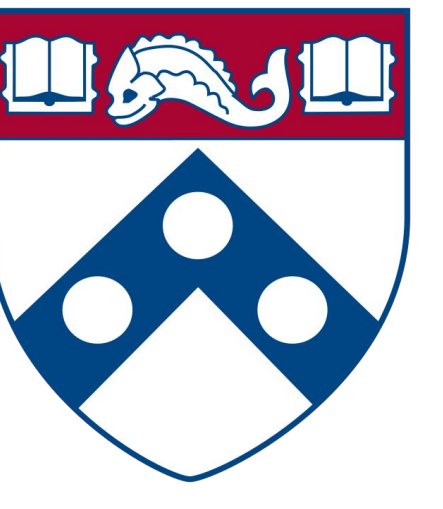


Evaluation of Direct Streaming versus External Audio on Music Enjoyment Among Cochlear Implant Recipients



Valora Wong¹; William Lee²; Rashmi Acharya²; Kevin Wong, MD³; Hannah Kaufman, AuD³; Jason A Brant, MD³; Tiffany Hwa, MD³

¹College of Arts and Sciences, New York University, New York, NY 10012; ²College of Arts and Sciences, University of Pennsylvania, Philadelphia, PA 19104; ³Department of Otorhinolaryngology - Head and Neck Surgery, University of Pennsylvania Health System, Philadelphia, PA 19104

Introduction

- Cochlear implant (CI) technology has transformed auditory rehabilitation, enabling individuals with severe-to-profound hearing loss to discern speech and sound.
- Music perception and enjoyment among CI listeners is diminished due to a complex interplay of subject-specific factors and limitations related to current implant technology.
- Direct streaming has been implemented in CI technology, but its impact on music listening is unknown.
- The objective of this study was to compare music enjoyment between direct stream (DS) and external audio (EA).

Methods

- This was a prospective cohort study in which CI listeners were presented with original, premixed, and subject-mixed excerpts from five major genres of music.
- Subjects rated the recordings based on enjoyment using a visual analog scale (VAS).
- The task protocol was administered via either DS or EA, and a retest was requested with the opposite method of stimulus delivery within 4 weeks.
- Inclusion criteria included age > 18 years, English-speaking status, and a minimum of 3 months of cochlear implant experience.

Results

- 13 adult subjects participated in this study, 38% (n=5) were bilateral implantees and the remaining subjects used a hearing aid and a CI. 7 subjects completed retests.

Mean Age ± SD, Range (years)	64 ± 13.80 (38-81)
Mean CI Experience ± SD, Range (years)	5 ± 5.63 (1-15)
Mean Period of Deafness ± SD, Range (years)	19 ± 13.38 (2-43)
Female (n, %)	69.2%
Male (n, %)	30.8%
History of Music Training = Yes (n, %)	46.2%

Table 1. Subject Demographics

- There was no statistically significant difference in the overall DS scores (mean score=6.16, SD 2.72, range 0-10) vs EA (mean score = 6.64, SD 2.14, range 0.33-10) [p=0.12].
- Subject ratings for EA presentation of premixed music stimuli trended higher than DS stimuli in the overall population (DS mean 5.81, SD 2.83, range 0-10 vs EA mean 6.70, SD 1.98, range 2-10; p=0.05).
- However, there was otherwise no statistically significant difference in overall subject ratings or mean difference based on stimulus type or musical genre.
- When evaluating the 7 retest subjects only, a notable difference was observed with higher subject ratings for the EA presentation (mean 7.14, SD 1.95, range 2-10) vs DS (mean 5.42, SD 2.19, range 0-9.33) [p<0.0001] regardless of genre or mix type.

