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Memory and learning: experiment on *Sonata KV 331*, in A Major by W. A. Mozart

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Abstract: *he brain is the most convoluted object studied. Musical research results showed that classical music could improve spatial-temporal understanding. Music written by great composers is used in order to cure disorders and develop the brain. This experiment presents the very well-known Sonata KV 331, in A Major, including the third part – Alla Turca in a minor, as a background for a thirty minutes logical test. There are two groups, each one containing 5 people. During this test, the first group will listen to the piano sonata while the second one will solve it in complete silence. As many studies showed, music supports the brain to operate better. Music enterprise involves every part of the brain and improves it temporarily. Of course, if such a music therapy is perpetual, it can get to permanent advancement. This experiment involve a temporarily situation, in which classical music helps the individual to concentrate better and to focus on the final goal. It is surprising what a song can do, but the group that solved the test in complete silence was far more slowly that the one that was accompanied by music. Experiments like this one and the therapy with music play a paramount role in increasing the brain mobility but also in helping movement overhaul. Music can bring down blood pressure and this can lead to reliving the muscle tension. In what concerns listening to classical music and solve a logical test, the results were significantly better for the group that listened to Mozart, the written exam being finished earlier and exam's grades being higher.*

Key-words: *brain improvement, piano sonata, memory and learning higher skills*

1. Introduction

Rauscher, Shaw and Ky (1993) claimed that brain conduct itself to classical music, notably when it comes to young and middle-aged people. Performances of any kind are highly improved if the subjects are listening to this type of music. As many studies reveal the qualities of classical music, this article would establish the potential of it, piano sonata KV 331, in A Major, written by W. A. Mozart being listen to, before a logical test. Classical music should not be used for learning and

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educational practice, but as a technique of increasing the brain functions and also a way to strengthen the spatial-temporal acumen.

The results obtained after listening to classical music may consist in the way in which music and spatial imaging are blended within the brain. IQ tests demonstrate that after listening to classical music, there is a temporary improvement of spatial-reasoning, highly bigger than sitting in silence, in the same period of time, or reading.

Classical music effects are multiples, including revamping of the test scores, cutting the training time and incorporating both sides of the brain for a more skilled learning.

Analysing the benefits of classical music, one of the explanations would be the aspect of music's vibrations. The unseen is in the pulse of music, which pervades everything, including the water and the cells.

The present inquiry tries to show the contribution of the great composers' music and the differences between two groups of students, whom results are compared after a solving a logical test in a session of listening to a piano sonata by Mozart and an equivalent period of time of resolve it in silence. The subjects rated their elicitation and mood and the results showed the distinction between the two groups.

2. Methodology

2.1. Participants

There were used 10 students (20 to 23 years of age). Participants came from Faculty of Music in Braşov and had almost the same level in what concerns grades during the whole semester.

2.2. Apparatus and Stimuli

The entirely piano sonata KV 331, in A Major, including the well-known third part – Alla Turca, composed by Wolfgang Amadeus Mozart, was played by a laptop, with professional external speakers, in order not to affect the quality of music. The recording was performed by a student at the Faculty of Music in Braşov. The control condition for the first group, formed by five students, consisted of listening to the entirely sonata, put on repeat, to cover 30 minutes for the logical test. The test had 15 logical problems, with graded levels, including progressive matrix problems.

A first effortless question such as in Figure 1, conducted to demanding and labored query, such as Figure 2, in which diagnostically thinking is far-reaching in accessing a high score.

