**Violent Sound and Its Effect on the Memory of Mice**

**Brittany Adams and Katie Ghinazzi**

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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. 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. It is possible that technology has multiplied a person’s material possessions but lessened his or her morality. Whether violence in television, radio, and music catalyzes these travesties or is merely used as a scapegoat, the violence is a 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 fifty-five music recordings with explicit content, all were targeted to children under seventeen. Fifteen of the fifty-five had marketing plans that were drawn especially to target minors. Of the forty-four movies reviewed, all rated R, twenty-eight were targeted towards minors.

Not only are violent media productions targeted towards an under-age audience, but also these sources are readily available to anyone interested. Though the Internet, namely sites such as the controversial Napster, offers many benefits, the sites also give many children unrestricted access to music. According to a study conducted by Nielson Media Research in 1995, ninety-nine percent of American households 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, 16,000 of 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 available. While some insist that violence in the media directly affects the mentality of those that experience it, others 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, in 1996, 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). Many believe that lyrics glorifying and threatening violent behavior have negative effects on those that listen to the music, and that violent images are damaging. However, instead of focusing on the effects of the lyrics or images, we decided to test the effects of the *sounds* of violent media on memory. 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 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 with denoted violent content. 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 of 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 the Detroit rapper Marshall Mathers, known under the alias 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 that reveals that mice are sensitized to sounds. Mice are classified rodents of the genus *Muridae* and *Cricetidae*, characterized by their long, hairless tails. 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 only thirty genes, a concept revealed with the completion of the Human Genome 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, then 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. Most mammals, including humans, 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 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 causes 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., PhD. 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 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, we test long-term memory where the mouse’s memory is “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 seen or heard. Patterns are created by a certain activity, such as running through the maze, 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 a long 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 and intensity of the sound. Typically violent music and action excerpts tend to have similar intensities and frequencies.

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 on the brain of mice, suggesting that the pure sound violent media either does or does not have a scientifically detrimental effect on the memory of human beings. Obviously, violence in American society is on a rampage; and one way to solve a problem is to secure a cause and effect relationship. By researching the effects of violent sound on mice and using repetition to build long-term memory, we hope to find evidence either for or against violent media.

**Hypothesis:** Exposure to violent sounds will produce negative effects in memory in mice.

**Prediction:** If exposure to violent sounds produces negative effects in memory in mice, then the mice exposed to the sounds will not decrease their times in a series of memory tests at the same rate at which the control group’s time decreases.

**Materials:**

10 colored, common female mice

2 cages

2 water bottles

2 food dishes

2 exercise wheels

common mouse food

paper shaving bedding

exercise ball

maze with interchangeable parts

tape and CD player

tape recorder

sound clips (rap music, punk music, R-rated movie soundtrack, sounds of gunshots, fighting sounds, screams, swearing)

The tape includes the following clips: “Stan” from Eminem’s album the Marshall Mathers LP, “Shake Your…” by rapper Mystikal (obtained from the Internet), “One of Those Days” by Limp Bizkit, “Beautiful People” by rocker Marilyn Manson, excerpt from a fight scene in the Matrix, screams and evil laughter from “Scary Sounds”, The Way I Am (from the radio) by Eminem, and sound clips from boxing taken off of Fox Networks.

edible reward (cheese)

stopwatch

**Procedure**

The key to an effective experiment is making sure that all variables are accounted for and constant if need be. When taking on this particular experiment, partially due to the fact that live animals were involved, we had to be very thorough in both planning our experiment, as well as ensuring that only one dependent variable existed: the sounds of violent media. By following this procedure, we hope to have produced accurate data and created a plan that others could repeat:

