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The Effect of Music Amplitude on the Relaxation Response

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The purposes of this study were (a) to ascertain how 3 different volume levels of music affect the relaxation response both psychologically (preference scores and self-report) and physiologically (heart rate), (b) to determine the amplitude preference for relaxation among young adults, and (c) to compare differences in preference response between music and nonmusic majors and between the genders. One hundred forty-four college-age music and nonmusic majors were participants in this study. Subjects listened to 27 minutes of music while relaxing. The amplitude of the music was changed every 3 minutes in a randomized order so that each subject received loud (80–90 dB) medium (70–80 dB) or soft (60–70 dB) music 3 times each during the experimental period for a total of 9 amplitude changes. A sample of subjects wore a small heart rate monitor on their wrist and chest during the procedure. Simultaneously with the selected listening, they were encouraged to turn a dial on a Continuous Response Digital Interface (CRDI) indicating their amplitude preference for relaxation. Self-report information was gathered at the beginning and end of the experiment. Results of the CRDI analyses indicate that overall, subjects showed overwhelming preference for the soft music in comparison to medium or loud. Males, however, preferred the loud music more than females, and music majors preferred softer music over non-majors who preferred louder music. There were no differences attributed to amplitude level in the analysis of heart rate data. Analysis of the self report data yielded a wide variety of responses concerning their individual preferences,

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not always consistent with the empirical measures. Overall, there was an increase in relaxation reported over the duration of the experiment. Response differentiation to loudness levels indicates a long line of useful research not only on relaxation and stress reduction in health related fields, but also on the effects of background amplitude of music while studying, driving, and engaging in other cognitive and motor tasks.

Individuals vary enormously in their reactions and perception to stimulation. Differential preference for types of auditory stimulation is among the sources that reveal substantial variability. It is thought that individuals come into this world with stronger or weaker nervous systems requiring different intensity levels and duration of stimulation, and these needs are outwardly reflected in their preferences (Fiedler & Fiedler, 1975).

Davis, Cowles, and Kohn (1984), point out a number of conflicting studies showing preferences of stimulation among different personality types. For instance, it is thought that "extroverts" in comparison to "introverts" prefer larger amounts of auditory stimulation and thus loud music may function as a source of arousal to elevate their naturally low levels of arousal (Daoussis & McKelvie, 1986). High sensation seekers are extroverts or "reducers" desiring more stimulation and thus louder music, while low sensation-seekers are introverts or "augmenters" seeking less intense stimulation and thus softer music (Davis et al., 1984).

Another variable that may be playing an important role in the preference for levels of stimulation is an individual's musical background. Geringer (1993) conducted a study to compare the perception of loudness in music excerpts between musicians and nonmusicians. Results indicated than nonmusicians perceived a larger magnitude of change than did musicians, and that crescendos were perceived as having a larger magnitude of change than decrescendos. These results may indicate that changes from soft to louder levels may be easier to perceive than from loud to soft, and that people with a music background may not be affected as much by changes of volume levels because of their familiarity with dynamic changes as a whole.

The detrimental effects of amplitude level in music and noise has been a topic under much debate over the years. Sensorineural hearing loss, as a result of excessive occupational noise in the work place, has been known for centuries. It appears to occur with exposures of 90–140 dB if the duration is long enough. This usually happens slowly and cumulatively over a period of time with sensory cells being destroyed and the tympanic membrane being replaced by scar tissue. Tinnitus is sometimes present within a few hours or days after exposure (Clark, 1992).

