The effect of rock music as a source of auditory distraction on the reading comprehension of undergraduate college students and the relationship between distractibility and achievement

Meghan Eileen Rush
Rowan University

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THE EFFECT OF ROCK MUSIC AS A SOURCE OF AUDITORY DISTRACTION ON
THE READING COMPREHENSION OF UNDERGRADUATE COLLEGE
STUDENTS AND THE RELATIONSHIP BETWEEN
DISTRACTIBILITY AND ACHIEVEMENT

by
Meghan Eileen Rush

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Dr. John Klanderman & Dr. Roberta Dihoff

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ABSTRACT

Meghan Eileen Rush
Dr. John Klanderman and Dr. Roberta Dihoff
Master of Arts in School Psychology

The purposes of this experimental research study were to (a) examine the effect of rock music as a source of auditory distraction on the reading comprehension of sixteen undergraduate college students; and (b) assess the relationship between distractibility and achievement. Participants in the study were given two reading comprehension examinations in two conditions: music and silent control. Achievement was measured by self-report of grade point average. Statistical analysis of the main effect of rock music on reading comprehension, using a repeated measures t-test, found no significant effect. Additionally, no significant correlation was found between distractibility and achievement. Problems with the difficulty level of the reading comprehension examinations as well as location of data collection are discussed.
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Chapter One - The Problem

Need:

There is a strong need for any study that has the ability to help undergraduate college students perform to the best of their ability, and this study has the possibility of doing just that. Undergraduate college students spend a great deal of time reading from textbooks, and studying those textbooks for examinations. Therefore, a large proportion of their potential success or failure in college is based on how well they comprehend and remember the material that they read in their textbooks. Reading comprehension, therefore, is a very important skill for an undergraduate college student. Most individuals would want to do everything possible to create an environment that supports their ability to comprehend the material that they must read to successfully pass their exams, and therefore successfully pass their courses.

One possible threat to college students' ability to comprehend what they must read, as proposed by this study, is rock music as a source of auditory distraction. Most undergraduate college students live in noisy environments with many other people, and many prefer to listen to music while reading and studying. If auditory distraction takes attention away from the task of reading, it is proposed that it may result in more difficulty comprehending what is being read. If this is the case, it would be in the best interest of undergraduate college students to place themselves in environments with low levels of auditory distraction, so that they can maximize their reading comprehension capabilities, and succeed to the best of their abilities in their courses.
Purpose:

The purpose of this study, is to determine how an individual's environment can effect their ability to comprehend material that has been read. Specifically, this study is interested in the effect of rock music as a distraction from reading, and how this distraction effects reading comprehension. This study serves the purpose of finding out if undergraduate college students are influenced by other factors in their environment, specifically auditory distractions, while reading. Furthermore, this study serves the purpose of finding out if these individuals can understand and remember, or comprehend, information from a read passage despite the increased stimulation from listening to rock music, which is a source of auditory distraction.

Hypothesis:

It is hypothesized that listening to rock music while reading will lead to decreased scores on reading comprehension exams among undergraduate college students. It is further hypothesized that there will be a negative correlation between distractibility and achievement among undergraduate college students.

Theory:

The hypothesis regarding the effect of rock music as a source of auditory distraction on reading comprehension is looking at the broader issue of attention and memory. Distraction involves the difficulty that the human mind experiences when trying to attend to more than one stimulus, or task, at a time. Reading comprehension is in many ways a task that involves memory, and attention is required for the human mind to remember information. A theory on attention, therefore, would support a hypothesis regarding distraction; as distraction involves an individual's brain or mind being
disrupted while attempting to attend to some task. In the case of the hypothesis being studied, that task is reading comprehension. The theory that best supports this hypothesis, is one of the oldest, but still most highly regarded theories, which is the early selection theory. Early selection theory supports the hypothesis that rock music as a source of auditory distraction will lead to decreased scores on reading comprehension exams among undergraduate college students. This hypothesis is supported in the details of the theory, the theory’s relation to auditory and visual stimuli, and the theory’s relation to dual tasks.

Early selection theory, also known as Broadbent’s filter theory, was first introduced by Broadbent in 1958 (Lyon & Krasnegor, 1996). His theory is one of early selection, which, simply put, means that the brain selects what information it is going to attend to early on in the attention process. According to Pashler, “Broadbent’s basic hypothesis was that all stimuli reaching the sensory system are processed to the point at which certain physical attributes (e.g., location, loudness, and pitch of auditory stimuli) are analyzed and explicitly represented (Pashler, 1998).” Thus all stimuli are initially processed, but not all stimuli pass on beyond this point in the process.

Broadbent felt that the brain had a “filtering device,” which allowed some stimuli to pass beyond this point for further processing, and filtered out the rest of the stimuli (Pashler, 1998). Broadbent looked at the mind as a “limited capacity system,” and this filter held the purpose of protecting this system from being overwhelmed by too many incoming stimuli (Lyon & Krasnegor, 1996). Thus, a main point in early selection theory is that early in the selection process, all incoming stimuli must pass through a filter. From this filter, only the information that the mind will attend to will pass beyond, and
the rest of the stimuli will be filtered out. The only information that is actually identified are the stimuli that pass through the filter into the "limited capacity channel" which can only process one stimuli or task at a time (Styles, 1997).

The question then would be, what happens to the information that is filtered out of the mind in the early selection process? Broadbent expected that there was a "short-term buffer store," which temporarily held the information for a short period of time that did not pass beyond the filter (Styles, 1997). It is important to note that this information is only held for a short period of time before it is discarded, at which point it can no longer pass through the filter and become attended to.

The basis of early selection theory is that the point when selection occurs is early in the process of attention, before the point when the stimulus itself is actually identified (Pashler, 1998). Thus, Broadbent felt that the individual is not even aware of what is selected until after it is already selected. To explain how the stimulus is selected, Broadbent assumed that selection occurs on the basis of cues. According to Styles, "the nature of the cue represents the level of analysis that has been achieved by the information that is selected (Styles, 1997)." One could conclude, therefore, that an individual attends to specific stimuli on the basis of cues received by that stimuli.

This whole process of selection occurs early in the course of attending to specific stimuli in order to protect the limited capacity of the mind’s sensory processing capabilities. According to Lyon, selective attention itself serves the purpose of "enabling the system to overcome its limitations in capacity (Lyon & Krasnegor, 1996)." Therefore, since the mind is limited in what it is capable of attending to, it must select which stimuli it attends to on the basis of cues, and then filter out the remaining stimuli. Broadbent
related this capacity limitation of the nervous system to a single channel, which could only process information from one stimulus at a time (Styles, 1997).

