Assessing the hearing of people with learning difficulties, especially those with profound and multiple learning difficulties, is rarely easy. Their use of hearing, furthermore, may be greatly affected by their wellbeing and by environmental factors, and it is difficult for clinical assessment to predict these effects. Staff or carers who work with such clients day by day are well placed to carry out on-going observation, and to interpret clients' responses. This paper suggests an approach to assessment that does not require expert knowledge of the processes involved in hearing: rather, it requires expert knowledge of the individual who is being assessed. It identifies a range of factors which may affect functional hearing, suggests how their effects may be recorded and considers some of the implications for programme and environmental planning.

People with learning difficulties are more likely than the general population to have impaired hearing (Kropka & Williams, 1986), and learning to identify and understand sounds may be difficult, even for those who hear them clearly. People with visual impairments, in particular, need to make optimal use of auditory information, but learning to do so is far more difficult without the reinforcement provided by vision.

Clinical assessment of hearing provides information on hearing thresholds (the intensity at which someone can just hear a sound) across different frequencies. Clinical assessment is designed to compare one person's hearing with that of the rest of the population. To this end, standard sounds are generally used, in excellent acoustic conditions.

For most people, clinical assessment provides appropriate and sufficient information. Early in life we become very skilled in using hearing, differentiating relevant sounds from background noise, for example, and
attending selectively to the sounds we find relevant. With people who have
developed the full range of auditory skills allowed by their level of hearing,
clinical assessment information generates accurate predictions about how
well they will be able to hear in different situations.

People with learning difficulties, however, may not have developed good
auditory skills. They may be able to hear much better, and/or make much
greater use of auditory information, in some situations than in others, and it
may not be easy to predict how particular conditions will affect them. For this
reason, it may be important to assess an individual's response to a range of
sounds presented in the range of environments which make up their world.
This process may lead to greater understanding of the factors which
(positively or negatively) affect the individual's use of hearing, and so allow
carers, educators and therapists to create a better auditory environment for
the person. The individual's response is not compared to other people's, but
to their own responses to different stimuli or under different conditions.

Those who work with people with learning difficulties day by day are ideally
placed to record and interpret their clients' responses. The approach
suggested below, and summarised in Figure 1, should assist staff or carers to
clarify the factors affecting an individual's use of hearing, even if their
understanding of the hearing process is sketchy. It allows assessment to
begin with sounds to which the person already responds, rather than
demanding responses to specified sounds which may be unfamiliar. For
people with learning difficulties, and especially for those with profound and
multiple learning difficulties, assessment should take place over time, in
familiar conditions, with responses recorded and interpreted by someone who
knows the person well.

Terry: Functional Hearing Assessment

Terry's functional hearing assessment will be described to illustrate the
process. Terry is fifteen and has profound and multiple learning difficulties,
with very restricted movement and a severe visual impairment. He is thought
to have a hearing loss and to gain very little information from sounds. He
spends much of his time in a very noisy environment, to which he seems to
pay little attention. He sometimes cries and sometimes laughs, but it is not
always clear why he does so.

Which Factors May be Affecting the Person's Use
of Hearing?

Many factors may affect how well a person can use their hearing at any given
moment. Using auditory information takes energy - something which we
never notice, because most of us always have sufficient energy available for
our skilled use of good hearing. People with multiple disabilities, however, may not be able to hear well, or move well, or see well, or understand well. All these things may be frustrating and tiring to attempt. Factors affecting the person's well-being may, in this sense, literally affect how well they can use their hearing. 'He can hear when he wants to' or 'she can hear it, she heard it yesterday' are inappropriate conclusions for this population. In addition, of course, some hearing impairments may cause fluctuating hearing levels - notably conductive impairments preventing sound from being efficiently transmitted in the ear. 'Glue ear' is a common cause of conductive impairment.

