Decision-Making Factors Impacting
Sound Acceptability Judgements by Young Typical Hearers

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Introduction

Standard audiological evaluations help determine if a person is a candidate for amplification; however, they do not determine how a person will acclimatize to or accept amplified sound. Hearing-aid wearers often report aversiveness to amplified sound, though not always related to loudness (Picou, 2020). In fact, varying levels of loudness can be adverse to some listeners, and it has been recommended that the individual's perspective of the sound should be taken into account. Sound acceptability is a multi-faceted construct encompassing factors such as annoyance, aversiveness, and pleasantness (Johnson et al., 2012) . However, the factors listeners use to make judgements about sound acceptability is not clear. Understanding these factors could inform hearing aid programming and counseling.

Aims
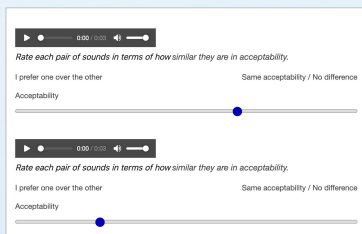
This project aimed to evaluate the possible factors that listeners consider when making judgments about sound acceptability.

Hypothesis

We anticipated that participants would consider loudness, duration, and pitch when judging acceptability.

Methods

- 53 self-reported typical hearing young adults participated in this descriptive study (M age=22.36 years; 39 female).
- Participants completed an online survey comprising demographic questions, the International Mini Markers personality test (Thompson, 2008), the Perth Emotional Reactivity Scale (Preece et al., 2018), the Digital Sound Acceptability Test (D-SAT; Huber and Johnson, 2020), and a sound comparison task using 1-second sound clips from the D-SAT.
- The D-SAT comprises 21 everyday sounds, randomized in two blocks. Participants were asked to rate the acceptability of these single-sounds using an 11-point Likert scale.
- The sound comparison test comprises 1-second clips of 9 sounds sampled from the D-SAT presented in comparison pairs. Participants were asked to rate how similar the acceptability of the sound clips were using a 100-point Likert scale. Each sound was compared to each of the other sounds, resulting in 45 comparisons..
- All sound files were calibrated relative to a 65 dB SPL speech passage. Participants were instructed to adjust their device volumes so that this passage was "Comfortable."

Rate each pair of sounds in terms of how similar they are in acceptability.

I prefer one over the other   Same acceptability / no difference

Acceptability

Rate each pair of sounds in terms of how similar they are in acceptability.

I prefer one over the other   Same acceptability / no difference

Acceptability

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Analyses

Overall sound acceptability similarity ratings were compared on a spatial plot (Figure 1) using a multi-dimensional scaling (MDS) analysis. Two dimensions were determined to be driving factors for these participants' judgements. While MDS shows the relationship between variables, the factors involved in the dimensions are left to interpretation. Loud sounds were rated high on dimension one while softer sounds were rated lower on this dimension, suggesting participants may have considered loudness when rating similarities, especially for loud sounds. Dimension two, however, had no clear trends involving loudness or pitch. There is somewhat of a trend with duration of these sounds; though it is not distinct. This suggests that dimension two may be driven by other factors unrelated to the acoustic aspects of the sounds.

To explore whether dimensions might be due to participant factors, participants' averaged similarity scores were plotted for each dimension (Figure 2). Interestingly, dimension one showed a general grouping of participants, rating either generally high or low on the dimension. However, dimension two was more variable and showed no clear grouping of participants.

To understand which participant factors might have impacted judgements, participants' demographics, personality traits, emotionality, and single-sound ratings for the D-SAT were compared.
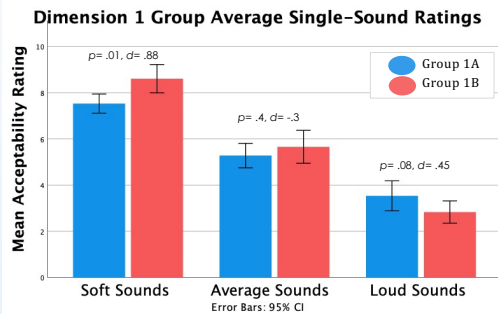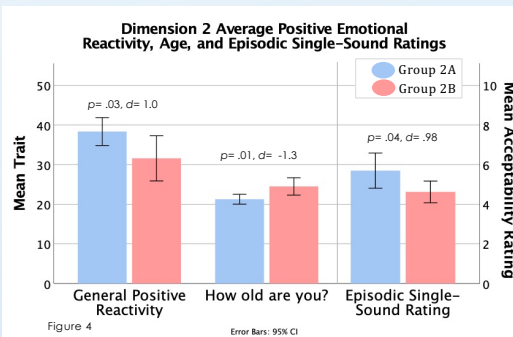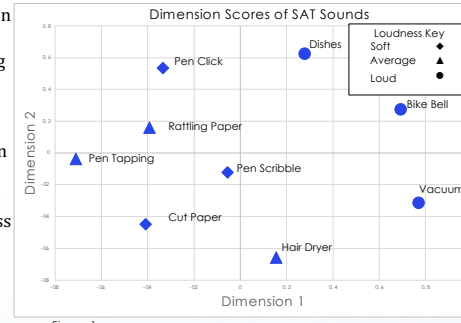