Several studies have discussed the effects of differing amplitude levels in a variety of musical settings. Ayres and Hughes (1986) classify normal recreational dB levels as follows: 70 dB—comfortable listening level; 100 dB—normal level in bars; 107 dB—amplified concert level. Schmidt, Verschuure, and Brocaar (1994) point out that sound levels in classical concerts (symphony orchestras, specifically) range between 76–100 dB, and in rock concerts between 107–116 dB, both exceeding the 80 dB industrial threshold norm. Percussive music in any musical setting is reported to be more harmful to hearing over time (Turunen-Rise, Flottorp, & Tvete, 1991). Rock concert and disco participants are routinely exposed to sound levels above 100 dB. In an analysis of published sound levels from rock concerts where the mean amplitude level was 103.4 dB, Clark (1992) concludes that the risk of permanent hearing loss from attending rock concerts alone is small but adds to the cumulative noise risk for teens. Similarly, teens seated 40 feet from the speakers experienced sudden hearing loss and tinnitus after attending a rock concert that they described as "very loud" (Emmett, 1994).

Listening through earphones is another leisure time activity particularly popular among teens and young adults (Wong, Van Hassell, Tang, & Yiu, 1990). Usually the output of these devices ranges from 60–105 dB or 114 dB at the highest volume setting. Via informal surveys, Clark (1992) found that 89% of children in a middle class elementary school owned or used personal stereos with earphones. Listening through earphones may pose a risk to hearing depending on the volume level chosen, amount of time spent listening, the individual's own sensitivity, and other cumulative exposure to high intensity sound. Listeners with headsets have a wide range of preferred volume settings. Most people select listening levels lower than 90 dB, but about 5–10% of those who listen frequently do so with intensities and duration long enough to present problems (Clark, 1992). Vittitow, Windmill, Yates, and Cunningham (1994) reported that using personal cassette players while exercising created more temporal threshold shift than listening to music alone or exercising alone on a cycle ergometer, suggesting that there may be some connection to amplitude or music listening in general and the body changes that occur with increased physical output.

Regarding preference among this age group, Ayres and Hughes (1986) found that teenagers reported noise at 107 dB as more disturbing than music at the same sound level. In another study, Stefani, Feijoo, Shufer de Paikin, and Calvo de Couget (1987) reported that teenagers demonstrated neutral or favorable attitudes toward loud music. Adults ranging in ages between 18–90 years were involved in a study to determine intensity preferences while listening to six selections of popular and classical music. Subjects manipulated an intensity equalizer across four frequency bands. The oldest age group (54–90 years old) preferred decreased intensity levels while the youngest age group (18–53 years old) preferred the highest intensity levels (Smith, 1989). From these studies it appears that age is a strong variable in preference.

The effects of differing volume levels have been observed physiologically as well. Wilson and Aiken (1977) compared the effects of two intensity levels; loud and soft with rock music and noise on three physiological parameters: GSR, heart rate, and respiration rate as well as subjective response of college-age students. The three physiological responses seemed to parallel an arousal/attention response to the music, however they did not seem to respond to the different intensity levels. There was, however, a clear subjective preference for soft music. In another study (Ferber & Cabanac, 1987), heart rate increased when adults were subjected to noise obtained from an electronic synthesizer. Mean heart rate was significantly higher when exposed to silence and preferred music at 90 dB, and even higher when noise was heard at 90 dB. These results are interesting when considering that increased heart rate is a strong indicator of stress.

