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INTRODUCTION

Self-efficacy is the confidence in one's ability to successfully undertake behaviors to achieve specific goals^{1,2}. This **goal** of this study was to examine the effects of amplification on listening-self efficacy, or the belief listeners have in their ability to plan and perform actions necessary to understand speech in different listening situations. We **hypothesize** that improving audibility through hearing aids will improve listening self-efficacy. We further hypothesize improvement will be greatest in one-on-one conversations in quiet and focused attention on a single speech source, with less improvement when listening in complex auditory scenes. Possible sources of variability in results such as patient- and device-centered factors explored. Should patient- or device-centered factors be associated with improved listening self-efficacy, better rehabilitation models and techniques could be developed.

PARTICIPANTS

Participants	Gender	Age		Right PTA		Left PTA		Average Hours of Daily HA Use		MoCA Score	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
170	97 F 73 M	67	10.9	40.64	11.88	40.42	11.74	11	4.54	26.82	2.18

Demographics of participants with sensorineural hearing loss, including gender (F = Female, M = Male), age (years), pure-tone average (PTA in dBHL; right and left; 500, 1000, 2000 Hz), average length of time using hearing aids (years; self-reported), and Montreal Cognitive Assessment (MoCA) score (≥ 26 score criteria for normal cognition).

All subjects were recruited across UW and UI as a part of a larger study investigating the relationship between signal-to-noise-ratio and hearing aid success. All subjects provided consent to participate (UW IRB #44197)

- 170 adult binaural hearing aid users
- Fluent speakers of American English
- Bilateral, symmetrical, mild to moderately-severe sensorineural hearing loss
- Montreal Cognitive Assessment (MOCA) screening indicating adequate cognitive function for testing ($> 21/30$)³
- Bilateral HA users: minimum of 8 hours/week

METHODS

Listening Self-Efficacy Questionnaire (LSEQ)³:

18 items, 3 subscales and 1 global score: dialogue in quiet (DQ), directed listening (DL), complex listening (CL), global self-efficacy (SE) averaged across all items.

- Higher scores indicate greater listening self-efficacy.

Hearing Aid Status:

Verifit test-box measures and real-ear measurements were taken to quantify hearing aid performance.

- Audibility (Speech Intelligibility Index; SII). Rear ear response to a 65 dB speech input.
- Noise reduction (dB of gain reduction). Test box with "Air Conditioning" stimulus at 70 dB.
- Directionality (average dB difference between the front and back microphones across frequency). Stimulus at 70 dB, signal-to-noise ratio of 0 dB.
- Hearing aid experience and use information from items 16, 17, and 18 of the Satisfaction with Amplification in Daily Life (SADL) questionnaire.

NEO Five Factor Inventory (NEO-FFI):

60 items, 5 personality domains: Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A), and Conscientiousness (C).

- Higher scores indicate a greater association towards the particular domain.

RESULTS

A linear mixed model was fitted to the data with hearing aid status (unaided, aided) and subscale (DQ, DL, CL, SE) as within-subject factors. Between subject factors included patient-centered (age, gender, PTA, personality) and device-centered (lifetime/current/daily hearing aid use, SII, directionality, noise reduction) variables. Interactions were included first, but removed from the model if non-significant. Only complete datasets were included in the analysis (n=165).