Figure 1

Figure 2

Figure 3

Figure 4

Error Bars: 95% CI
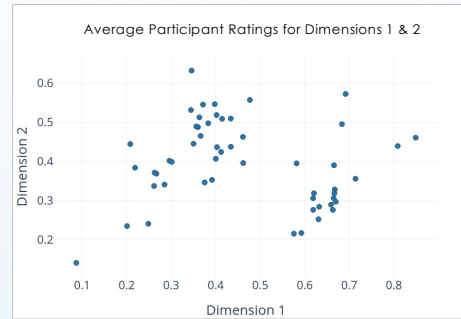
Dimension 1:
Dimension one was divided into the two naturally occurring groups for these comparisons: Group 1A (0-0.5) and Group 1B (0.55-1). While no demographic, personality, or emotionality differences were seen, t-tests revealed that there was a tendency of Group 1A to rate soft sounds as less acceptable (p=.01) and loud sounds more acceptable (p=.08) than Group 1B (Figure 3). This suggests dimension one may be related to expectations about or preferred loudness.

Dimension 2:
Dimension two did not have a clearly defined grouping of participants. To further evaluate this group, participants were separated into Group 2A (<.3, n=11) and Group 2B (>.5, n=10) for comparison. When this dimension's demographics and single-sound acceptability ratings were compared, there were some group differences. Group 2A tended to have higher positive emotional reactivity (p=.03), was younger in age (p=.01), and rated episodic single-sounds as more acceptable (p=.04; Figure 4). This suggests dimension two may be related to emotionality, age, or the duration of the sound.

Discussion

- MDS was used to illuminate dimensions that individuals use when making judgements about the sound acceptability of auditory stimuli. For these young adult typical hearing participants, there were some noticeable differences in the way they determined if two sounds were similar or different in acceptability. Sounds in each loudness category tended to be rated as similar in acceptability; however, there were factors unrelated to the acoustics of sound that also seemed to be influential.
- Positive emotional reactivity was a significant factor for dimension two, with a large effect size between the sub-groups.
- Another factor that seemed to impact the dimension two sub-groups was the age of participants.
- Finally, episodic single-sound ratings were different between the dimension two sub-groups. Since the comparison sounds were all 1s in length, it is possible that participants recalled the full single-sounds heard earlier in the survey while comparing the acceptability of the 1s sound clips. While it is unclear why ratings of full-length sounds may be related to acceptability similarity ratings, it does support previous research that postulates individuals consider more than just loudness when evaluating sound acceptability.

Conclusion

- MDS analysis results suggest that several factors influenced participants when making judgements about sound acceptability. The most salient dimension of their decision-making is related to loudness. The second dimension is likely related to the duration of the sound and may be influenced by age or emotionality of the person. It is possible that previous experiences with sounds impact in-situ judgements about sound acceptability.
- The limited age range and emotionality of this group may not show the full impact of these factors. Additionally, normal-hearing young adults comprised this participant group, and it is unclear if these are the same dimensions that hearing aid wearers use when making sound acceptability decisions about amplified sounds. Future research expanding the age range and hearing abilities of the participant group may provide more insight into how aging, hearing loss, and acoustic characteristics of amplified sounds might impact sound acceptability.

References:
Hernandez, A. R., Chalupper, J., & Powers, T. A. (2006, July). An Assessment of Everyday Noises and Their Annoyance. The Hearing Review.
Huber, R., & Johnson, J. (2021). Huber Exploring the Relationships Between Sound Acceptability, Emotional Reactivity, and Personality. https://doi.org/10.13140/RG.2.2.30795.52005
Johnson, J. (2012). Development of the Sound Acceptability Test (SAT) [Poster]. American Auditory Society Convention, Scottsdale, AZ. https://harlmemphis.org/files/1913/7753/3743/SAT2012_Poster_embedded_fonts.pdf
Picou, E. M. (2020). MarkeTrak 10 (MT10) Survey Results Demonstrate High Satisfaction with and Benefits from Hearing Aids. Seminars in Hearing, 41(01), 021–036. https://doi.org/10.1055/s-0040-1701243
Preece, D., Becerra, R., & Campbell, G. (2018). Assessing Emotional Reactivity: Psychometric Properties of the Perth Emotional Reactivity Scale and the Development of a Short Form. Journal of Personality Assessment, 101(6), 589–597. https://doi.org/10.1080/00223891.2018.1465430
Thompson, E. R. (2008). Development and Validation of an International English Big-Five Mini-Markers. Personality and Individual Differences, 45(6), 542–548. https://doi.org/10.1016/j.paid.2008.06.013

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