The theory of early selection, because of the idea of a single channel with limited capacity, is highly relevant when considering the idea of dual tasks. Broadbent theorized that people are limited in their ability to perform multiple tasks or attend to multiple stimuli in parallel (Pashler, 1998). Thus, according to early selection theory, it is difficult if not impossible to perform more than one task at a time. According to Styles, "Broadbent suggested that there was a central bottleneck in processing which limited dual-task performance (Styles, 1997)." Thus the limited capacity of the mind's ability to attend to multiple stimuli can be compared to a bottleneck, which narrows in likeness to a channel. This prevents multiple stimuli from passing through, thus limiting the ability to attend to multiple tasks, and decreasing the possibility of performing dual tasks. Since it is common knowledge that people actually do perform two tasks at one time, Broadbent explained this possibility through the idea of time-sharing, which involves switching back and forth between the processing of two tasks (Styles, 1997). This idea of switching back and forth between tasks involves only attending to one task at a time, thus each task would go through periods of time when unattended to. This description of how the human mind attends to dual tasks obviously is suitable to some tasks where constant attention is not required, but could be quite problematic when dealing with tasks that involve the need of close or constant attention.

In addition to being a good source of explanation for dual task performance, early selection theory is also quite relevant when examining visual and auditory stimuli. According to Parasuraman, "Studies using event-related brain potentials (ERP's) have
clearly shown that selective attention modulates early-latency ERP components, both in the visual and the auditory modality (Parasuraman, 1998).” Thus, studies using event-related brain potentials have shown that selection occurs early in the attention process when the stimulus involves the visual or auditory perceptual systems. This provides support for the theory of early selection being applied to a situation where the stimuli involve the visual or auditory senses.

Since early selection theory supports a situation where the visual and auditory senses are involved, the hypothesis that rock music as a source of auditory distraction will result in decreased reading comprehension exam scores should be supported by this theory. Furthermore, according to this theory, the processing system of the mind has a limited capacity and can attend to only one task at a time. Therefore, the task of attending to a reading comprehension passage while also attending to the rock music would be difficult because it involves a dual task situation. This dual task situation would involve switching back and forth between attending to the two tasks (based on cues from the two tasks), thus resulting in periods of time when the reading comprehension task is not being attended to. During the time periods when the rock music is being attended to, the reading comprehension passage is not being processed, thus making it difficult to comprehend the material being read. Since reading is a task that requires close and constant attention to comprehend the information being read, this theory lends support to the hypothesis that rock music as a source of auditory distraction will lead to decreased reading comprehension exam scores among undergraduate college students.
Definitions:

Auditory distraction: As used in this study, auditory distraction refers to any sound stimulus that has the potential to take an individual's attention away from another task or stimulus. The source of auditory distraction used in this study was rock music.

Reading comprehension: This is defined as an individual's ability to remember and understand information that has been read. Reading comprehension involves both remembering factual information and understanding broader concepts as well. This is tested in this study per the use of reading comprehension examinations.

Distractibility: This is defined as the degree to which an individual is distracted from the task that they are trying to attend to (in this case, the reading comprehension examinations) by another task or stimulus (in this case, rock music).

Achievement: For the purpose of this study, achievement is defined as the individual's academic success in their undergraduate college education as measured by cumulative grade point average.

Assumptions:

With regard to this study, there are several assumptions that must be made. First, one must assume that the only difference between the two testing conditions is the presence or absence of the independent variable (rock music). This would lead one to assume that there are no other variables influencing each participant’s score on the reading comprehension exam. Another assumption, is that the two reading passages are of the same length, quality, and level of difficulty. Additionally, one must assume that the two comprehension examinations are of the same level of difficulty. This would be to assume that the passages and exams themselves will not in any way influence the results.
of this study. Finally, one further assumption is that all of the participants in this study exhibit an adequate ability to comprehend reading material. This assumption is based on the fact that undergraduate college students must achieve adequate scores on the SAT exam in order to be accepted into college, and the SAT exam consists of many reading comprehension items. Additionally, undergraduate college students must complete high school with some degree of success, and to do this, they must be able to read at an adequate level.

Limitations:

There are several limitations to this study. First, the sample size is relatively small when compared to the population of undergraduate college students. Additionally, the sample is not randomly selected from the population. All of the participants in this study are undergraduate psychology students. These psychology students must participate in research as a requirement for their class, thus random selection does not exist. Furthermore, the fact that all of the students are introductory level psychology students, results in this sample being less representative of the entire population of undergraduate college students. For this sample to be more representative of the population, students from a wider variety of disciplines of study would have to be represented in the sample in closer proportion to that of the population. These limitations result in this study being less generalizable. This study is limited to being generalizable only to other undergraduate college students, but not to individuals of other age, reading ability, or educational level.
Summary:

Chapter two of this thesis will be a review of research relating to the hypothesis regarding distraction and reading comprehension. Chapter three of this thesis will explain the design of the study. Chapter four will provide the analysis of data collected in this study. Finally, chapter five will summarize the results of this study, and discuss any conclusions drawn from the data analysis.
Chapter Two - Review of Related Literature

The review of literature related to the effect of auditory distraction on reading comprehension is organized from more general studies to studies that more specifically approach the content of the current research design. The review begins by examining auditory distraction and memory-related tasks such as recall. Literature examining the effects of auditory distractions such as noise and speech on reading comprehension are then reviewed. Closer to the current study, literature on studies of music as a form of auditory distraction on reading comprehension are then examined, including both studies that found significant results and those that did not. Finally, associated with the second hypothesis of the current study, literature investigating the correlation between achievement and distractibility will be reviewed. The main results from all areas of reviewed related literature will then be summarized.

Auditory Distraction and Memory, Recall, and Other Tasks:

Several researchers have been interested in studying how memory is influenced by various sources of auditory distraction. A 1983 study found that recall is better when lists are presented auditorily rather than visually, however a thirty minute period of distraction between presentation and recall eliminates this difference in recall, and recall is decreased more by auditory than by visual distraction (Gathercole, Gregg, & Gardiner, 1983). Thus, auditory distraction tends to have a greater impact on memory than visual distraction, and the presentation of the items to be recalled may additionally be a factor that may influence recall. With reading comprehension, the presentation of material is visual, and it is
hypothesized that auditory distraction will impact reading comprehension which involves the use of memory and recall.

