness.

- For differences between the left and right ear as seen in the diagram we recommend the hearing perception training with the HPT home/praxis. Reciprocally high and low frequencies are given to the left/right ear. With this the control circuit is activated via the outer hair cells and so the sensitivity feedback in the cochlea is trained. The HPT home/praxis is supplied with a balance-switch. In the software (expert mode=on) you can choose the volume distribution (usually 50%/50%) and emphasis the weaker ear.
- In case both ears are similarly weak, a high-pitch training with the speech perception trainer SPT home may be sufficient.

In this case the same is valid as above, only that the use of a HPT home/praxis is not essential. With the cheaper SPT home both ears can be stimulated at the same level (no reciprocal turns between left and right).

Experiences:

Comparing before and after the hearing perception training with middle or light partial deafness we usually see an increase of the hearing curve. An increase of 10-30dBcan be seen in the diagram. Many therapists confirm positive effects in this area. Research of Dr. H. Rosenkötter in schools with physically disabled children confirms these findings¹.

Tinnitus:

There are many causes of a tinnitus. To explain all of that would go beyond the scope of this introduction. Nevertheless we introduce you to the auditory therapy options.

American Tinnitus-training-Therapy:

In this therapy a noise-generator, which partly drowns the Tinnitus, is used. The patient forgets about the Tinnitus and starts to direct his attention towards the environment again. 2 we offer you a handy noise generator for this method 'Tinnifresh' which can supply both ears at the same time.

Use of hearing perception training:

In Tinnitus with high whistle tones the high pitch filtering can be equalled out in phase A with music and provide relaxation.

1. Die Grundlagen, Definitionen und Therapieverlauf bei Hyperakusis wurde von Dr. H. Rosenkötter untersucht (nachzulesen in „Auditive Wahrnehmung und Hörtraining“, 2001, AUDIVA-Verlag, Best. Nr.: ATA3T).

Diagnosis and Therapy

Table of contents:

The following combinations will be explained in the text below.

Perception category	Diagnosis	Therapy
Auditory attention		
<ul style="list-style-type: none"> Turning to auditory events 	<ul style="list-style-type: none"> All subjective test events 	<ul style="list-style-type: none"> Harmonic and motivating contents of therapy material
Direction hearing		
<ul style="list-style-type: none"> Locating of sound sources in the horizontal level (2D): time difference between the ear signals- 	<ul style="list-style-type: none"> Testing direction hearing left-front-right 	<ul style="list-style-type: none"> Room perception training DPT (also called lateral training) Direction listening training (R)
<ul style="list-style-type: none"> Locating of sound source in median level (3D): direction identifying frequency group 	<ul style="list-style-type: none"> Testing direction hearing top-bottom/behind-in front 	<ul style="list-style-type: none"> Speech perception training SPT (Also called high tone training)
Selection		
<ul style="list-style-type: none"> Differentiate stimuli on qualitative basis, increasing of useful sound - 	<ul style="list-style-type: none"> Test of discrimination of useful-disturbing sound with /without noise Dichotic hearing test 	<ul style="list-style-type: none"> Hearing perception training HPT Order threshold training serial (Os)
Storing and remembering		
<ul style="list-style-type: none"> Acoustic symptoms are stored for further processing 	<ul style="list-style-type: none"> Mottier-Test etc. Order threshold lateral (Ol) Order threshold serial (Os) 	<ul style="list-style-type: none"> Hearing perception training HPT Order threshold training lateral (Ol)
Sequence		
<ul style="list-style-type: none"> Order of how to be stored information is registered 	<ul style="list-style-type: none"> Mottier-Test etc. Order threshold lateral (Ol) Order threshold serial (Os) Synchrony test (S) 	<ul style="list-style-type: none"> Order threshold training lateral (Ol) Order threshold training serial (Os) Synchrony training (S) Tone height training (T) Hearing perception training HPT
Differentiation		
<ul style="list-style-type: none"> Discriminate auditory symptoms of stimuli order 	<ul style="list-style-type: none"> Tone level differentiation (T) Mottier-Test etc. Order threshold (Os) 	<ul style="list-style-type: none"> Order threshold training serial (Os) Hearing perception training HPT
Analysis		
<ul style="list-style-type: none"> Distinguishing single components of the complex context 	<ul style="list-style-type: none"> Tone level differentiation (T) Mottier-Test etc. Dichotic hearing test WTT unmasked 	<ul style="list-style-type: none"> Hearing perception training HPT with music and speech (indirect effect) Hemispheric-coordination training (HCT)
Synthesis		
<ul style="list-style-type: none"> Auditory complex configurations are made from single elements 	<ul style="list-style-type: none"> Areas of higher processing modes, influence of intelligence 	<ul style="list-style-type: none"> Hearing perception training HPT with music and speech (indirect effect)
Complement		
<ul style="list-style-type: none"> To complete auditory fragments to meaningful information (supply strategies!) 	<ul style="list-style-type: none"> Areas of higher processing modes, influence of intelligence 	<ul style="list-style-type: none"> PC programmes for training of reading- and writing performance

Anamnesis and Diagnosis:

Anamnesis:

Anamnesis should not be missing in any diagnostic phase. Since only with anamnestic data can one find out if perception relevant events took place in the past.

- Middle ear infection, drainage tubes
- Many colds
- Over sensitivity to sound.
- Behaviour disorders due to hearing problems
- Etc....

You can download the complete anamnesis questionnaire of AUDIVA for free on www.audiva.org (not yet, put check for updates).

Auditory Perception

Auditory perception is measured indirectly in all tests. Therefore the ability to concentrate is always a prerequisite for relevant test results. For patients with limited attention span the testing should not be too long and several tests at different times should be conducted.

Testing direction hearing (R):

Direction hearing left front right



On the horizontal level (2D) of natural dimensional perception of humans, the difference in volume only plays a limited role, since a difference between both ears in natural surroundings is rarely more than 10dB. Important in this area is the delay/running time - which means at which ear the sound arrived first.

To test this in earlier times one simply used a hole between both ears, which was knocked at on the left or right side. The signal then went to the direction of the closer ear first. Today we use the following processes and devices:

- Clicks are given with slight delay in time on both ears. For this one needs a test device with the function of direction hearing (e.g. Brain Fit home)
- A sound generator (see picture), creates a broad sound signal in the free dimension (white noise). For this you need a noise generator (e.g. MZL 400C). This device can also be used for the next test:

Direction hearing above-below/ front-back

How can humans discriminate sound which is always built symmetrically on the axis of both ears?