1. **Pet Care:** The first important step of this project is to research how to care for mice and what type of mouse to use. By looking on the Internet and asking the employees of a pet store, we concluded that using all female specimens would be the best, mainly because they are less aggressive towards each other and less odorous. By using females, one does not have to run the risk of reproduction and lessens the chances of cannibalism. We also decided to purchase common, colored mice. These are not terribly costly and are less inbred than feeder or hopper mice. Also, there will be no discrepancy about the identities of each mouse since they have different color coat markings.
2. **Obtaining Materials:** The next step we took was gathering all of our materials. We called around different pet stores and found the least expensive equipment. While some pet stores offered common mice for up to seven dollars apiece, we found that PetCo® offers them for roughly two dollars each. We purchased 10 mice, five for the control group and five to be tested with the dependent variable. We bought all the mice from the same place so that they would have a similar background and would be of the same age. Unfortunately, later in our experiment, five of the mice became ill. We later bought five more mice (one of which died also), and although they are younger, they are evenly split among the control and variable groups. We also bought all needed supplies listed in the materials section of the web site. Each group has the exact same products. In addition, we continued to purchase the same brand of food throughout the experiment so that would not be a variable.
3. **Grouping and Living Conditions:** The mice were originally grouped five for the control and five for the variable group in the exact same surroundings. The temperature was roughly 65 to 70 degrees Fahrenheit, and they were kept in the exact same spot in the house throughout the experiment. They each were provided with the same amount of food and water and were fed every morning to every other morning between 7:00 and 7:30 a.m. Unfortunately, when four of our specimens died as a result of an unknown virus, the mice had to be split unevenly in their cages. The four new mice were in one cage, while the original mice were grouped in factions of two and three. Because three mice died in the control group and two died in the variable group, they had to be left separated in that manner. The new mice could not be introduced into the other mice’s cages because they would fight (mice establish ranking and when the ranking is disturbed by the introduction of a new member, the leader of the mice becomes aggressive). Dealing with these circumstances, we decided to take two of the new mice from each group, two of the mice left in the variable group, and one of the old mice of the control group and make them one group. This way the ages of the mice and the conditions they live in (whether it is with one mouse or two) would be uniform in the control and variable groups even though mice from the two groups would be living together in the same cages. The most important objective in conducting this experiment is to make sure that there are no differences between the control and variable groups, so that unknown variables could affect the results.
4. **Violent Media:** The next step in our experiment was to make the violent sound tapes. Because violent media surrounds us, it was not difficult to obtain sound clips. Using the definition of violence in the American Heritage Dictionary, we found sounds that are deemed “violent.” In addition, we only used sounds that are recognized by society as inappropriate for the younger population. All sounds come from R-rated movies, CDs with parental advisory stickers, and television with “viewer discretion advised.” A complete listing of all sounds is available in the materials list. We simply recorded a series of sound clips onto an audiotape for six minutes. We made sure the mice were exposed to more than one artist and type of violent media.
5. **Testing Our Hypothesis:** Our actual test was rather simple. We did a series of 30 trials every day over a 5-week period between 6:30 and 7:30 p.m. For the first week (5 trials), one person in our group ran each mouse through the maze. Times were measured using a regular stop-watch. In the maze, we marked a line for the beginning and for the end so that we would know the exact spot to put each mouse and the exact spot to stop the clock when the mouse arrived at that place. At the end of the maze, we placed alternately their regular food or a slice of cheese and left the top of the maze open at the finish line. The mice seemed more enthusiastic about getting out through the top of the maze (their obvious incentive to move through the maze) than their edible treat. It is important that the mice have an incentive to run through the maze in order to test their memories. After running the mice through the maze without any sound clips playing to either group, we began the important data-collecting part of our experiment. For the next 25 trials, we ran each mouse through the maze. Half were exposed to no sounds and the other half each listened to the violent sounds audiotape while running through the maze. The decibel level of the tape player was kept constant at a medium level, and the location of the player was kept constant as well. After 15 trials, the maze was rearranged.
6. **Analyzing Data:** After all the trials occurred, we analyzed our data, and this information is located in the data and conclusion sections of our website. It is important that the mice are compared to themselves because they, like humans, are individuals with different characteristics. We also conducted an ANOVA statistical test to discern if there is enough of a difference in the mice’s times that the changes are not left up to chance alone.