Another study examined the study of selective attention and recall under auditory distraction in eight and eleven year old children (Zukier & Hagen, 1978). Their results indicated “that older subjects made greater use than did younger subjects of strategies that enabled them to (a) focus on the relevant features of the task at the expense of extraneous information, and (b) deploy their selective attention with greater efficiency and flexibility” (Zukier & Hagen, 1978). Therefore, the development of selective attention in children results in a decrease in distractibility with age, as shown with a memory recall task. Other research has examined distractibility in association with personality characteristics, such as a study by Hovey that found there to be no relationship between distractibility and extraversion-introversion (Hovey, 1929). Thus, the personality characteristics of introversion and extraversion should not influence an experiment on distraction.

Other experiments on memory utilized more than one source of auditory distraction. Significant differences in recall performance have been found demonstrating that narrow-band high frequency noise as a source of distraction produces more errors in recall than performance under the distraction of white noise (Lord & Finlay, 1978). Other research has compared music and noise as sources of distraction on recognition memory and found that “music played a distracting role in the recognition of the nonsense material and a helping role in the recognition of meaningful material,” and the opposite relationship was found when noise was a source of distraction (Goel, 1984). Therefore, the type of distraction as well as characteristics of the task being attended to may
influence the impact of distraction.

Researchers have also been interested in the influence of auditory distraction on specific tasks such as homework (Pool, van der Voort, Beentjes, & Koolstra, 2000) or proofreading (Weinstein, 1974). One experiment found that both noise and music as sources of distraction decreased the speed and accuracy of both juvenile and adult participants performance on a cancellation and addition test (Obata, Morita, Hirose, & Mastumote, 1934). Thus, various sources of auditory distraction can impact an individual’s performance on different types of tasks, and the complexity of reading comprehension should not be excluded from this effect. One study, with an even closer relation to reading comprehension, involved the effect of noise on proofreading (Weinstein, 1974). Noise distraction resulted in decreased identification of grammatical errors, however detection of spelling errors and recall of the content of the passages was not affected (Weinstein, 1974). It is possible that the complexity of identifying grammatical errors requires a great degree of concentration, resulting in susceptibility to distraction. It is hypothesized that reading comprehension, also being a complex task that requires much attention, will be susceptible to distraction as well.

An early study on distraction investigated the effect of two sources of distraction, noise and short stories or articles, on men’s performance on the Otis Self-Administering Test (Brown, Lyon, & Stein, 1934). Their results indicated that both sources of distraction led to improvement in the quantity of work done, but the quality was sacrificed in that there was an increase in the amount of errors on the test (Brown, Lyon, & Stein, 1934). Thus, the distraction may have increased the rate at which the individuals worked, however the accuracy of their performance was disturbed.
A common source of distraction in a student's life, other than music, is television. Not surprisingly, the effect of television as a source of distraction has been studied in relation to the performance of eighth-grade students on homework assignments (Pool, van der Voort, Beentjes, & Koolstra, 2000). It was found that homework performance was decreased by the distraction of watching a soap opera, but not by watching music videos (Pool, van der Voort, Beentjes, & Koolstra, 2000). These sources of distraction involved multiple senses, and by limiting the source of distraction to a single sense, such as hearing, and limiting the task to something more specific, such as reading comprehension, we can come to more specific conclusions about what is causing distraction and what performance is or is not being disrupted.

Noise and Speech as an Auditory Distraction and Reading Comprehension:

Several researchers have studied the effects of irrelevant noise, background sounds, or speech as a source of auditory distraction, and how reading comprehension is effected by such a distraction. One such study, examined how reading comprehension would be effected by the distraction of both meaningful and meaningless speech (Oswald, Tremblay, & Jones, 2000). The researchers of that study examined the reading comprehension of 60 undergraduate college students in three conditions: meaningful irrelevant speech, meaningless irrelevant speech, and quiet control (Oswald, Tremblay, & Jones, 2000). The results to this study found that comprehension was disrupted by both meaningful and meaningless speech, however meaningful speech was found to be more disruptive than meaningless speech (Oswald, Tremblay, & Jones, 2000). Thus, according to this study, auditory distraction seems to have more of a detrimental impact on reading comprehension when the source of distraction is meaningful. This importance of
meaning in the source of distraction is why the source of distraction for the present study
is rock music, as rock music tends to portray intense meaning in both its lyrics and music.
An additional finding of this previous study is that participants in the meaningful speech
condition made more of a specific type of error than participants in the meaningless
speech condition; and that error is called a question error, which involves the participant
responding to a question with the wrong part of the right sentence (Oswald, Tremblay, &
Jones, 2000). This shows that auditory distraction can have an impact on comprehension
of material, even when the participant remembers the actual material that was read.

Other studies on auditory distraction and its effect on reading comprehension, are
less concerned with the meaning, and more concerned with the practicality of the source
of distraction. Some studies have examined the effect of regular environmental
background noises as found in classroom or office environments. One such study
examined the effect of office noise level on reading comprehension of a sample of 100
individuals (Veitch, 1990). This study found no main effect for noise, however the
researcher noted that “the test was too easy, as a small number of subjects who scored
low on the test caused most of the variability and the overall mean score was high”
(Veitch, 1990). This study highlights the importance of utilizing tests and measures that
are at the appropriate level of difficulty; and that using tests that are too easy or too hard
can prevent a researcher from finding significant results.

A quite different and much earlier study, done by Carter and Diaz, examined the
reading comprehension of both brain injured and non-brain injured sixth grade boys in
three conditions of auditory distraction: silence, low volume typical classroom sounds,
and louder typical classroom sounds (Carter & Diaz, 1971). This study found that, as
expected, the non-brain injured group had better overall performance on the reading exam than the brain injured group, however no significant effect was found with increased levels of background noise (Carter & Diaz, 1971). It is possible that the increased levels of background noise did not result in significantly lower reading performance because the source of distraction not only was meaningless, but was typical to the learning and testing environment. These students probably did not have much trouble avoiding attending to the distracting stimuli, since it is a meaningless source of distraction that they are used to ignoring on a daily basis. Rock music may be a source of distraction that some individuals may encounter or choose to encounter while reading, however this source of distraction has meaning and is easily avoided by turning the music off if distraction becomes too problematic. When the source of distraction is unavoidable, such as typical background noises, it is possible that individuals may better develop an ability to ignore or not attend to the source of distraction.

