

# Music Therapy and Suggestibility – Methods of Activating Mechanisms to Improve Cognitive Processes

Dr. Liliana Neagu

PhD Medical Psychology, Assistant University Dr. "Carol Davila" University of Medicine and Pharmacy, University "CAROL DAVILA" Bucharest, Bucharest, Romania

## ABSTRACT

There are numerous research studies focused on the brain's processing of information and on finding patterns and strategies to improve cognitive processes. To increase the capacity of memory and concentration we need to understand both the physiological and biochemical mechanisms, and the role of the external factors on these processes. The suggestions and harmonic combinations of music have proven their effectiveness by acting as a major influence in the field of neurophysiology, ameliorating a wide spectrum of memory and attention issues.

**KEYWORDS:** *memory, attention, music therapy, suggestibility*

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## INTRODUCTION

Nowadays, the development of research in music therapy and suggestibility is at a stage where its effectiveness has been proven for a wide range of disorders. Thus, a large number of researchers have demonstrated the scientific support and the effectiveness of these methods.

"The slow baroque music provides the installation of memorizing conditions – for the individual with an average intellect it creates the mental advantages of gifted individuals" (Iamandescu, 2004)-[1]

Starting with 1950, medical institutions have begun recognizing the fact that placebo treatments have powerful effects. It has been shown then that they have a high degree of clinical efficacy in treating and ameliorating a wide range of conditions, being present in almost 35% of clinical cases. [2]

## MUSIC AND MEMORY. THE SUPER MEMORY EFFECT

In his evolution, man has sought to perfect his cognitive abilities in order to adapt to the ever refined demands and to understand the mechanisms underlying them.

In this sense, several psychological theories have been developed, attempting to explain the various stages of the memory process, assuming the existence of several types of memory, partially superimposed.

With regard to the contribution of music to cognitive processes, as a method of memory enhancement, numerous researches have been reported to have highlighted the major influence of different types of harmonic rhythms and combinations acting in the field of neurophysiology, impacting on information retrieval and increasing information storage capacity. [3]

Physiological research has shown that in a calm state, the body works efficiently with less energy, giving more power to the brain. One of the secrets of memory is slowing down brain waves to the slowest alpha level (7-13 cycles per second), as well as for body rhythms to the most relaxed levels.

By processing neural activity on the computer, neurophysiologists have proven the existence of an isomorphism between the brain's rhythmic activity and the rhythm of Mozart's music [4]. The isomorphic elements were represented by the sound cycles (the amount of sounds per time unit) of a certain conformation – with sequences of increases and decreases in the intensity of the sounds that repeat every 20-30 seconds – and which act on the neural groups whose functions are developing similarly, in cycles of 30 seconds (results obtained by a team of musicologists and neurologists from the University of Illinois).[5]

The use of Mozart's music has proved useful even in the case of the elderly, suffering of Alzheimer's disease [6]. A team of musicologists and neurologists from the University of Illinois believes that the already demonstrated "Mozart effect", that improves spatial thinking, is involved.

### THE PLACEBO EFFECT

'The Placebo effect' consists of the physiological and psychological manifestations that determine the improvement of a patient's health condition following the administration of a drug without pharmacodynamic action. [7]

The perception, codes and symbols that the brain uses in processing the internal and external information strongly determine the placebo effectiveness, form and response. The thought that a drug is effective can cause the body to release its natural analgesics, the endorphins. Dr. Dragoş Popa [8] states that 'important changes have been observed in the thalamus, in the anterior cingulate cortex, the prefrontal cortex and the orbitofrontal cortex. Each of these areas has its function. Tomas Furmark of the Uppsala University (Sweden) states that a gene has been linked to the placebo effect.[9]

The placebo effect is a dynamic, multi-variable phenomenon, in which factors such as personality, cognition and conditioning influence the human body through mechanisms which are still not quite clarified. In addition to the pharmacodynamic actions, the nonspecific effects of psychopharmacological drugs raise the issue of the psychological effects that accompany all therapeutic actions.[10]

## PERSONAL RESEARCH ON THE USE OF COGNITIVE AND SUGGESTIVE METHODS FOR IMPROVING MEMORY AND ATTENTION IN HEALTHY SUBJECTS VS DEPRESSIVE SUBJECTS

### I. PROBLEM

There is continuous technological progress and people are being bombarded with information, images, sounds, and our brain is becoming more saturated. In this context, more and more people are beginning to take an interest in their intellectual abilities and are scared by the poor performance of their memory. Their concern is justified, because factors such as: stress, caused by the anguish of tomorrow, emotional trauma, depression, a series of infectious diseases, advanced age, etc., lead to memory impairment. Therefore, scientists are more and more concerned in finding strategies and techniques of stimulation and active sustenance to serve in the interest of memory performance.

