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Auditory Analgesia:

Do Different Genres of Music have Different Analgesic Properties?

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Introduction

It is well established in psychology that attention plays a significant role in perception (Passer & Smith, 2001). However, only recently have psychologists started to believe that cognitive and psychological factors also influence the feeling of pain, and that humans do not only sense pain but perceive pain (Laura A. M., 2002). Subsequently, it is hypothesized that any intense stimuli can affect pain perception (Gardner, Licklider, & Weisz, 1960), and an area known as audioanalgesia is developed to study the analgesic properties of auditory signals. Historical evidence suggests that music is used for controlling pain in many cultures (Laura A. M., 2002), and hence music is often chosen to provide the auditory stimuli in experiments of this area. Many of the literatures suggest music achieves its magic by diluting the attention of the audience (Rogers, 1995). It has also been theorized that dissociative strategies like audioanalgesia are most effective only when a small amount of pain is inflicted (Passer & Smith, 2001). Majority of the researches examined indicate that music exhibits analgesic properties against light pain stimuli, but only under certain circumstances. For example, Lavine, Buchsbaum, and Poncy (1976) suggest that prompts before playing the music is a necessary condition. Perlini and Vita (1996) also concludes that subjects report less pain only when they receive their preferred piece of music – regardless of whether or not they can control what music is being played. However, it is interesting to note that in the experiment conducted by Perlini and Vita (1996), most of the subjects happen to prefer heavy metal and rock music. This suggests that the study may be biased by the genre of music chosen. The result contrasts strongly with the view of Rogers (1995), who insists that it is important to play soothing music without strong rhythms – although only vocal music is examined in his study. Different operational definitions of perceived pain and "innovative" mechanisms to generate pain stimuli were often used in separate studies, and consequently inconsistent conclusions were reached. Most importantly, dissimilar genres and types of music were played, and it is possible that this factor alone may account for the discrepancies in previous experimental results – it is not whether the preferred music is played, but whether "heavy" music is played. In light of the conflicting evidence, it is logical to hypothesize that the genre of the music can influence the effectiveness of pain control. In particular, the goal is to investigate if heavy

metal music is a better "anesthetic", as previous studies have shown that intense stimuli are more distractive (Gardner et al., 1960).

Experimental Design

Inconsistent recommendations on the ideal genre of music to employ to achieve audioanalgesia lead to my hypothesis – heavy metal music can induce the greatest reduction in artificially inflicted pain. No previous study has been found that target this hypothesis, and my study aims to clear up the confusing issue. It appears that all the studies assumed without reference that classical or vocal music have better audioanalgesic properties.

The independent variable in my study is the genre of the music. The variable is operational defined to have three discrete values – heavy metal music, classical music and no music. In particular, "Enter Sandman" and "the Moonlight Sonata" are chosen to be the representative of heavy metal and classical music respectively. The no music case is designed to provide baseline measurements for data analysis purposes.

Although the relaxing properties of classical music may seem to be promising for audioanalgesic effect (Laura A. M., 2002), it does not draw as much attention as heavy metal does (Rogers, 1995). I predict that distraction plays a more prominent role in non-chronic pain reduction than relaxation does, and hence strong rhythms from heavy metal will be more effective.

The amount of pain perceived is the dependent variable. To create maximal compatibility to compare results, my study employs operational definition that is used in previous studies by other researchers. Because pain perceived is vastly a subjective experience, it will be operationally defined to have both a subjective and an objective component – Average Evoked Response (AEG) derived from electroencephalograph readings will be used to provide objective measurement (Lavine, Buchsbaum, & Poncy, 1976), and the widely accepted McGill's Pain Rating Index (PRI) will be used to provide a subjective account (MacDonald et al., 2003). Cold pressor(CP), a device that submerges subject's arm into cold water producing moderate irritating pain, will be used to generate pain (Perlini, & Vita 1996). The perceived pain level would then be recorded and later analyzed.