The effects of background music/noise on human task performance has been an area of interest among researchers. Ayres and Hughes (1986) tested normal teenage recreational sound levels on visual performance including visual acuity, pursuit tracking error, and visual search latency. Stimuli consisted of recorded instrumental rock music and noise at 70 dB and 107 dB. There were no significant differences on tests requiring fast responses but a significant decrease in visual acuity with loud music. There were no performance decrements associated with loud noise. In a similar study, Warner and Heimstra (1972) determined the effects of continuous white noise of different intensities (silence, 80 dB, 90 dB, 100 dB), on visual target-detection performance of 20 males using earphones. Some interaction was apparent between task difficulty and noise intensity. The 80 dB condition had a detrimental effect at the moderate and difficult task levels. The 90 dB condition facilitated task performance only in the most complex task. Overall, effects were most prominent in task speed but not task accuracy. In another study, 15 female college students completed math problems under background conditions of speech (87 dB), hard rock music (95 dB), industrial noise (105 dB), and silence with earphones. A significantly greater number of problems were answered in the music condition than with the industrial noise (Wolf & Weiner, 1972). Wolfe (1983) determined the effects of four conditions (silence, 60–70 dB, 70–80 dB, 80–90 dB) on computing math problems. Although there was no difference in the number and the correctness of math problems completed among the four experimental conditions, the loudest condition was perceived as the most distracting. In a study investigating the effects of silence, soft jazz-rock (60 dB ± 5 dB) and loud jazz-rock music (90 dB ± 5 dB) on the frequency of group vocalizations of mentally retarded institutionalized individuals, percentages of vocalizations were higher during the soft music condition and lower in the loud music condition (Cunningham, 1986). In another study, 10 adult men exposed to four different background auditory stimuli (low noise—70 dB, high noise—90 dB, preferred music—90 dB, and silence) tasted sweet and salty solutions. Preference for sweet solutions were significantly greater with loud noise and music suggesting that people desire food under stress (Ferber & Cabanac, 1987). In another similar study, 30 young adults were exposed to silence and pop music played at 70 dB or 90 dB while consuming soft drinks. Increased loudness levels of music produced increased total consumption (McCarron & Tierney, 1989).

Despite all the empirical studies accumulated in this area, there is very little consistency. The extent to which auditory stimuli, music in general, and volume in particular, predictably affect physiological and psychological parameters and task performance, remains variable.

Music and Relaxation

The sedative effects of music in our society have been recognized for years. The application and benefits of music and music therapy techniques for stress and anxiety reduction is widely used in therapeutic settings and is well documented in the literature (Hanser, 1985). In the medical field, where individuals may experience pain or acute stress due to uncomfortable medical procedures, music may be perceived as a distracter, although there may not be a corresponding physiological change (Menegazzi, Paris, Kersteen, Flynn, & Trautman, 1991; Schorr, 1993). Music listening has been shown to be one of the most popular techniques used for relaxation purposes in a variety of settings (Hanser, 1988). Traditionally, music for stress reduction has been classified as "stimulative" and "sedative," and before the appearance of "New Age" music, "sedative" music was considered most effective for relaxation. Although in more current studies, music preference has been identified as a key variable in obtaining therapeutic changes (Hatta & Nakamura, 1991; Standley, 1996), "New Age" music seems to have a more calming effect (Mornhinweg, 1992).

Until very recently, studies examining the physiological and psychological effects of music used periodic or intermittent recording for physiological measures, and adjective descriptors and self-reports for psychological measures. Difficulties inherent in the psychological methods have been that the measurements are made in retrospect, after the stimulus-listener interaction has terminated (Madsen, Brittin, & Capperella-Sheldon, 1993).

The impetus for this study was the desire to find a more continuous psychological measure to assess music listening responses during relaxation, and to identify specific components of music which influence this process. The specific purposes of this study were (a) to ascertain how three different volume levels of music affect relaxation both psychologically (preference monitor and self-report) and physiologically (heart rate), (b) to determine the amplitude preference for relaxation among young adults and (c) to compare music and nonmusic majors and male and female responses on these psychological and physiological measures. While there is some information on the effectiveness of melodic, rhythmic, and timbre-related aspects of music for relaxation and stress reduction, there is little information on the physiological and psychological effects of music amplitude. It is important for music therapists and other health related professionals to know if the volume of music is a positive or detrimental factor in the relaxation response, as this tool is used for the purposes of relaxation in many areas of treatment.

Methodology

Subjects, Apparatus, and Music

One hundred and forty-four college age music and nonmusic majors within a normal threshold of hearing, participated in the study. Subjects were volunteers from the psychology and music departments of a small liberal arts college, and were tested in groups of one to four subjects per group.