For this purpose, many self-training guides have been developed, for solving exercises to train memory.

### II. RESEARCH OBJECTIVE

The objective of the research is to find ways to actively sustain and improve cognitive and regulatory capacities, taking into account the efficacy, the effectiveness, the costs and benefits of using them, on the one hand, and understanding the mechanisms underlying the activating of different types of memory and attention, on the other hand.

For this purpose, I compared the effectiveness of three different interventions by manipulating the independent variables represented by: 1. baroque music; 2. rhythmic music; 3. placebo substances, on dependent variables: 1. semantic memory; 2. visual memory; 3. contextual memory (work memory); 4. focused attention; 5. distributed attention/multitasking/the ability to multitask both in healthy subjects, as well as with depressive subjects.

### III. HYPOTHESES

The hypotheses are the following:

- A. Does music therapy have an effect on improving cognitive processes?
- B. Does the placebo effect influence memory and attention?
- C. Are there significant differences in healthy population's outcomes compared to the group of depressive patients?

### IV. RESEARCH METHOD

#### 1. Subjects

In the samples used, there have been 260 healthy subjects included, divided in four equal groups aged between 17 – 19 years and 260 depressive patients that meet the DSM-IV criteria for depressive disorder, who achieved a score of at least 10 points at the HAD-S – Hospital Anxiety and Depression Scale, aged between 24 - 65 years.

#### 2. Tools/materials

For dependent variables the tools used to assess the results were the following:

*Semantic memory* has been evaluated using a test that included words starting with the same letter, from four different categories – execution time: 10 minutes;

*Visual memory* has been measured using the **Ray-Claparedé test**, which includes 30 images – execution time: 10 minutes; *Work (contextual) memory* has been assessed using a test that comprised three different texts, out of which five questions were asked from each one, marking with one point the correct answers – time used: 20 minutes;

*Focused attention* has been measured using the **Toullouse – Pieron test**.

*Distributed attention* has been measured using the **D.A. and Praga tests**.

### V. DESIGN

1. The design used is an experimental one and it includes the following variables:
  - A. **Independent variables** are represented by interventions involving the use of two different styles of music, namely **baroque music** (Vivaldi, Haendel, Bach, Telemann) vs **rhythmic music** (Michael Jackson), and syrup-like **placebo substances**.
  - B. **Dependent variables** are those to which the expected effect refers, namely: **semantic memory, visual memory, contextual (work) memory, focused attention, and distributed attention**.
2. Basic concepts about the dependent variables included in the experiment

**Visual memory** has a duration of approximately 100 ms, with unlimited capacity. It is used to extract the physical features of the stimulus (colors, contour, intensity, etc)

**Semantic memory** refers to the memory of meanings, significances...

**Work (contextual) memory** is involved in a wide variety of complex cognitive behaviors, such as understanding, reasoning, or problem solving.

**Focused attention** is the function of attention which ensures the selection and convergent organisation of operations and actions of behavior adjustment.

**Distributed attention** is the function of attention that allows multiple activities to take place at the same time.

**The correlated numerical values**

➤ **Effectiveness coefficient:** reflects the speed of perception and observation processes indicating the dynamism of nervous processes;

- **Accuracy coefficient:** reflects the capacity of selection, orientation, and optimal focus of the psycho-nervous energy towards an activity;
- **Mnemonic coefficient:** reflects the memory's operativity which consists of the duration of the learning period, the durability of the operational scheme over time.

**VI. PROCEDURE**

The measuring was made before and after the introduction of independent variables. Each group was originally given memory and attention tests, taking into account the features contained in the monograph mentioned in the "tools" section.

**VII. DATA ANALYSIS**

In order to substantiate the conclusions a sample of 65 subjects was selected for each group.