Some of the factors which may affect the use of hearing are summarised in Figure 2. They can be divided into 'internal' factors, which relate to the well-being of the individual, and 'external' factors, which relate to the environment. Some people with multiple disabilities show a marked delay in responding to stimuli, and this can make it difficult to identify the stimulus to which they are responding. Some people respond in what seems an exaggerated way to particular sounds, or particular frequencies of sound.

If someone has difficulty maintaining their balance when walking, they may be more able to understand and respond to sounds when they are seated and feeling secure. Any additional disability may compound the individual's problems in using hearing. In ordinary babies, responses to sounds become progressively more sophisticated with age, so developmental level may affect hearing function (responses to sounds are discussed more fully below).

Whether a person is familiar with a sound, and how much they like the person or object or activity creating it, may also affect their response.

People with good hearing can differentiate relevant sound from irrelevant noise when the former is only slightly louder than the latter. People with impaired hearing need a greater difference in intensity levels. People with learning difficulties, in addition, may have difficulty in appropriately classifying sounds as relevant or irrelevant. Hearing aids will amplify all sounds. Background noise (such as a radio playing) may therefore affect how well someone can hear.

The acoustic qualities of the environment (for example, reverberation) will affect the sounds a person hears. Visual or other sensory distractions within the environment may make it more difficult to attend to sounds, because the individual's attention is attracted by a new stimulus, or because the person can cope with only a limited amount of sensory input at any one time. If the skills of discriminating and ignoring some stimuli are not well developed, then the person may attend to information from only one sensory channel at a time, or may 'shut down' if there is too much input.
The first stage in the assessment process is to consider which of these factors might affect the person being assessed. Some factors will be instantly dismissible by those who know the person very well. Others may be known to apply, and may already be considered within the person's learning and living environments. Some may not have been considered previously, or it may not be clear whether or not they affect the person's responses. These, in particular, need to be borne in mind throughout assessment.

**Terry: Factors Affecting His Use of Hearing**
Terry has epilepsy, and his alertness is known to be affected by his epilepsy and his general state of health. He does no wear hearing aids. Staff wonder whether his laughing and crying might perhaps relate to sounds he hears, although they do not think that he recognises sounds. It is unclear whether his responses to stimuli are delayed, or affected by the familiarity of sounds or the level of background noise. So these factors are identified for further assessment.

**How Does the Person Respond to Sounds They Hear?**
People at very early developmental levels may not respond to experiences in ways that are easy to interpret. Systematically recording their responses to a range of sounds, in a range of conditions, can give a wealth of information about how quickly they respond, which behaviours seem to indicate liking or disliking or listening, and the intensity of their responses. Observation should involve sounds which form part of everyday routines (observed while the routines are taking place), and may also involve the same sounds presented under different (perhaps quieter) conditions. In this way patterns of behaviour can be identified, interpreted and recognised when they recur.

**Terry: Patterns of Response**
The Affective Communication Assessment (Coupe et al, 1985) was used to record Terry's responses to a range of sounds. Patterns of behaviour were identified by those who know him well as meaning that he likes a sound, or dislikes it, or is startled by it, or is listening intently. These patterns are shown in Figure 3. An interesting discovery is that he reacts immediately to the presence of a sound (for example, blinking), but does not show any emotional response (such as smiling) until five to ten seconds later.

**What is the Person Responding to?**
If someone responds to some sounds but not to others, it may be possible to work out which aspects of the sound lead to the response. If so, other sounds with similar qualities can be used to help extend the person's use of
hearing. If someone shows a marked preference for environmental sounds rather than voice, for example, this may suggest new activities to introduce, or suggest ways of using sound cues to help the person anticipate activities about to happen.

Some useful aspects to consider are listed in Figure 4. Some, such as loudness (or intensity) may be a matter of preference (some people prefer quieter sounds, others big, brash noises) or they may indicate a possible hearing impairment which should be investigated further. This might be the case, for instance, if someone consistently responds to very quiet low-pitched sounds, but only responds to high-pitched sounds which are much louder.