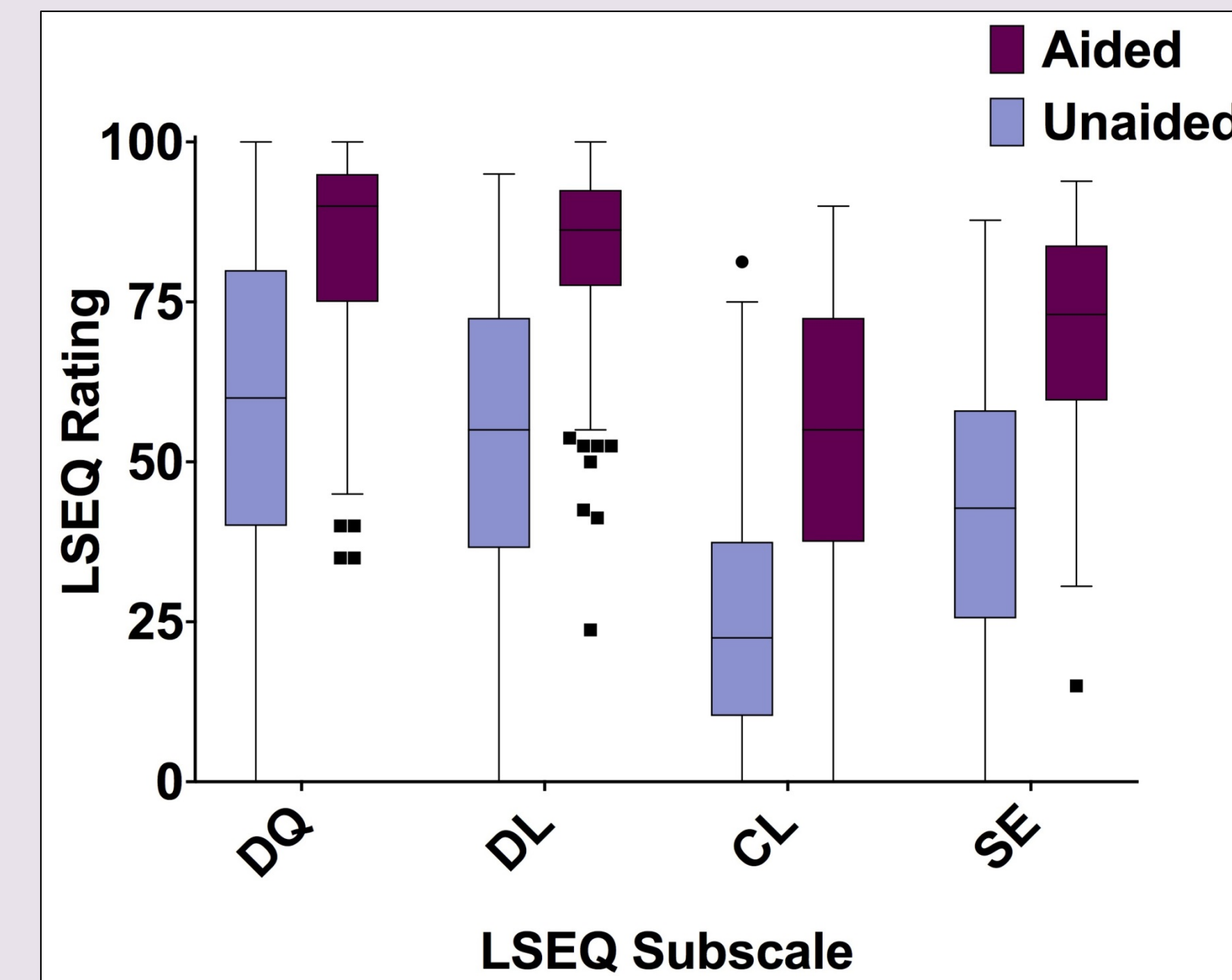


Figure 1. Boxplot of LSEQ scores for each condition showing median (mid-line), 1st to 3rd quartile, and variance within 1.5 interquartile ranges of the lower and upper quartiles. Outliers are shown as individual points. Overall effect of hearing aid was significant [$t(156)=10.49$, $p<0.0001$] with higher self-efficacy scores reported for aided than unaided listening. However, the interaction between subscale and hearing aid was not significant ($p>0.05$).