Since the focus is on how different genres of music can affect pain perception, it is desirable to minimize any effect that is due to preference on the type. It is well known that many of the teenagers and young adults favor heavy metal music over classical music, and it is thus necessary to draw my random sample from a wider age group – in an attempt to increase the chance of having an approximately same number of subjects that prefer each type of the music. Previous study that selects volunteers from age 19-35 is shown to have an overwhelming music preference bias (Perlini, & Vita 1996). To overcome the challenge, 102 healthy volunteers from the Vancouver community from age 19 to 55, 51 men and 51 women, will be asked to participate in my experiment.

Patrons in a random shopping mall will be approached, and if they satisfy the age and gender requirement, they will be asked to participate in the study. Handy brochure that covers the background of audioanalgesia will be given, and they will also be informed that moderate amount of pain will be inflicted during the study. They will be paid when the trial is complete. The volunteers will be randomly assigned into three groups of size 34 – the control group and two experimental groups. In the control group, no music will be played when cold pressor inflicts the minute pain. Hence, baseline measurements from AEG and PRI will be obtained. Heavy music and classical music will be played, at the composers' intended volume, throughout a trial in the first and second experimental groups respectively. The subjects will be exposed to the cold pressor ten times in each trial, and data will be collected after each exposure. Each exposure would last one minute, and a five-minute mandatory break will be inserted between exposures.

It may appear to be unethical to inflict pain on subjects. Fortunately, only moderate amount of irritating pain is generated by cold pressor, and the pain is not long lasting (Perlini, & Vita 1996). Subjects will procure no persistent damage to their physical or mental-well being. People who receive the type of music that they dislike may be temporarily annoyed during the trial, but it will not lead to psychological breakdown. Before the experiment begins, all volunteers will be informed that they will undergo "pain trials", and the study aims to identify any causal relationship between auditory stimuli and amount of perceived pain. They will be blinded from the exact hypothesis – the fact that

that I expect heavy metal would actually alleviate pain will not be disclosed. This is done to avoid confounding the experimental results.

Data will be collected by recording the EEG activities of the subjects, and the apparatus will be set up using the standard procedure – skin will be rubbed with alcohol and ensure it has impedance below a certain threshold (Lavine et al., 1976). Subjective ratings from PRI and objective measurements from EEG will subsequently be analyzed using computer-aided statistics software. In particular, data from both experimental groups will be compared against the baseline measurements from the control group to identify if one group experiences less pain than the other.

If it is statistical significant that the group exposed to heavy metal music throughout the trial perceives less pain than the other two groups, it can be concluded that heavy metal music is indeed more effective in causing reduction of pain perceived – at least in the case where small amount of pain is inflicted for a short period of time. This result would suggest that previous studies have overlooked this aspect, and the genre of the music used actually is a stronger determining factor.

However, if no difference of perceived pain level between the two experimental groups, it suggests that other factors such as prompts and preferences are more prominent. It might be the case that the relaxation properties of music are more important than the distraction effect, and the result would then support the claim from Rogers (1995). It is also possible that heavy metal music is such an aversive stimulus that annoys the subject, and the annoyance may actually enhance pain perception.

Regardless of whether the result supports the hypothesis, other sources of artifacts may be influential. It may be the case that most of the random sample still consists of people who prefer heavy metal, and that the preference is correlated with braveness. Such quality may further be associated with innate high pain tolerance. Furthermore, the volume of the music is not controlled in the experiment. Since an intense stimulus is found to be more effective (Gardner et al., 1960), it may have positively biased with the general loudness of the heavy metal genre. The random sample is drawn from a shopping mall, and the subjects may have been classical conditioned to associate happiness with classical music that is frequently played at malls. The participants may also have heard from outside sources the recommendation of using classical music to control pain, and may

have consequently biased their subjective ratings. Moreover, random sample that is collected outside AMV may produce a significantly different result from a sample that is collected outside Tom Lee music store.

