

# IMPACT OF FAMILIARITY ON MUSIC PREFERENCE DURING SIMULATED COCHLEAR-IMPLANT LISTENING

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## ABSTRACT

Recreational music-listening preference is dependent on numerous variables including song familiarity and audio quality. For cochlear implant (CI) users, perceiving high-quality audio is impossible. In the current study, we explored relationships between familiarity, quality, and preference in music. Participants with typical hearing listened to excerpts of familiar and unfamiliar songs—both in intact form and in a degraded form simulating the perceptual experience of a CI user—and responded with their preferences. Quality played a greater role in determining preference than familiarity. Still, participants preferred familiar excerpts when presented with two intact excerpts or two degraded excerpts, though not as drastically as in the conditions where there was a difference in quality.

## 1. INTRODUCTION

Most research on music preference assumes that the music is experienced in an ideal listening environment [2]. In many cases, however, audio is experienced in less-than-ideal conditions, whether due to environmental factors or the hearing capabilities of the listener. In this study, we examined preferences for familiar and unfamiliar music of high and low audio quality, specifically audio that has been degraded using a cochlear implant (CI) simulation. We predicted that for intact (non-degraded) audio, listeners would have a slight preference for familiar music, and that familiarity would become an even greater driver of preference for degraded audio.

## 2. METHODS

### 2.1 Participants and Stimuli

Eighteen participants aged 19-39 years (mean 24 years, 10 female) took part in the study. Many were music students or casual musicians, and all self-identified as avid music listeners. Stanford University's Institutional Review Board


approved this study, and all participants delivered informed consent prior to participating.

The experiment included 20 song excerpts as stimuli (Table 1). Ten 'familiar' songs were selected from a dataset of validated well-known songs [1], and each was paired with a corresponding 'unfamiliar' song. Unfamiliar songs were selected from datasets of popular songs in Australia, New Zealand, and Canada. They represent commercially successful songs in their respective countries, but are not popular in the U.S. We matched each unfamiliar song with its corresponding familiar song according to release year and musical similarity. Thirty-second song excerpts were obtained via the Spotify Web API,<sup>1</sup> and later shortened to 20 seconds. Finally, a 32-channel noise-vocoded CI simulation of each excerpt was created using a publicly available web tool;<sup>2</sup> these constitute the degraded versions of the stimuli. After accounting for song pairing and quality conditions, each stimulus could thus be categorized into one of the following four categories: Familiar-Intact (FI), Familiar-Degraded (FD), Unfamiliar-Intact (UI), Unfamiliar-Degraded (UD).

### 2.2 Procedure

The study was run using AudExpCreator Matlab software [3]. Each participant was randomly assigned two unique conditions for every song pair, for a total of 20 song pairs in 10 trials. In each trial, the participant listened to a song pair and was asked, 'Which song did you prefer listening to?' as well as whether or not they were familiar with each excerpt. Responses were collected on a sliding scale ranging from -50-50, with 0 being neutral. Participants listened via over-ear Sony headphones, and most took 15-20 minutes to complete the task. Following the experiment, participants completed a brief questionnaire.

As a preliminary analysis, we report average ratings for the six possible (unordered) combinations of song-pair conditions: FD/FI, UD/FI, UD/UI, FD/UI, UI/FI, and UD/FD. Trials where a participant was unfamiliar with an assumed familiar song were excluded from analysis, as were trials where a participant was familiar with an assumed unfamiliar song.

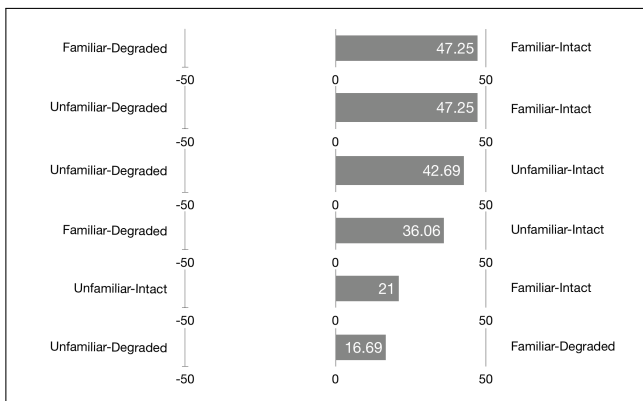
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<sup>1</sup> <https://developer.spotify.com/documentation/web-api/>

<sup>2</sup> <http://www.tigerspeech.com/angelsim/>

Familiar Songs	Unfamiliar Songs
Dancing Queen (ABBA)	Science Fiction (Divinyls)
I Will Survive (Gloria Gaynor)	Tears (The Crocodiles)
We Are the Champions (Queen)	Blue Lady (Hello Sailor)
Hey Jude (The Beatles)	Hello How Are You (The Easybeats)
I Gotta Feeling (Black Eyed Peas)	Don't Hold Back (The Pobelleez)
Singe Ladies (Beyoncé)	Burn (Jessica Mauboy)
Hotel California (The Eagles)	Carry Me (The Stampeders)
Every Breath You Take (The Police)	High School Confidential (Rough Trade)
I Believe I Can Fly (R. Kelly)	Loyal (Dave Dobbin)
Imagine (John Lennon)	I Hope I Never Die (Split Enz)

**Table 1.** Final selection of ‘familiar’ and ‘unfamiliar’ song pairs listed with song title and artist. Songs were paired based on release year and musical similarity.



**Figure 1.** Average preference scores for subjects in the six song-pair conditions. Participants listened to two song excerpts in the stated conditions, and responded with their preferences on a sliding scale ranging from -50–50.

### 3. RESULTS

As expected, preliminary results showed that preference was driven more by audio quality than familiarity (Figure 1). Notably, when participants listened to a song pair consisting of FD and UI excerpts, participants strongly preferred the UI excerpt. Though familiarity ended up being the less impactful of the two variables, participants preferred familiar excerpts when presented with two intact or two degraded excerpts, though not as drastically as in conditions where there was a difference in quality.

It is notable that while audio quality was consistently the deciding factor when determining preference, quality played a larger role with familiar rather than unfamiliar excerpts. This is contrary to previous research, which has found that ratings of music quality and preference are more strongly correlated when familiarity is removed [4]. In the current study, participants on average preferred intact audio more strongly when both samples were familiar than when both were unfamiliar. Similarly, in the case where both excerpts were intact, participants preferred familiar excerpts more strongly than when both excerpts were degraded.

### 4. CONCLUSION

In this study, we investigated whether music familiarity is a larger decider of preference when audio quality is degraded. Results indicate that this may be so. If unfamiliar music is enjoyable only when audio quality is high, music recommendation and discovery systems could benefit from considering this in relation to weighting ‘exploration’ versus ‘exploitation’.

We chose to present CI-simulated stimuli to normal-hearing participants in order to bring about a consistent listening experience, and compare preference of intact versus degraded audio. It is important to note, however, that CI users always experience music in degraded form. As CIs are optimized for music and not speech, prior knowledge of a song proves especially critical not only for enjoyment, but for basic comprehension of a musical excerpt. Therefore, music recommendation systems could also take into account the hearing abilities of the user, and as an extreme case, recommend only highly familiar songs to those users.

A final application of this study was to educate listeners with normal hearing, showing them what CI users hear every day so they could better appreciate the experience of music afforded by their auditory systems.

### 5. REFERENCES

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