

Distraction in the Learning Environment

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Abstract

This study analyzed whether the nature of a potentially distracting piece of music has a significant effect on one's reading speed. A volunteer was asked to read three passages, one with no music playing, one while listening to an instrumental piece of music, and one while listening to music with lyrics. Their speed of eye movement was monitored during all three readings to assess whether their reading speed had been affected. The results showed a significant decrease in reading speed while listening to the music with lyrics, supporting the hypothesis.

Understanding the role of distractions in the learning environment is a key factor in developing effective study settings, and implementing effective study strategies.

Distraction in the Learning Environment

What role does distraction play in the learning environment? Are subjects able to learn, and create memories, under divided attention? What sorts of distractions are harmful to the process of learning, which are benign, and which, if any, are beneficial?

It is not under dispute that dividing attention can have adverse effects on the encoding of stimuli and the creation of memories. It's been shown over and over that dividing attention during encoding reduces recall of information: distractive elements in a learning environment contribute unnecessary cognitive input, decreasing one's ability to recall stimuli (Otgaar, Peters, & Howe, 2012). The exact measure of a student's cognitive load, or the amount of information they can process at one time, is personal to the student (Lin, & Bigenho, 2011). Generally, students rated as more easily distracted by teachers are those whose cognitive load is the most susceptible to overloading, leading them to be unable to focus on the target stimuli (Cole, & Newcombe, 1983; Mulligan, 2003). Cognitive load is a combination of intrinsic load (information inherent to the material students are expected to learn), extraneous load (methods and materials in the learning environment), and germane load (the encoding and processing required to learn information) (Beaman, 2004). The first problem with distraction during the encoding of information is the capabilities of a student's cognitive functions—essentially, their available cognitive load. This explains the decreasing trend in recall accuracy as the environment in which subjects were asked to learn is increasingly complex. It also supports that teachers should avoid distracting information that will overpower the students' cognitive loads, and that it's important to figure out which parts of the environment are distracting in order to remove them.

Generally, students asked to take notes in chaotic or distracting environments were self-reportedly less able to focus, and had a tendency to remember the information less accurately than those in non-distracting environments (Lin, & Bigenho, 2011). Distraction seems undisputedly to be the enemy of learning because so many such studies have shown the negative effects of distraction on learning and memorization. And scientifically, this is assumed to be so because short-term memory—visual memories especially—are vulnerable during encoding, and any sort of distraction can negatively impact one’s ability to solidify these memories (Quinn, & McConnell, 2006). Across the board, irrelevant information presented to distract subjects has interfered negatively with the subject’s ability to complete a task (Thomas, & Hasher, 2012)—but there have also been instances of distraction having insignificant or positive effects (Lin, & Bigenho, 2011; Thomas, & Hasher, 2012). Studies have shown that, depending on the sorts of cognitive functions required for a task, distraction that requires different functions may have no significant effect on the learning process (Bell, Röer, Dentale, & Büchner, 2012; Beaman, 2004; Otgaar, Peters, & Howe, 2012). Furthermore, since pre-exposure to distracters for as little as 20 minutes can nullify the effect of these distracters, many of the “distracters” seen as malignant may actually be having no effect at all (Bell, Röer, Dentale, & Büchner, 2012). There’s also extensive evidence that verbal and image-based strategies can reduce distractions to a negligible amount.

The obvious meeting point in this controversy and the angle from which the issue should be researched is that distraction has both positive and negative consequences, and sometimes no consequences at all. It’s been widely demonstrated that different types of distraction affect different people and situations differently, with variables in subjects’ ages and the nature of the tasks and distraction creating vast and contradictory results (DeCaro, Thomas, Albert, & Beilock,

2011; Mulligan, 2003; Cole, & Newcombe, 1983). The most basic argument for further research is that so many previous experiments have overlooked the interference between different perceptual treatments of different sorts of input, labeling all forms of information potential distracters while only sources presenting their information in the same cognitive medium as the task have the capacity to fight for attention (Ellwart, Rinck, & Becker, 2003). This rules out a lot of previously-labeled-as-distraction sensory information as inconsequential in terms of limited attention and distraction.

The visual or verbal, or language or non language, nature of information is a huge factor in whether this information has an adverse effect on learning, as does the distinction whether the task and the distraction require automatic or controlled processing. Controlled processing, or processing that requires you to actively encode information to absorb it, is more demanding of attentional resources, and information absorbed through controlled processing should be the only information affected when attention is divided (Otgaar, Peters, & Howe, 2012; Maddox, Naveh-Benjamin, Old, & Kilb, 2012). Studies have shown that negative stimuli undergo the most automatic processing and are therefore the most susceptible to the interference of distractors (Maddox, Naveh-Benjamin, Old, & Kilb, 2012; Harvey, Weintraub, & Neale, 1984). This could be used in another argument against distraction in learning environments: it will cause the subjects to remember, proportionally, more negative than positive or neutral stimuli. Positive memories may also be helped by automatic processing, but negative memories are either prioritized or helped significantly more (Maddox, Naveh-Benjamin, Old, & Kilb, 2012; Mulligan, 2003). Another problem with letting automatic processing take over while distracted is that both true and false memories arise out of automatic associative processes (Bell, Röer, Dentale, & Büchner, 2012). This could mean that under divided attention, someone will create a

higher amount of false memories relative to the true ones they're creating, which could obviously be problematic in a learning environment.