**Data**

We collected our data by running each individual mouse through the maze for thirty trials. During the first five trials we established a base with which to compare future trials, and no mouse was exposed to sound. During the next fifteen trials, the sound clips were played to the variable group; and the last ten entries was a new maze configuration with the sounds played again to the variable group. It is important to note that trial 21 marks the beginning trial of a new maze. From our data it appears as if the second configuration was easier for the mice to weave their way through because all their times are quicker than when they went through the other maze. The dropping times at this point do not signify that the mouse is remembering anything. In addition, the times of the mice occur on a wide scope, and there is no pattern between the mice from the original group or from the new group obtained after half of the original mice died. Mouse 1 through Mouse 5 are the variable group. Mouse 6 through Mouse 9 are the control group. The time is in minutes.

**Trial Data Table**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |

**The following is the mathematical work for the statistical testing:**

## **Analysis of Variance**

Source DF SS MS F P

Factor 8 462.44 57.80 49.16 0.000

Error 261 306.87 1.18

Total 269 769.31

Individual 95% CIs For Mean

Based on Pooled StDev

Level N Mean StDev ---------+---------+---------+-------

C1 30 4.355 0.881 (--\*--)

C2 30 3.207 1.760 (-\*--)

C3 30 3.104 1.979 (--\*-)

C4 30 2.731 1.054 (-\*--)

C5 30 0.815 0.434 (-\*--)

C6 30 3.911 0.734 (--\*--)

C7 30 1.105 0.623 (-\*--)

C8 30 0.543 0.290 (--\*-)

C9 30 3.186 0.696 (-\*--)

---------+---------+---------+-------

Pooled StDev = 1.084 1.5 3.0 4.5

**Important Symbols Key:**

C#=Mouse# under Level

N: number of trials

Mean: the average times of the mice

STDev: statistical deviation

P: p-factor

## **GRAPHS**

(located on CD with pictures)

**General Observations and Characteristics of the Mice**

**Variable Group:**

**Mouse One:** This mouse is a very passive, tan and white mouse that would slowly make her way through the maze. She is the largest (strangely *very* FAT!!!) mouse that we have, and she actually resembles a hamster. Accordingly, this mouse never runs on the exercise wheel and always seems to be eating!!!! While at first she had somewhat random times, she eventually increased her time through the maze. When the music was played, she would sometimes shiver. She was one of the original mice we obtained.

**Mouse Two:** This mouse is a very active mouse, and she would run rapidly throughout the maze. She would get very agitated while the music was being played and would often whip her tail around, a sign of aggression, and stand in the corners of the maze (what we believe is a sign of fear). By just making a visual observation, we believe she was frightened by the violent sounds. She was one of the newer mice.

**Mouse Three:** Mouse three is a smaller, light gray mouse. She was very timid in the maze regardless of the music. Though she at first had quicker, but slightly random times, her time steadily increased as the trials progressed. She is one of the newer mice.

**Mouse Four:** This mouse is a part of the original group and is a very active mouse. She often runs on the exercise wheel. When the music was being played, she would also whip her tail around and stand in corners.

**Mouse Five:** This mouse is completely white with black eyes and was in the original group. She is the most aggressive mouse that we have and the only mouse to ever bite anyone. She ran very rapidly at first and seemed to have a very keen memory. However, when we played the music, her times slowed way down, though she moved as rapidly as she had before. We had trouble getting her out of the maze because she did not like to be touched.

**Control Group:**

**Mouse Six:** This is also a very large mouse, and she shared quarters with only Mouse One. She shares similar characteristics with Mouse One. We like to call them the “Fat sisters” as they eat more than the other mice and often turn their exercise wheel into a bed! She also ran very slowly in the maze and has a very passive temperament. Her times seem pretty random and continued to be so throughout the trials. She seemed a little disinterested in running the maze.

**Mouse Seven**:This mouse is a light brown mouse with very passive behavior. She was also part of the replacement group.