A sound close by a person naturally sounds louder than one further away, but a closer sound is also more likely to be accompanied by other cues. Someone shouting from across a room, for example, may not be perceived as relevant, whilst someone speaking quietly next to the person may be visible, warm, scented and perhaps in physical contact.

The importance of background noise levels has already been discussed. Because we are so adept at selectively attending only to sounds we consider relevant, it can require conscious effort to become aware of background noise, particularly when the sounds involved are very familiar. It may be worth distinguishing three levels: extremely quiet; some background noise, but not enough to require a raised voice in conversation; and background noise loud enough to cause a speaker to raise their voice to be heard.

People with learning difficulties may respond more readily to familiar than to unfamiliar sounds in general, because the former are more likely to carry meaning for them. Unfamiliar sounds may seem meaningless, or threatening, and so may be ignored, or feared.

Once carers or staff are aware of the behaviours which express listening, liking, disliking or other responses, they can identify which sounds the person responds to over a period of time. It may be that the person responds to some sounds very consistently, alerting whenever the biscuit tin is rattled, for example, or appearing frightened when members of staff shout. It may be that the person shows no apparent response to certain sounds. Other sounds may sometimes get a response, sometimes not. By considering how someone responds, when they respond and what they respond to, a detailed account of their functional hearing can be constructed. This may give information about the factors which enable the person to make best use of their hearing.

**Terry: Sounds to Which He Responds**

Terry seems to prefer high-pitched sounds to low-pitched ones, smiling to a spoon chinked on a cup, a bell and a toy making a high-pitched sound on several occasions. His responses to low-pitched sounds are generally more
muted. Sudden loud sounds startle him, and if they persist he shows dislike and may cry, although this reaction is delayed. His everyday environment has high levels of background noise, and he shows few responses in this setting. If sounds are presented more quietly (at about the same volume as quiet conversation) in a room with no extraneous noise, he consistently responds. It was previously thought that he could not hear sounds at this level. It is difficult to attribute any distinction between familiar and unfamiliar sounds, or between voice or environmental sounds.

What Use is the Person Making of the Sensory Information They Receive?

Sensory input is interpreted to give us information about what is happening to us, and what may be about to happen. On the basis of this information, we decide how to behave, usually without being aware of the information processing involved. Ordinary babies develop the skills needed during the first years of life. People with teaming difficulties, especially those with profound and multiple learning difficulties, may not have developed the range of skills we take for granted. Analysing their responses may make us more aware of how they are able to use sensory information.

Gleason (1984) identifies six levels of response: awareness, attention, localisation, discrimination, recognition and comprehension. Awareness level responses are unintentional, reflexive responses such as starting or blinking. Intentional responses such as stilling to listen, or increasing or decreasing vocalisation, indicate attention; the person is aware that there is a sound though they may not know the source.

Localisation involves identifying where a sound comes from. In ordinary babies this skill develops in a set sequence, with sounds at the sides of the infant the first to be located, and those above and behind the head the last. Hearing or visual impairment may hinder localisation. Someone with better hearing in one ear than the other will have difficulty in localising, and someone who cannot see a sound source may not turn towards it.

Discrimination involves knowing whether two sounds are the same or different, for example, smiling each time a favourite song is heard. At this level the person may be able to discriminate a familiar relevant sound from background noise, and may be able to link a sound to its source.

Recognition (for example, knowing one’s name) indicates that the sound and its meaning have been remembered. The final level, comprehension, shows an ability to recognise sounds and relate their meaning to what is happening currently, for example, looking towards the coat rack when the car is heard outside the window.
Generally, these levels form a developmental sequence, although localisation may be affected by sensory impairment. A person will not, however, respond to all sounds at the same level; they may be able to recognise very familiar sounds, for example, but show no discrimination between unfamiliar ones.