**VIII. RESULTS**

**Results of the T test in depressive subjects**

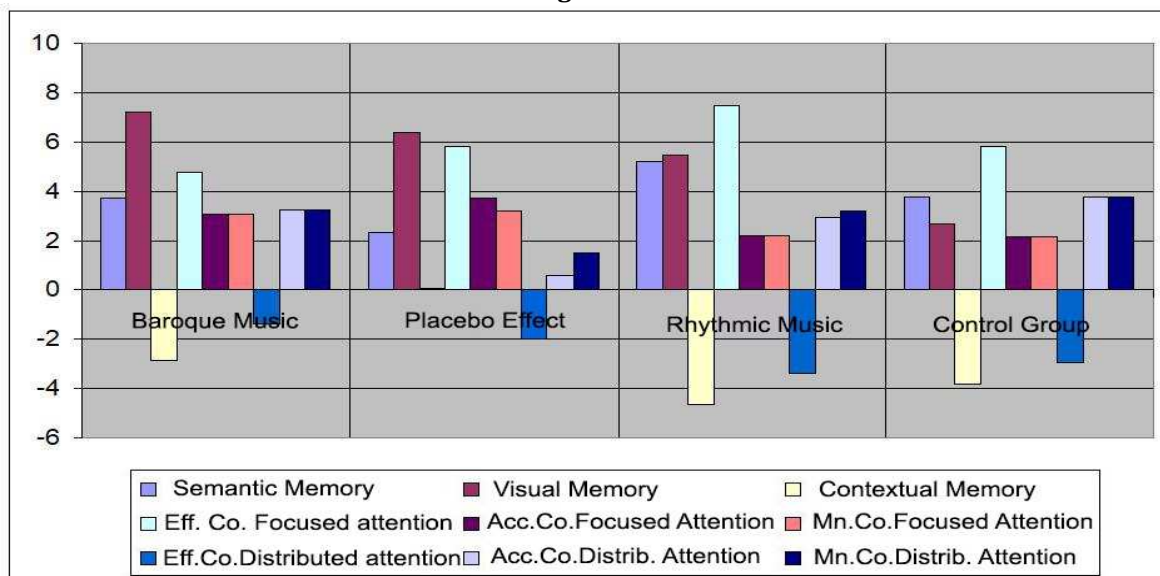
**Table no.1(meaning of the results)**

	Baroque music	Placebo effect	Rhythmic music	Control group
Semantic memory	Significant +	Significant +	Significant +	Significant +
Visual memory	Significant +	Significant +	Significant +	Significant +
Contextual memory	Significant -	Insignificant	Significant -	Significant -
Focused attention	Eff. c.	Significant +	Significant +	Significant +
	Acc. c.	Significant +	Significant +	Significant +
	mn. c.	Significant +	Significant +	Significant +
Distributed attention	Eff.c.	Insignificant	Insignificant	Significant -
	Acc.c.	Significant +	Insignificant	Significant +
	Mn. c.	Significant +	Insignificant	Significant +

**Table no. 2 (values of T test)**

	Baroque music	Placebo effect	Rhythmic music	Control group
Semantic memory	3.711	2.345	5.212	3.795
Visual memory	7.195	6.386	5.485	2.653
Contextual memory	(-)2.831	0.049	(-)4.675	(-)3.866
Focused attention	Eff.c.	4.78	5.809	7.511
	Acc.c.	3.102	3.702	2.198
	Mn.c.	3.102	3.213	2.213
Distributed attention	Eff.c.	(-)1.405	(-)1.987	(-)3.407
	Acc.c.	3.258	0.563	2.978
	Mn.c.	3.238	1.531	3.21

**Fig. no. 1**



**Results of T test in healthy subjects**

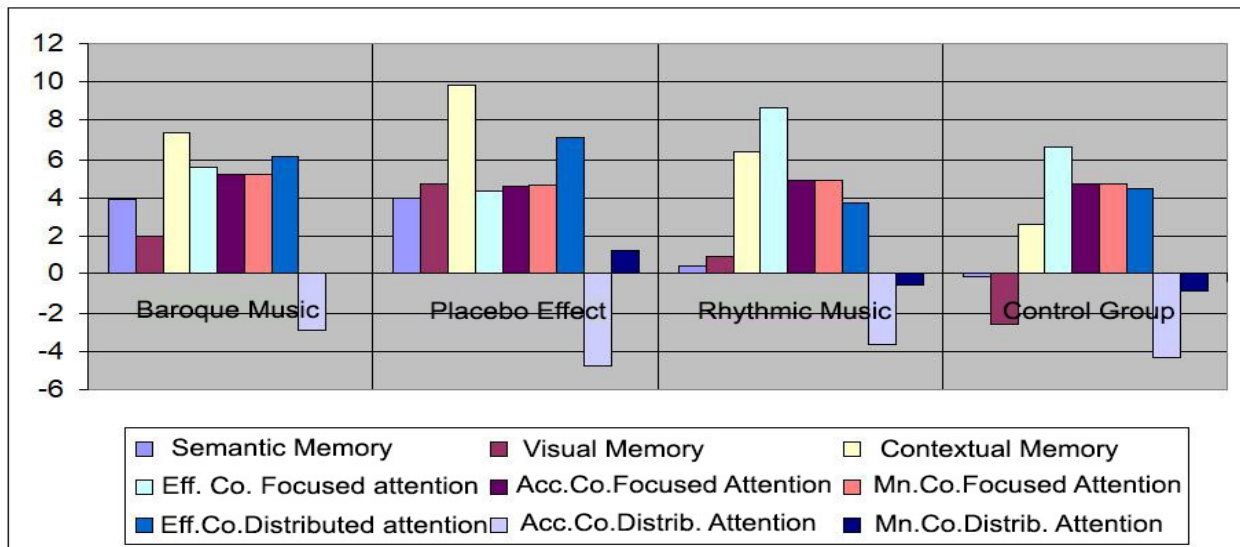
**Table no. 3 (meaning of results)**

	Baroque music	Placebo effect	Rhythmic music	Control group
Semantic memory	Significant +	Significant +	Insignificant	Insignificant
Visual memory	Significant +	Significant +	Insignificant	Significant -
Contextual memory	Significant +	Significant +	Significant +	Significant +
Focused attention	Eff.c.	Significant +	Significant +	Significant +
	Acc.c.	Significant +	Significant +	Significant +
	Mn.c.	Significant +	Significant +	Significant +
Distributed attention	Eff.c.	Significant +	Significant +	Significant +
	Acc.c.	Significant -	Significant -	Significant -
	Mn.c.	Insignificant	Insignificant	Insignificant

**Table no. 4 ( values of T test)**

	Baroque music	Placebo effect	Rhythmic music	Control group
Semantic memory	3.934	3.977	0.468	(-)0.132
Visual memory	2.004	4.713	0.911	(-)2.606
Contextual memory	7.345	9.866	6.393	2.563
Focused attention	Eff.c.	5.532	4.314	8.729
	Acc.c.	5.243	4.586	4.921
	Mn.c.	5.243	4.636	4.921
Distributed attention	Eff.c.	6.176	7.119	3.746
	Acc.c.	(-)2.932	(-)4.773	(-)3.690
	Mn.c.	0.056	(-)1.247	(-)0.579

**Fig. no. 2**



**IX. DISCUSSIONS**

Regarding the placebo effect, the results obtained in healthy subjects were favorable for almost all components, while depressive subjects had a decrease in the degree of influence.

In the specialty literature, it is known that young people are less responsive and unlike normal people, patients generally have more suggestibility and therefore a greater responsiveness to placebo, but the motivation to improve their cognitive capacities (memory and attention) was higher for students, given the fact that high-school graduation exams were approaching. Some of them were clearly interested in asking even the source of where they could buy their substance to better memorize before the

exams. The marked difference of the placebo effect between depressive subjects as opposed to healthy subjects is explained by the symptomatology of these patients, expressed by the lack of hope and interest, anhedonia, fatigability – making it impossible for the mobilization of an additional and equitable energy to determine the placebo efficacy and response.

Regarding the influence of music on mnemonic and proseic processes, we can ask the following questions:

Does the sound background modify the material substratum of memory or that of the electrical activity of the brain when we memorize or pay attention? Which of these favours cognitive processes?