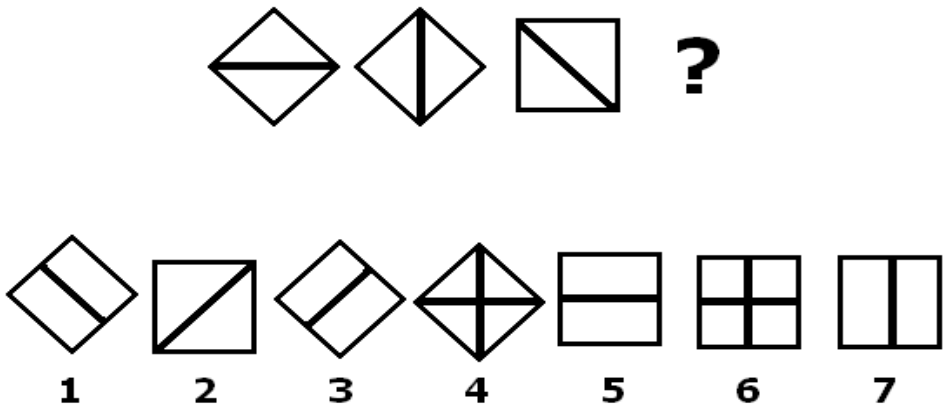


Fig. 1. *Example of one type of exercise used in the logical assessment, in the experiment, this being a very easy one*

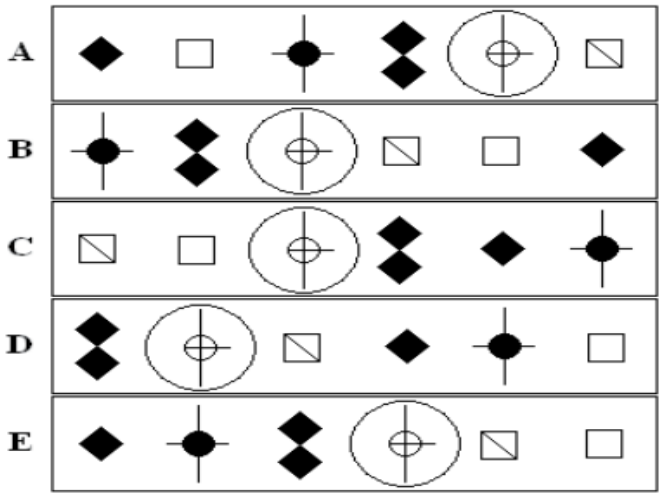


Fig. 2. *This task challenges the individual to circle the odd one out, between A, B, C, D, or E*

They listened to the first movement, in A Major. The opening movement is a theme and variation and the *tempo* marking is *Andante grazioso*. The second movement of this piano sonata is a minuet and a trio in A Major. The minuet is 40 measures long

and the trio is 52. The third movement, Alla Turca, is one of the most popular pieces of all times, being also known as *Turkish March*.

The second group had to solve the test in silence for the same period of time. There were used two separate rooms for each group, 10 chairs, one for each participant, the experiment being simultaneously developed. The chosen moment for the experiment was a short period of time – 30 minutes. Before this period of listening to music while resolving the problems or solving the test in silence, they were waiting another 5 minutes and after that, the examination papers were being given. All participants had the same subjects for this test and the maximum time for solving it was 30 minutes. There were 15 questions, from a lower level to an advanced one, including little puzzles and questions that require levelheaded thinking. The logical exercises were the ones used in IQ tests, such as Mensa type of assessment.

The participants were being chosen in order to be balanced, in what concerns the level. The average medium of these students is between 9.50 and 9.75, during the last semester.

The time in which every subject finished the test, was written on a paper, in order to be compared. The tests were quickly graded by a professor who didn't know the name of the students. Participants also provided a global rating of mood, elicitation and power of concentration, on a scale from 1 (weak) to 5 (strong).

At the end of this test, the grades and the participants' rating would be compared in order to present the results of this experiment.

2.3. Procedure

The procedure was controlled by a computer program created in order to replay music at a very high quality, exactly as it was recorded. Participants in the first group were listening to Mozart's piano sonata, during the entire test. The logical exam was from 11 A.M. to 11.30 A.M. The 10 participants were tested individually, in two classrooms, in complete silence, with no cell phones or computers opened. Sessions were conducted on Saturday in the morning when the building of the Faculty of Music was quiet.