**Mouse Eight:** This mouse is a very friendly mouse that hits its water bottle when it is empty! It always places its paws on the window whenever anyone walks by. She is dark brown and white and is part of the younger group. She ran very quickly through the maze. She lives with Mouse Seven, Mouse Three, and Mouse Two.

**Mouse Nine**: This is a very larger, dark brown mouse. She is very passive, but does not like to be held. She was very slow in the maze and had pretty random times. She is part of the older group of mice.

**Mouse Ten:** One of our replacement mice, she died before we had the chance to run her through the maze. May she rest in peace!

**\*\*\***It was also common that all mice would urinate to mark their territories, and most seemed more interested in getting to the end of the maze to escape through the open top than to eat their reward treat.**\*\*\***

**Conclusion**

To analyze the data that we had collected during a five-week period of 30 trials of running each individual mouse through the maze, we decided to use two methods. First, we entered the data into the Microsoft Excel program and created graphs to discern the difference between the control and variable groups’ times in the maze and then looked at the raw numbers of the mice. Second, we conducted the ANOVA statistical test to further ensure that we analyzed our data correctly.

After charting the data in graphs (present in the Data section of our website), we decided that, indeed, we correctly predicted the results of our experiment: the variable group’s time did not decrease as fast as the control group’s times. In fact, the variable group’s times running through the maze often increased, showing that the effects of the violent sound does have detrimental effects on the memory of mice. We also looked at the raw numbers of each mouse’s times to view trends. By having five trials without either group being exposed to the violent sounds, we created a basis with which to compare further trials.

Though some mice’s times seemed to fluctuate freely in the maze, those mice in the control group continued to have random times throughout the rest of the experiment. However, in the variable group, the mice with the seemingly random times during the first five trials ended up steadily increasing their running times when listening to the violent sounds. The control mice that seemed to decrease their times in the maze in the first five trials, generally continued to decrease their times throughout the next 25 trials (for both maze configurations). One example is that a mouse went from running the maze in the first trial at a time of three minutes and twenty seconds to two minutes and twenty seconds in trial 20. On the other hand, the variable mice that seemed to decrease their times in the maze the first five trials, generally increased their times when exposed to the violent sounds (again for both maze configurations). An example of this is one mouse going from fifteen seconds in the first trial to around five minutes in the last few trials of the first maze configuration. Because one mouse’s time was around five minutes when first starting out in the maze and another’s time was under a minute, it was important to compare the mice to themselves to look for time trends.

One factor that worried us was that we were not testing the memory of the mice and that the times were completely random. To make sure that this was not the case, we used the statistical ANOVA test under the recommendations of Amador’s statistics teacher, Mrs. Nash, to rule out chance alone by comparing the variable and control group as a whole. The ANOVA test analyzes data from more than two samples and compares them. The test gives the tester a p-value, which indicates how accurate the data is. After conducting the ANOVA test, the results suggested that there is a significant difference between the maze times of the control and variable groups as a whole, as our p-value was approximately zero. The p-value zero signifies that the difference in times was the result of some other factor besides chance, as the difference in the times would occur zero out of one hundred times when left to chance alone. In our case, violent sound derived from media productions was the factor that influenced the discrepancy in each group’s maze times.

Though we could have run into a problem if the results of comparing the control group and variable group as a whole had not coincided with the results of comparing each individual mouse to itself, the two tests gave us the same results. However, a few factors exist that could have tainted our results. The death of some of our mice in the beginning of our experiment was an unexpected occurrence, though we hope to have prevented any problems by splitting the older mice with the younger mice between the control and variable groups. In addition, we only had groups of five and four mice each, and the statistical ANOVA test relies on the fact that large test groups exist. Larger specimen groups could produce more accurate results. In addition, two of our mice were very fat, though we split the two into the different groups. Also, we used only one tape of violent sound clips. Though we tried to vary the types of sounds used as much as possible, we could not possibly use the wide range of sounds that the average person is exposed to. Also, we are relying on the fact that the mice were motivated to move through the maze. Luckily, the results of the ANOVA test imply that chance did not play a part in our experiment, suggesting the mice were motivated.

