

Reference: Zamarippa A, Hammit JS, Reel LA, Lau M, Hicks CB. (2019). Effect of Auditory Task Type on Subjective and Objective Measures of Listening Effort in a Pediatric Population.

Context: Pupillometry measures changes in pupil dilation to infer cognitive load. The relationship between pupil dilation and cognitive load is directly proportional. Examining the relationship between objective and subjective measures of listening effort provides a comparison of physiological and behavioral characteristics of the inference of cognitive load and degree of perceived effort, respectively.

Objective: To determine whether measurements of pupil dilation, subjective ratings of perceived effort, and sentence recognition accuracy varied by listening condition in an adolescent population. Objective and subjective measures were also assessed for degree of correlation.

Design: A cross-sectional, within-subjects repeated measures design.

Setting: Texas Tech University Health Science Center Speech, Language, and Hearing Clinic, Lubbock, TX.

Specimens, Patients or Other Participants: 40 participants met inclusion criteria and passed the hearing screening (9 females, 11 males) met the capture accuracy criteria (>70% capture accuracy). Participants ranged from 12-17 years of age, with an average age of 13.95 years.

Method(s): Sentence recognition was performed in four conditions: CQ, C12, C6, and C0, which represent quiet (CQ), a signal to noise ratio of +12 dB (C12), +6 dB (C6), and 0 dB (C0). Maximum pupil dilations for each trial were averaged across each condition to determine pupil dilation per participant. Accuracy was measured for correct responses in the sentence recognition task. Listening effort was measured subjectively through ratings of perceived difficulty.

Results: Individual repeated measures ANOVA indicated that pupil dilation [ $F(3, 33) = 1.892$ ;  $p = .150$ ] was not significant, subjective ratings [ $F(3, 33) = 13.146$ ;  $p = .00$ ] were significant, and percent correct scores [ $F(3, 33) = 19.248$ ;  $p = .00$ ] were significant. Results from a Pearson Product correlation analysis revealed no correlation between pupillometric measures and subjective rating measures.

Conclusions: Pupil dilations increased in more difficult conditions (0 SNR and +6 SNR) as compared to easier conditions despite the inability to attain statistical significance. Significance in subjective rating indicates that participants perceived the task to be more difficult and require more effort when more noise was present. Percent correct scores decreased as conditions increased in difficulty, indicating that more effort was being allocated to listening and processing speech. Future directions include increasing the sample size, mixing pupillometry with use of goggles, and shortening the duration of the experiment.