To assess preference, subjects manipulated the dial on a Continuous Response Digital Interface (CRDI). This instrument provides a temporal measurement by listeners of their reaction to music stimuli while the music is being played. The accompanying software for data collection and analysis (Gregory, 1989) has been used in prior research in music education (Brittin, 1991, 1992; Capperella, 1989; Fredrickson, 1994; Geringer, Duke, & Madsen, 1992; Gregory, 1994; Johnson, 1992; Madsen & Geringer, 1990; Rentz, 1992; Robinson, 1995) and in music therapy settings to address a variety of research questions (Madsen, Capperella-Sheldon, & Johnson, 1991; Standley, 1991).

A sampling of subjects wore a heart rate monitor (Polar Vantage XL) of which one part was wrapped around their chest and the other, around the wrist on the same hand which manipulated the CRDI dial.

A CD entitled *Celtic Twilight II* (Hearts of Space Records CD# HS 11106-2) was used as the music stimuli. It consisted of six selections of continuous music (see Appendix A). The music was chosen for its melodic nature and progressive reduction over time from a faster to slower, more sustained style. The music contained a variety of instruments and the style of all selections was predominantly Irish. The music stimuli was played on a Sony CD player (X111ES) with Sony receiver (GX47ES). Amplitude was measured via a decibel meter (Radio Shack Sound Level Meter Model # 33-2055) placed in the center of the table.

Procedure

After placing heart rate monitors on a sampling of subjects, all subjects were directed to sit around a large table where the CRDI monitors were placed. Subjects filled out an informed consent form and demographic information including their musical background, related relaxation experiences, and current level of relaxation. They were told informally that the monitor represented an ordinal scale from 0–255 with a dial which could be moved continuously during the music as their preference changed. Then they were given the following formal instructions:

> You will be listening to some music for about the next half hour. Please sit comfortably on your chair with your hand on the dial in front of you and your arm resting comfortably on the pad in front of it. As you listen, please indicate by turning the dial to the right or left how much the *volume* of the music is contributing to your relaxation during the entire time and on an ongoing basis (that is, you may turn the dial continuously throughout the whole time as your preference for the volume subtly changes.) You may turn the dial toward the right indicating increasing preference to the volume of music and to the left indicating decreasing preference to the music volume for relaxation. The furthermost point on the right suggests that you prefer the loudness level of the music the most while the furthest point to the left, means least preferred. The point in the middle indicates that you neither like nor dislike the volume level of the music as it contributes to your relaxation. Feel free to close your eyes and sit in a comfortable position throughout the listening period as long as your hand remains on the dial. Please also make sure that the chest portion of your heart rate monitor remains above the table as it needs to make remote contact with your wrist monitor. Are there any questions? (pause) So you understand that you are focusing on the loudness level of the music and not the selection itself.

At this point, the heart rate monitors and music were turned on. Each consecutive group received the same order of music selections with a different presentation of volume stimuli. The amplitude of the music was changed every 3 minutes in a randomized order so that each subject received loud (80–90 dB), medium (70–80 dB), and soft (60–70 dB) music three times each during the experimental period for a total of nine amplitude changes. Each stimulus lasted 3 minutes for a total of 9 minutes for each volume level and a total listening time of 27 minutes. During the study, the experimenter manipulated the volume manually. In order to minimize the sudden al-

TABLE 1
Order of Music Volume Stimuli

Order	Group #	Total *n*
LMS LMS LMS	1, 7, 13, 19, 25, 31, 37, 43, 49	19
MSL MSL MSL	2, 8, 14, 20, 26, 32, 38, 44, 50	23
SLM SLM SLM	3, 9, 15, 21, 27, 33, 39, 45	19
LSM LSM LSM	4, 10, 16, 22, 28, 34, 40, 46	20
MLS MLS MLS	5, 11, 17, 23, 29, 35, 41, 47	24
SML SML SML	6, 12, 18, 24, 30, 36, 42, 48	22

teration of volume, these changes were made over a period of 2 seconds. Simultaneously with the selected listening, subjects turned the CRDI dial indicating their amplitude preference for relaxation. At the end of the 27 minutes, the CRDI automatically completed its run and the heart rate monitors were turned off manually. The volume on the last music selection was faded out gradually and subjects were instructed to complete the last page of the questionnaire which included their current level of relaxation, their enjoyment of the music selections, and open comments pertaining to the experiment.