One additional study utilizing typical background noise as a source of distraction, was done with the two conditions of silence and cafeteria noise (Ng & Turnbull, 1997). This study examined not only the effect of auditory distraction on the effectiveness of reading comprehension of college students, but also examined its effect in relation to preference for noise (Ng & Turnbull, 1997). This study found that the participants performed slightly better in the cafeteria noise condition, and that there was no statistically significant interaction between noise condition and preference for noise (Ng & Turnbull, 1997). This is similar to the results found by Carter and Diaz, in that common background noise did not interfere with the comprehension of reading material. Additionally, the lack of interaction between noise condition and noise preference may be
due to the source of the auditory distraction used in the study. In a study utilizing a more meaningful source of distraction, it is possible that the results for the interaction may differ.

Other studies have utilized meaningful sound, such as speech or background television, as a source of auditory distraction. One such study examined the effects of conversational noise as a source of auditory distraction on the reading comprehension of 44 undergraduate college students (Collins-Eiland, Dansereau, Brooks, & Holley, 1986). The results of this study found that overall, there was no significant difference between the noise and no noise conditions, despite the researchers using conversational noise that “was created to possess characteristics which students report to be major contributors to the potency of typical distractions (e.g., variability in volume and content and high interest value)” (Collins-Eiland, Dansereau, Brooks, & Holley, 1986). The authors suggest that the content of the conversational “noise was not personally relevant to each student,” thus they could ignore the distraction because it was of no interest or importance to them (Collins-Eiland, Dansereau, Brooks, & Holley, 1986). Rock music may be a more appropriate form of distraction than conversational noise, since the lyrics of rock music tend to be more universal in their meaning and interpretation than typical conversational noise.

A quite different experiment was done evaluating the “effect of distraction on reading versus listening,” which utilized counting aloud and shocks delivered to the participants left hand as two separate sources of distraction (Margolin, Griebel, & Wolford, 1982). The finding of this experiment was that both sources of distraction resulted in more interference with reading than listening, which led the researchers to
conclude that they, “ascribe the selective interference effect to the relative difficulty of reading over listening rather than to the importance of speech recoding in reading” (Margolin, Griebel, & Wolford, 1982). Thus, the difficulty inherent in the task of reading requires much more sustained attention than the task of listening, leading to reading comprehension being more susceptible to interference from distraction than comprehension of speech. This would make one suspect that various forms of meaningful auditory distraction, such as rock music, could potentially impact performance on a reading comprehension task.

Further support for the impact of auditory distraction on reading comprehension was found by a study that explored the effect of background television on reading comprehension of undergraduate college students and whether there was any additional effect by adding the television source of distraction during the recall/testing portion of the experiment as well (Armstrong & Chung, 2000). The results to this study found that although background television as a source of distraction during reading resulted in a decrease in performance on a reading comprehension task, background television had no effect when added at the testing portion of the experiment (Armstrong & Chung, 2000). This provides support for the idea that auditory distraction is interfering with the initial comprehension and encoding of the read material, and not causing interference at the retrieval end of the testing process.

Another study utilizing background television as a source of distraction from a reading comprehension task in undergraduate students, took the study of distraction even further by analyzing distractibility in relation to “the five major personality domains: extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience”
(Ylias & Heaven, 2003). This study found that the only personality domain to effect distractibility is extraversion, in that extraverts outperformed introverts in the distraction condition (Ylias & Heaven, 2003). This study is extremely flawed, as recognized by the researchers, in that participants were tested in groups, resulting in additional distraction being present due to the presence of others (Ylias & Heaven, 2003). This highlights the importance of testing for distractibility on an individual basis as to eliminate additional sources of distraction that could effect the dependent variable of reading comprehension. These studies have exemplified how various sources of auditory distraction can impact reading comprehension, thus a researcher would want to avoid any additional sources of auditory distraction that could impact their study.

Another study investigated the association between chronic noise exposure (aircraft noise) and several characteristics in elementary school children, including an assessment of reading (Evans, Hygge, & Bullinger, 1995). They found that there was an association between chronic noise exposure and “deficits in a standardized reading test administered under quiet conditions” (Evans, Hygge, & Bullinger, 1995). Thus, the overall effects of chronic noise exposure in everyday life may have an effect on an individual’s reading comprehension ability, possibly due to the distracting effect the noise may place on the individual when trying to practice and develop reading comprehension skills.

Music as an Auditory Distraction and Reading Comprehension:

Some researchers have manipulated the auditory distraction condition in a study on reading comprehension by utilizing music as the source of auditory distraction, as is being done in the current research study. Similar to the previously mentioned study by
Ylias & Heaven, several studies have examined the relationship between extraversion, introversion, and reading comprehension in the presence of auditory distraction, however the source of distraction in these studies is music (Furnham & Strbac, 2002, Furnham, Trew, & Snead, 1999, Furnham & Bradley, 1997). One such study examined reading comprehension and other tasks of extraverts and introverts under three distraction conditions: silence, background music, and office noise (Furnham & Strbac, 2002). The results of this study found that performance in general on all tasks was significantly worse in both the noise and the music condition compared to the silence condition, that there was no significant difference in performance between the music condition and the noise condition, and that extraverts performed significantly better than introverts only on the reading comprehension task in the two distracting conditions (Furnham & Strbac, 2002). These findings differ from an earlier study by Furnham, Trew, and Sneade which found no significant interactions between introversion and extraversion and reading comprehension (as well as other tasks) in the three conditions of silence, instrumental music, and vocal music (Furnham, Trew, & Sneade, 1999). Although no significant interactions were found in this study, "there was a trend for the introverts to be impaired by the introduction of music to the environment, and the extraverts to be enhanced by it, particularly on the reading and coding tasks" (Furnham, Trew, & Sneade, 1999). An even earlier study by Furnham and Bradley found that introverts' performance on a reading comprehension task in the presence of pop music was significantly worse than the performance of extraverts in the presence of pop music, as well as introverts in the presence of silence (Furnham & Bradley, 1997). The results to these studies show that distractibility in relation to reading comprehension can differ between groups of
individuals based on personality characteristics. The current study is examining not only how reading comprehension is effected by the presence of rock music as an auditory distraction, but how this distractibility may differ between high achieving and low achieving students. Thus, if groups of individuals can differ on distractibility in relation to personality characteristics, it may be possible that groups of individuals can differ in relation to other characteristics such as achievement as well.

