



Guidelines for Hearing Assessment of Children with Complex Needs

Margaret Glasgow, Cert ToD, MSc Aud
Education Audiologist

These guidelines have been devised by the Audiology and Educational Technology Committee of BATOD to help professionals who are involved with Hearing Assessments of children who, for many different reasons, prove difficult to test.

1997

Contents

1. Aim of Hearing Assessment
2. Pre-test Information and Observation
 - 2.1 Gathering of information
 - 2.2 Visiting before the test
 - 2.3 Points that need to be addressed
3. Examples and Reactions to Environmental Sounds
 - 3.1 Indoor environmental sounds
 - 3.2 Outdoor environmental sounds
 - 3.3 Reactions to sounds
4. Test Modifications
 - 4.1 The Testing Environment
 - 4.2 Occupier in distraction test
 - 4.3 Distractor in distraction test
 - 4.4 Co-operative test
 - 4.5 Performance test
 - 4.6 Toy test
 - 4.7 Pure tone audiometry
5. Points to Consider when Testing
 - 5.1 Acquiring the most helpful information
 - 5.2 Levels of stimuli
 - 5.3 Position of the child for all tests
 - 5.4 Consideration for visually impaired children
 - 5.5 Consideration for children with Downs Syndrome
 - 5.6 The presence of someone who knows the child well
- 6.. Ideas for Further Reading

Appendices

These include some examples of leaflets from Surrey Service for the Hearing -Impaired as an example of practice.

Definition of profound and multiple learning difficulties

Levels of auditory skill development

Screening of hearing for children at SLD schools

Response to sound

Exemplars 1 & 2

Recording response to sound

Behavioural definitions of response

Audiological assessment

Guidelines for Hearing Assessment of Children with Complex Needs

1 AIM OF HEARING ASSESSMENT

To establish whether a child who has any combination of multiple physical, sensory, learning or behavioural disabilities has a significant hearing loss.

Important factors to consider are:

- Hearing impairment may not be the major problem
- Hearing impairment may not be present

2 PRE -TEST INFORMATION AND OBSERVATION

2.1 Gathering of information

It is important to bring together observations from:

- parents / carer
- extended family (if appropriate)
- Education Service
- Health Service
- Social Services

2.2 Visiting before the test

It is helpful if the tester can visit the child before the test in order to:

- observe in an environment that is familiar to the child
- talk with parents, class teacher, assistant etc about how the child reacts to sound
- note and measure levels and types of responses to environmental sounds

2.3 Points that need to be addressed

- Beware of the four clue areas: olfactory, visual, tactile and auditory.
- Establish level of receptive language eg Does the child know/respond to her/his own name?
- Establish level and form of expressive language.
- Establish any involuntary actions or repetitive behaviour eg intermittent kicking, turning of head to one side etc. that are not triggered by noises.
- Establish any physical disability that could prevent child responding behaviourally to sound.
- Establish the time of day when the child is most responsive so that the test can be arranged within that time if possible. Change of certain routines can sometimes upset the child.
- Check on the physical state and drugs the child is taking and the effect medication may have on responses.
- Establish visual awareness (a darkened room may be needed).
- Establish who would be best to accompany the child to the test situation eg parent/carer.

- Ask about mood swings particularly with adolescent girls.
- Decide which test would be appropriate according to developmental level in order not to waste time and tire the child. It is most likely that the appropriate test will not match the child's chronological age.

If it is not possible for the tester to visit the school beforehand s/he may be able to arrange for another ToD to gather some information. The tester would then need to have time to observe the child before testing and to talk to the accompanying adult.

3 EXAMPLES OF ENVIRONMENTAL SOUNDS AND REACTIONS

3.1 Indoor environmental sounds

banging doors	music and television being switched on	noisy toys
furniture moving	sounds during food preparation	dinner trolley coming
singing	people's voices and footsteps	whistling etc.
flush of toilet	washing machine cycles	computer noises

3.2 Outdoor environmental sounds

planes	traffic	animal sounds
shop sounds	voices and footsteps	shouting etc.

(note type of response to sound eg voicing, pointing, signing etc.)