Results and Discussion

CRDI Scores

Because of technological failures and subjects who had fallen asleep, the total *N* for the CRDI analysis was 122 subjects. Data management, graphics, and analyses were performed using SAS[1] software. CRDI preference was measured in seconds over the 27 minute period. The analyses looked at two types of comparisons; (a) an ANOVA comparing mean preference scores calculated from the total accumulation of increments on the CRDI dial itself, and (b) an ANOVA comparing mean amount of time spent in the "like zone." The points on the CRDI dial corresponding to these preferences were designated as: "dislike zone" (0–105), "no preference zone" (106–150), and "like zone" (151–255). The analysis indicated that there was a significant difference in mean CRDI preference scores, $F = 37{,}854.31$; $p < .0001$, among loud, medium and soft volume levels. The Least Squares Means pairwise comparison test in-

[1] SAS is a registered trademark of SAS Institute Inc. in the USA and other countries.

dicated significant findings at the .0001 level among all combinations (between soft and medium $t = 47.26$, between soft and loud $t = 258.39$, and between medium and loud $t = 211.32$). Mean time spent in the "like zone" yielded similar significant findings, $F = 123.61$; $p < .0001$. The LS Means test indicated that there was a significant difference in time spent between medium and soft ($t = 2.67$; $p = .0078$), between loud and soft ($t = 14.81$; $p < .0001$) and between loud and medium ($t = 12.14$; $p < .0001$). The largest difference was between loud and soft which is consistent with the previous comparison of CRDI preference scores.

The analysis of males and females yielded the same information as above, with soft music being preferred the most by both genders, $F = 35{,}098.62$; $p < .0001$. The analysis also indicated that there was a significant main effect attributed to gender, $F = 2{,}348.91$; $p < .0001$, with males consistently responding to the higher end of the preference zone than females in all three volume levels. This discrepancy between males and females is more apparent at the loud volume and diminishes at the soft volume. Looking at time spent in the "like zone," the same discrepancy between males and females appears with males spending more time overall in the "like zone" in all sound levels. In this analysis, however, the gender main effect is marginal although not significant, $F = 3.19$; $p = .0747$, but closely supports the results of the CRDI scores in this area.

Of particular interest in this analysis is that males appear to have a more robust response in all three amplitude levels; they spend more time in the "like zone" regardless of the amplitude. Females on the other hand, do not have as great a magnitude of response, perhaps evidencing more sensitivity to sound levels in general. Of further interest in this data is that males and females appear to agree more in their preferences as the volume level decreases. At the louder level there is more discrepancy. One might suggest from these results, then, that a male choosing to play loud music in the presence of a female ought to know if their collective objective is relaxation. It is interesting to note that all of the verbal comments concerning preference for loud music came from males.

In the analysis of majors, the same significant pattern was observed over the three volume levels, $F = 169.97$; $p < .0001$, with soft being most preferred overall. There were significant major by volume interaction effects, $F = 402.79$; $p < .0001$. Music majors tended to prefer soft music slightly more than nonmusic majors while nonmusic majors preferred loud music more than majors. The gap be-

TABLE 2

Mean CRDI Preference Scores

Volume level	Mean CRDI score
Loud	84.6
Medium	156.1
Soft	172.1

tween majors is more prevalent in the loud condition and diminishes with softer music. In the analysis of time spent in the "like zone" between majors, though, no significant difference was apparent, $F = .49$; $p = .483$ however the reversed trend of major preference is similar to the results of the CRDI scores.

