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Introduction  
We live in a world where one can hardly escape a newspaper or news report on television without seeing an outbreak of violence, and one suggested instigator for the commonplace of violent crime is media. Crime rates are on the rise and successful marriages are on a downward spiral. The world is a place where sheep can be cloned, but children cannot be prevented from killing their classmates. Technology has multiplied a person’s material possessions but lessened his or her morality. It is a time of instant dinners, instant information, and in an instance, the world has morphed into the quick, the easy, and the disposable, whether the disposed be Styrofoam plates or ethics. Whether violence in television, radio, and music catalyze these travesties or if violent media is merely used as a scapegoat has been one such characteristic of our flawed society that has lately been under much public scrutiny.   
Recently there has been much debate over the actual effects of violent themes in the media, especially music and action sequences in television and cinema to which the youth of our culture have access. On September 11, 2000, the government agency the Federal Trade Commission issued a report entitled “Marketing Violent Entertainment to Children: A Review of Self-Regulation and Industry Practices in the Motion Picture, Music Recording and Electronic Game Industries.” This study revealed that violence in the media is extremely prevalent, especially in media targeted towards children under the age of seventeen. Of 55 music recording with explicit content, all were targeted to children under 17. 15 of the 55’s marketing plans were drawn especially to target minors. Of the 44movies reviewed, all rated R, 28 were targeted towards children under 17. Not only are violent media productions targeted towards an under-age audience, but these sources are readily available to anyone interested. Thought the Internet, namely sites such as the controversial Napster, offer many benefits, the sites also give many child unrestricted access to music. According to a study conducted by Nielson Media Research in 1995, ninety-nine percent of American household have a television, and the Center for Media and Public Affairs stated that the average American child will witness over 200,000 acts on violence on television, 16,000of those murders, before they are eighteen years old. Obviously one can access “violent” media with little effort. The question is what effect this media has on those that are exposed to it.   
The opinions about violent media are just as numerous as the types of media that are out there. While some insist that violence in the media directly affects the mentality of those that experience it, other claim that the media provides an outlet to channel rage. One child psychologist, Melanie Moore, believes that “fear, greed, power-hunger, rage: these are aspects of our selves that we try not to experience in our lives but often want, even need, to experience vicariously through stories of others. Children need violent entertainment in order to explore the inescapable feelings that they've been taught to deny, and to reintegrate those feelings into a more whole, more complex, more resilient selfhood. There is even an organization, the American Coalition for Violent Media, specifically aimed at protecting the rights of those that create violent media on the grounds that “hiding things from children causes a loss of security and feelings of isolation which are the real causes of violent acts, not fake violence from media.”   
On the contrary, the American Academy of Child and Adolescent Psychology believes violent themes in the media “make children become ‘immune’ to the horror of violence, accept violence as a way to solve problems, imitate the violence they observe on television; and identify with certain characters, victims and/or victimizers.” Some feel so strongly that violence in the media is a severe problem that, in1996, legislation was approved by President Bill Clinton to require television makers to include a “v-chip” in the sets to enable parents to block out violence.  
We decided to take a scientific approach to this controversy and to investigate the hypothesis that violent sound actually does have detrimental effects on those that hear it (in this case mice). It is well-accepted that lyrics glorifying and threatening violent behavior has no positive effects on those that listen. However, instead of focusing on the effects of the lyrics, we decided to test the effects of the *sounds* of violent media. Our first task was to define what exactly “violent” media is. We took into account the definition of the word “violent” from *the American Heritage Dictionary*, “showing or having great emotional force” and “marked by or resulting from great physical force or rough action.”   
Because the definition of violence, as portrayed in the media, is still subjective to those that view or hear it, we decided to draw our compilation of sounds from what society deems violent. Our excerpts originated from compact discs labeled with “parental advisory: explicit content”, our videos are rated-R for violent content, and other selections. We also looked for the violent themes that the American Academy of Child and Adolescent Psychology targets as problematic concepts in media: the idea of suicide as an “alternative”; or “solution”; graphic descriptions of violent acts, and sex which focuses on control, sadism, masochism, and violence toward women. We then compiled a series of these types of excerpts from action films, compact discs, television, and radio, and played them to two groups of five common mice while they weaved their way through a wooden maze.  
