

Conventionally, hearing ability is assessed mainly through oral interaction with an audiologist (ISO 8253-3, 1996; American Speech-Language-Hearing Association, 1998). ~~Such an~~ Generally, the assessment ~~generally~~ contains two elements: ~~A~~ the hearing threshold evaluation and ~~a~~ the speech discrimination assessment. ~~As the first elements, the h~~ Hearing threshold level (HTL) is assessed using an audiometer that relies on the user's explicit responses, typically ~~via~~ by ~~pushing a~~ button ~~press~~ or by ~~an~~ oral response. HTL is the smallest ~~auditory~~ sound level of pure tone that a user can hear, and ~~obtaining a precise measure it~~ takes ~~considerable~~ time and concentration ~~to obtain a precise result~~. The HTL is evaluated ~~forat~~ both left ~~and~~ /right ears and at several frequencies, such as 250 Hz, 500 Hz, 1 KHz, 2 KHz, and 4 KHz. The initial ~~hearing aid~~ fitting is executed based on the HTL ~~evaluation~~-results ~~provided~~ by the audiologist. There are ~~various~~ theories ~~regarding the best approach to the initial~~ for fitting. ~~For example,~~ NAL-NL1 (Dillon, 1999) is one ~~such of the~~ standards ~~for initial fitting~~. This initial fitting enables the hearing aids to produce sound pressure levels ~~that are~~ over the user's hearing threshold. However, ~~this approach is not sufficient, given~~ -that ~~is not enough, because~~ the HTL test ~~does not assess~~ ~~is about~~ ~~the sound pressure level, not about the~~ speech discrimination. ~~The s~~ Speech signal consists of a mixture of many frequencies and is ~~constantly~~ ~~time~~-changing as time unfolds.

~~Then, the assessment of speech discrimination is conducted as the second elements,~~ ~~b~~ Because the ~~primary~~ purpose of ~~the~~ hearing aids is to facilitate ~~the~~ conversation, ~~speech discrimination should be a key component of any hearing aid assessment~~. A ~~s~~ Speech discrimination test evaluates the ability ~~to correctly~~ of distinguish ~~the~~ confusable ~~ing~~ words ~~correctly~~; ~~speech discrimination it~~ is roughly assessed by oral interaction with an audiologist. The general assessment procedure (without ~~the use of EEG~~) ~~occurs~~ is on a word-by-word basis (Nilsson, Soli, & Sullivan, 1994), ~~such that~~ and the user is instructed to listen ~~to~~ and repeat aloud whatever is heard or understood. ~~Because each word has special frequency features, the audiologist can use the user's errors to determine which frequencies need to be emphasized~~ ~~Once the user made errors to repeat, audiologist understands which frequency is needed to be emphasized, since each word has special frequency features~~. In an alternative procedure ~~At the other speech discrimination test,~~ the user has to respond to ~~the~~ speeches ~~played from a~~ the ~~evaluation test~~ CD by speaking or writing, ~~and it needs~~ a time and labor ~~intensive~~ process. ~~After the speech discrimination test was finished, a~~ Additional tuning is ~~done after the discrimination test, made,~~ if necessary.

An EEG measures potentials on the scalp surface, ~~thereby~~ and ~~reflecting~~ neuronal activity in the brain. Since ~~event-related potentials (or ERPs; Handy 2004)~~ (~~Handy, 2004~~), which are a kind of EEG signal, are automatically elicited to external stimuli, a user does not have to answer explicitly by choosing a correct key on the keyboard or ~~answering~~ by ~~saying~~ words. ~~Therefore,~~ ~~A~~ assessment based on ERPs could be a candidate ~~approach for of the~~ objective, ~~and~~ quantitative evaluation, ~~which is lacking in the conventional evaluation of hearing parameters~~.

Some EEG studies ~~have~~ dealt with the assessment of hearing ability. Possible analyses of EEG signals ~~include~~ are audio evoked potentials (AEP, a ~~specific~~ kind of ERP) (Burkar, Don, & Eggermont, 2007) and ~~a~~ Auditory steady-state response (ASSR) (Galambos, Makeig, & Talmachoff, 1981). ASSR was proposed as an assessment of HTL that uses a physiological response to 40 Hz auditory stimuli. If a user ~~does~~ ~~perceive~~ ~~pts~~ small auditory stimuli, the degree of synchronicity to 40 Hz increases. John and Picton (2000) proposed a method to ~~speed up~~ ~~fasten~~ the evaluation ~~using with~~ amplitude-modulated tones (~~John & Picton, 2000~~). This method utilizes multi-frequency modulated stimuli, and extracts the states of perception in multi-frequency by separating the mixed synchronicity. Naatanen and Picton (1987) showed that the