While it's generally agreed upon that distraction in the learning environment is negative, there is no such thing as a distraction-free learning environment, so it's important to know what effect distraction is having on people trying to learn, as well as which types of distracters should be avoided. I designed this study to help shed light on the roles of distraction and divided attention in learning. I will do this by measuring subjects' ability to do different learning tasks in the presence of different types of distraction (i.e. reading and comprehending a passage while listening to different types of music). When distracters (music) involve some of the same mental processes as reading (language comprehension), the distracters will have a significantly higher effect on one's ability to quickly and comprehensively read a passage, as measured by a decrease in the speed of eye movement, showing that it takes them longer to read each line. I hypothesize that, when listening to music with lyrics as opposed to instrumental music, one's reading speed (measured speed of eye movement across the paper) will be at least 20% slower.

Method

Participants

One male participant, age 18, in the 11:00AM General Psychology class, during the spring 2013 semester was chosen to be tested.

Materials

One desk and one chair was used, to seat the participant; one Biopac MP40 Device (with a built-in EOG monitor) was used to record the test results (subjects' eye movement); a computer (to aid in the use of the MP40 device); three passages of approximately the same length from *The Great Gatsby*, a reading level 1070L on the Lexile scale; two versions of Muse's *The Small Print*

(one with lyrics and one instrumental), which is classified as modern rock and has a tempo of approximately 161 beats per minute, was used, as well as one mp3 player and one set of headphones, in order for the participant to listen to the music. Finally, a pencil, paper, and Microsoft Excel were used to record data and analyze results.

Procedure

Before the experiment, the procedure was explained to the participant and informed consent was obtained. Next, the participant was sat at a desk, hooked up to the MP40 machine (which was hooked up to the computer) by electrical probes, and was given the first of the three passages to read. He was instructed to read the passage, and that the MP40 machine would be recording his speed. He was then instructed to put on the headphones, given the second passage, and instructed to read it while listening to the instrumental piece of music. Finally, he was given the third passage and instructed read it while listening to the music containing lyrics. He was then debriefed to ensure that he hadn't been harmed during the experiment and didn't need anything further explained to him.

Method of Analysis

Measurements of the participant's reading speed for each passage were compared to find a percent difference in the speed of eye movement between passage one, passage two, and passage three. The amount of time it took the participant to read each line was recorded during all three tests. For each test, the amount of time required to read each line was averaged into a seconds-per-line value. A seconds-per-line value was calculated for each test to provide easily comparable values for each test. By comparing the average amount of time it took the participant to read a given line during the control test to the amount of time it took the participant to read a given line during the tests with music shows a correlation of decreased reading speed as

a result of listening to music. Comparing the control test to the instrumental test indicates the reduction of reading speed associated with listening to instrumental music versus no music at all. Likewise, comparing the control test to the test including music with lyrics shows the reduction of reading speed associated with listening to music with lyrics versus no music at all. Finally, by comparing the instrumental music test to the test including music with lyrics provides us with the conclusion that music containing lyrics is more distracting than instrumental music.

Results

After completing the experiment the results were analyzed by measuring the amount of time it took our subject to read each individual line within the text. This measurement was taken from every line read during each of the three tests. The data was then averaged to provide an average time it took our subject to read any given line within each test. This average allows for a value that is easy to compare to the value of other tests. The control test was performed first. During the control test our subject read at an average of 1.367 seconds per line. The next test was done with instrumental music playing. During this test our subject read at an average of 1.441 seconds per line. The reading speed differed from the control test to the instrumental test by 5.27%. This is a relatively small increase but still appears to support that music is a distraction whether there are lyrics or not. The third test done was with music that included lyrics. During this test our subject averaged 1.791 seconds per line. As expected, the slowest reading was done during the test in which the subject was listening to music with lyrics. Furthermore, during the test containing music with lyrics the subject read 26.85% slower than during the control test. A decrease in speed of 26.85% during the test containing music with lyrics versus a decrease in speed of 5.27% in the instrumental music test indicates that music with lyrics is significantly more distracting than instrumental music. The most important comparison when evaluating the

hypothesis is the difference in reading speed during the instrumental music test versus the test with music containing lyrics. During the third test, while listening to music with lyrics, our subject read at a rate 21.65% slower than during the test while listening to instrumental music. Overall we do feel that the data supports that music is, in fact, a distraction to one's ability to concentrate on reading. Furthermore, the raw data shows a decrease in speed of just over the 20% originally hypothesized.

Discussion

Generally we are pleased with our experiment and our collected data. We feel that the test does help demonstrate that music is a distraction when trying to read. While some factors were not entirely controlled within the experiment, the results are congruent with our expectations. If the Procedure could be modified slightly, we believe that more accurate results could be achieved. The first modification to the procedure would include indexing the music to be played to the correct point within the song to provide lyrics immediately upon starting the test. Since some songs with lyrics begin with long preludes, starting a song with lyrics at the beginning does not always accurately test the subject's ability to read while hearing music that does in fact contain lyrics. The second issue would be to insure that all equipment is in functional order before beginning the experiment. In our experiment we had a malfunction with the headphones, which caused the need to restart the test containing instrumental music. This presents issues because the subject was allowed exposure to the passage for a short time before being retested. This could change the subject's reading speed because he had already read the first few lines. Another part of the experiment that we feel was lacking in control was the method for measuring reading speed. Since each individual line of text within any given passage will differ from passage to passage it is impossible to determine if the reading difficulty for each passage is

entirely equal. Additional tests are necessary to determine how distracting music is while reading. It would be useful to test the retention rates of what the subject read during a similar series of three tests. Although the speed varied only slightly, retention rates may have been decreased drastically. When distracted, it is common for a person to scan across words, reading them, but not comprehending them. Another way this could have been achieved is to have the subject read aloud. While reading aloud does not insure comprehension, it does insure that the subject is actually reading the words and not just scanning over them with their eyes.

With all factors in consideration, we feel that our experiment successfully evaluated whether or not music playing is a distraction to someone who is reading.

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