In order to assure that we did not just test the effects on one artist or one type of violent sound, we included an array of different excerpts. Such artists, who have lately been condemned for instigating violent outbursts among our nation’s children are Detroit rapper, known under the alias as Eminem, and metal rocker Marilyn Manson, named for the infamous serial killer Charles Manson. To diversify the arena of sounds we used, we also included the sounds of rock groups, other rappers, R-rated movies with violent content, and even an excerpt from a Halloween CD filled with screams and evil laughter entitled “Scary Sounds.”  
Though mice do not understand the lyrics or realize what they are listening to (i.e. gun shots, a person’s scream, etc.), mice have a keen sense of hearing, a trait that makes them perfect for a study incorporating sound. One mouse can hear the warning scream of another at 100,000 cycles per second, assuming the scream is of a modern intensity. In addition, studies have shown that mice are drawn to music, and have appeared in people’s homes while music is being played, a fact which reveals that mice are sensitized to sounds. Mice are classified rodents of the genus *Muridae* and *Cricetidae*, characterized by their long, hairless tail. Mice are mammalian, and have a rapid reproduction rate, with an average gestation period of one month.   
Because of their rapid reproductive rate and small size, they are commonly used as laboratory animals. As lab animals, they have assisted researchers in a wide range of fields from medical research to behavioral studies. Basic behavioral psychology states that animals may be studied and the results of the studies can be applied to human behavior. A further, interesting fact is that human DNA differs from the genetic sequences of mice in thirty genes, a concept revealed with the completion of the HumanGenome Project. From this behavioral psychology generalization and the linkage between human and rodent DNA, we derive a real-world connection to our project. If the mice are negatively affected by the violent sounds, than it is possible that humans, as it has been suggested, are negatively affected as well.  
One similarity, crucial to our research, is that humans and mice hear sounds in a very similar matter. Both humans and most mammals have hair cell bundles called cilia arranged on a strip of tissue in the ear called a basilar membrane. This membrane coils with the cochlea in the inner ear. When sounds generated by mechanical forces are heard, three bones of the middle ear vibrate, which jiggles a part of the cochlea. The vibrations of the cochlea stimulate the cilia, which send out a rapid-fire code of electrical signals about the frequency, intensity, and duration of a sound. The signals are then sent to the brain, where the brain interprets the sound, mainly in the cerebral cortex. Several new techniques, such as the PET scan (positron emission tomography) and the fMRI ( functional magnetic resonance imaging) allow researchers to see how the human brain interprets sound. The brain interprets sound in a different area of the brain than it does when it interprets visual images. Because the areas of the brain are different when hearing rather than seeing, our research tests only the *hearing* of violent media and is not coupled with both hearing sounds and *seeing* violent images. In addition, the mouse cannot interpret meaning to the sounds, and so our experiment is testing the raw effects of the sounds of violent media, without the any other variables –such as understanding, bias, or unleashed, past fears connected to the sounds.  
While we depend on hearing and the ear, the root of our experiment lies in the brain: memory. Though there are obvious differences in the ways that man and mouse remember information, mice have been traditionally used to test the effects of a certain variable on the memory. One incidence of memory research that used mice was the investigation of the effects of aspartame on mouse memory by Olney, a professor, neuroscientist and researcher in the department of psychiatry, School of Medicine at Washington University. By studying test groups of mice he was able to find substantial evidence that consuming such sugar supplements as Nutri-Sweet caused damage to human memory.  
The memory is strengthened by repetition, and accordingly, we have run the mice through the same maze under identical conditions in order to test their memories. In addition, memory fades with time, so it was necessary to test the mice on a regular basis. According to Barry Gordon, M.D., P.h.D. in his book Remembering and Forgetting in Everyday Life, there are two main types of memory: immediate and long-term. Immediate memory is defined as memory as a type of echo, usually lasting seven to ten seconds. The second type of memory is long-term or permanent memory, where information lies dormant in the brain and must be retrieved by reactivation. In our experiment, the mouse’s memory should be “reactivated” each time she progresses through the maze.  
Memories are created by the actual firing of nerve cells in the brain that make a record of what was see nor heard. Patterns are created by a certain activity, such as running through, and at the same time, the neurons firing electric signals in the brain establish a connection between themselves so that the pattern can be fired up later. The first process of seeing or hearing information is stored in the cerebral cortex of the brain. Sounds are recorded in the left temporal lobe and sights are recorded in the occipital lobes in the back of the head. Temporary processing of information occurs here. If one is going to remember something for along period of time, the information will be stored in the thalamus, deep in the center of the brain, or in the hippocampus of the brain.   