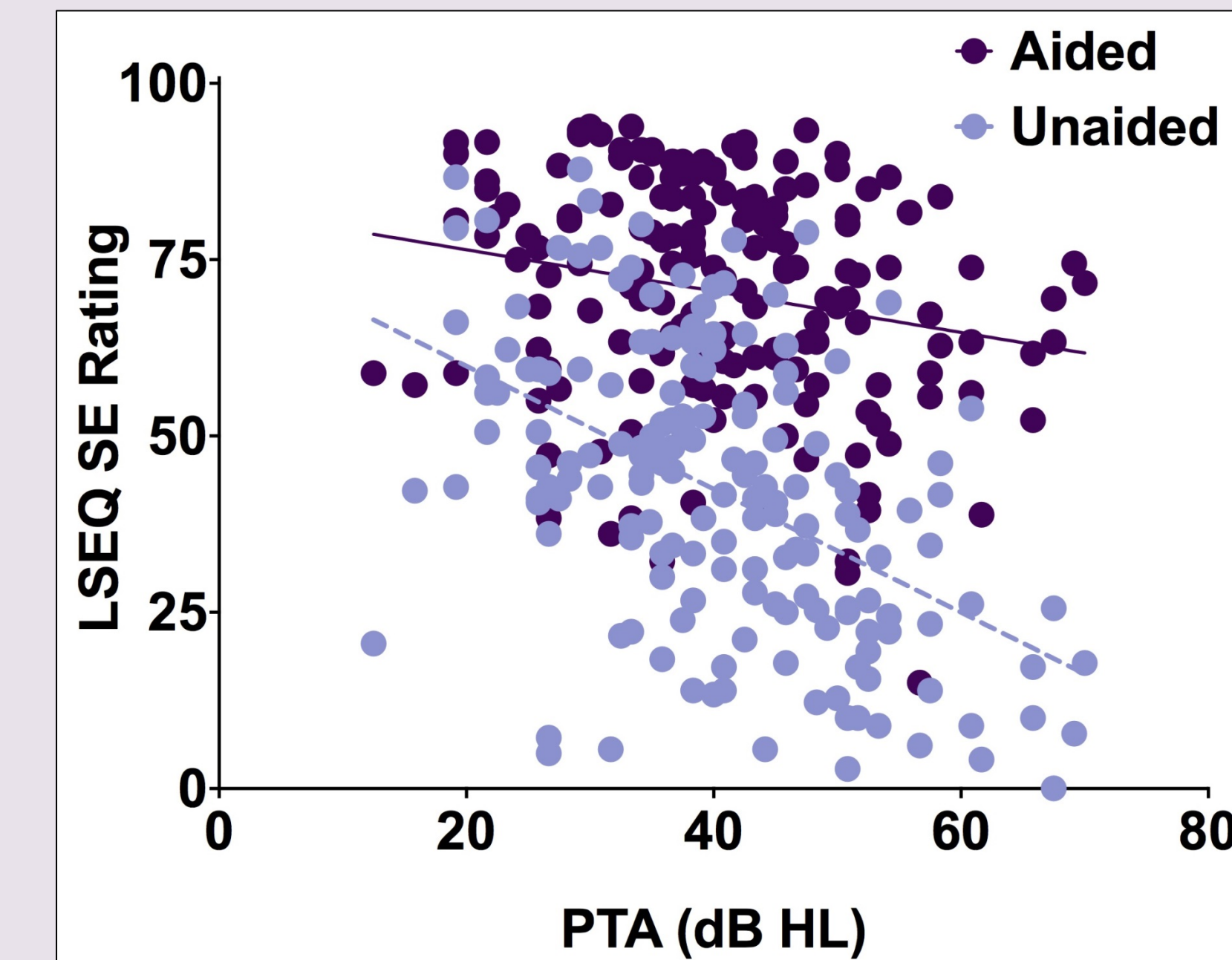


Figure 2. Scatterplot of LSEQ aided and unaided scores in relation to PTA. The interaction between hearing aid status and PTA was significant [$F(1, 1141)=111.24$; $p<0.0001$]. As PTA increases, the improvement in listening self-efficacy also increases. The main effect of PTA on LSEQ was also significant [$F(1, 153) = 19.98$; $p<0.0001$].