After the paper examinations were provided, students were given the opportunity to ask questions. In the examination period, there was a 10 seconds warning of the end of each 10 minutes period. After time elapsed, all participants were asked to rate their mood during the test and the power of concentration and the sheets were distributed. They had to grade with marks from 1 to 5, depending on their capability to focus, on their speed in solving the tasks and on their mood, after listening to Mozart's music or solving the test in complete silence.

3. Results

Classical music had so much leverage on the focus control in the first group. As musical consciousness is processed in the right hemisphere of the brain that involve spatial abilities and long-term sequencing operations, the second group, the one that solved the test in complete silence, had results that were less than expected.

Tests were graded by a professor who didn't know the names of the participants in the assessment. The maximum score of this evaluation was 100. The level of the first group can be surely recognized in their grades (Figure 3).

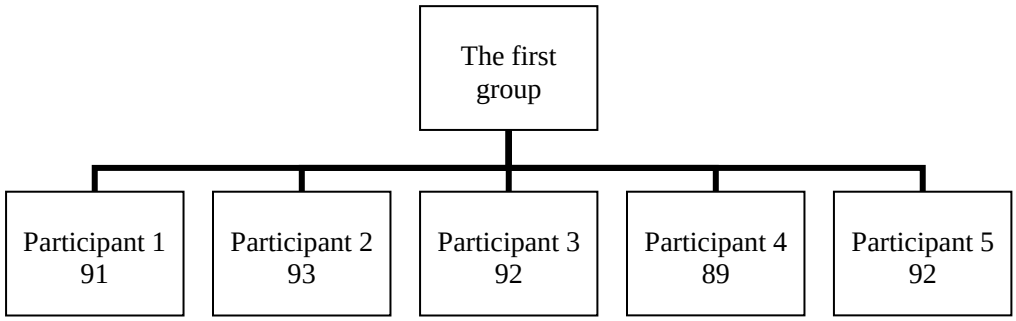


Fig. 3. *The results of the assessment for the first group*

In order to place in juxtaposition the two groups, results for the second group, that sat in the noiseless classroom, are being shown (Fig. 4).

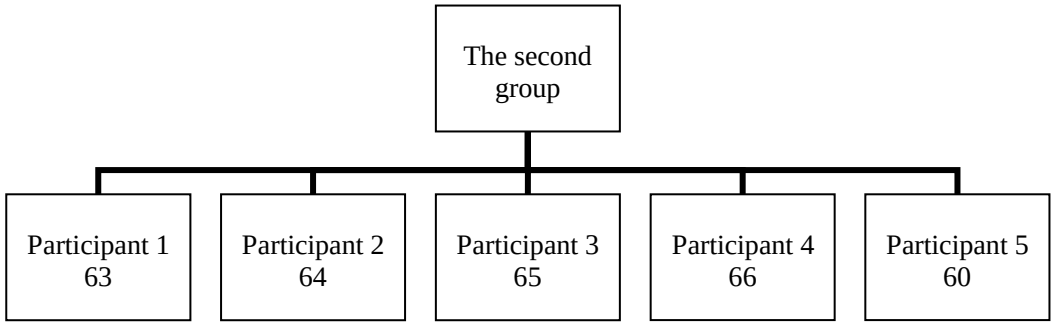
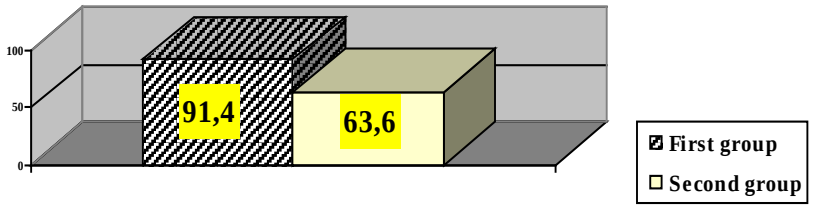


Fig. 4. *The results of the tests for the second group*

The differences between grades of the first group and the second one can be easily noticed (see Graph 1). The background of the 10 participants was slightly similar, so that we can't describe the results as unrighteous.

An average for the first group was 91,4 out of 100, while for the second group 63,6 out of 100.



Graph 1. *Grades in the logical exam, for each group*

A more meaningful measure is to asses changes at the level of individual. The global rating that was required is relevant for this experiment. This next appraisal shows us how participants from the first group, evaluate their mood, on a scale from 1 to 5, their power to stay focused and their capability of remaining calm in stressful situations such as exams (see Fig. 5).

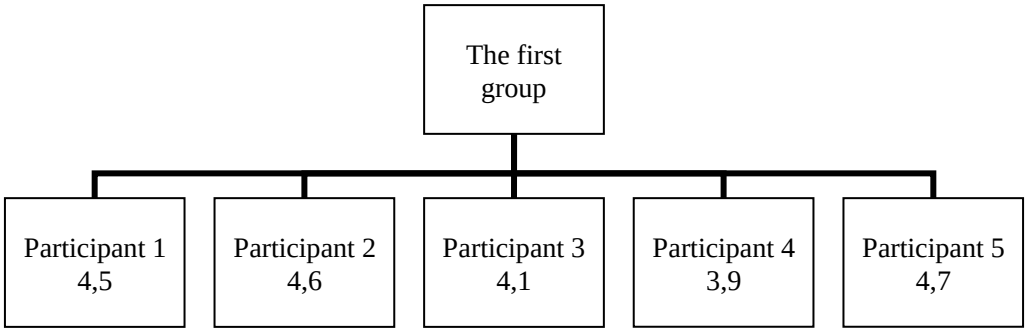


Fig. 5. *Self-evaluation – the first group*

Figure 6 describe the situation in the second group, concerning the capacity of self-control, the capability of staying focused during the entire exam and the self-control in a stressful task (see Fig. 6).

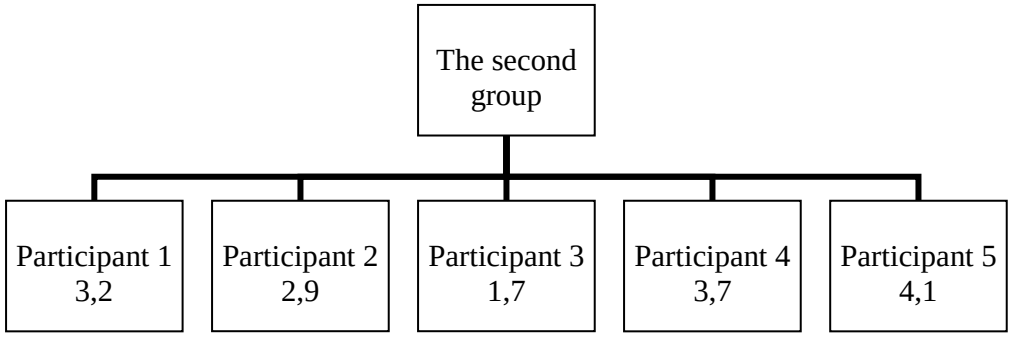
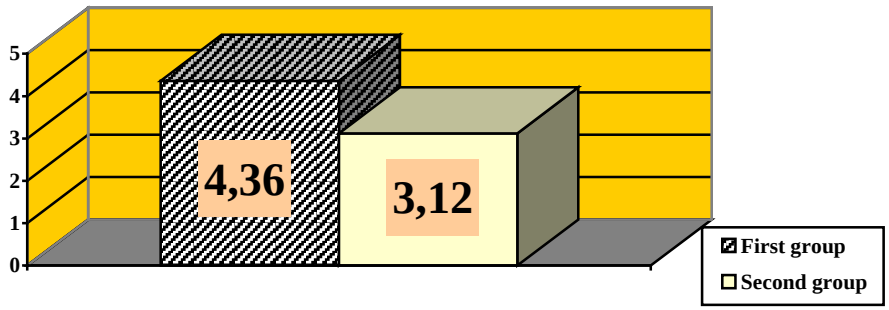


Fig. 6. *Self-evaluation – the second group*

As it can see in the results, the participants evaluated themselves objectively. The participants in the first group claimed that the piano sonata that they listened to, relaxed them and helped also for a better focus. Comparing the two self-evaluations, the results can be observed in the chart (Graph 2), with 4.36 out of 5 for the first group and 3.12 out of 5 for the second one.



Graph 2. *Self-evaluation comparison between the two groups*

Subjects in the first group managed to remain calm and focused for the entire period. They also finished sooner that they have expected, in less than 25 minutes. The subjects in the second group got exhausted easier and they finished in 30 minutes. Grades were germane and the quantity and quality for the first group were far better than in the second one.

An interpretation for this discrepancy would present a major improvement that music can provide – a deliberately link between the right and the left brain's hemisphere. The left hemisphere is focused on evaluations, judgments, and also on worries and self-doubt problems. For this reason, there is a strong link between our logical test and this part of the brain, used for analytical thinking and also future-

past aspects. Music can stop the left brain of causing thoughts to become divided and arbitrary. The right side of the brain perceives analogies and wholes and it should be used in stressful situations. This hemisphere is dominant in remaining in the present and using mental images, which are very helpful when it comes to pinnacle performance.

The left brain accords progressively with information through analytical thinking, while the right brain works synchronously with information through fusion. It takes practice and self-control to create intentionally switching back and forth from the left to the right hemisphere but classical music can reach such levels in an involuntarily manner

4. Discussion

This study analyses the effects of exposure to classical music on a specific spatial-temporal activity. In this experiment, performance was significantly better after participants in the first group listened to music during a logical exam than after participants in the second group sat in silence.

Classical music is physically accessible to the general audience. The participants were chosen from a faculty that apparently doesn't have an obvious connection to mathematical thinking. They may be keen on logical and puzzling tests but the experiment proves that every person can be helped by classical music. As I claimed in this article, his music is not a substitute for any kind of activities but it is a marvelous way to improve brain's activity, aspects that concern memory, on short or long-term.

There are neurological foundations for music's effects on cognitive ability. Theory of sensory stimulation is another explanation that should be considered when it comes to this experiment. When listening to classical music, the brain is excited by stimulation and finally there would be improved conduits of brain function. Also, it is very important to specify that music similar to classical music, concerning tempo, structure, melodic and harmonic consonance and predictability has also the same results as classical music.

Rauscher and Shaw presented their studies and results in many articles. The "neural resonance" theory of Rauscher is about stimulation which is the confounding variable that mediates the relationship between spatial ability and music that defines this amazing effect on listeners. When Rauscher claimed that, after listening to classical music for 10 minutes, normal subjects would show better response to tasks than after a period of silence designed to lower blood, there were lots of studies that would agree or contradict those statements.

This very studied aspect of music, the classical music's effect on people, is so popular due to its claim to be a quickly way to improve short and long-term condition, due to its capability of enhancing the mood and its power to keep one individual focused longer on advanced tasks. The results of this experiment prove that classical music is far better than complete silence, especially when it comes to activities such as logic problems and challenging situations such as tests, exams or public performances.

The brain has a certain plasticity, it's able to change and music can be one element that influences its activity. The injured brain can be reeducated and a normal brain can be highly improved, when it comes to a link between it and the classical music.

Techniques such as functional magnetic resonance, imaging and electroncephalography, are combined to music and the results are amazing. Positron emission tomography (PET) is one of the tests that has shown that listening to classical music, especially Mozart, activates a wide distributions of brain parts. After PET scanning, there were activated the prefrontal, temporal and precuneus regions. Listening to music activates those areas of the brain which are concerned with spatial reasoning.

Even though, studies regarding this network that present this amazing connection between art and health, are not being known among people. Listening to classical music increases the neurotransmitter dopamine, which plays a very important role in impetus. It also boosts spatial intelligence and this is one of the reason this experiment used classical music for a logical test.

The experiment tried to prove the existence of classical music benefits when it comes to multiple tasks. Even if the subject is well-prepared is very important to use stimulation that excites the brain in different situations, so that it can be created a relaxing and enhancing atmosphere that help the individual to perform better and think faster than usual.

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