Due to the form of the outer ear the sound from above is perceived as differently from the sound from below- from above it sounds higher and from below it sounds lower.

To perceive this, in the central hearing line, certain neurons react to those sound differences.

For testing purposes a noise generator is used which creates white noise. With this device one can test in free space around the patient.

Tone height differentiation (T) testing

Perception of different tone heights is important for controlling speech- especially for the pronunciation. Therefore a monotonous voice can be a sign for problems with tone heights differentiation (anamnesis).

Tone height discrimination is also important for direction hearing (above-below/ front-back).

The following tests and devices are used.

- Manual test with a piano or keyboard
- Testing devices with the function of tone pitch discrimination. Those show the smallest possible time interval (e.g. Brain Fit home).
- AUDIVA-testing CD¹ with various high pitch tests

Testing of Disturbing-/Useful Noise Discrimination



Our Central hearing has an effective neuronal function to filter disturbing noise and increase useful noise. The following tests and devices are used:

- Simple screening with functions called 'noise signal' in the HPT praxis, where speech signals are mixed with different doses of noise.
- AUDIVA testing-CD² (typical testing situation see picture) with meaningless syllables with or without noise.
- As well as dichotic hearing tests for this perception:

Testing of both ears (dichotic testing):



With the dichotic hearing test two different words are given at the same time on the left and right ear. With this the word given to the opposite ear functions as noise to the first ear.

This test is contained on the AUDIVA Test-CD³ for adults or children (typical testing situation see picture). With this test one can see clearly whether the patient can process the signals to both ears at the same level or whether one ear is neglected.

1. In time, the AUDIVA testing CD is only available in german. Please check for updates.
2. In time, the AUDIVA testing CD is only available in german. Please check for updates.
3. In time, the AUDIVA testing CD is only available in german. Please check for updates.

Testing Memory abilities

Mottier-Test



The Mottier-Test has been used for a long time (in German speaking area) already and is therefore well documented. It is used to test short-term memory and can be done by speaking (one hand covers the mouth) from behind. With this method differences in pronunciation occur.

On the AUDIVA test-CD¹ it is already available and can be used with headphones (see picture). Recently concerns with reference to age-according performance as measured by a norm table occurred. There seem to be fewer children who manage the test according to their age norms.

Repeating Numbers:

When repeating numbers the child hears different numbers in monotonous speech (similar to Mottier-test), which they are asked to repeat. The amount of numbers is increased stepwise.

The number test is available in monotonous and pronounced form on the AUDIVA test CD (typical testing situation see picture).

Repeating sentences and stories

This is another classic speech-therapist test for long-term memory.

Children are asked to repeat sentences of increasing difficulty.

When retelling stories the child is read a short story and is asked to repeat it back as closely as possible. Often the children seem to have forgotten the contents, but when asked, they can remember. Both testing methods can be found on the AUDIVA test CD².

Order threshold (O) testing



Order threshold is the amount of time, which is necessary for a human to discriminate two following sensory stimuli from each other in their time frame.

Since this threshold is in the millisecond area, special devices are used with a function for order thresholds (see picture).

In Germany order threshold has primarily been surveyed at the University of Munich. In Ernst Pöppels book 'Grenzen des Bewusstseins' (borders of consciousness).

he pointed out the possible importance of order threshold in relation to consciousness (speech).

Order threshold lateral (OI)

To determine the order threshold, the participant receives clicks and light flashes over a constant duration of 1 ms via headphones. The left or right stimuli are created randomly.

The task is to detect the first stimuli and then press the according key (left or right). Children with laterality problems can be asked to point out the sides with the hands (therapist can press the key). The device will check for false or true answers.

This method has been tested from different researchers

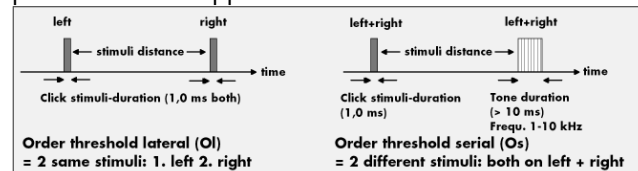
Age (years)	auditory (ms)			visual (ms)		
	Mean	Unusual	Pathologic	Mean	Unusual	Pathologic
5	160					
6	155	>300	>450			
7	145	>220	>300	370		
8	140	>170		150	>300	
9	100	>150	>200	150	>200	>300
10	85	>120	>160	120	>120	>170
11	75			75		

during the last years so that there is an age-appropriate norm table available for auditory and visual order thresholds (see table).

Order threshold serial (Os)

In previous research only the lateral order threshold was determined. The connections with phonematic structure of speech are however imprecise, since speech is serial information -and is not divided to the same extent on the left and right ears. Additionally phonemes and clicking noises are not similar.

With the serial order threshold training by AUDIVA speech-like tone-clicks are used for both ears so that the laterality problem will not appear.



Picture above: on the left side the stimuli is presented to the lateral order threshold and on the right side to the serial order threshold. This procedure can be compared to the research of Paula Talla, who works with serial stimuli (phonemes of a computer voice) instead of lateral clicks.

Testing Synchronizing (S)



The task is to synchronise a given time with own motor finger movements. This task increases in difficulty the faster the time becomes. With a metronome the test can be done by hand.

A Synchronizing Testing device allows you to do visual and auditory tests at the same time and provides the results. A Synchronizing test of 600 to 200ms is available on the AUDIVA test CD (typical testing situation see picture).

1. In time, the AUDIVA testing CD is only available in German. Please check for updates.
 2. In time, the AUDIVA testing CD is only available in German. Please check for updates.

Synchronizing without stimuli:

At first the synchronized finger movements are practiced with constant speed. Since every human has the ability for inner reference input guiding (automatic movement) the task of the therapist is to find out how long the patient can keep the stimuli accompaniment, after the reference input stimulus has been turned off. To compare this to a manual version one should try to find out how long the patient is able to hold the time without the metronome.

A testing possibility for integration of easy motor patterns is given by the above technique.

