

# Letters to the Editor

## To the Editor:

I first want to applaud the recent work of Dr. Karin Neijenhuis and her colleagues on auditory processing disorders (APD). The field needs these types of insights and ideas brought forth in their recent articles on APD. However, I would like to comment on their article concerning the effects of hearing loss on the frequency patterns test and dichotic digits test, which appeared in the January issue of this journal (Neijenhuis et al, 2004). Dr. Neijenhuis and her colleagues have drawn comparisons from this particular study to studies that we had conducted previously, and reported greater effects of hearing loss for digit and pattern tests in their study than was the case for our earlier test studies. There are several points that Dr. Neijenhuis and her colleagues make in the article that I feel require further discussion. Hence, I do have some concerns and comments about the article referenced above. These are as follows:

1. First, I want to be clear that we have stated numerous times that central tests can be, and often are, affected by peripheral hearing loss. Our view is best stated by this published statement: "In spite of the fact that virtually all central tests can be affected by the presence of a peripheral hearing loss, some tests [discussed in this chapter] appear to be less affected than others" (Baran and Musiek, 1999, p. 402). Having stated this, other comments are warranted.
2. The dichotic digits test used by Dr. Neijenhuis and her colleagues was markedly different from the digits test we developed and the one that is used most frequently in the United States (Musiek, 1983). Dr. Neijenhuis's digits test involved the presentation of three digits to each ear—a procedure similar to the one used in the original dichotic test developed by Kimura in 1961. We realized early on that the presentation of three digits to each ear was not a viable clinical approach; hence, our digit procedure was developed in order to present only two naturally spoken digits to each ear. To put it simply, Dr. Neijenhuis and her colleagues have not

used the same test for which the claims are made. I agree with their view that cochlear hearing loss can influence central test results (see Baran and Musiek, 1999). In a 1991 article (Musiek et al, 1991), we acknowledged that hearing loss did in fact influence performance on the dichotic digit test, and we offered the use of different norms for the digits test for individuals with high-frequency hearing loss. However, the critical issue here is that it is not appropriate to compare two markedly different tests in regard to how they are influenced by hearing loss. Interestingly, despite using a more complex dichotic test, Dr. Neijenhuis and colleagues' own data show no statistical difference between the control and hearing loss groups for right ear and overall scores on their digits test.

3. Another factor deserving consideration when comparing the results of the current study with those of our earlier investigation is that the test used in the present investigation is likely to be both acoustically and phonetically different than the version of the dichotic digits test that we used based on language differences between the United States and the Netherlands. Again, it is difficult to make direct and fair comparisons of the test findings given these language issues. Additional differences in these dichotic tests are reflected in the performance of normal-hearing subjects for the respective studies. The control group's scores in the Neijenhuis et al study (2004) fell in the low 80s and mid-70s, whereas the mean performance scores for our control subjects were in the high 90s (%) for both ears, with only a 2 to 3% standard deviation.
4. The frequency pattern test results of the current investigation are indeed different from our earlier study (Musiek et al, 1987). In this article we showed an effect of hearing loss, but not to the degree that was documented in the present study by Dr. Neijenhuis et al (2004). In our 1987 study, six out of 50 ears were below the norm (75%), but this represented only 12% of the ears with cochlear pathology.

It is difficult to reason as to the differences between the two studies. However, upon careful inspection there may be some differences between the studies that might be worth pondering. (1) In our 1987 article (Musiek et al, 1987), our cochlear subjects were screened to be sure no neurological factors were present—it does not appear this was the case in the present study, or at least it was not mentioned. The authors did mention that the acoustic reflex test was used to rule out retrocochlear involvement; however, this procedure is not affected by high brainstem, subcortical, or cortical lesions and assesses function only through the low brainstem level. (2) Our cochlear subjects were younger with a mean of 47 years (range of 20–60 years), whereas the mean age in the Neijenhuis et al study was 54 (range of 38–69 years). (3) There are also some noteworthy differences in the presentation levels used in the two studies. Dr. Neijenhuis and her colleagues administered the pattern tests at 60 dB SPL. According to information presented in Figure 1 of their article, at least one of their subjects demonstrated a 50 dB HL or 57.2 dB SPL hearing loss at 1000 Hz. Since the frequency pattern test is composed of tones near 1000 Hz, this is a key frequency. This means that at least one subject and possibly others were administered the patterns test at less than 3 dB sensation level (SL), which is an insufficient presentation level for the test stimulus if one wants to measure optimum performance. In our 1987 study, we administered the frequency pattern test at 50 dB SL to our cochlear population. Granted, we have shown no difference between administering the frequency pattern test to normal-hearing subjects at 20 and 50 dB SL, but SLs less than 20 dB can be problematic and not fair to the test. Sufficient audibility is needed to make accurate frequency discriminations on the frequency pattern test (probably more so than on the duration patterns where there is no frequency differential in the tones). (4) Another consideration is that in the current study, only 30 patterns were administered (diotically); in the 1987

study, 30 patterns were presented to each ear independently.

In their conclusion, Dr. Neijenhuis and colleagues state, “pattern recognition tests still proved unsuitable for detecting auditory processing disorders” in patients with hearing loss. However, by their own statistics there was no difference between the performance of control and hearing loss groups for duration patterns. There was only a difference for frequency patterns (as was discussed above). This fact should be stated as such, and the results along with the interoperation of the significance of these results for the two tests should not be aggregated. Frequency and duration patterns should be viewed as two individual tests, not subtests (Musiek et al, 1990); hence, the language used in defining them can be more precise.

I am sure that Dr. Neijenhuis and her colleagues would agree with what we have stated many times. That is, to optimally utilize central auditory tests they should be applied to those with normal hearing sensitivity. We also realize, however, that on some occasions clinical demands may require APD evaluation of those patients with peripheral hearing loss. Therefore, further research and discussion on the influence of hearing loss on central auditory tests is warranted and encouraged.

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## REFERENCES

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## Editor's Note:

In response to my invitation to reply to this letter to the editor, Dr. Neijenhuis indicated her concurrence with Dr. Musiek on most points.