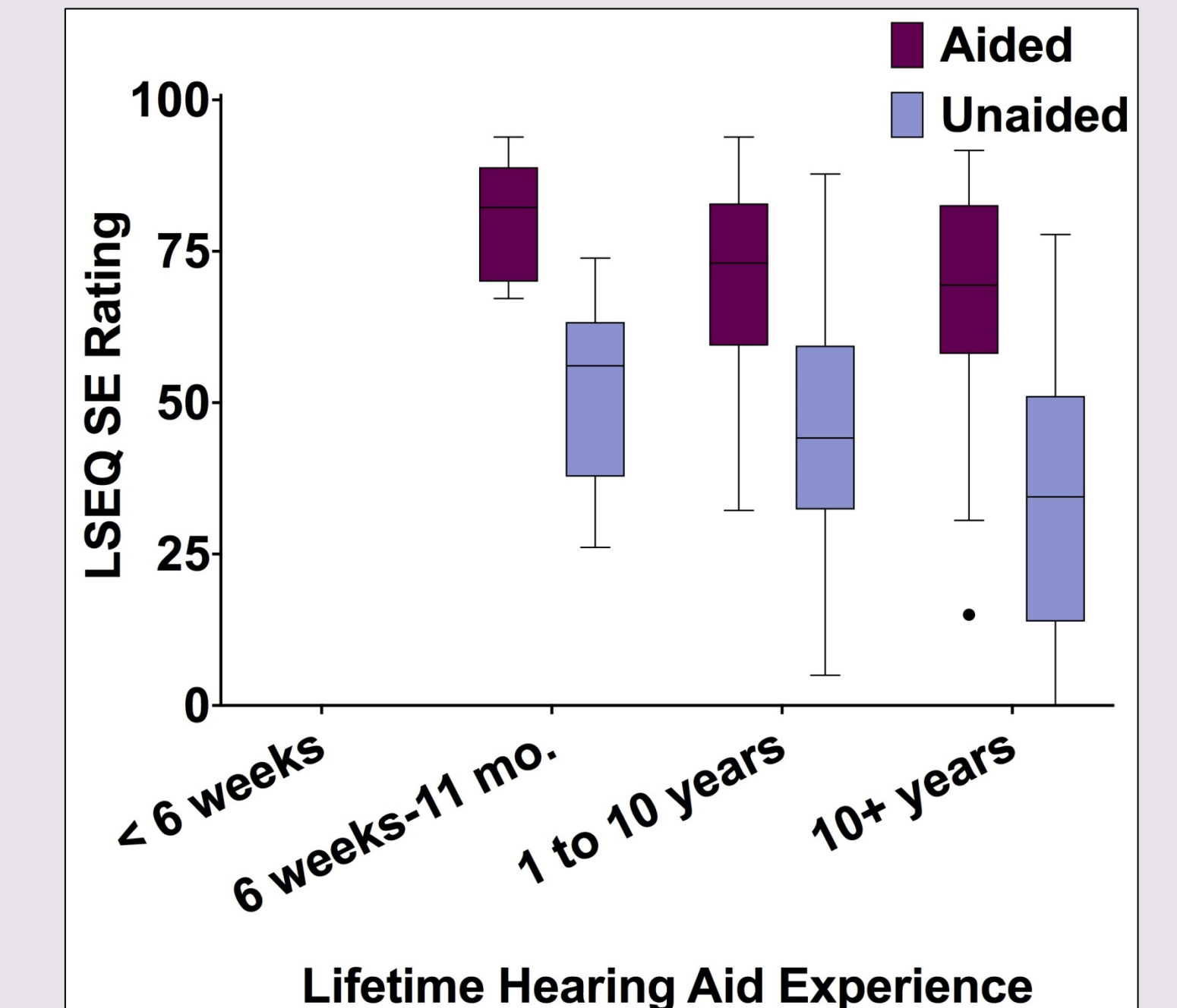


Figure 3. Boxplot of aided and unaided LSEQ SE scores in relation to their lifetime experience wearing hearing aids (SADL, item 17). The interaction was significant between hearing aid status and lifetime experience [$F(2, 156)=4.68$; $p=0.01$]. The main effect of hearing aid experience was not significant. Compared to individuals wearing aids for greater than 10 years, those wearing aids for less than a year report less improvement in LSEQ by 7 points.