Though we recognize that there are a few outstanding factors that could have played a part in our results, we conclude that the violent sounds the variable group was subjected to did have a negative impact on their memory. Each of the mice in the variable group showed an increase in the times through the maze; while the control group did not show an increase, and three of the four control mice decreased their times. If it is true, as our research has suggested, that the behavior of mice can be compared to the behavior of humans, then it is highly possible that the same violent sounds that the mice were exposed to could negatively affect human memory. In addition to the statistical analysis of our data, we made a few basic observations that suggested the variable mice were disturbed by the sounds that they heard such as backing into corners, shaking, and whipping their tail. Considering the fact that we took many of the sound clips from the CD collections of our friends, from radio, and from box office smashes, maybe some people want to rethink the choices they make about entertainment!

**Recommendations:**

By carrying out this experiment we have had successes and struggles. We hope the following recommendations will assist anyone that is planning on using mice in a future experiment:

* One of the first obstacles we came across was that sometimes, pet storeowners will tell you a lie or are just careless!!! Requesting *all* females, we managed to get out of the store with eight females and two males. Realizing this after we got home (because of the…uh…..actions of the males), we had to go back to the store and demand a change. Now, if we had known in the beginning what to look for, we could have checked out the mice ourselves. Also, don’t believe the pet stores when they tell you they cannot tell what gender a mouse is. We could tell by the time we went back to get more mice. Kinda gross we know, but a little research could save you if you find a few pictures about what mice genitalia looks like. Males are very obvious once you know what exactly to look for!
* This brings us to another problem that could be encountered: pregnancy! Though having all females eliminates the risk of them reproducing while they are in your custody, you could buy them pregnant. The gestation period of a mouse is roughly one month. By waiting two weeks after you buy the mice before you conduct any experiments, you can make sure you are not running a pregnant mouse through the maze. This way you won’t have to worry about pregnancy as a variable. Though one of our mice was pregnant, we noticed it before starting the maze. Sadly (and fortunately), she was one of the mice that died in the great viral massacre, so having a mother mouse did not affect our experiment.
* We would also recommend that you do not purchase your mice until you are ready to carry out the maze trials. We waited awhile and some of our mice got sick and died. Though sickness could occur at any time, the deaths of our mice wouldn’t have delayed our experiment if we had collected our data right after we bought the mice.
* We had planned to do another type of experiment as well. In addition to playing the music while the mice were running through the maze, we were going to do an experiment, using another maze formation, where we would play violent media sound bites to the variable group for a few hours during the day and then run them through the maze to see how that affected them. Unfortunately, due the to fact that four of our specimens died and we had to have the control and variable groups living together in the same cages, we could not carry this experiment out.
* Also, we noticed that the mice are very different from each other. We thought it was important to compare each individual mouse’s progress in getting through the maze to itself. While one mouse may steadily decrease their times in the maze, another may have random times. The point of this experiment is to see *how* the sound clips affected the mice’s time pattern in the maze, if it affected it at all. We also recommend that you use the ANOVA statistical test, as it seemed to work well for us.
* We also recommend that you handle the mice (evenly of course) to familiarize them to you so that they will let you pick them up to put them in and out of the maze. Sometimes we had trouble getting the mice to let us take them directly out of the maze. One mouse in particular would always dart away when we tried to take her out. We think if we had petted them more, we would not have had that problem.
* And finally, if you are going to use mice in your experiment, whether it is for testing the effects of violent sound or something else, we HIGHLY recommend knowing where the mice are going to go after the experiment has been completed. At first, we though we could just give them back to the pet store (a future that does not ensure that they will not become feeder mice) or give them to someone who owns a pet snake. What we did not realize is how attached we would become to the little guys. So if you would like a pet mouse…………….

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