Non-experimental/Correlational study

To complement the experimental result, a correlational study will be executed to investigate how well the result generalizes to patients that suffer from acute and chronic pain due to injury. I hypothesize that the "heaviness" of the music is negatively correlated with the amount of anesthetic the patient uses, where heaviness is defined to be how throbbing the rhythms are and how loud the music is intended to be played at. Both variables will be observed but not manipulated.

A random sample of one thousand patients from Burnaby General Hospital that suffer a moderate injury from car accidents will be asked to participate in a survey after they are completely cured. Car accident is chosen because people of any age can be involved in one. It is assumed that moderate injury procures moderate level of pain. Participants are randomly chosen from a group of patients who underwent a moderate injury and have spent 20 hours per week listening to music during the treatment period. Each volunteer will be asked to fill in a questionnaire, indicating the "heaviness" of the music he/she listens to most of the time – they would provide self-rating from "very heavy and throbbing" to "pieces that liken lullabies". With the patients' consent, the collaborated amount of anesthetic used during their treatment will be noted. The amount is collaborated because it is possible that different anesthetic is used, and the values need to be adjusted to account for the various drug strengths. The amount of anesthetic used and the heaviness of the music listened to will be graphed to identify any correlation between the two variables.

Informed consent will be required for this study as it deals with medical information of patients. By the setup of the design, the knowledge about the study should not confound the results – as the patients are asked to participate after their complete treatment. The study is ethical if no information collected will be disclosed to others, and the individual medical information will be destroyed after the study is completed.

It is assumed that less anesthetic will be used if the patient perceives less pain. Hence, if the result confirms the hypothesis, it infers the "heaviness" of music positively correlates with audioanalgesic property. It would thus be logical to include heavy metal music as a possible selection to use in music therapies.

If the result shows no significant anesthetic usage correlation with the genre of the music listened, then it is possible that all music serve the same purpose with respect to audioanalgesia. Other possible sources of error may have influenced the result as well. For example, many hospitals would periodically play soothing music, and it may have balanced out the effectiveness of listening to heavy metal music.

Several other unaccounted variables may impact the result of the study. For example, it may be the case that people must listen to their preferred music to perceive less pain, but it happens that people who prefer heavy metal music get into car accident more easily and make up the majority of the studied sample. Furthermore, there may not be enough patients would listen to extremely heavy or soothing music during the treatment, and most people listen something in between on the scale. The data generated would thus be inconclusive. Moreover, it is also possible that playing heavy music at hospital is disallowed or discouraged, with the presumption that heavy music may agitates patients and heightens the pain level.

Conclusion

Both the experimental and the correlational design aim to investigate whether "heaviness" of the music influences pain perception. The basis of the argument is that "heavier" music would draw more attention, and the distraction property of music might be more important than its relaxation property with respect to its pain-relief function. Through random assignment, the experimental design intends to eliminate the confounding influences due to the subject's preference on the genre. Even with this practice in place however, the preference effect may not be eliminated, and the result is dependent upon the characteristics of the experiment sample. Similar to the preference effect, in correlational design, age can be a highly influential third variable - it may happen that younger people enjoy heavier music, and they are stronger and require fewer anesthetics. Furthermore, the genre of a

piece is difficult to define precisely, but a strict definition may limit the number of samples we can collect from the correlational study.

It may be difficult for people to consent and have themselves subjected to painful stimuli – volunteers who are willing to go through pain trials may have exceptionally uncharacteristic pain tolerance levels to start with, and the collected data may not generalize. In correlational design, medical information is collected, and privacy issues need to be carefully handled. Due to social desirability effect, patients may be dishonest about what kind of music they listen to. For example, they may pretend to be fashionable and claim that they only listen to classical music. Furthermore, it may be difficult to identify one thousand patients who match the criteria and are willing to participate in the study.

The result of this study will direct what genre of music will be used in music therapy. It may also shed light on more research possibilities, and discover more interesting aspects of audioanalgesia. Patients with chronic pain often need non-intrusive ways to ease their discomfort, and any guidance to maximize the pain relieving properties of music will benefit them significantly.

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