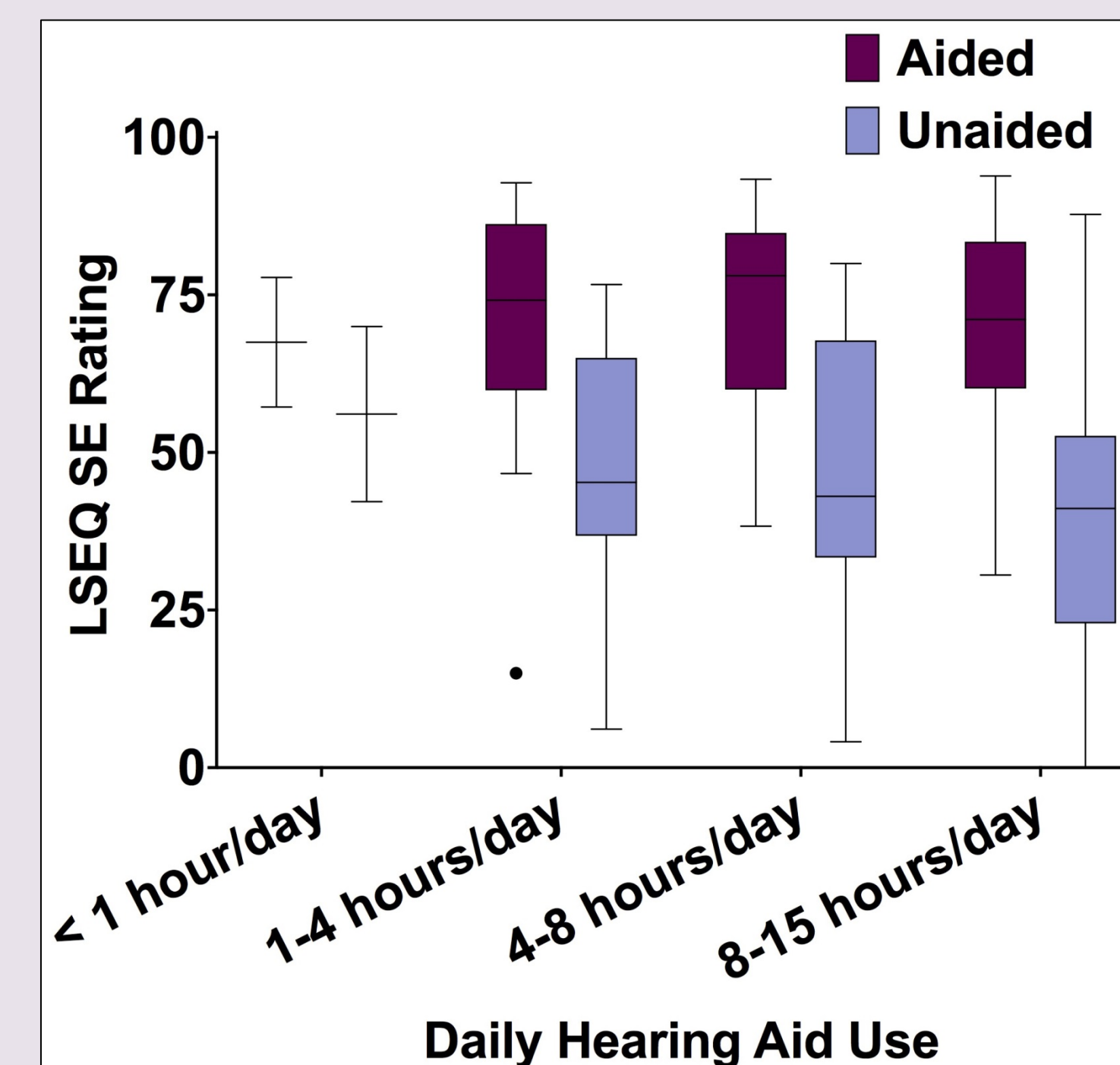


Figure 4. Boxplot of LSEQ SE scores for unaided and aided listening and the relation to daily hearing aid use (SADL, item 18). The interaction was significant between hearing aid status and daily use [$F(3, 156)=5.88$; $p=0.0008$]. The main effect of daily hearing aid use was not significant.