Associated movements:



This test gives us guidance about the developmental status of the laterality of motor control. With this test one hand has to be held still and low, the other hand is held above the head and rotated (See picture). If the 'still' hand moves anyway this shows uncompleted neuronal development (from 7 years on).

Audiometric tests

Pure tone audiograms (air-/bone conduction) should be provided before the tests (paediatrician, otolaryngologist (ear, nose, throat specialist), phoniatrist, audiologist).

They can provide the hearing curves for high pitch loss/dissipation and noise oversensitivity.

High pitch loss

High frequencies of 3000Hz + sound a little unusual with auditory hearing problems at the same time, one can assume that the height pitch loss is related to this symptom. For this deficit the height pitch training is helpful, it trains the central processing in the weakened hearing area. After this one can usually see improvements in the Audiogram. Surprisingly we got replies from patients with a hearing order improvement of up to 30dB.

Noise over-sensitivity

When there are obvious signs for hyperacusis during anamnesis it is usually enough for a general diagnosis. If necessary the discomfort threshold can be measured with an audiometer (but this measure is not used much and is uncomfortable for the child).

Training for auditory perception

For the last few years technical hearing training methods are used increasingly. With the increase of auditory perception disorders the need for efficient therapy methods has become very big.

Reasons for use:

- the knowledge that with manual methods only, success is often insufficient.
- Increased demand for success in shorter time and with generally less therapy sessions per patient
- Higher therapy frequencies for strong disorders with training at home or in groups in the praxis

Different methods have become well known over recent years. Usually names of the initiators like Tomatis, Bérant and Volff are associated with hearing training. The concept of AUDIVA combines different methods to result in the most effective therapy for each individual.

We offer high pitch training (speech perception training), lateral training (space perception training), order threshold training (and other functional methods), vibrotactile stimulation etc... by itself or in combined form.

Training from home - borrowing service

We offer a borrowing¹ service to support training from home for the support of therapy. If you are working in a practice or institution it might also be economic to buy your own devices and organize a borrowing system like ours. You are welcome to copy our borrowing system or get advice on how to do it. With the borrowing system the patient has a higher therapy frequency and the therapy success can be increased. One condition is the cooperation of parents/guides for an optimal integration of training times in the daily routine.

According to our training programme the hearing perception training (HPT) consists of phase A and B over altogether 12 weeks, which is one training block. See page 25. Depending on cause schemata of each individual the training will lead to differently quick and strong success. Often it is necessary to perform another training block. Between the active training blocks there is a break (Phase C), which will be developed individually.

Hearing training method according to AUDIVA

Within this method, the use of technical devices is seen as a new milestone in the overall therapy on offer. We discern emotional and functional effective methods.

Use

In language schools and language preschools as well as in language support classes.

The children are in this institution for several hours and can be supported by themselves or in groups. This process will also be effective, when there is no training at home.

In therapeutic practices

In case a continuation of home training is impossible, there should be training at least 2 times per week with an emphasis on hearing perception in the therapy session. If training at home is possible for the support of therapy, a therapy frequency of 1-or 2weeks is sufficient. In this case the training can be done at home during long waiting list times prior to therapy.

Hearing perception training can also be conducted in groups since as many headphones as you like can be attached to the device (a headphone distributor KV Z is needed). The microphone in phase B can be passed on from one child to the next.

For training at home

Training at home can be initiated and supported by a therapeutic practice. This is usually the most beneficial way of doing it. Motivated parents can also do the training by themselves. For this we have developed a training programme, which describes how to integrate training into daily life (see page 25). The devices are easy to use, so that non-professionals will have no problems.

For advice on the optimal combination of devices we are happy to answer your questions by phone. We will also be able to advise you on how to use the material available.

For questions for use please have the turned on therapy device ready and call us. We will advise you on the phone on unclear steps.

1. the borrowing service is actually (10/2003) only available in Germany, Austria and Switzerland. For other countries: please ask us for contact addresses.

Hearing perception training (HPT)

Emotional and functional training in 3 phases: training programme see page 25

Phase A with music

- Indicated for children from 1 year on and for adults

Phase B with speech

- Indicated for children from 3 years on and for adults

Phase C break

The training uses basal learning reflexes, which are still there in young children (spontaneous repeating of words and imitation, integrated learning). This results in an extreme sensory stimulation of hearing perception in the training programme in phase A and B. The cognitive demands are very low in phase A and easily directed in phase B. Therefore the training can be used in almost all developmental stages.



Hearing training arouses attention and concentration with harmonic music in phase A. Whilst listening to the music, creative games can be done at the same time. This increased ability to learn is directed on speech in phase B.



Here phonologic exercise material or stories are used. The use of them is done in an integrative way, which means that materials are read via microphone/training device/headphones.

According to our concept- and in contrast to many other concepts- it is important that the musical

ability is trained previously in an easy and casual way before training speech. Only when you follow the basic ideas of the training programme, the success of AUDIVA devices can be reached. It is not our concept to immediately train the patient's symptoms- but prepare him/her and train their attention and concentration previously.

This process, in contrast to other processes where patients are straight away confronted with their symptoms- prevent supply strategies being developed (behaviour to circumvent deficits).

One of our aims is to harmonise the basal and emotional side of perception. Only then higher processes like speech, reading, writing or calculating can be dealt with.

The single components of hearing perception training (HPT)

- Music in phase A
- Text in phase B
- Speech perception training (SPT)
- Spatial perception training (DPT)
- Hearing perception training (HPT)
- Vibrotactile arousal

Music in phase A

Or how to integrate the beauty and melodiousness in therapy

Sounds and noises contain a mixture of single frequencies and individual sounds. Overtones are frequencies of the basic tone, which are responsible for the sound. Are the frequencies above the basic tones not in musical harmonic combinations, they are perceived as unclear. Example: off-tune musical instruments. Are those frequencies in a harmonic combination, it results in a melodious sound?

Text in phase B

According to speech development it is important to train the basic phonological patterns before reading training. With this the material in phase B builds on each other, see programme p 25.

Children's songs and singing

When children are singing they are creative and use their speech and listen to themselves (and sometimes a CD or singing partner). In this process they direct their speech. The circle between articulation, perception and articulation control is closed. In this case rhyme and tunes can be learnt easily. Singing has a positive influence on the whole speech development. Exercises from the following area can be made more interesting with singing and rhyming:

Phonological training materials

This material uses the basic ability of analysing, adding, rhyming, storing, articulating and connecting. The different areas are trained specifically and can be used in therapy sessions as well as at home.