3.3 Reactions to sounds

stopping	rocking	cessation of rocking
crying	cessation of crying	change of breathing or holding breath
kicking	eye flicks	cessation of kicking
eye widening	blinking	cessation of singing
singing	smiling	cessation of vocalisation
grimacing	startling	cessation of mouthing
laughing	body wriggle	banging with hands
twitching of limbs	dribble	momentary cessation of dribbling
frowning	voicing	normal locating turn to sound
shouting	moving away from sound source	

or any other change in behaviour which the child consistently makes to stimuli and are repeatable and specific

4 TEST MODIFICATIONS

The test may need to be modified in order to ascertain the child's hearing function. However it is important that flexibility in applying the principle of the test does not result in any reduction of rigour. In most situations it will be necessary to have two experienced testers.

4.1 The Testing Environment

Tests in a familiar environment/school can establish whether or not the child has any significant hearing difficulty which could be contributing to speech and language delay. The child is usually more relaxed in an environment that they know. The room used needs to be visually and acoustically quiet, at a comfortable temperature and a size that is suitable to complete the test. If the room is used for other purposes, try to ensure that staff know test times and put a notice on the door, so interruptions can be avoided.

4.2 Occupier in distraction test

- may need to stand to be on eye level (see section 5c)
- needs to be sensitive to the child's needs, eg may be more attentive to voice or touch than small objects when occupying etc. (see section 5e)
- may need to present the test sound in front and let the tester continue behind
- needs to be very observant of the child's change of behaviour when stimulus is presented and decide whether or not it is a response to sound. This should be in conjunction with a parent or another person who knows the child well (see section 5f)
- should be aware of alternative responses eg rocking, stilling, voicing etc. (see section 3c)
- should be aware that Deafblind child may reach out. Watch for reaction to air puff (this may give a clue as to what sort of auditory response the child will make)
- may not need to occupy but simply observe child's responses
- should be aware that autistic children may not be consistent, they may only respond when they become annoyed with the stimulus or when there is 'a window' of attention to external stimuli

4.3 Distractor in distraction test

- may need to give child stimuli at supra-threshold levels because of interest response. (see section 5b)
- may need to use non frequency specific stimuli in order to get response. These can often be used at minimal levels. It has to be remembered that they give information across the frequencies and do not give information about specific frequencies
- should be aware that certain stimuli may trigger a fit
- should use a sound level meter to measure sounds accurately

Examples of non-frequency specific sounds that could elicit a response

sweet paper	crisp bag	musical toy
football rattle	cup and spoon	clink of bottles etc. voice (particularly mother's)

4.4 Co-operative test

- Establish that child knows names of objects/people that are used.
- Consider size of toy - child may not be able to grip a small brick or may have problems releasing it.
- Response may be glance/nod in the direction of the object/person.
- May not be able to cover face to preclude speech reading except with hand as child becomes insecure.

4.5 Performance test

Find the most suitable.

4.5.1 Ways of conditioning to sound, for example:

- tactile
- light, eg torch shone in eyes
- vibrotactile stimulus on wrist / mastoid
- any combination with sound

4.5.2 Stimulus. It may be:

- voice, eg >go' and >ss'
- wide band noise
- narrow band noise
- warble tones
- non frequency specific sounds of interest, eg musical instrument, crisp packet
- frequency specific sounds , eg high frequency rattle

4.5.3 Waiting posture, for example:

- holding object near ear
- holding object near machine
- holding teddy with brick / peg etc.
- holding Mummy / Daddy / carer's hand (beware of cueing)

4.5.4 Response. It may be:

- putting >men' in the >boat'
- dropping brick in the box or a large bucket for physically disabled
- inserting large peg into hole
- giving to parent/carer
- knocking brick or similar toy to ground with hand
- kicking toy away
- any movement the child does consistently in response to stimuli

The response chosen should relate to the child's available response repertoire.

4.5.6 Reward. It may be:

- good girl / boy' - voice
- smile
- clap
- hug
- jump toy up and down

4.6 Toy Test (McCormick or Kendall)

- Child may need to stand and have hands on supports. Some children feel more secure this way.
- Only use toys known to the child.
- Child may become insecure if lip reading is denied and refuse to respond. (see section 5b).
- Toys do not need to be named or signed (test of hearing).
- Make sure toys are within easy pointing/giving range.
- If using eye pointing responses, make sure that there is a clear change of focus between test items.

4.7 Pure tone audiometry

As for performance test find most suitable means of response whilst conditioning. In addition the response to this test could be:

- voicing
- rocking
- kicking

plus any of those listed in section 3c.