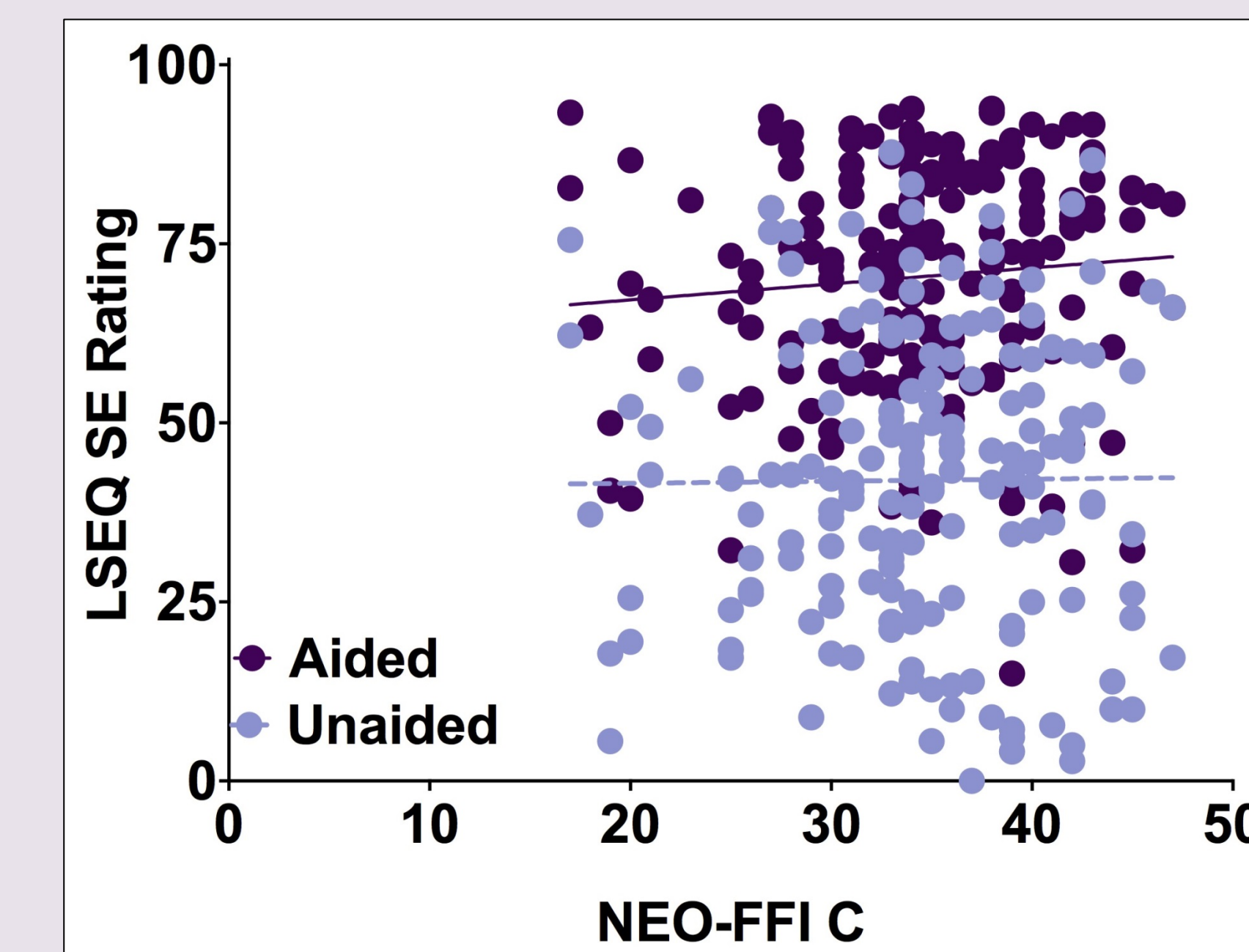


Figure 5. Scatterplot of LSEQ SE aided and unaided scores in relation to score on the NEO-FFI Conscientiousness domain. Higher levels of Conscientiousness were associated with slightly greater improvement in LSEQ under aided listening conditions [$F(1, 1141)=9.14$; $p=0.0026$], but the main effect of Conscientiousness was not significant.