Using time: 15 to 20 minutes of daily training over at least 6 weeks can be enough preparation.

Children's books (book with CD) for reading training: Listen first- then reading

Spoken word arouses inner imagination. This is the first learning step. You can easily test whether this inner world is available by asking the child to retell a story just heard. The next step is to listen and read in silence- with the finger passing along the words. With this the hearing gets connected to the writing.

The following step is to read aloud into a microphone (CD-player is turned off). This exercise can be conducted with books as well as with phonological exercise materials. Especially effective in this step is the acoustic feedback of ones own voice via the microphone and the emphasis with a hearing perception training device HPT (or SPT) and the headphone.

This exercise can also be conducted with the speaker voice (CD player on) and simultaneously reading aloud into the microphone. If this is too much, listen to one part of it first and narrate it or reread it. For this step the CD player is paused.

Here the motivation for speaking and reading is increased- finally the child can hear and read themselves without stress. With Book-CD products you have several advantages.

- Hearing-speaking/reading is combined
- The text read on the CD contains exactly the same words as the written text
- The reading speed is defined on the CD (SgA to SgD, see table)
- Read by a nice female voice- which is good for children due to the higher vocal formants (with AUDIVA products)
- Practice fitted CD-track division per book page/chapter

Reading speed

Taking 3 samples of 60 sec each from each test, count the words and calculate the mean. This will give you a classification into 4 categories of speaking speech:

Sg:	Speed	Words/Minute	
SgA	Very slow (syllables emphasised)	40-60	AUDIVA Produktion ^a
SgB	slow	60-80	AUDIVA Produktion
SgC	normal	80-100	
SgD	fast - normal	100-150	Talking books ^b

a. at this time, only in german language available, speak to us, if you found some english speaking titels in slow speed or if you want to make it.
b. for example Harry Potter books with CD's

Mainly SgA and SgB are used in AUDIVA products. This gives the children more time to connect the contents of the words with their inner imaginations and makes it easier to understand.

The typical reading speed can be found in talking books with the speech speed SgD.

High Pitch training • Emphasis of high frequencies

High pitch training was started by Tomatis in the 1950's, where he conducted speech therapy with singers and enabled several noise traumata patients to hear well. He used high frequency filtering with acoustic feedback and used microphones and headphones first.

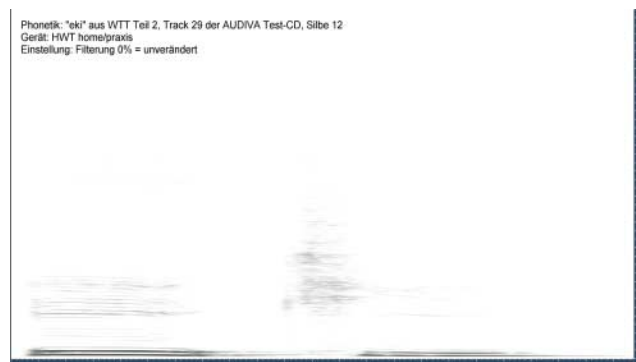
Tomatis also often speaks of the energy provision of the brain by high frequencies. This has only received scientific confirmation recently. Biochemical metabolism processes

are increased with sensory arousal and the connection of the neurons is only then possible (Dr. N. Annunziato). Especially high frequencies are useful due to the natural hearing threshold, because Frequencies between 2000 and 5000 Hz can be perceived best by humans.

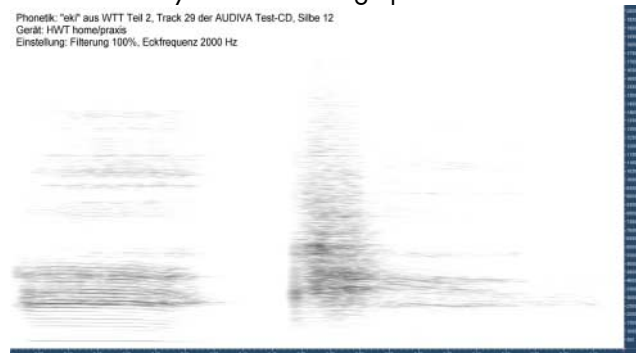
High pitch training and consonants

Especially in children with auditory differentiation problems the high pitch filtering helps the important frequencies in speech (consonant area) to be perceived and integrated in a better way.

Picture: the spoken syllable 'eki' without changes



Picture: same syllable via the high pitch filter



(Explanation: the darker the louder, Time from left to right, frequency bottom to top)

Phonemes like s, F and also the perception discrimination like b, p, d, t, g, k can be made especially good for hearing with height pitch increases and so better for integration since the differences in each phoneme takes place between 1000 and 6000 Hz.

The high pitch training is integrated in the hearing perception trainer (HPT).

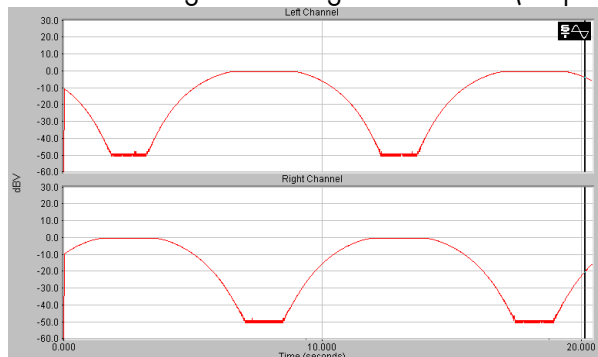
Lateral Training • The movement of sound between both ears.

This training was first conducted at the end of the 1960s by the speech therapist and speech educator Pelz (germany). He used simple mixing consoles and tape recorders to produce cassettes.

Today AUDIVA developed an increased trainings system. In spatial perception training with bilateral hearing the central hearing processes are trained in receiving acoustic

information from movement and in decoding it. The movement between both ears results in attention direction and trains the spatial location.

With a soft change from the right to the left ear (see picture)



the training of the crossed over hearing is conducted.

Diagnostically we can often see that children with hearing problems often only use one ear. You can easily imagine what it means for these children when they have to decide in a busy school situation which direction the useful noise comes from. In situations like that bilateral hearing makes the selection of useful sound optimal.