**Terry: Use of Sensory Information**

Terry rarely attends to sounds if background noise levels are high. In a quieter environment, he shows preferences for certain sounds, indicating some discrimination. On one occasion, it was noticed that he seemed thirsty some ten seconds after water had been poured into a jar. This might have been coincidence, but the delay in response was consistent with his behaviour on other occasions. It has always been assumed that he cannot recognise sounds, and so (further hindered by his delayed responses) staff have not looked for evidence that he can do so. Those working with him plan to investigate this further, to identify whether other familiar sounds may hold meaning for him.

**How Can the Person’s World be Modified to Allow and Encourage Better Use of Hearing?**

By this stage, carers or staff will have a clearer picture of which factors (from Figure 2) affect their client’s functioning. Those in the first (‘internal’) category may have implications for how staff work with the client (for example, making sure that the person is appropriately and comfortably positioned) or may require an acceptance by staff or carers that the person’s use of hearing will be better on certain occasions (for example, someone with epilepsy may be able to gain more meaning from sounds at some times than at others). Planning programmes which focus on one thing at a time may be appropriate; someone with poor balance may need to expend a lot of energy on walking, for example, and may find it much easier to hear and listen when seated.

‘External’ factors can always be optimised, although constraints (for example, financial restrictions) may obstruct the process. Hearing aids should be well-maintained, and staff should be trained in their use and maintenance. Carpets and curtains will improve the acoustic quality of the environment, as will close-fitting doors and windows. Rubber tips on chair legs and soft-soled shoes will also help. Background noise can be reduced (although rarely eliminated) and other sensory distractions curtailed. It may well be worth developing a distraction-free area, with plain walls and good acoustics, for one-to-one interaction.

Encouraging people to develop their functional hearing may involve attention to how sounds are presented. Are they offered consistently? Is the individual given enough time to respond? Can the individual’s range of preferred sounds be extended by using sounds which share some of the same
properties? Can sounds be used as cues for events about to happen? The heightened awareness of staff or carers following the assessment process should encourage suggestions specifically designed for the individual, tailored to the individual's likes and needs.

**Terry: Strategies Following Assessment**

Terry's functional hearing seems to be better than had been thought, but his responses are greatly affected by environmental factors. Following assessment, a number of ideas are being tried out by staff working with him (see Figure 5). It must be stressed, however, that these ideas need to be evaluated over time. If Terry's use of hearing changes, then further modifications to the environment, and how sound is used with him, may become appropriate.

**Conclusion**

The assessment approach suggested in this paper will not give detailed or accurate information about an individual's hearing thresholds, or frequency-specific responses. It is designed to consider the effects of differing circumstances on hearing function, with carers or staff who know their client well taking the central role in assessment. Their observations form the basis for evaluation of how a person is responding to the sounds they hear every day, and which factors may affect the individual's response. This information, and the increased awareness which accompanies its collection, may help staff or carers to provide conditions encouraging a person with learning difficulties to make the best possible use of their hearing.

**Correspondence**

All correspondence should be addressed to Heather Murdoch, School of Education, University of Birmingham, Edgbaston, Birmingham, B15 2IT.

**References**

Figure 1 Assessment of hearing function

This approach to assessment uses information from people who know the individual were to answer the following questions:

Which factors may be affecting the person's use of hearing?

How does the person respond to sounds they hear? What do they do?

What is the person responding to? What are the properties of the sound?

What use is the person making of the sensory information they receive?

How can the person's world be modified to allow and encourage better use of hearing?

Each of the questions is addressed in detail in the text.
Figure 2 Factors which may affect a person's use of hearing

**Internal factors**

- hearing impairment; ear infections; earwax; tinnitus; general health; epilepsy; medication
- pain; discomfort; fatigue
- motivation; emotional state; stress
- hunger; thirst
- physical position
- demands of other disabilities
- developmental level
- relationship with the sound source

**External factors**

- whether hearing aids are worn
- whether hearing aids are working
- level of background noise
- familiarity or relevance of sound
- environmental distractions
- acoustic qualities of environment
- attitude of staff or carers involved in the activity
- intensity (volume) and frequency (pitch) of sound
- too much input to other senses

© Sense 2007