Findings from the CRDI preference analyses support previous studies (Wilson & Aiken, 1977) in clearly suggesting that softer music is overwhelmingly preferred for purposes of relaxation. In the confines of this subject pool, males prefer louder music as compared to females, and generally respond with greater enthusiasm to all sound levels. The gap between preferences for music majors and nonmajors occurs with the loudest music; nonmajors prefer this the most while majors prefer this level the least. The reverse trend is apparent for the softest sound level.

Heart Rate

Heart rate was measured at minute intervals, and downloaded manually after each group completed the experiment. Due to mechanical failures and a limited supply of heart rate monitors, the sample size for this comparison was $N = 95$. Comparisons of mean heart rate among the three amplitude levels suggest that there were no significant differences, $F = .47$; $p < .6254$. The gender effect is obvious, though with females ($N = 60$) having a significantly higher overall heart rate than males ($N = 35$); ($\bar{X}$ of females = 88; $\bar{X}$

TABLE 3

Mean Time Spent in "Like Zone"

Volume level	Time in seconds
Loud	105.8
Medium	331.6
Soft	380.6

TABLE 4

Mean CRDI Preference Scores by Gender

	Female $n = 75$	Male $n = 47$
Loud	76.3	97.7
Medium	150.6	164.9
Soft	170.0	175.0

of males = 74); $F = 191.64$; $p < .0001$, regardless of amplitude level. Females were, on average, 13–14 beats higher than males, a normal occurrence between the genders.

Regarding major, there is a significant effect attributed to major, with music majors' heart rate higher than that of nonmajors', $F = 5.84$; $p = .0158$, but this is undoubtedly attributed to the fact that there were only females in the music major sample wearing heart rate monitors. Overall, heart rate trends over the duration of the 27 minutes of listening indicate a great deal of variability rather than a decrease in this physiological measure. That there was no particular effect of heart rate over time may not be surprising because of the changes in the music throughout. That there was no interaction with volume suggests that the loudness of the music is really not making as much difference physiologically on this measure and amplitude range, as it is psychologically. This lack of physiological response to sound intensity is supported in the literature as well (Wilson & Aiken, 1977) although studies with greater amplitude (>90 dB) indicate the opposite, and may reflect the aversive, stressful nature of extreme volume levels (Ferber & Cabanac, 1987).

Self Report

An analysis of perceived relaxation on an interval scale of 1–10 indicates that overall, there was a significant increase in reported relaxation between pre and posttest scores ($T = -13.3$; $p < .0001$).

TABLE 5

Mean Time Spent in "Like Zone" by Gender

	Female $n = 75$	Male $n = 47$
Loud	94.7	122.3
Medium	316.5	355.4
Soft	374.3	390.7

TABLE 6

Mean CRDI Preference Scores by Major

	Music $n = 19$	Nonmusic $n = 103$
Loud	68.1	87.6
Medium	154.5	156.4
Soft	177.5	171.1

Females demonstrated a slightly greater increase in relaxation than males, but this was not significant ($T = -1.24$; $p = .2166$). Music majors had a significantly higher self report of relaxation than did nonmajors ($T = -2.3132$; $p = .0248$). This result may have occurred because the majority of these subjects were music therapy majors who are sensitized to the use of music for emotional and behavioral change.

Results of the open questionnaires indicate that subjects almost unanimously felt relaxed by the 27 minutes of music listening. Eighteen subjects particularly commented that they were dozing off or wanted to go to sleep. Only 2 subjects reported that the experience was not relaxing. Most people commented that the selections of music were beautiful and that they enjoyed listening and participating in the study. Data from their questionnaires regarding enjoyment of music indicated, on a 1–10 scale where 10 was "most preferred", a mean of 7.2 ($N = 144$).