This can also be seen when you ask children with this deficit to decide on which side of the headphone the voice or music can be heard. The children can often not distinguish where the sound came from.

Spatial perception training can also be used with aphasics since those often have a lowered useful sound differentiation and get tired very easily.

The lateral training is available in the hearing perception-training device (HPT).

Hearing perception training HPT

As you have read before, the HPT is a combination of high-pitch and lateral training. In the HPT the sound colours are moved laterally between both ears. The sound colours are created with high pitch filters. Through this both methods are combined and the effect is increased.

In the HPT devices there are 6 programme steps for training with 3 sub programmes each for morning, afternoon and evening. This programme is according to the requests for the training programme on page 25.

Vibrotactile arousal and bone conduction

A bone conductor is a little vibrator to conduct sound on the body. In hearing -with and without headphones- the percentage of bone conduction is around 40dB quieter than the air sound and can therefore not be perceived consciously.

Increase of Hearing training

The bone conductor can be used for aimed tactile kinaesthetic arousal. In the middle of the headphone bail

the bone conductor touches the skull and adds vibrotactile stimulation to the hearing.

- The sound is passed onto both ears at the same level and reaches the inner ear
- Vibrotactile vibrations are perceived over the skin receptors in form of vibration
- At the same time the brain fluid is vibrated

Speech and bone conduction

Intracavernous in the head high frequencies are built when talking and singing through resonance (formants of speech and singing voice). These high tone areas are especially stimulated with bone conduction.

Sensory integration

The bone conductor can be used at the fingertips, the hands, the lower arm, the upper arm and the shoulders etc... for sensory integration of these parts. The patient can feel the musical vibration localized on his skin. This concept can be integrated in different therapies.

Body Sensations



Children with auditory perception deficits (secondary deficits) and especially with motor hyperactivity often don't perceive their own body very well (analogous to self-perception in hearing). Their motor activity is often spontaneous and extreme and seems uncontrolled. It is possible that the bodily feedback for movements is not optimally processed.

In this case sound and rhythm should be felt via harmonic music vibrations. The whole body can be stimulated with the sound box, to stimulate self-perception.

If you only use the sound box (without headphones), one can use music. African Drumming provides a very strong rhythm.

CD-Player/Discman, Computer, MP3, Minidisk

We explicitly tell you that computers with a CD-Rom are not useful as a sound source.

- There is no guarantee that no disturbing noises from the digital signals of the computer are being conducted on the audio signals; especially the quality of the CD-ROM and the soundcard cannot be tested in each case.
- A running computer usually produces a monotonous basic noise through the airing system and the hard disc. This disturbs the quiet atmosphere necessary for training.

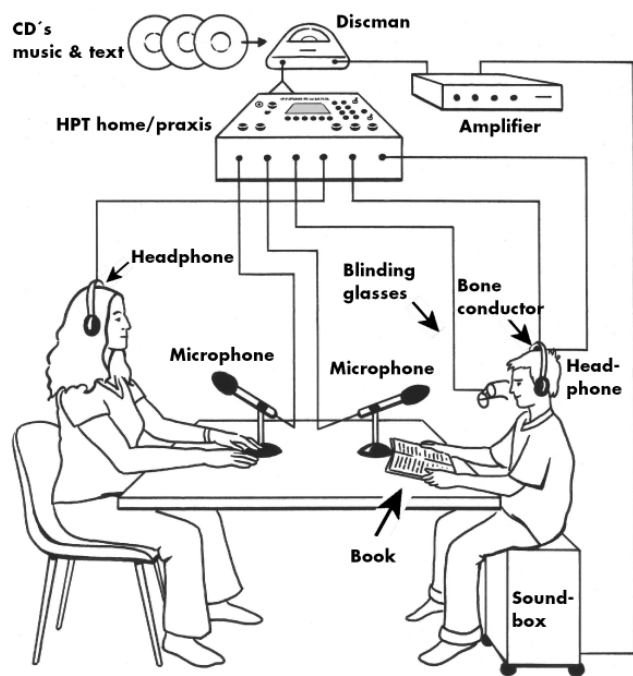
MP3-Player and Mini-Disc Players are not useful due to the data reduction techniques they use.

- Those technologies reduce the audio material to up to 5% of the original size and are normed for people with 'average'-hearing in an 'average'-hearing situation. Especially the latter point is not given in a hearing training. The hearing perception training device (HPT) and speech perception training device (SPT) use (via filtering) exactly the sounds that would be otherwise filtered away with this 95% in the above devices.

CD-player and Discman are also digital audio devices but they don't use reduction and therefore provide all the information in good quality.

Technique in the therapeutic setting

The HPT (praxis version) is shown as the training device. In connection with 2 headphones, 2 microphones, bone



conductor and diaphragm glasses the training can be optimised for the individual needs of each patient and can be enlarged to the visual (diaphragm glasses) and tactile (bone conductor) areas.

Of course we use the materials according to the training needs into the modalities with the according training material. Detailed information can be found in our catalogue.



Headphones should directly be used without other sources or reflections in the room influencing the hearing.

Music and speech process' travel directly to the hearing modality. This is especially important since the performance of the training devices is due to high pitch filtering and lateralisation, which can only be in used fully via headphones.

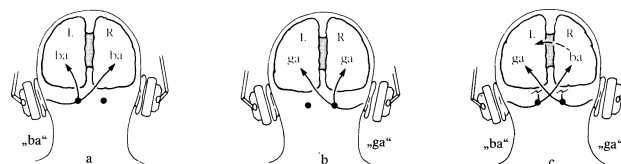
Hemispheric Coordination Training

(Dichotic differentiation training)

Improvement of hemispheric coordination cannot be trained through the lateralization of auditory stimuli (like speech or music) due to anatomic reasons.

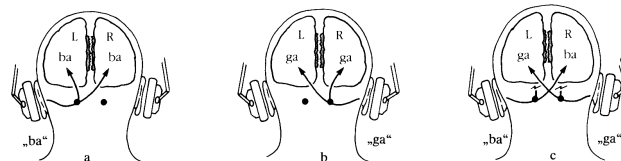
In contrast to e.g. hands or eyes each ear gives information from all its receptors to both hemispheres. Therefore a stimulus, which is only provided to the left ear or the right ear, gives the full information to both hemispheres.