Other researchers studying reading in the presence of music as a form of auditory distraction have been interested in the rate of reading as well as the comprehension. A 1952 study by Freeburne and Fleischer found that the participants in the group that listened to jazz music read at a significantly faster rate than the participants in the classical, semi-classical, and popular groups (Freeburne & Fleischer, 1952). They additionally found that there were no significant differences between the groups on reading comprehension test scores (Freeburne & Fleischer, 1952). Thus, at that time, jazz music was the only type of music to have any type of effect on reading. It is now half a century past when this study was performed, and music has changed and broadened into many other categories, such as rock music, which may have an effect on the comprehension of reading.

Many other studies, similar to the current study, have focused mainly on the effect of music as a form of distraction on reading comprehension. Several of these studies have found that music has no distracting effect on reading comprehension and others have even found it to have a beneficial effect. A study of reading comprehension and rate of reading in sixth grade students during conditions of radio, television, and quiet, found no significant effects (Cool & Yarbrough, 1994). Similarly, a 1930 study found that radio
reception had no distracting effect on the reading and arithmetic performance of high
school students on the Stanford Achievement Tests (Ross, 1930). The results of a 1952
study found that background music actually resulted in an increase in reading
comprehension test scores among high school students compared to a silent background
(Hall, 1952). The findings of various studies on music as a source of distraction on
reading are inconsistent with one another and may depend on various characteristics of
the music such as volume, clarity, lyrical content, and interest to participants in the study.

Some studies investigated various sources of distraction on reading, and still
found that music did not have a negative effect. One such study examined instrumental
music, instrumental music accompanied by singing, unaccompanied singing, speech, and
a quiet control condition on reading and found that speech and other vocal sounds do not
have a significant effect on reading comprehension despite participants reporting them to
be very distracting (Boyle & Coltheart, 1996). An earlier study similarly found that
music did not affect the reading comprehension of undergraduate college students,
however this study did find that reading comprehension is significantly effected by
unattended speech (Martin, Wogalter, & Forlano, 1988). Furthermore, an even earlier
study found that both popular music and connected speech were not a significant source
of distraction on reading comprehension, but that industrial noise was (Zimmer &
Brachulis-Raymond, 1978). These studies clearly demonstrate that the results in
experiments studying various forms of distraction are inconsistent, and that further
research is necessary in studying all forms of distraction on reading comprehension.

Other researchers were interested in examining specific characteristics of music as
a source of distraction. Music information-load, or the characteristics of "loudness,
variety, complexity, and tonal range” have been studied in association with reading comprehension (Kiger, 1989). Kiger found that when comparing two conditions of music information-load with a silent condition, the only significant effect was that “reading comprehension scores were significantly higher in the low information-load condition than in either the silent or high information-load condition” (Kiger, 1989). Thus, low information load was found to be conducive to reading comprehension. However, contrary to these findings, a 2002 study on the effects of background music on reading news from a pocket computer found that slow music significantly lowers reading rate and efficiency when compared to fast music (Kallinen, 2002). Once again, this is an example of how contradictory the results of studies on distraction can be. In some situations and for some people it is possible that different characteristics of music may be conducive or injurious to reading comprehension. Further research on the topic is necessary.

Instead of specific characteristics of music, Hilliard and Tolin studied the effect of familiarity with music on reading comprehension tasks (Hilliard & Tolin, 1979). There results found a significant difference in that familiar background music was associated with higher reading comprehension test scores than unfamiliar background music (Hilliard & Tolin, 1979). Thus there are many qualities and associating factors of music that may contribute to the effect of the particular source of music as a source of distraction.

Despite the many studies that have found that music is not a significant source of distraction on reading comprehension, there have been some studies that have found a significant decrease in reading comprehension performance during the distraction of music. An early study on reading efficiency found that when comparing a group of
college students in a distraction condition (phonograph records) with a non-distraction condition, “there was a consistent difference favoring the efficiency of the non-distracted group, which may have statistical significance” (Fendrick, 1937). Thus, their results support the current research hypothesis that college students will perform worse on a reading comprehension task under the distraction of music as compared with silence. However, Fendrick’s study was over 65 years ago, and there may or may not have been changes in typical or common response to music such as frequency of listening to music or preference for studying to music.

In the past, research has found that reading comprehension may be “facilitated by silent study for participants who seldom listen to music” while studying (Etaugh & Ptasnik, 1982). It was also found that participants that frequently studied to music performed better on a reading comprehension task while listening to music than in silence, however these results were not significant (Etaugh & Ptasnik, 1982). Similarly, an earlier study found that “the more frequently students reported studying to music, the less music impaired their performance” (Etaugh & Ptasnik, 1975). Thus, it is possible that the condition in which one typically reads or studies may have an impact on the distractibility of an individual. This is of particular concern when studying college students, as they tend to live in noisy environments, such as dorms, where they may not have control over the music or noise level that they read with, unless they move to another location while reading.

Other studies, similar to the current study, have limited themselves to specific categories of music. In a 1945 study, researchers examined the effects of popular and classical music on college females scores on the paragraph and vocabulary sections of the
Nelson-Denny Reading Test (Henderson, Crews, & Barlow, 1945). Their findings support the current research hypothesis in that the only significant effect found was for popular music on the paragraph section of the test, which is the section that would involve reading comprehension (Henderson, Crews, & Barlow, 1945). According to the researchers, “A reasonable explanation for the lack of distraction of classical music is that the rhythms and melodies of classical music are usually more complex and less obvious than those of popular music. The simpler and obvious rhythms and melodies of popular music are easily grasped by a group of subjects and are therefore listened to by the subjects” (Henderson, Crews, & Barlow, 1945). Thus, some may argue that characteristics of certain categories of music may cause them to be more significant sources of distraction than others.

A 1991 study examined the effects of the same category of music that the current study is researching, and that is rock and roll music (Tucker & Bushman, 1991). This study by Tucker and Bushman, however studied mathematical and verbal performance in addition to reading comprehension in undergraduate psychology students (Tucker & Bushman, 1991). The results of their study found that listening to rock and roll music resulted in decreased performance on the verbal and mathematical performance sections of the test, however reading comprehension was not effected (Tucker & Bushman, 1991). This is one more example of the inconsistent results found when studying sources of distraction on reading comprehension. One possible explanation for these inconsistent results is that some researchers may not be adequately controlling for additional sources of distraction, such as the case with Tucker and Bushman, where testing was done in groups, where other people being present may prove to be distracting in and of itself.
(Tucker & Bushman, 1991).