Tester must be completely sure that the response is to the sound. (see section 5b)

5 POINTS TO CONSIDER WHEN TESTING

5.1 Acquiring the most helpful information

- It is important to liaise with other professionals and parents/carers before assessing any child with complex needs.
- Decide what you need to know and how best to find out.
- For example when doing a pure tone audiogram get the most useful responses first in case the child tires easily eg 1KHz and 4KHz in each ear, then 500Hz and 2KHz.
- It may be necessary to allow up to two hours when testing, for familiarisation, testing, observation, confirmation, and discussion.
- It may be necessary to complete the test at a later date.
- The false positive rate may be much higher than with other children. A lot of patience and encouragement is required.
- Videoing the child during testing can be helpful.
- Refer to section 2.3 for pretest information and observation.
- Establish whether the child has fits. It may be that certain sounds or situations could trigger a fit.
- Too many people in a room can be disturbing.
- Tympanometry and stapedial reflex can provide useful information

If an audiology centre can provide information from VRA and OAE or BSER re cochlear function, this can be a very helpful addition to the overall picture.

5.2 Levels of stimuli

- Stimuli for all tests may need to be given at levels higher than screening levels to elicit a response. This may be the interest level of the child and not necessarily the threshold of detectability.

To distinguish between levels of interest and detectability means taking into account observations of parents and staff, and results of other assessments to give a fuller overall picture of hearing function.

- Stimuli may need to be given for 15 - 20 seconds as child may need a longer time to listen.
- A time lapse of 15 - 20 seconds after normal stimulus presentation may be needed to give child time to respond.
- The child may '>still' to quieter sounds (detectability) and '>locate' louder sounds (interest).
- Child may be responsive to high frequency sounds which are more alarming than low frequency sounds which are more soothing.

If whilst carrying out co-operative, performance or toy tests, the child is unsettled when speech reading is denied, strategies include:

- covering mouth with hand rather than screen
- directing child's gaze away from the tester's face, ie towards the toy/other person
- standing behind child, possibly touching his/her shoulder to reassure, and direct

child's gaze forward

5.3 Position of the child for all tests

It is important that the child is comfortable so that effort goes into listening and not holding him/her self up. Consult the child's physiotherapist if available and/or appropriate. It may be:

- sitting on an ordinary chair at suitable height so that the child is comfortable
- sitting on someone's lap
- sitting in his/her own wheel chair
- sitting on the floor
- sitting in his/her own specialist chair
- lying on the bed
- standing with help of a standing frame / support

It is impossible to seat some children and they constantly move around the room. On these occasions the tester has to do a distraction test >on the run' eg following the child and introducing the stimulus when they are paying attention to external stimuli. Practice is needed in presenting sound stimuli within their field of interest, but without giving visual or tactile cues.

5.4 Consideration for visually impaired children

They may not have experience of visual reinforcement when they turn to sound and therefore do not always respond with a turn although they may be physically able. It is possible that:

- they may need subdued lighting or bright lights..
- child watches for glare and reflections.
- for occupying in the distraction test there may be the need for flashing torch light, bright reflective spinning objects, puppets with clear features and shiny surfaces etc.
- the occupier may need to talk and touch the child. Talking should stop and hands remain still for sound stimulus to be introduced.
- clues can be easily given when the stimulus is introduced, eg don't leave a consistent time gap between stopping talking/touching and presenting stimuli. Be extra aware of possible olfactory or tactile cues.
- there is a need for materials and games to be played beforehand so that child is familiar with what they have to do.

5.5 Consideration for children with Downs Syndrome

These children may need:

- regular tympanometry (most Downs Syndrome children have a conductive hearing loss)
- a watchful eye for presbycusis
- insertion gain measurements if fitted with hearing aids to avoid over amplification because of a small auditory meatus
- otoscopy to identify a build up of wax and/or debris in the external meatus

5.6 The presence of someone who knows the child well

This is usually helpful (parent, teacher, assistant etc.) They can advise tester about responses, usual behaviour patterns, random movements and may help the child to feel more relaxed and secure etc.