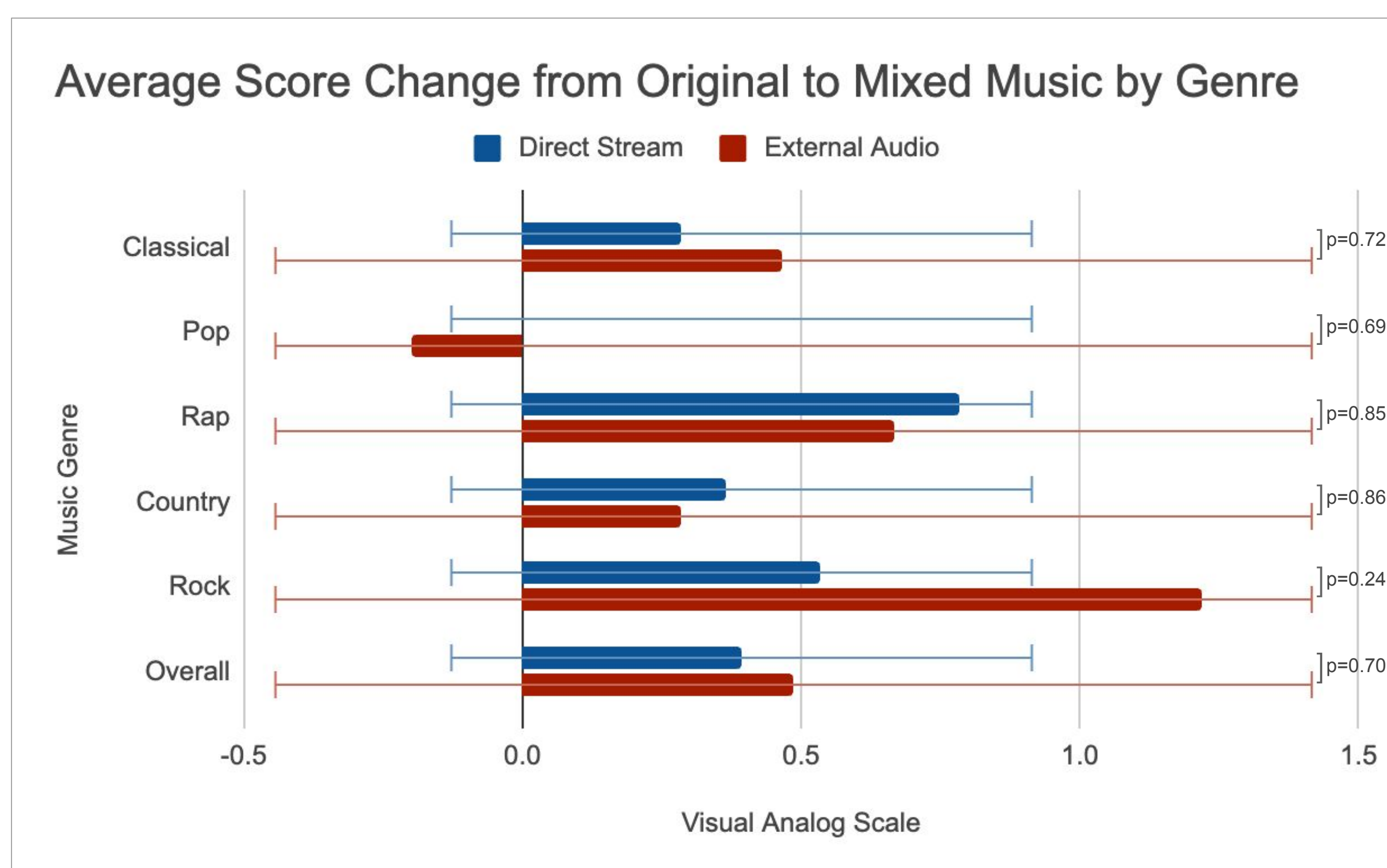


Figure 1. Change in score from original to mixed music using average enjoyment measures (musicality, pleasantness, naturalness) based on music genre. Error bars depict two standard deviations.