**Distractibility and Achievement:**

Some researchers have attempted to examine the relationship between distractibility and achievement, similar to the second hypothesis in the current research experiment. One such study examined the effect of popular instrumental music on the reading comprehension of seven “bright” and seven “non-bright” eighth grade students (Fogelson, 1973). Fogelson found that popular instrumental music did result in a significant decrease in reading comprehension of all fourteen students, however the effect was greater for the “non-bright” students than the students referred to as “bright” (Fogelson, 1973). Since the “non-bright” students are probably lower achievers than the “bright” students, this would lend support to the hypothesis that there is a negative relationship between distractibility and achievement.

Another study investigating the relationship between achievement and distractibility was done examining the “susceptibility to distraction in academically underachieving and achieving male college students” with humorous conversation as the source of distraction (Baker & Madell, 1965). The results to this experiment had three important findings: reading comprehension scores did not differ between achievers and underachievers in the quiet control condition, both achievers and underachievers showed decreased reading comprehension performance under the distraction condition, and a greater degree of impairment on reading comprehension by the distraction condition was shown by the underachievers (Baker & Madell, 1965). This study also lends support to the current study’s research hypotheses. The authors of the 1965 study feel that the study of distractibility in relation to reading comprehension test performance is important, and
that their results, “illustrate clearly the principle that personality characteristics which are not operative and determinative of behavior under relatively benign circumstances may become so under more stressful conditions. This finding has important implications for improving the sensitivity of psychodiagnostic devices in general, but in particular it suggests a means of enhancing the capacity of a reading comprehension task to predict academic performance.” (Baker & Madell, 1965).

Summary:

The past research on auditory distraction as related to the current research study can be divided into several categories: auditory distraction and memory, recall, and other tasks, noise and speech as sources of auditory distraction and reading comprehension, music as a source of auditory distraction and reading comprehension, and distractibility and achievement. These past studies have all attempted to understand attention, and how auditory distraction can impact performance. The past research has explored many areas of distraction, however the defining feature of these studies can be seen in their results. This defining feature is that the results to these studies are highly inconsistent, leading to a necessity for future research on distraction.

The research on auditory distraction and memory, recall, and other tasks has several important findings. One study found that auditory distraction tends to have a greater impact on memory than visual distraction. Furthermore, a study with children found that the development of selective attention results in distractibility decreasing as age increases. Distractibility may differ with age, however it was found that there was no relationship between distractibility and extraversion and introversion. Additional findings of research on distraction are that the impact of distraction may depend on the
type of distraction as well as characteristics of the task being performed, however various
sources of distraction can impact an individual’s performance on different types of tasks.
Additionally, one study found that auditory distraction led to a larger quantity of work
being completed, however auditory distraction also led to an increase in errors.

The research on noise and speech as sources of auditory distraction and reading
comprehension also have some findings that are of great interest. It was found that
reading comprehension is disrupted by both meaningful and meaningless speech,
however the effect is greater for meaningful speech. Other studies have found there to be
no effect of noise on reading comprehension. One such study highlights the importance
of choosing reading comprehension measurements that are of the appropriate level of
difficulty, which can impact the results to a study. One study even found that
performance improved with auditory distraction, and furthermore that there was no
interaction between noise condition and preference for noise. An additional important
finding was that background television while reading resulted in a decrease in
performance on reading comprehension, however there was no effect when background
television was added at the testing portion of the experiment. Other findings were that
extraverts outperformed introverts in the distraction condition of one study, and that there
may be an association between chronic noise exposure and deficits in reading
comprehension ability.

Further research has concentrated on music as a source of auditory distraction and
reading comprehension. Several studies have examined the personality characteristics of
extraversion and introversion in relation to music and reading comprehension, and most
studies have found there to be a greater degree of distractibility in introverts than
extraverts. Other studies on music as a source of auditory distraction have found that it either has no effect on reading comprehension or even improves reading comprehension. These results are inconsistent with the other research that has found music to decrease reading comprehension performance. Another example of the inconsistency in the results of research on distraction and reading comprehension, is that one study found that low information-load in music improves reading comprehension when compared to silence and high information load, while another study found that slow music significantly lowers reading rate and efficiency when compared to fast music. It has also been found that familiar background music is associated with better reading comprehension than unfamiliar background music. Despite the studies that have found music to either have no effect or an improvement on reading comprehension, there have been several studies that have found various sources of music to decrease reading comprehension performance. Additional findings were that frequency of studying to music may be related to the degree of reading comprehension impairment in conditions of distraction, with individuals who normally study with music being less impaired by music.

Finally, a few researchers have studied the relationship between distractibility and achievement, although there is not a great deal of available research on this relationship. The research that is available on this relationship has found that there is a relationship between achievement and distractibility, with the reading comprehension of underachievers being more impaired by distraction than that of achievers.

There has been a variety of past research on the distraction of memory, recall, and reading comprehension. The main problem with this past research is that the results are very inconsistent. This inconsistency may be the result of researchers not controlling for
various extraneous variables. Further research is necessary on the effect of auditory
distraction on reading comprehension, where as many extraneous variables as possible are
controlled for.
Chapter Three - Design of Study

Sample:

The sample consisted of sixteen undergraduate students currently enrolled in an introductory psychology course at Rowan University. Participation in research was a requirement for their psychology course, and their participation in this study was on a voluntary basis. The participants ranged in age from 18.5 to 45 years old, and the sample consisted of 4 males and 12 females. All participants in this study were assumed to have adequate reading capabilities from their status as college students.

Measures:

Reading comprehension was measured with two reading passages and associated reading comprehension examinations. These passages were obtained from a practice test within a study guide for the Praxis Exam for teacher certification (Postman, 2001). The two passages and exams are assumed to be at the same level of difficulty, and should not be familiar to students in an introductory psychology class. The reading passage and examination, designated as passage and examination A, were on the topic of the War of 1812, and consisted of six multiple choice questions that involved making inferences from the passage, finding the main point of the passage, and summarizing and describing portions of the passage (Postman, 2001). The second passage and examination, designated as passage and examination B, were on the topic of the scientific discoveries of Louis Pasteur, and consisted of six multiple choice questions that involved making inferences from the passage, finding the topic of the passage, and summarizing and
describing portions of the passage (Postman, 2001). For both examinations, all questions had five choices for each answer, labeled a, b, c, d, and e. Participants were instructed to answer all questions, and to circle only one choice for each question. Each question was worth one point, with the total exam being worth six points. Additionally, the participants were timed for completion of the reading comprehension examinations.

For measurement of achievement, and for collecting other data on the reading and study habits of each participant, a self-report form was used (Appendix A). This form requested that students fill in their cumulative grade point average. This self-reported measure was used by the researcher as a measure of achievement.