6.0 SUGGESTIONS FOR FURTHER READING

CHEROW, E (Ed) 1985

Hearing-Impaired Children and Youths with Developmental Disabilities

Washington, Gallaudet College Press

CONINX, F & LANCIANI, G E (Eds) 1995

Hearing Assessment and Aural Rehabilitation of Multiply Handicapped Deaf Children

Scandinavian Audiology Vol. 24. Suppl. 41

McCRACKEN, W & LAOIDE-KEMP, S (Eds) 1997 (March)

Audiology in Education

Whurr

McCRACKEN, W March 1994

Deaf Children with Complex Needs: A Piece in the Puzzle

Journal of British Association of Teachers of the Deaf Vol.18, No 2, Page 54

KERSHMAN & NAPIER 1982

Systematic Procedures for Eliciting and Recording Responses to Sound Stimuli in Deaf-blind and Multi-handicapped Children

Volta Review 84, 4 Pages 226 - 237

This comprehensive and clear procedure considers frequency bands, intensity and variations in responses.

WALKER, V 1986

Assessing Auditory Function

Talking sense 32,4 Page 6

Looks at assessment based on the first three of Gleason's levels

Auditory Assessment of the Visually Impaired Pre-schooler: A Team Effort

Education of Visually Handicapped 16, 3 Pages 102 - 113

A useful article as it shows levels of auditory response which provide a good basis for assessment.

Suggestions for supporting auditory development in Visually Impaired children

Appendices

Included are some examples of proforma
used by the Surrey Service for the Hearing-Impaired

PROFOUND & MULTIPLE LEARNING DIFFICULTIES

A DEFINITION

Pupils with profound and multiple learning difficulties:

- are not a homogeneous group
- appear to function at the earliest levels of development
- have additional physical and/or sensory impairments
- may be ambulant
- may exhibit difficulties with communication
- are likely to require the involvement of a range of professionals.

The School Curriculum & Assessment Authority (1996)

LEVELS OF AUDITORY SKILL DEVELOPMENT

Gleason (1984) identified 6 levels of response:

- Awareness
- Attention
- Localising
- Discrimination
- Recognition
- Comprehension

Awareness;	Unintentional, reflexive responses (eg startle reflex, blinking reflex, etc.).
Attention	Intentional responses (eg stilling, increasing or decreasing vocalisations etc.). Beginning to show some differentiation of something happening around him/her. Responses may be fleeting and inconsistent.
Localising	Child is able to localise a sound. Becomes more consistent in responses made.
Discriminating	Knowing whether two sounds are the same or different.
Recognition	The sound and its meaning have been remembered. Identifies auditory features of a sound.
Comprehension	Not only recognising sounds, but also relating meaning to what is currently happening.

THE SCREENING OF HEARING FOR CHILDREN AT SLD SCHOOLS

Introduction

1. This procedure is designed for children with profound learning/physical difficulties, who cannot respond conventionally to distraction techniques.
2.
 - a) Ideally the children would be observed by an Advisory Teacher of the Deaf in their familiar situation, eg classroom
 - b) Record observations
 - c) Request observations from staff, based on the enclosed guidelines
3. Advisory Teacher of the Deaf to explain and hand observation record sheet to staff two weeks before educational audiologist's visit.
4. It is very important to have no sound trials and observe random movement, etc that can be mistaken for responses.

RESPONSE TO SOUND

- observation of child with severe learning difficulties

Examples of sounds

- 1 Indoor environmental sounds (eg banging doors, music and television being switched on, noisy toys, furniture moving, sounds during food preparation, dinner trolley coming).
- 2 External environmental sounds (planes, traffic, animal sounds).
- 3 People's voices (singing, whistling and familiar person's voice as they enter the room, etc).

Examples of reactions to sounds

cessation of activity	hits objects and derives pleasure from sounds
cessation of crying	vocalisation
change in breathing	facial grimace
crying at sudden noise	stops vocalising
rocking	changes vocalisation
banging	startling
interest in sound source	joins in singing
eye widening or blinking	reaction to sound stopping
attempts imitation of sound;	

Examples of communication (child's own voice):

any vocalisations	derives pleasure from use of own voice
shouts, squeals	tuneful/guttural sounds
babbles	imitates sounds
laughs when pleased	vocalises to attract attention
cries when distressed;	

WARNING!