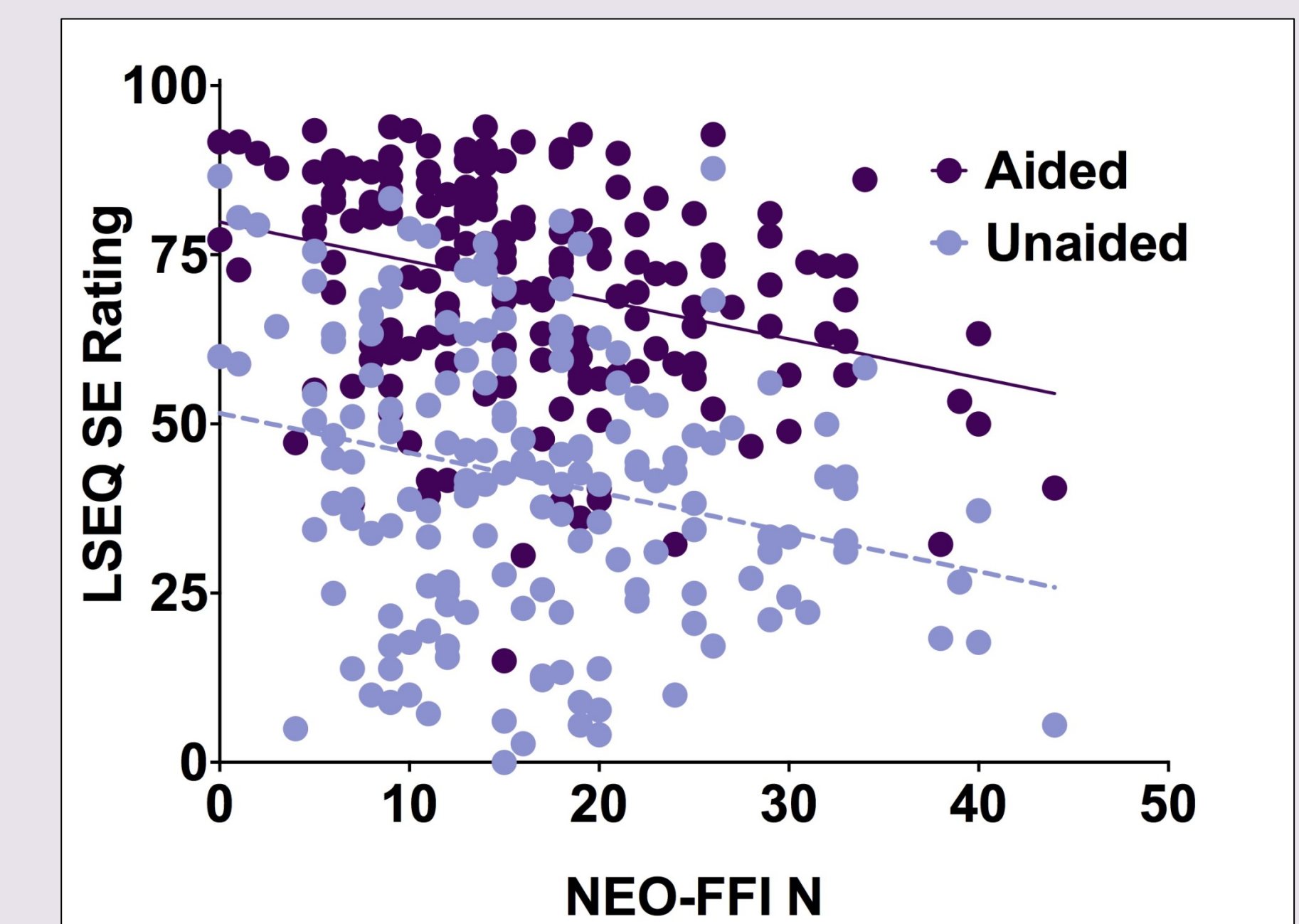


Figure 6. Scatterplot of LSEQ SE scores in aided and unaided conditions in relation to score on the NEO-FFI Neuroticism domain. Higher levels of Neuroticism were associated with poorer listening self-efficacy [$F(1, 153) = 11.53$; $p=0.0009$], and the interaction with hearing aid status was not significant.

CONCLUSIONS

- Listening self-efficacy was higher than unaided listening by approximately 28% (Figure 1).
- The improvement in aided listening self-efficacy did not depend on a particular listening environment (Figure 1).
- Greater degrees of hearing loss were associated with poorer listening self-efficacy, but were also associated with the most improvement between unaided and aided conditions (Figure 2).
- Greater hearing aid use (either lifetime or daily; Fig 3 & 4) was associated with greater improvements in listening self-efficacy. The causal characteristics of this relationship are unknown and require further study.
- Higher levels in the conscientiousness domain of personality result in larger increases in listening self-efficacy with hearing aids (Fig 5). Higher levels of Neuroticism were associated with poorer listening self-efficacy (Fig 6).

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