Design:

This study was done using a traditional within subjects experimental design, where a single group of subjects were tested for reading comprehension in two conditions. Testing was done on an individual basis, and participants were in a room alone, as to avoid any outside influences of distraction. Upon arrival to the laboratory, before beginning the experiment, each participant was given a consent form to read and sign and any questions or concerns involving their participation in the study were answered by the researcher. Participants were then placed in a room with or without the distraction of rock music, and given one of the two reading comprehension passages and associated examinations. The rock music used for every participant in the study was in this order: "Show Me How to Live" and "Gasoline," by the band Audioslave. After completion of the exam in the first condition, participants were then required to remain seated, and the distraction of rock music was either added or taken away from the room. The participant was then given the second examination (whichever one was not taken in
the first condition). The participants were told before beginning both examinations, that there was no time limit for completion of the examinations, but that they would be timed on how long it took them to complete the exams. They were also told to answer all questions to the best of their ability, and to circle only one choice for each question.

The experiment was counter-balanced for condition, with half of the participants testing in the silent control condition first, and the other half of the participants testing in the experimental distraction condition first. Additionally, the experiment was counter-balanced for presentation of examinations, with half of the participants receiving passage and examination A first, and the other half of the participants receiving passage and examination B first. Thus, participants were divided into four groups based on order of conditions and order of presentation of examinations, with four participants being placed in the silent condition with examination A first, four participants being placed in the silent condition with examination B first, four participants being placed in the distraction condition with examination A first, and four participants being placed in the distraction condition with examination B first. Participants were placed into these four groups on a random basis.

Following completion of both examinations, each participant was given a form to fill out to collect data regarding achievement, study habits, age, and gender. They were told to fill out the form to the best of their ability, and any questions they had regarding the requested information were answered by the researcher.

Testable Hypotheses:

I. The testable hypothesis, or alternate hypothesis states that rock music as a source of auditory distraction decreases the reading comprehension of undergraduate college
students. Another possibility is that rock music as a source of auditory distraction increases the reading comprehension of undergraduate college students. The null hypothesis states that rock music as a source of auditory distraction has no effect on the reading comprehension of undergraduate college students.

II. Furthermore, the second testable hypothesis suggests that there is a negative relationship between distractibility and achievement, with participants that showed a larger decrease in reading comprehension scores from the silent to the distraction conditions reporting lower cumulative grade point averages than participants that were less effected by the distraction of rock music. Another possibility is that there is a positive relationship between distractibility and achievement. The null hypothesis states that there is no relationship between distractibility and achievement.

Analysis:

Results from the reading comprehension examinations were compared for the two conditions of silence and rock music using statistical analysis. The repeated measures t-test was used to determine whether rock music has an effect on reading comprehension. Additionally, the degree of distractibility, or the difference in reading comprehension scores between the two conditions, was compared to achievement, as measured by cumulative grade point averages, to examine whether there is any correlation between distractibility and achievement. The Pearson (r) correlation was used to examine this relationship.

Summary:

In this study, the researcher compared the reading comprehension performance of sixteen undergraduate college students in the conditions of silence and rock music.
Statistical analysis was performed using the data collected, in order to determine whether rock music, as a source of auditory distraction, decreases reading comprehension in undergraduate college students. Data was also collected from the participants regarding their academic achievement, as self-reported cumulative grade point averages, and statistical analysis was done to test for any correlation between distractibility and achievement.
Chapter Four - Results

This study examined the effects of rock music as a source of auditory distraction on the reading comprehension of undergraduate college students. This study also examined the relationship between distractibility and achievement. Sixteen undergraduate college students at Rowan University participated in this study on a volunteer basis. The participants took two reading comprehension tests in the conditions of silence and music and filled out a data collection form for achievement information. This study was counterbalanced for both condition and test form. It was first hypothesized that the reading comprehension scores of undergraduate college students would be lower in the presence of music than during silence. It was further hypothesized that there would be a negative relationship between distractibility and achievement, as measured by self-report of grade point average.

Hypothesis # 1:

With respect to hypothesis # 1, which examined the effect of listening to rock music on the reading comprehension scores of undergraduate college students, the data indicated that the results were not significant (t(15)=1.962, p=.069). Thus the null hypothesis, which states that rock music as a source of auditory distraction has no effect on the reading comprehension of undergraduate college students, would be retained. The mean reading comprehension score for the sixteen participants during the condition of music was 2.3750, with a standard deviation of 1.6683, and a standard error of the mean equal to .4171. The frequencies of the different scores received by the participants on the
reading comprehension exams during the music listening condition can be seen in the following graph (Figure 4.1).

Figure 4.1

The mean reading comprehension score for the sixteen participants during the condition of silence was 3.2500, with a standard deviation of 1.4832, and a standard error of the mean equal to .3708. The frequencies of the different scores received by the participants on the reading comprehension exams during the silence condition can be seen in the following graph (Figure 4.2).
The researcher further examined the amount of time each participant took to complete the reading comprehension examinations in the two conditions to explore whether or not a significant difference in time existed. This data indicated that the results were not significant ($t(15)=.711$, $p=.488$). Thus, there was not a significant difference between the two conditions for the time taken to complete the reading comprehension examinations. The mean time for the sixteen participants during the music listening condition was 269.2500 seconds (or 4.4875 minutes), with a standard deviation of 67.9544 seconds, and a standard error of the mean equal to 16.9886 seconds. The frequencies of the various times taken to complete the reading comprehension exams during the music condition can be viewed in the following graph (Figure 4.3).
The mean time for the sixteen participants during the silence condition was 279.6875 seconds (or 4.6615 minutes), with a standard deviation of 80.2461 seconds, and a standard error of the mean equal to 20.0615 seconds. The frequencies of the various times taken to complete the reading comprehension exams during the silence condition can be viewed in the following graph (Figure 4.4).
Figure 4.4

Hypothesis # 2:

With respect to hypothesis # 2, which examined the relationship between distractibility and achievement, the data indicated that the results were not significant (r=.231, p=.388). Thus, this study failed to find a correlation between distractibility and achievement, and the null hypothesis, which states that there is no relationship between distractibility and achievement, would be retained. The mean distractibility score, or difference between the reading comprehension scores in the conditions of silence and music, for the sixteen participants was -.8750, with a standard deviation of 1.7842. The mean grade point average for the sixteen participants was 3.0563, with a standard deviation of .8214. The matching grade point average and distractibility score for each of the five participants can be viewed in the following scatterplot (Figure 4.5).
Figure 4.5

Summary:

This study examined both the effect of music as a source of auditory distraction on the reading comprehension of undergraduate college students, and the relationship between distractibility and achievement. Data was also collected and examined regarding the time taken to complete the reading comprehension exams in the two conditions. This study failed to find any significant results.
Chapter Five - Summary and Conclusions

Summary:

Chapter one introduced the topic of this thesis and examined the purpose, need, and theory supporting the research hypothesis. The purpose of this study was to examine the effect of rock music as a source of auditory distraction on the reading comprehension of undergraduate college students, and to evaluate the relationship between distractibility and achievement. Broadbent's early selection theory of attention was discussed in relation to the hypothesis that listening to rock music while reading would lead to a decrease in reading comprehension among undergraduate college students.

Chapter two of this thesis examined a broad range of literature related to the current study's research hypothesis. Research was discussed involving the effect of auditory distraction on memory, recall, and other tasks; the effect of noise and speech as an auditory distraction on reading comprehension; the effect of music as an auditory distraction on reading comprehension; and the relationship between distractibility and achievement. Inconsistencies in the past research were noted.

Chapter three described, in detail, the methods and procedures of the current research design. Sixteen undergraduate college students participated in this study as part of a research requirement for an introductory level psychology course. Each participant completed two reading comprehension tests, one in the presence on music and the other without music. They also provided a self-report of their grade point average as part of a data collection form. This study was also counterbalanced for presentation of test and
condition.

Chapter four discussed the statistical results of the current research study. With regard to the first research hypothesis involving the effect of listening to rock music on the reading comprehension scores of undergraduate college students, this study failed to find any significant effect. Additionally, this study failed to find any significant effect of listening to rock music on the time needed to read and complete the reading comprehension exams. Finally, with regard to the second research hypothesis, this study failed to find a significant correlation between distractibility and achievement.

Discussion:

This study first examined the main effect of listening to rock music on the reading comprehension of sixteen undergraduate college students, and failed to find a significant effect. This result is consistent with some of the past research, in that it failed to find that music had any impact on reading comprehension (Cool & Yarbrough, 1994, Ross, 1930, Boyle & Coltheart, 1996, Martin, Wogalter, & Forlano, 1988, Zimmer & Brachulis-Raymond, 1978, and Tucker & Bushman, 1991). On the other hand, the past research on this topic has been very inconsistent, and other researchers have found that music does have either a positive or negative effect on reading comprehension (Hall, 1952, Fendrick, 1937, and Henderson, Crews, & Barlow, 1945). This study does not support the results of the past research that did find music to have a significant effect on reading comprehension. This study also looked at the effect of listening to music on the amount of time taken to read and complete the reading comprehension exams, and found no significant results there as well.

The second research hypothesis examined the relationship between distractibility
and achievement, as measured by self report of grade point average. This study failed to find a significant correlation between these two variables. This contradicts the past research on the relationship between distractibility and achievement (Fogelson, 1973, and Baker & Madell, 1965), however the failure to find a correlation could be the result of failing to find a significant main effect for rock music on reading comprehension.

The failure to find any significant results in this study could have been influenced by several factors. First, the sample size used in this study was much smaller than originally planned, as there were limited volunteers available for participation. A small sample size can make it much more difficult to find statistically significant results. Another factor that could have had an extreme impact on the results to this study is that the location where the research had been conducted was not totally silent. This prevented the silence control condition from being completely free of auditory distraction. This could have resulted in a distraction effect being present in both the silence and music conditions, thus preventing a significant difference in reading comprehension between the two conditions. Finally, the failure of this study in finding a significant distraction effect could be influenced by the reading comprehension measures used. The tests used for this study were evaluated by individuals with a minimum of a four-year college education, and were not previously tested on individuals with less education. After evaluating the performance of the participants in this study on the reading comprehension tests, it became apparent that the tests had a difficulty level too high for undergraduate college students. No participant in this study answered all six questions correctly on either of the two tests. Furthermore, there were two participants that answered zero questions correctly on one of the two tests. Because the tests were too difficult for the sample of
undergraduate college students, the tests failed to be an accurate measure of reading comprehension. Thus, there were several interfering variables that could have had an impact on the results to this study.

Conclusions:

From the results of this research, it can be concluded that this study failed to find rock music to be a significant source of auditory distraction on the reading comprehension of undergraduate college students. Furthermore, this study failed to find a relationship between distractibility and achievement. The possibility exists that these results could be an accurate measure of the reality of the undergraduate college population. However, due to flaws in the research design of this study, such as small sample size, inappropriate reading comprehension measures, and interfering sources of auditory distraction, these results could be the result of these interfering variables. This research study shows some of the possible flaws in studies on this topic of rock music as a source of auditory distraction on reading comprehension. These flaws in research design and methods could be what has led to the inconsistency in the research on this topic. From this study, it can be concluded that rock music may not be a significant source of auditory distraction on the reading comprehension of undergraduate college students, and there may not be any correlation between distractibility and achievement, however further research on the topic is necessary.

Implications for Further Research:

Further research on the effect of various sources of auditory distraction on reading comprehension is necessary in order to resolve some of the inconsistencies in the current available research on the topic. In all future research involving auditory distraction it is
important that the researchers make all efforts to maintain an environment free from all outside sources of noise that could impact the study. Furthermore, it is important for future research on reading comprehension to involve the use of reading comprehension measures that have been tested on and evaluated as appropriate for the population that they will be used on. Further areas of possible research involving the effect of rock music on the reading comprehension of undergraduate college students could involve self perceptions of distraction, achievement, and regular study habits.
References


Appendix A
Participant #: ________

Please answer the following questions honestly and as accurately as possible.

1.) What is your current living arrangement: (circle one)
   A) dorm
   B) apartment
   C) house

2.) How many people do you currently reside with: ________

3.) Where do you normally study:
   A) home/apartment/dorm
   B) library
   C) other (please specify) __________________________

4.) Do you normally listen to music while studying: yes / no (circle one)

5.) Do you normally listen to music while reading: yes / no (circle one)

6.) What is your current cumulative grade point average: (example 2.6) ________

7.) What kind of music do you prefer listening to:
   A) rock
   B) rap / hip-hop
   C) pop
   D) country
   E) classical
   F) other

8.) What is your current major in college: __________________________

9.) What did you score on the SAT: verbal ________ math ________

10.) What is your current age? ________ years ________ months

11.) What is your gender? male / female (circle one)