Be aware that the child may be responding to clues, such as:

Tactile;	Olfactory;	Visual
vibrations	perfume	pointing (eyes)
tap / touch	dinner smells	signs, gestures

Observations on child's general behaviour

- voluntary movements (range, symmetry)
- involuntary, random behaviours
- observe behaviour when wakeful but unstimulated

**RECORDING RESPONSE TO SOUND
(CHILD WITH SLD) - EXEMPLAR I**

Name

<i>Date</i>	<i>Sounds/Situation</i>	<i>Responses</i>
Autumn term 1991	Indoor environmental sounds, eg banging door	No reaction
	Familiar voices	No assessable response
	Musical instruments	Apparently no response
	High pitched tin whistle	Stopped vocalising - left and right However, became unresponsive to sound after four trials
	Very loud bang on tambourine	Opened eyes
	Communication	a) enjoys making open vowel sounds usually when lying on side b) cries when distressed c) laughs but usually for no apparent reason, and can alternate with crying

Generally it is felt that the child has a limited basic response to sound which is not consistent.

**RECORDING RESPONSE TO SOUND
(CHILD WITH SLD) - EXEMPLAR II**

Name

<i>Date</i>	<i>Sounds / Situation</i>	<i>Response</i>
11.4.91.	Banging classroom door (repeatedly)	Smiling. Wide eyed. Head on one side.
11.4.91.	Singing Incy Wincy Spider	Stopped crying
11.4.91.	Putting classical music tape on	Jumped up and down, flapping his hands.
15.4.91.	Colin spinning bells - very loud	Child came close and watched intently but put his hand over both ears.
16.4.91.	Singing A Good Morning@ (child's name)	Stopped crying
16.4.91.	Spinning bells	Stopped crying
17.4.91.	Singing A Good Morning@ (child's name)	Stopped crying
17.4.91.	Singing A Good Morning@ (child's name)	Stopped crying
18.4.91.	Putting classical music tape on	Stopped screaming and kicking
18.4.91.	Singing Incy Wincy Spider	Calmed down a little from having a tantrum.
	Classical music tape	

Observations 19.4.91.

Autism causes to inhibit on occasions. Loves singing and listens intently. A Incy Wincy Spider@ and A Round and round the garden@ are his favourites. During the latter humming along tunefully and appropriately, stopping when anticipating tickling at end. With sound making toys creates sound and experiments with stopping/ starting at source. Also responding to quieter A squeaky@ toys. Turned when name spoken in conversation. If in good mood will co-operate nicely for distraction, but does frequently choose not to respond.

RECORDING RESPONSE TO SOUND (child with SLD)

Name:

<i>Date</i>	<i>Sounds / Situation</i>	<i>Responses</i>

BEHAVIOURAL DEFINITIONS OF RESPONSE (1)

(Kershman & Napier 1982)

The presence or absence of a response to auditory stimulus is recorded up to 10 seconds after the stimulus has ceased.

A response is considered to be any change in the pre-stimulus state of behaviour.

When 2 or more responses are observed, all are recorded.

The INTENSITY (or strength) of response is recorded using the following code:

0	No Response	Child does not appear to perceive stimulus. Remains in pre-stimulus state.
1	Low Response	Child responds with minimal activity for only a brief moment. Presence of response may have been difficult to determine.
2	Medium Response	Child exhibits an obvious response, but with only moderate interest. Reacts then reverts back to pre-stimulus state.
3	High Response	Child exhibits an intense response and is completely occupied by response to the stimulus.

BEHAVIOURAL DEFINITIONS OF RESPONSE (2)

(Kershman & Napier 1982)

Definitions for recording CHILD BEHAVIOURS:

No response

Cessation of activity

Quieting -child discontinues vocalisations

Increased activity -any motion of child's body parts that is initiated.

Jerk/Startle (Extension) -child shows sudden involuntary movement with limbs extending outwards.

Jerk/Startle (Inflexion) -sudden involuntary movement with limbs drawing inward.

Crying

Laughing

Smiling

Eye blinking

Eye widening

Eye localisation

Head turning (localisation)

Body localisation

Reaching

SPEECH DISCRIMINATION TESTS

Kendall Toy Test

Distractors: mouse, book, string, glove, plane

Toy	Named as	Toy	Named as
house		cow	
spoon		shoe	
fish		brick	
duck		cup	
gate		plate	
SCORE: at dBA +/- lipreading		SCORE: at dBA +/- lipreading	

Manchester Picture Test*/Junior*/Short Word Lists/Other

Score at dBA +/- lipreading

Examples of Expressive/Receptive Language

EXAMINATION OF EARS

TYMPANOMETRY

SUMMARY

RECOMMENDATION

Signed Educational Audiologist

Signed Medical Officer

Copies to: