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Case report: Earworms on the perpetual music track – biological parameters, and an evolutionary perspective of music

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Abstract

The concept of a "perpetual music track", PMT, as special form of musical imagery, was introduced by Steven Brown (2005) [1] for a syndrome observed by composers and musicians. The author of this paper (WMS), a biologist specialized in bioacoustics and familiar with earworms (EWs), experienced the Steven Brown's syndrome of musical imagery for seven years and he recorded and analysed his perceptions with the tools of his trade. Here, WMS presents a brief case Report. Results and discussion will be published in another Journal.

WMS proposes to view the biological underpinning of the perpetual music track as a complex neural module that generates a perpetual sequence of discrete time frames, ready to be filled with auditory information from the current or past ambient soundscape. This module presumably evolved as an evolutionary ancient memory module for the management of the perception and selective suppression of ambient noise.

Abbreviations: EW: Earworm; PMT: Perpetual Music Track; WMS: Wolfgang M. Schleidt

Case report

WMS is a 93-year-old right-handed academic biologist [2]. He grew up within the European musical tradition: a concert grand piano in the living room and music written in notes mostly in 4 beat or 3 beat measures, varying around 440 Hz. The first fragments of classical music he remembers were the introductory measures of the second movement of Haydn's Surprise Symphony, which his mother played on that piano. He took piano lessons but never really mastered the keyboard. He did not like vocal music, with a few exceptions (e.g., Schubert's Lieder), and never became a member of a choir or other assemble of musicians. But classical music remained a dear companion until his seventies, when hearing aids became a necessity, the quality of hearing deteriorated, and the best orchestras sounded out of tune.

During the last days of WW II WMS barely survived an explosion of 2 tons of TNT nearby, resulting in a permanent hearing loss of 60 dB at 4 KHz, and proportional impairment between 2 and 8 kHz, still visible in 1983 (Figure 1). As a consequence, WMS' attention was funnelled into the octave below his upper hearing range of 22 kHz at that time. He observed vocalizations of various small rodents, measured their hearing thresholds far into the range of ultrasound and became a pioneer of bioacoustics and animal communication.

Living with headphones during his professional life, WMS was subject to occasional noise abuse, but he was also aware of his hearing thresholds and documented the age-related hearing loss. Hearing aids became a necessity at age 70 (1997), and a hiss-sounding tinnitus became a permanent part of background noise. Even with hearing aids, his participation in public discussions became increasingly difficult. He stopped formal teaching in 2003, presented his last public lecture in 2009 [3], and restricted his scientific communications to the internet.

WMS' earliest recollection of a transient EW dates back to an episode at age 20, after a live concert, when on the way home the hymn from the fourth movement of Brahms' first symphony he had heard half an hour earlier, appeared in his ears. Such transient EWs became part of his daily life.

This condition changed dramatically on June 11, 2014, when WMS, after listening to a popular version of the "Ode to joy" of Schiller/Beethoven [4] for about two hours. The "Ode to joy" continued as an

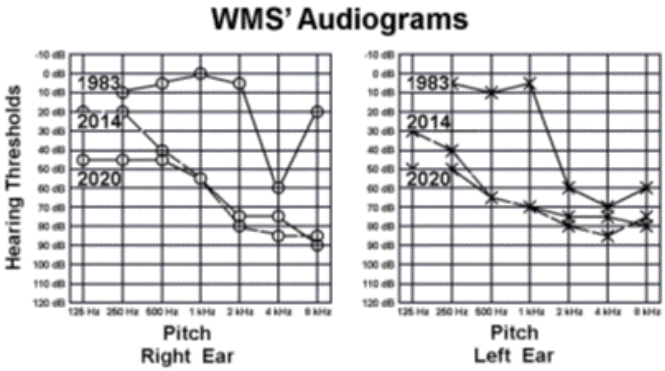

Figure 1. WMS' Audiograms, measured on October 28, 1983 (University of Maryland, College Park), on May 28, 2014, two weeks before the start of his "Perpetual Music Track" (Hansaton, Vienna) and on January 3, 2020 (ENT KH Hietzing. Vienna)

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EW for the rest of the day, was audible when he awoke in the middle of the night and was still present the next morning.

When WMS realized that he was unable to kill the worm he managed to replace it – first with something sombre: the choir of Brahms' Deutschem Requiem ". . . denn alles Fleisch es ist wie Gras . . ." As he succeeded with this substitution, he tried familiar children's songs and in the long run WMS became an experienced DJ of his EWs, that have been running perpetual, relentlessly ever since 2014.

Over the years, WMS' EW repertoire deteriorated: long melodies were reduced to a few measures and only occasionally sweet melodies from the depth of his subconscious appeared.

Starting in January 2020, in connection with an episode of sudden hearing loss on WMS' left ear, a pulsatile tinnitus appeared in this ear, synchronous with his heart beat, competing in loudness with the EWs. While previously no correlation between heart beat and EW-beat were found (see Results), the pulsatile tinnitus became the EW's pacemaker. In April 2020 a different variety of pulsatile tinnitus occurred in his right ear. By July, both pulsatile tinniti had disappeared, and there remained only the hissing tinnitus and the EWs on his perpetual music track.

During the ongoing data analysis, a striking regularity of the EWs' lengths in multiples of two, four, and eight notes caught our attention, and between February and May 2020 the EWs' lengths was recorded with a stopwatch several time a day. Most EWs consisted of 32 tones.

Toward the end of this study WMS's EWs were reduced to simple rhythms with a limited melodious range (within the musical interval of a third or a fifth) and remained his constant companions. But he remained able to switch from a boring rhythmical beat to "Tochter aus Elysium" or "Amazing Grace" in an instant, and listen to it for a while, before the "EW of the day" had taken over, once again

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