The goal of our experiment was to detect any negative effects that a plethora of different violent sounds has on the memory of mice, and possibly substantiate that violent media is in fact detrimental, not because of the suggestive violent images and or frightening lyrics, but rather the sheer nature of the sound. As above mentioned, the brain reacts and interprets sounds based on the duration, intensity, and typically violent music and action excerpts tend to have similar intensities and frequencies of a sound.   
Both rap and rock music has distinctive sound patterns. Rap music emphasizes rhythmic accompaniment and quality of tone, timbre, rather than harmony, uses synthesized mechanical sounds, and often lacks chord changes. Rock music is characterized by complex technical aspects using chords known tonic, subdominant, and dominant; and many rock songs have similar chord progression such as the *drone,* a single pitch sustained through a progression of chords, and the parallel movement of chords, derived from a technique on the electric guitar known as bar-chording repeated chord patterns called riffs, backbeats which emphasize the second and fourth beats of each measure. Also, screams, gun shots, and yelling have very specific sound patterns that will usually be interpreted in the same manner as other screams, gun shots, and yelling.  
On the premise that mice are closely linked to humans in the areas of both hearing and memory, we hope to find substantial evidence about the effects of violent sound of the brain of mice, suggesting that the pure sound violent media either does or does not have a scientifically detrimental effect on the health of human beings. Obviously, violence in American society is on a rampage; and the one way to solve a problem is to secure a cause and effect relationship. By researching the effects of violent sound on mice, using repetition to build long-term memory, we hope to find evidence either for or against violent media.

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Data   
The firstfive data entries are both the variable and control without the music for fivestraight days. The next fifteen thesound clips are played to the variable group, and the last ten entries is a newmaze with the sound clip played.  
  
Variable –   
1) 3:29.00, 3:20.05, 2:30.02, 4:56.00, 2:00, 2:57.48, 3:50.27, 4:22.62, 4:25.43, 4:20.74,4:28.53, 4:20.15, 4:25.16, 3:56.14, 4:15.16, 3:11.97, 4:56.41, 5:05.62,4:47.59, 5:10.47, 4:15.62, 4:14.04, 5:10.39, 4:39.57, 5:11.84, 5:16.14,5:35.63, 5:15.72, 4:57.07, 5:14.97  
2) :15.50, 3:18.72, 5:00.00, :35.71, :21.78, :53.51, 4:29.25, 5:40.04, 4:47.42, 5:20.64,5:00.18, 5:10.06, 1:55.04, 1:56.03, 1:54.16, 3:42.75, 4:46.14, 3:39.17,5:15.43, 5:16.73, 1:29.14, 1:57,14, :58.17, 01:26.79, 2:10.16, 3:10.14, 2:45.75, 3:14.61,4:43.00, 5:00.17  
3) :43.34, :20.32, :32.79, 2:26.57, :13.19, 1:43.16, 2:24.14, 2:51.58, 2:50.61, 2:55.31,2:47.73, 5:01.15, 5:56.41, 5:49.00, 6:01.46, 6:00.55, 6:15.72, 6:30.14,6:14.41, 1:32.14, 1:40.61, 1:47.14, 1:13.14, 1:59.73, 1:57.61, 2:01.15,3:10.74, 4:14.01, 3:05.16, 2:47.16  
4) :36.13,33.90, :09.09, 19.97, 2:15.41, 3:06.58, 1:56.58, 2:59.07, 3:00.00, 3:10.14,2:49.54, 3:00.61, :22.35, 3:39.28, 2:15.47, 2:56.00, 3:14.72, 3:16.17, 3:02.43,3:16.19, 3:00.61, 3:21.16, 2:47.61, 2:34.52, 3:15.61, 3:51.72, 3:14.61,3:15.73, 2:45.16  
5) 27.05, 18.53,13.19, 11.10, 17.06, 35.78, 21.47, 37.65, 35.47, 32.17, 36.71, 1:30.85,1:20.51, 45.01, 56.41, 1:16.74, 1:20.16, 58.63, 1:05.42, :32.16, 40.71, 45.73,36.14, 20.12, 1.00.67, 59.61, 1:00.00, 1:15.01, 1:20.14, 1:56.13  
  
Control  
1) 3:20.69,5:00.00, 3:29.75, 4:15.88, 1:34.88, 4:37.79, 4:30.65, 4:25.69, 4:10.14,4:19.08, 4:03.21, 4:07.61, 4:01.59, 4:20.42, 4:10.09, 4:08.57, 4:01.57,4:00.06, 3:52.41, 2:20.61, 4:01.32, 4:15.41, 4:30.12, 3:59.16, 3:58.17,3:59.61, 2:00.10, 4:00.10, 3:51.61  
2) 28.09, 48.34, 1:47.38, 1:26.41, 3:25.44,36.84, 1:37.41, 1:19.33, 1:15.47, 24.50, 34.15, 51.10, 59.25, 31.03, 41.46,1:28.41, :54.16, 2:21.43, 1:15.43, 52.60, 31.61, 42.14, 1:20,10, 1:19,17,1.00.12, 1:15.31, 59.14, 45.01, 40.19, 50.26  
3) 30.66, 32.28,53.28, 1:30.01,17.13, 57.36, 26.94, 37.38, 25.14, 30.23, 29.31, 28.43, 17.25,21.53, 22.14, 55.88, 32.16, 31.12, 35.14, 12.14, 1:13.46, 25.67, 32.58, 26.19,31.23, 13.47, 20.21, 31.43, 19.67, 18.21  
4) 3:00.72,5:00.56, 3:45.84, 2:23.63, 3:41.75, 3:33.87, 3:25.43, 3:20.40, 3:15.26,3:05.74, 3:04.75, 2:03.16, 2:41.16, 2:16.47, 3:42.75, 2:17.36, 2:05.58,2:27.62, 2:01.42, 4:00.01, 3:59.76, 4:15.02, 3:25.43, 3:20.73, 3:17.61,3:19.14, 3:22,73, 3:22.05, 2:57.16

To assess the data that was collected we used the statistical ANOVA test. The ANOVA test analyzes data from more than two samples and compares them. According the ANOVA test there is a significant difference between the control and variable groups. We obtained a p-value of approximately zero. This signifies that more than chance was occurring to cause the difference of times. A p-value of zero suggests that the difference in the times would occur zero out of one hundred times, when left to chance alone.

Based on the results of the statistical analysis and a graphical analysis, we conclude that the violent sounds that the variable group was subjected to did have an impact on their performance and memory when running through the maze. The variable group showed an increase in their times, while the control group did not show an increase, and in some instances decreased their times.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Trials | Mouse 1 | Mouse 2 | Mouse 3 | Mouse 4 | Mouse 5 | Mouse 6 | Mouse 7 | Mouse 8 | Mouse 9 |
| 1 | 03:29.0 | 00:15.5 | :43.34 | 00:36.1 | 00:27.1 | 03:20.7 | 00:28.1 | 00:30.7 | 03:00.7 |
| 2 | 03:20.0 | 03:18.72 | 00:20.3 | 00:33.9 | 00:18.5 | 05:00.0 | 00:48.3 | 00:32.3 | 05:00.6 |
| 3 | 02:30.02 | 5:00.00 | 00:32.8 | 05:09.0 | 00:13.2 | 3:29.75 | 1:47.38 | 00:53.3 | 3:45.84 |
| 4 | 04:56.00 | 00:35.7 | 2:26.57 | 00:20.0 | 00:11.1 | 4:15.88 | 1:26.41 | 1:30.01 | 2:23.63 |
| 5 | 02:00.0 | 00:21.8 | 00:13.2 | 2:15.41 | 00:17.1 | 1:34.88 | 3:25.44 | 00:17.1 | 3:41.75 |
| 6 | 02:57.5 | 00:53.5 | 1:43.16 | 3:06.58 | 00:35.8 | 4:37.79 | 00:36.8 | 00:57.4 | 3:33.87 |
| 7 | 03:50.3 | 04:29.25 | 2:24.14 | 1:56.58 | 00:21.5 | 4:30.65 | 1:37.41 | 00:26.9 | 3:25.43 |
| 8 | 04:22.6 | 05:40.0 | 2:51.58 | 2:59.07 | 00:37.6 | 4:25.69 | 1:19.33 | 00:37.4 | 03:20.4 |
| 9 | 04:25.4 | 04:47.4 | 2:50.61 | 3:00.00 | 00:35.5 | 4:10.14 | 1:15.47 | 00:25.1 | 3:15.26 |
| 10 | 04:20.7 | 5:20.64 | 2:55.31 | 3:10.14 | 00:32.2 | 04:19.1 | 00:24.5 | 00:30.2 | 03:05.7 |
| 11 | 04:28.5 | 05:00.2 | 02:47.7 | 02:49.5 | 00:36.7 | 4:03.21 | 00:34.1 | 00:29.3 | 3:04.75 |
| 12 | 04:20.1 | 5:10.06 | 5:01.15 | 3:00.61 | 1:30.85 | 4:07.61 | 00:51.1 | 00:28.4 | 2:03.16 |
| 13 | 04:25.2 | 1:55.04 | 5:56.41 | 00:22.4 | 01:20.5 | 4:01.59 | 00:59.3 | 00:17.3 | 2:41.16 |
| 14 | 03:56.1 | 1:56.03 | 5:49.00 | 3:39.28 | 00:45.0 | 4:20.42 | 00:31.0 | 00:21.5 | 2:16.47 |
| 15 | 04:15.2 | 1:54.16 | 6:01.46 | 2:15.47 | 00:56.4 | 4:10.09 | 00:41.5 | 00:22.1 | 3:42.75 |
| 16 | 03:12.0 | 3:42.75 | 6:00.55 | 2:56.00 | 1:16.74 | 4:08.57 | 01:28.4 | 00:55.9 | 2:17.36 |
| 17 | 04:56.4 | 4:46.14 | 6:15.72 | 3:14.72 | 1:20.16 | 4:01.57 | 00:54.2 | 00:32.2 | 2:05.58 |
| 18 | 05:05.6 | 3:39.17 | 6:30.14 | 3:16.17 | 00:58.6 | 04:00.1 | 2:21.43 | 00:31.1 | 02:27.6 |
| 19 | 04:47.6 | 05:15.4 | 06:14.4 | 3:02.43 | 1:05.42 | 3:52.41 | 1:15.43 | 00:35.1 | 2:01.42 |
| 20 | 05:10.5 | 5:16.73 | 1:32.14 | 03:16.2 | 00:32.2 | 2:20.61 | 00:52.6 | 00:12.1 | 4:00.01 |
| 21 | 04:15.6 | 1:29.14 | 1:40.61 | 3:00.61 | 00:40.7 | 4:01.32 | 00:31.6 | 1:13.46 | 3:59.76 |
| 22 | 04:14.0 | 1:57.14 | 1:47.14 | 3:21.16 | 00:45.7 | 4:15.41 | 00:42.1 | 00:25.7 | 4:15.02 |
| 23 | 05:10.4 | 01:26.8 | 1:13.14 | 2:47.61 | 00:36.1 | 4:30.12 | 1:20.10 | 00:32.6 | 3:25.43 |
| 24 | 04:39.6 | 00:58.2 | 1:59.73 | 2:34.52 | 00:20.1 | 3:59.16 | 1:19.17 | 00:26.2 | 3:20.73 |
| 25 | 05:11.8 | 2:10.16 | 1:57.61 | 3:15.61 | 1.00.67 | 3:58.17 | 1.00.12 | 00:31.2 | 3:17.61 |
| 26 | 05:16.1 | 3:10.14 | 2:01.15 | 3:51.72 | 00:59.6 | 03:59.6 | 1:15.31 | 00:13.5 | 03:19.1 |
| 27 | 05:35.6 | 2:45.75 | 03:10.7 | 3:14.61 | 1:00.00 | 2:00.10 | 00:59.1 | 00:20.2 | 3:22.73 |
| 28 | 05:15.7 | 3:14.61 | 4:14.01 | 03:15.7 | 1:15.01 | 4:00.10 | 00:45.0 | 00:31.4 | 3:22.05 |
| 29 | 04:57.1 | 04:43.0 | 3:05.16 | 2:45.16 | 1:20.14 | 3:51.61 | 00:40.2 | 00:19.7 | 2:57.16 |
| 30 | 05:15.0 | 5:00.17 | 2:47.16 | 02:53.2 | 1:56.13 | 03:52.9 | 00:50.3 | 00:18.2 | 03:01.3 |
|  |  |  |  |  |  |  |  |  |  |
| Average | 04:24.1 | 02:43.4 | 02:13.2 | 02:08.4 | 00:36.2 | 04:05.4 | 00:45.5 | 00:29.1 | 03:19.4 |