Listening effort discounting

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Abstract:
Under adverse listening conditions, such as those caused by background noise, speech processing can be cognitively demanding. Factors such as age, hearing ability, and working memory capacity have been objectively shown to impact the success of perceptual processing, but their relationship with subjective listening effort remains largely unexplored. A challenge in this work has been a lack of clarity regarding how to best measure subjective listening effort. In the present study, we examine individual differences in listening effort for young and older adults using a discounting paradigm adapted from behavioral economics. Using speech-in-noise presented at multiple signal-to-noise ratios (SNRs), on each trial subjects were offered the choice between completing an easier listening trial (presented at 20 dB SNR) for less monetary reward, and a harder listening trial (presented at either 4, 0, -4, -8, or -12 dB SNR) for more monetary reward. By varying the amount of the monetary reward offered for the easier option, the subjective value of performing effortful listening trials at each SNR could be assessed. A preliminary analysis of the data indicates that older adults (N = 32) discount more than younger adults (N = 27), opting to accept less money in order to avoid more difficult SNRs. A summary statistic of these discounting scores, area-under-the-curve (AUC), was used for further individual differences analyses. Pure-tone averages (i.e., hearing thresholds) and working memory capacities (measured using the Word Auditory Recognition and Recall Measure) significantly correlated with discounting AUCs for older, but not younger, adult participants; specifically, the direction of the correlations indicated that older adults with poorer hearing and smaller working memory capacities were more likely to choose easier trials worth less money (r = -0.48, p = 0.005; and, r = 0.56, p < .001, respectively). Additionally, across SNRs older adults had lower scores for sentence intelligibility (i.e., proportion of keywords correctly recognized) than the young adults (p < .001). These findings suggest that discounting paradigms are a useful approach for assessing subjective effort, and subjective effort measured this way relates to individual differences in hearing and cognitive ability.

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Poster Only