Verbal reports on the open comments section of the final questionnaire indicate that, like the CRDI results, most people reported a preference of "soft" for relaxation. Others, however, commented that medium music was best and still others, that they preferred the louder music. Regarding the loud music, comments suggested that this amplitude level helped distract them from the here and now: ". . . when the music was loud it seemed to engulf me and I became very relaxed." "When the music was loud I felt consumed and felt

TABLE 7

Mean Time Spent in "Like Zone" by Major

	Music $n = 19$	Nonmusic $n = 103$
Loud	57.2	114.8
Medium	316.1	334.5
Soft	407.9	375.6

TABLE 8
Mean Heart Rate

Volume	*M*
Loud	82.3
Medium	83.0
Soft	83.5

as if I was drifting away in it." These kinds of comments were reported entirely by males which supports the CRDI findings between gender.

There were also a few comments indicating that the changes or alterations of volume level in the experiment were disturbing, but that they were able to adapt quickly to the new volume level. The most disturbing variables reported were aspects related to instrumentation. Six people reported that high pitched instruments were most bothersome and two subjects, that percussion or bass notes were most distracting. Three people specifically reported that high and low pitches influenced their preference choice more than volume.

The more frequent comments pertained to subjects' inability to separate between their preference for actual music selections and the volume level. "Some of the selections sounded better louder while others were still annoying quiet." "I found that my volume preference was not simply a preference for soft versus loud music; my preference tended to be for softer volume for music of higher frequencies." "Whether or not I liked the music was sometimes affected by how much I liked the music. If I liked the music, I liked it louder." These comments suggest a strong interaction between music preference and amplitude. Certainly, a study controlling for volume with different music selections would offer clarification of this point.

The only analysis pertaining to the music selections was one which looked at the effects of the six music selections and the few seconds of silence occurring between selections, as they affected CRDI preference scores and heart rate. Data was analyzed by averaging all subjects' scores at each second for the CRDI information, and at each minute for heart rate, and coordinating them with points corresponding to the different music selections. Graphic analysis of this information indicates no obvious trends. The only pattern that seems to appear at all is that the CRDI scores seem to be the highest at the beginning and end of musical selections and the lowest in the middle, as if there is a lull or period of boredom in the middle of the listening period of each selection. Unlike the verbal reports, this data did not confirm that certain selections contributed to preference.

Conclusion

The findings in this study contribute to the base of research in this area by suggesting that softer music (60–70 dB) on the whole, is preferred for purposes of relaxation in comparison to louder volume levels for young adults. This study is limited only to three decibel ranges and therefore further studies might investigate more increments of "soft" and even the highest acceptable threshold of "loud" for those individuals (usually males) who prefer loud music. Clearly, men and women and musically experienced and nonexperienced sometimes differ in their amplitude preference. Heart rate changes attributed to these three amplitude levels are not apparent in this study. Perhaps it is comforting to know that the heart does not fluctuate rapidly with the vicissitudes in normal amplitude ranges. Self reports of preference roughly parallel that of the data, but a clearer picture of individual variability is observed, with some people reporting preference for other volume levels. Self reports also indicate that specific aspects of the music and the selections themselves are more influential in preference than amplitude level. Even in the overwhelming positive response to softer music for relaxation, individual variability exists and should be assessed prior to its application for relaxation or stress reduction. Response differentiation to loudness levels indicates a long line of useful research not only on relaxation, and stress reduction, but also on the effects of background amplitude of music for studying, driving, and engaging in other areas requiring task accuracy.

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APPENDIX A

Musical Selections from Celtic Twilight II

	Selection	Minute	Sec	Total time
1st	*For Eamonn* By Nightnoise	0	0	6:49
2nd	*Highstep* By Bill Douglas	6	36–41	2:58
3rd	*The Journey Home* By John Doan	9	35–42	4:16
4th	*Tonight My Sleep Will Be Restless* By Alasdair Fraser & Paul Machlis	14	12–54	2:55
5th	*Women of Ireland* By Deiseal	16	46–53	5:03
6th	*The Hills of Home* By Kevin Braheny & Tim Clark	21	49–57	5:12 (part of piece)