Examples from examinations of split-brain patients (pati-



3.2 Kimuras Modell des dichotischen Hörens bei normalen Versuchspersonen. a) Stimuli, die nur dem linken Ohr (monaural) dargeboten werden, gelangen über kontralaterale Verbindungen zur rechten Hemisphäre und über ipsilaterale zur linken Gesichtsfeldhälfte. Die Versuchsperson gibt die vorgespielte Silbe („ba“) richtig wieder. b) Bei monauraler Darbietung zum rechten Ohr werden die Reize über kontralaterale Verbindungen zur linken Hemisphäre und über ipsilaterale zur

rechten geleitet. Die Silbe „ga“ wird richtig wiedergegeben. c) Bei dichotischer Darbietung werden die ipsilateralen Verbindungen unterdrückt, so daß „ga“ nur zur linken (sprachdominanten) Hemisphäre und „ba“ ausschließlich in die rechte Gehirnhälfte gelangt. Die Silbe „ba“ ist der linken Hemisphäre nur über die Kommissurenbahnen zugänglich. Das führt zu einem Vorteil des rechten Ohrs: Die Versuchsperson gibt „ga“ häufiger richtig wieder als „ba“.



3.3 Modell des dichotischen Hörens bei Split-Brain-Patienten. a), b) Monaurale Darbietungen funktionieren genauso wie bei normalen Versuchspersonen. Da weder ipsilaterale noch kontralaterale Verbindungen durch die Split-Brain-Operation beeinträchtigt werden, kann der Patient Reize von jedem Ohr richtig wie-

dergeben. c) Bei dichotischer Darbietung werden die ipsilateralen Verbindungen unterdrückt (wie bei normalen Versuchspersonen), aber die Silbe „ba“ kann nicht in die linke (sprachdominante) Hemisphäre gelangen, weil die Kommissurenbahnen zerschnitten sind. Nur „ga“ wird wiedergegeben.

ents where the corpus callosum has been cut) show that when communication between both hemispheres is only dichotic (simultaneous stimulation of left and right ear with different stimuli each), there are problems in hearing perception. They can only hear with one ear. When there is only one stimulus the ipsi- or contra-lateral connections to the other brain area provide normal (neurological healthy) hearing reactions.¹

Therefore we conclude that to increase the hemispheric coordination in auditory perception (in contrast to the visual one!) dichotic training programmes are necessary.

1. See english version in the book „left brain, right brain“; Freeman and Company, New York

This is offered by AUDIVA with their new hemisphere-coordination trainer HCT. This new device produces different stimuli at exactly the same time at the left and right ear. Dichotic hearing training should in theory lead to better information processing between the brain hemispheres and therefore have positive effects on complex processing. Whether this is clinically relevant will be shown.

Functional training methods

Training certain perceptual function with playful exercises



Children from age 6 use the functional training method. A basic understanding of the playful tasks is necessary.

Under the word playful training method we understand:

Order threshold lateral	(OI)	The smallest time distance between two stimuli (left-right)
Fusion threshold	(F)	The smallest time distance that 2 stimuli are still perceived as 2 and not as one stimuli
Inter modality	(I)	The shortest time distance between 2 visual stimuli (auditory-visual)
Synchrony	(S)	The keys shall be pressed synchronous to the auditory/visual model
Order threshold serial	(Os)	See OI but with a serial sequence of different auditory stimuli
Tone pitch discrimination	(P)	Discrimination of different tone heights
Direction hearing	(D)	Perceiving which direction the stimuli comes from
Gap detection	(G)	Detection of short gaps in a long tone

The goal is training of the auditory and/or visual abilities in the above areas and to get as good values as possible.

Functional training is useful for

- Memory abilities (all methods)
- Left-right detection (OI, D)
- Short-term discrimination (Os, F, G)
- Faster processing of auditory/visual stimuli (all methods)
- Auditory/visual motor coordination (S)
- Even attention distribution on auditory and visual stimuli (I)
- Direction hearing in the horizontal level (D)
- Tone pitch discrimination (P)

Way of working

Therapy contents and stimuli are provided by an electronic device and connected with an exercise the child has to solve. You work with a device, which supports one, or several of the methods mentioned above: auditory over headphones and/or visual via light flashes.

Only the patient wears headphones and the therapist can observe the testing phase via a digital signal on the device. In case of training, the device will provide the starting values calculated from the hits during the first session. These values are saved and the training can continue at home.

Order threshold training (OI) and (Os)

We recommend you the order threshold test as content for the primary diagnostic phase and repeated during therapy.

If the patient cannot make the age according norms, it would be sensible to conduct separate order threshold training. For this, one uses the test results of the order threshold and the training start value will be put about 50ms higher at the training device. In this case it is important that you own a device where you can adjust the starting value, which is possible in all AUDIVA devices.

According to sense-related points the following performances will be trained with order threshold training:

- Auditory/visual attention direction
- Short-term memory in relation to remembering of the first stimulus
- Auditory-motor coordination (the child will press the key itself)

Research in Order threshold training:

Research¹ showed that in children with different forms of dyslexia there was a significant increase in memory abilities after some weeks of regular training in almost all the cases. These improvements were partly assessed with the Mottier Test. Additionally behaviour observations were conducted and improvements of ability to differentiate were found.

However children with dyslexia from the age of 10 onwards did not show significant improvements after order threshold training.

Therefore we can conclude that an isolated training of the order threshold is a sensible co-therapy method in the

1. (note: only in german)

• *Mergen, Thomas; Die Ordnungsschwelle bei Kindern im Grundschulalter unter besonderer Berücksichtigung von sprachlichen Beeinträchtigungen; 1997; Universität Koblenz-Landau

• *Müller, Jochen A.; Pädagogische Förderung von Kindern mit Beeinträchtigungen in der Aussprache; 1997; Universität Koblenz-Landau

• Pöppel, E.; Grenzen des Bewusstseins; 1985; DVA Stuttgart

• * Sommer-Stumpfenhorst; Untersuchungen zur Ordnungsschwelle an einer Grundschule; 1996

Steinbüchel; Referat anlässlich der Jahresfortbildungstagung des DBL in Aachen; 1997

• * Tremmel, Raimund; Einfluss der Geschwindigkeit zentraler Verarbeitung von Hörreizen auf das Stammeln von Kindern; 1996; Universität Koblenz-Landau

*Download on: www.audiva.de

improvement of language performance if the problem is in memory and differentiation areas.
However it cannot be used in preschool children or those who do not understand the task or cannot comply.

