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Letter to the Editor

Response to the Letter to the Editor From Moncrieff (2017) Regarding de Wit et al. (2016), “Characteristics of Auditory Processing Disorders: A Systematic Review”

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Purpose: The purpose of this letter is to respond to Moncrieff’s (2017) letter to the editor, “Response to de Wit et al., 2016, ‘Characteristics of Auditory Processing Disorders: A Systematic Review,’” published in May 2017 by the *Journal of Speech, Language, and Hearing Research*.

Conclusion: We believe that our original conclusions are valid given the limited evidence that is currently available about the etiology of auditory processing disorders (APD). The focus of our systematic review was to identify the characteristics of children with a diagnosis of APD or a

suspicion of APD. The results of our study showed that the characteristics of these children are not specific or limited to the auditory modality but are multimodal instead. In our view, it is incorrect to use the diagnosis APD, because there is not necessarily a specific auditory deficit in a large group of children suffering from listening difficulties. Before we start using any new diagnoses, a better insight into how bottom-up and top-down processes are precisely involved in listening needs to be developed. In addition, more insight is needed with respect to the similarities and differences between the different developmental disorders of children.

We thank Dr. Moncrieff (2017) for her response to our article, “Characteristics of Auditory Processing Disorders: A Systematic Review” (2016), and we are pleased to have received the opportunity from the *Journal of Speech, Language, and Hearing Research* to give a response. We believe that the lack of clarity about

auditory processing disorders (APD) can be reduced by conducting the debate. It is our contention that discussions like these contribute to a better understanding of the problems experienced by children with listening difficulties, so that the care and treatment of these children can be optimized. Moncrieff (2017) disputes the conclusion of our systematic review (de Wit et al., 2016) and claims that the conclusion that “the listening difficulties of children with APD may be a consequence of cognitive, language, and attention issues rather than bottom-up auditory processing” (p. 384) is not consistent with the current developments in the field of APD. According to Moncrieff (2017), progress has been made in the (a) clinical diagnosis and (b) treatment of bottom-up APD in children.

The primary aim of our systematic review (de Wit et al., 2016) was to determine the characteristics associated with (suspected) APD and to provide a summary of the differences in performance between children diagnosed with APD or children suspected of APD and typically developing children on behavioral, physiological, and neuroimaging measurements. It was not our intention to investigate the auditory

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processing skills of children with a primary diagnosis other than APD, such as learning difficulties (LD), dyslexia, or specific language impairment (SLI), as this was not appropriate to the research question of our review. In addition, such reviews have already been published in the past (e.g., Bailey, 2012; Bailey & Snowling, 2002; Hämäläinen, Salminen, & Leppänen, 2012; McArthur & Bishop, 2001; Miller, 2011).

We agree with Moncrieff (2017) that it is valuable to investigate whether the performance of children with APD is different from the performance of children with another developmental disorder, such as SLI, dyslexia, LD, attention-deficit/hyperactivity disorder, or autism spectrum disorder. That is why we carried out a second review (de Wit et al., 2018) in parallel with the first review (de Wit et al., 2016), in which we described the differences and similarities in performance to different outcome measurements between children diagnosed with APD, SLI, dyslexia, attention-deficit/hyperactivity disorder, and LD. The results of this second review (de Wit et al., 2018) confirm our initial observation that the behavior of children with a diagnosis of APD broadly corresponds to the behavior of children diagnosed with another developmental disorder. We found only minimal differences between the performance of children diagnosed with APD and children diagnosed with a different developmental disorder. Together with the results of our first systematic review (de Wit et al., 2016), in which we found that children diagnosed with APD or children suspected of APD have poorer performance across multiple domains, we argue that there is not necessarily a specific auditory deficit in a large group of children currently diagnosed with APD. Otherwise stated, these results support the idea that in a group of children with listening difficulties there seems to be a more general neurodevelopmental syndrome or supramodal global deficit instead of a specific auditory processing disorder.

