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Temporal Integration Windows for Auditory Statistical Estimation

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ABSTRACT

Sound textures result from the superposition of many similar acoustic events, as arise from falling rain or galloping horses. Such sounds are often approximately stationary, and are thought to be represented in the auditory system with time-averaged statistics. Recent work has suggested that texture statistics can be averaged over windows as long as several seconds [McWalter and McDermott, 2018]. However, it remains unclear whether all statistics are averaged over the same extent, or whether averaging windows might differ across statistics, potentially adapted to the variability of the statistic. We measured integration windows for individual classes of statistics from an auditory texture model [McDermott and Simoncelli, 2011]. In a psychophysical experiment, listeners judged which of two sound textures was most similar to a reference texture. We measured performance for different stimulus durations, using textures synthesized to vary in individual classes of statistic. We found texture discrimination improved with stimulus duration but then leveled off, presumably signaling the averaging window used to estimate the statistics. However, the performance asymptote occurred at different durations for different statistics (from ~150ms to ~2.5s). The results reveal that the extent of time-averaging varies across texture statistics, as might be required for robust estimation of the statistics.

Keywords: Sound texture, Temporal integration, Natural sound statistics