Synchrony training (S)

Click noises are given in turns left and right so that a simple rhythm results (auditory and/or visual). The starting value is adjusted to the abilities of the patient.

The task of the patient is to copy the simple rhythms by pressing the left or right key in a way that the stimuli of the left side is in exact accordance to the key pressed on the left side.

AUDIVA training devices with a synchrony function give you the following possibilities:

- Constant sequence: the time is given and will not change. We measure how exact (In millisecond) the patient answers the stimuli.

When time is held constant, the training request is low. However it becomes more difficult when the time increases itself in accordance with the correct performance.

- Various time changes: time increases when the patient answers synchronous and decreases when she answers asynchronous. The patient will end up with very fast timing when training is done successfully.

Another variant is to shortly practice a time and then repeat it from memory:

- Gap: the time has a gap as soon as the requested number of synchronous answers is given. The longer the time is held in memory the better.

Tone pitch training (P)

A training of tone pitches makes sense when the patient:

- Mixes up vocals
- Talks very monotonously
- Sings unsound

You can train this ability with a device with the function tone pitch discrimination (e.g. Brain Fit home, OAV 18E). For training we use the starting interval found in the test where the patient is just still able to discriminate.

An additional possibility is to combine the recognition of tone intervals with actions (e.g. high-low lift arm up-put it down, high-high move head etc...).

Direction hearing (D)

Training devices with the function 'direction hearing' give click impulses between 20 and 1000 μ S against each other. It is randomly directed which side will begin. The side on which the click starts is taken as direction information. The patient presses the key on the according side.



















Therapy material

Individual therapy materials	Audio devices	Special therapy devices	Sound conduction
Functional and emotional Useful training beginning from 1 (phase A - music) or 3 (phase B - speech) Years of age			
Music <ul style="list-style-type: none"> • Mozart • Baroque • Gregorian • Natural sounds Speech <ul style="list-style-type: none"> • Children's songs • Phonological exercise materials • CD-book combinations Voice <ul style="list-style-type: none"> • Patient and therapist 	CD-Player or Discman Microphone and microphone holder	Hearing perception training (HPT) A combination of speech (high pitch) and direction (lateral) training Practice: <ul style="list-style-type: none"> • Hearing perception trainer HPT praxis At home: <ul style="list-style-type: none"> • Hearing perception trainer HPT home 	Headphones Acoustic half-closed headphones with padding all around the ear for training, e.g.: <ul style="list-style-type: none"> • Headphones for adults HD 570, HD 265 by Sennheiser • Children and adult headphones HDK 66 by AKG Acoustically closed headphone with padding all around the ear for diagnostic, e.g.: <ul style="list-style-type: none"> • HD 265 by Sennheiser
		Only speech (high pitch) training At home: <ul style="list-style-type: none"> • Speech perception trainer „SPT home“ 	
<ul style="list-style-type: none"> • Recordet speech samples - loading in the device 		Hemisphere coordination training (HCT) Dichotic speech stimuli for arousal of interhemispheric communication (From age 7)	
Functional useful training From age of 6 years			
Each device produces the sounds by itself (clicks, tones, noise etc) Therefore the therapy materials and the audio devices are not needed.		Training of (Ol) (F) (I) (S) (Os) (P) (D) Practice: <ul style="list-style-type: none"> • OAV 18 E (brain fit praxis) • Brain Fit home Homes: <ul style="list-style-type: none"> • Brain fit home 	Headphones see above Attention: Some products are provided with simple head/ earphones. Those are not sufficient for hearing perception training.
		Training only of Ol and Os <ul style="list-style-type: none"> • Brain fit easy+ OT 2000 (Ol) • Brain Fit Easy OT 70 (Ol) 	
		Training of only (S) At home: <ul style="list-style-type: none"> • Brain-Fit Synchro OT 73 	
		Tinnitus-Retraining- Therapy At home: <ul style="list-style-type: none"> • Sound generator in pocket format: Tinnifresh TF 81 A 	

The training programme

Examples for training with following products:

- Hearing perception training device HPT home
- Spatial perception training device DPT home
- Speech perception training device SPT home
- Combination of speech and spatial perception training

	Phase A						Phase B					
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Level 6												
Level 5												
Level 4												
Level 3												
Level 2												
Level 1												

In the table you can see the hearing programme from level 1-6 (in HPT home/praxis): the first 6 weeks are used for stamina training followed by speech training.

Phase A: activation of Hearing

Perception and processing of free and creative processes

Time span: about 6-8 weeks, no microphone, 2-3 times a day, 10-20/30 minutes

Many children are already emotionally weakened by their hearing problems. Therefore one is working with music as a harmonizing element. Listening to music can be integrated in an easy way in the daily routine.

In the mornings (very effective):

In bed, during breakfast or after, in any case before school. Hearing becomes very effective in preparation of the school strains. It is better to listen for 10 minutes only than not at all. Headphones can be put on in bed or during breakfast (take care of jam on the headphone cables...). Before familial strains result (e.g. from time constraints) other hearing times (less often but longer) should be preferred.

Afternoon:

After school, after lunch before or during homework (test it: many children can do their homework better when listening

to music via the headphones at the same time, others need total silence)

Evening:

In bed, after dinner. When children become too much awake by listening to the music the training should be conducted earlier. This can also be reduced with a different music (or different presentation).

Whether you conduct the hearing training 3 times a day for 10-15 minutes, 2 times for 30 min, 1 time 15 min and 1 time 30 min or only once a day for 30-60 min can be found out individually.

Later when work with the microphone (phase B) is added, the listening to music is reduced so that it takes approximately the same amount of time for both.



Children can relax during listening to music



You can also do creative things during listening to music (like drawing, play-dough, puzzling, reading etc...).



Children can also play in groups when listening to music over the headphones. With acoustically half-closed headphones they can talk to

each other (take care that the surrounding is quiet).

The children should not watch TV or play computer at the same time. To avoid putting pressure on the child you should not communicate expectations towards its performance or things that could emphasize the weaknesses of the child.

It can take a few weeks before one can see progress. However many children profit very much from this training phase A and already show increased attention, more self-consciousness and staying power.