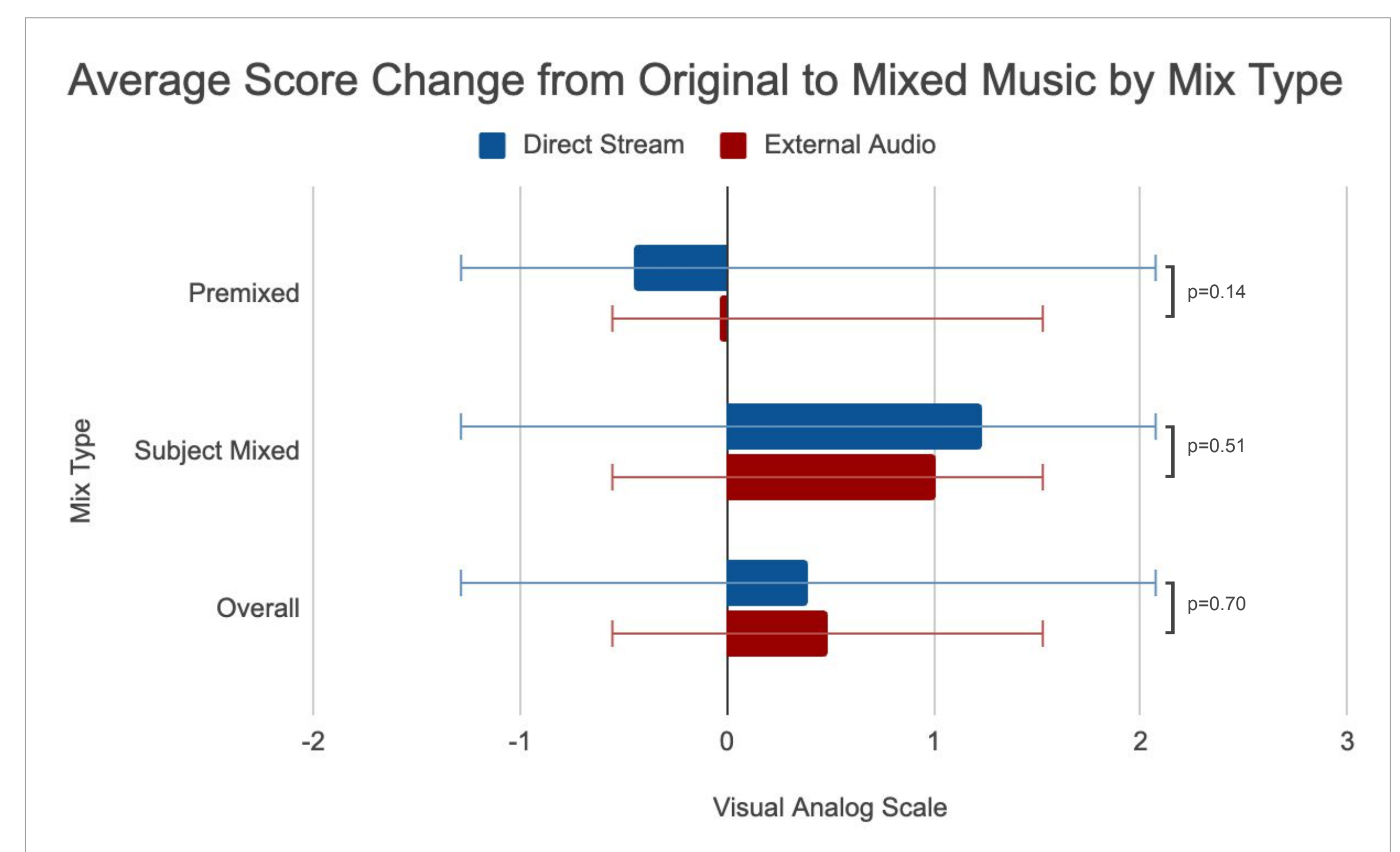


Figure 2. Change in score from original to mixed music using average enjoyment measures (musicality, pleasantness, naturalness) based on mix type. Error bars depict two standard deviations.

Discussion

- Overall, subjects largely rated their enjoyment of music similarly in EA vs DS presentation irrespective of music stimulus type or genre.
- Retested subjects rated their enjoyment higher when presented via EA than via DS.
- Additional research is needed to further elucidate the impact of direct streaming on music enjoyment and to inform the development of music technology for CI listeners.

Acknowledgements

- I am extremely thankful to my Penn mentor, Dr. Tiffany Hwa, for being intensely supportive and constantly available to guide me through this entire process, and to my NYU mentor, Dr. Claude Desplan, for serving as my faculty sponsor for this project.
- Thank you to my partners, William Lee and Rashmi Acharya, for assisting with everything from subject testing to statistical analysis.
- Many thanks to the audiologists for coordinating with me and to the thirteen participants who generously shared their time and interest.