Moncrieff (2017) suggested in her response that the line of causality may also run in the other direction: The similarities found between children with various disorders can also justify the fact that there is a bottom-up processing deficit rather than a top-down processing deficit in children with the various diagnoses. We believe this is one of the main points in the discussion around the concept of APD. The question whether listening difficulties in children result from problems with bottom-up auditory sensory processing or top-down modulating cognition is certainly legitimate (Moore, 2015). There is no doubt that intelligence, working memory, attention, and executive functioning are associated with children's auditory processing skills (e.g., Barry, Tomlin, Moore, & Dillon, 2015; British Society of Audiology [BSA], 2017; Dharmani, Leung, Carlile, & Sharma, 2013; Gyldenkerne, Dillon, Sharma, & Purdy, 2014; Moore, Ferguson, Edmondson-Jones, Ratib, & Riley, 2010; Sharma, Dharmani, Leung, & Carlile, 2014; Tomlin, Dillon, Sharma, & Rance, 2015; Tomlin & Rance, 2016). However, exactly how bottom-up processes and top-down processes are involved in listening is not yet clear. In fact, it was argued that it is impossible to separate both processes

(Bellis, 2003; BSA, 2017; Moore, Rosen, Bamiou, Campbell, & Sirimanna, 2013). According to Moore (2012), the integration of bottom-up, auditory "sensory" information with top-down, multimodal "cognitive" information is necessary in the case of auditory perception. Based on the results of our systematic review, it cannot be concluded with certainty that listening difficulties of children are caused only by deficits in bottom-up or top-down processes. However, the results of our systematic review show that the problems of children with listening difficulties are multimodal and that the listening difficulties of children may also be a consequence of cognitive, language, and attention issues. This is in support of an interaction between bottom-up and top-down processes in case of listening difficulties. This is the exact reason why we argue it to be incorrect to use the diagnosis APD in these cases, because it is often unclear whether the difficulties are caused exclusively through auditory sensory problems.

We agree with Moncrieff (2017) that "efforts to differentiate specific bottom-up weaknesses that can respond to analytic treatment approaches should be strongly encouraged" (p. 1449). However, at the moment, it seems unclear whether the listening difficulties of children with a diagnosis of APD are exclusively caused by a bottom-up deficit or a top-down deficit. Moreover, currently available tests in today's clinical practice do not allow distinguishing both processes. The results of our systematic review show that there is more than just a bottom-up disorder in children currently diagnosed with APD. Differences between children with (suspected) APD and typically developing children were found in auditory, visual, and cognitive functioning as well as in communication, language, reading, and auditory brain measures such as auditory event-related potentials and otoacoustic emissions. As a consequence, we argue that APD is not an appropriate term to use as a diagnostic label. This is not to say that the auditory function of children should not be properly investigated and dealt with. We agree that if audiological assessment indicates that there is an underlying auditory problem, such as amblyaudia or a spatial processing disorder, this must be remediated or taken into account before further treatment can take place. This is also why we recommended multidisciplinary evaluation of listening difficulties, including an audiologist, speech-language pathologist, and behavioral scientist. The audiologist is responsible for determining whether there is an auditory component that can explain the listening difficulties and has to minimize confusing cognitive and language-processing variables during testing (Chermak, Bamiou, Iliadou, & Musiek, 2017).

Before we start using new diagnoses, we believe that a better insight is needed into how bottom-up and top-down processes are precisely involved in listening. In addition, more insight is needed in the similarities and differences between the different developmental disorders of children. The studies of Moncrieff and colleagues on the dichotic listening skills in children with dyslexia certainly contribute to this (Moncrieff, 2011; Moncrieff & Black, 2008; Moncrieff, Keith, Abramson, & Swann, 2016). In our recent systematic

review (de Wit et al., 2018), we found that subtests of the Listening in Spatialized Noise–Sentences test (Cameron & Dillon, 2007) could possibly differentiate between children with listening difficulties and children with language, reading, and attention disorders. We think the functioning and disabilities of a child with listening difficulties must be identified in a broad and holistic manner by a multidisciplinary team of specialists. Rather than focusing on the disorder itself, the possible reason for the problems must be identified in as much detail possible, and individual treatment should focus on remediating and/or managing those identified characteristics.

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