The only useful music is by Mozart, Vivaldi, Bach and other compositions from baroque. In some cases this music programme can be enlarged with instrumental folk songs (e.g. flamenco) or Gregorian singing (they should have a balancing emotional effect, light and harmonic melodies and be learning activating). Electronic music (meditation music, as well as Rock, Techno and Pop music) is not very useful and should not be used.

Phase B: speech integration

Perceiving and processing in the interactive dialogue

Duration 6-8 weeks - with microphone. Only in this therapy phase the child is working on his/her language directly.

Listening to music goes on:

Before talking and reading themselves, the children continue to listen to music 1-2 times a day. Additionally once a day the child listens to stories (of CD) via a training device and headphones.

Via the microphone the child can hear itself clear and sound. Through this he can learn new and right ways of permanent speaking. In accordance with age and developmental stage there are several training methods:

For children below the reading age:



The child can describe the picture with his own words. Mother, father or the rapist give clues, ask questions and point out certain speech aspects, which are important at the moment.

Answer questions:

First the parent/therapist reads via the microphone, asks the child some questions and then the child answers with the

microphone. The questions can be asked directly after reading or a bit later (without putting too much strain on the child).

For children in reading age:

Direct repetition: the parent/therapist reads a sentence or



part of the text, the child repeats or reads it back aloud (both over the microphone in turns).

Work with Book with CD:



The child can listen to the whole book with the CD via headphones and follows the text with her fingers. According to the size of the book this can take several weeks. After that the same chapter is read again, now without the CD but read by the child herself. At this point one can include tasks like rhythmic reading.

Direct reading with the CD-book:

The child listens to the CD one sentence at the time (half a sentence) and then presses the pausing key on the Discman/CD player and repeats the text into the microphone. The child listens to the CD each chapter in turn and reads parallel to the speaker into the microphone (careful: this can only be done with increased reading ability, since it is more difficult).

Tasks:

Find words with certain endings etc.... Possibly the therapist can choose certain material for the according symptoms of the child and give the material as homework.

Talk slowly and clearly:

When parents themselves are reading stories for their child via the microphone they should try to read slowly and clearly and have as much easiness and rest in their under tone as possible.

Text materials

We recommend you material helping children to learn to read. These are usually book-CD combinations read especially slowly. You can also take talking books of stories or actual school material (if they are not available on CD the parent can read it into the microphone).

Phase C: break

Increased perception and processing are integrated into everyday life.

Duration: 8-12 weeks.

Since the children have changed their daily routines for the



last few months there should now be a phase without hearing perception training.

Most children show advances in behaviour and in school performances in phase A and B. In some cases this progress can only be seen in phase C.

In phase C no training is conducted anymore. At the beginning of this phase the child should undergo another examination. After 8-12 weeks break another diagnosis should be conducted.

- Changes in behaviour at school towards other pupils and at home towards siblings should be examined.
- Diagnostic points should be tested and compared to the primary ones: then the therapist can decide whether another training block is necessary.

In this second hearing training block the therapist can use her experiences from the first one.

If training at home is not possible...

If there is not much compliance in training at home, and a hearing training of the above way cannot be conducted there are the following alternative possibilities:

- Offer hearing perception training in the practice for several months at least twice a week (can be done in groups)
- Daily hearing perception training in support classes at school, in special need schools, day care centres etc...
- Hearing perception training as learning strategy in support lessons (tell your support teacher about the techniques)

Case studies

Functional effects:

This example shows the effects on the functional neurosystem (neocortex) down to the hearing neurons in phase B of the training programme (speech). Functional deficits are things like articulation problems, sound mixing up....

- A child mixes up certain sounds (usually consonants). He does not seem to notice the differences between the sounds. At the therapist's sometimes the discrimination works OK, but at home and in school the old habits are still persistent. Overall the conventional therapy is not very successful since the integration fails again and again.

The therapist uses hearing perception training for the first time in this case. She puts the high pitch sounds on 4000Hz to present the sounds especially clearly. The effect is put on 75% (not 100% to not surprise or frighten the patient). Now the patient can hear via headphones the problematic sounds in especially clear ways and recognises the differences between the sounds he used to mix up before. Through the fact that the patient can hear himself via microphone, his self-perception is much better and therefore the integration more stable. An intensive influence on the phonematic pattern can be practiced, which can be reused by the child in normal situations to distinguish disturbing and useful sound.

Emotional effects:

Children who only processes heard stimuli in an inhibited way, due to their previous bad experiences often show functional deficits like very reduced memory abilities. This can be trained with hearing perception training.

- A boy had forgotten everything he has just learnt in school already at lunchtime at home. He also forgot his homework. The mother spent much time practicing with him. Still he didn't do well at school. Since doing the hearing perception training in the mornings before school, he can remember things much better and even remembers his homework. He also got much quicker in doing his homework. This has been shown in several cases.
- Although the child is concentrated in school he/she does not perform as well as expected. The child doubts him/herself. The self-esteem goes down. It is not helpful when the teacher tells the child to practice more. Tension develops in school and at home.

Vegetative effects:

There are signs for the direction of neurotransmitters and other transmitters via the hearing. Obviously with this incomplete knowledge of the subject no hearing training is

prescribed. However our experiences in this area are very rich:

- A child who still wets the bed at 8 years of age stopped after hearing training.
- Children who had repeated colds and following hearing problems showed fewer colds after hearing training and had better immune systems.

Brain areas

The following examples are supposed to show you that hearing perception training always works in different brain areas. The human brain can be looked at in three parts:

- Neocortex, which represents the Ego and the free will and is the conscious, rational level.
- The emotional brain (limbic system) which directs the feelings
- Vegetative system also called reptile-brain, which directs life-pertaining bodily functions and protective functions.

When we hear a noise this information is passed on to all three brain-areas. Therefore there is a threefold effect on different levels. The emotional system reacts before a conscious perception is done in the neocortex.

This makes it possible for the emotional system to direct whether the neocortex should process the new stimuli or not (inhibition or arousal). When the decision is to process the stimuli the optimal processing in the neocortex is guaranteed.

This means that the information (music, speech) used in training has to be of a quality (not quantity) with highest possible probability of being processed, so that the information is lead on to the neocortex.

The three phases in training by AUDIVA try to apply this knowledge in practice.



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