Dr. Aryel Routtenberg [11] was among the first to discover that electrical stimulation of certain areas of the brain engages the release of large amounts of neurotransmitters involved in memory processes. Dr. Capel [12] found that different forms of the waves trigger the release of different neurotransmitters. For example, frequencies of 90-111 Hz produce endorphins, and frequencies of 4 Hz – catecholamines, which are important in the process of memory and attention. Research shows that after listening to high-frequency music for a certain period of time, the mind harmonizes itself, charging itself with energy, and it sharpens. Then, the brain starts to emit the signals corresponding to the rest of the system and ease replaces the learning difficulty. Mozart's tempo at high frequencies, as a background for material reading, gives an energy stimulus to the brain cortex to recharge and rebalance the brain and the body, stimulating the connections between the neurons. The „Mozart effect” would be explained by the fact that the rhythm of his music reproduces the cyclical rhythms of brain cells. Dr. Lozanov [13] found that 60 beats/minute music increases alpha activity with 6% (associated with relaxation) and lowers beta activity by 6% (associated with the state of readiness), creating a collage of baroque music which favors the conditions for a global improvement of memory. Transmitting specific frequencies in the brain stimulates it to produce specific chemicals to restore memory.

The material substratum of memory is not yet elucidated. Penfield assumed that memories would be located in the temporal lobe, but this assumption was not accepted. There is a hypothesis in the case of short-term memory that could be explained by the existence of „reverberating” circuits: neuron chains forming a closed circuit. When an excitation comes from the outside it oscillates for several seconds in this circle – which would explain the persistence of memory. There are many such circuits in the hippocampus, and the lesions caused in this region generate serious disorders of the memory. Eccles argues another hypothesis that repeated neuron excitation leads to the emergence of new contact points, either with the dendrites or with the body of another cell, which would facilitate the circulation of the nervous influx and implicitly the possibilities of remembrance. It is certain that there are no special areas for memory and there are multiple and unlimited possibilities of engraving.

## X. CONCLUSIONS

**A. For healthy subjects** all processes have a degree of influence, with significant values for almost all components.

Compared to the control group (without music therapy and placebo substances), the three forms of psychotherapeutic intervention had the following effects:

**1. Baroque music** (creations of Bach, Haendel, Vivaldi, Telemann) has statistically improved the performance of subjects in semantic memory tests in Significant mode, – being on the first position (it increases the power of evoking), in visual and work memory, as well as focused attention – the influence being average, but significant, and distributive attention (the effectiveness coefficient and less the mnemonic one).

It can be concluded that baroque music has a homogeneous influence on the types of memory and attention, confirming the data from the literature that referred to the performance

of the memory in general without differentiating them. *Semantic memory*, linked to the complex processes of reasoning, registered the highest score against the other methods, justifying the hope that baroque music, used as a background sound during study favors long lasting mnemonic engraving and an easy updating of the data.

**2. Rhythmic music** (Michael Jackson's repertoire) improves focused attention for the three coefficients – especially the coefficient of effectiveness, which obtained the best score. This highlights increased possibilities of constant, voluntary orientation, channeling and focusing of the nerve energy. It can be said that rhythmic music determines a well-adapted and controlled effectiveness, committed voluntary effort, developed psychomotor skills, good calibration ability between what the task demands to do. During the hearing, subjects performed the tasks more quickly and correctly. In terms of semantic and visual memory, rhythmic music has not achieved significant values, as well as distributed attention, being a mild inhibitor of these forms of memory, compared to baroque music and the placebo effect that have achieved a superior effect increase.

**3. The placebo effect** was the surprise of the study by its particular influences on contextual memory (increasing the power of recording), especially – obtaining the highest values on the difference between the average rates and the other forms (visual and semantic) and – quite a lot – on focused attention (the accuracy and mnemonic coefficient). For the distributed attention, the effectiveness coefficient is the highest, but there is a decreased precision, clarity of perception – the accuracy coefficient, characteristic of a mobile nervous system, dominating the process of excitation which determines a less stable keeping of orientation and channeling of the nerve energy. It is worth mentioning the fact that the placebo effect can be invoked in the case of its favorable influence, in percentages exceeding 30-35%, this possibility being signaled back in 1967, by Janke (quot. Iamandescu, 1997), the author estimating that a doctor/psychologist, with a high therapeutic prestige can induce a placebo effect in 80% of his patients. Nevertheless, these suppositions can not shade the favorable role of music in stimulating the mnemonic-proseic capacity.

**4. In the control group** there is a decrease of the differences between the averages, some being significantly negative, others positive, but compared to the other interventions, the results are weaker, which may mean that simply repeating the questionnaires without a sound stimulus or suggesting an increase in performance after the administration of a placebo substance does not have the same effect, a certain lack of interest in performing tasks emerging, which can be interpreted as a weak resilience to monotony. Thus, we can say that in the course of a monotonous unilateral activity, the mobilizing processes are extinguished. Therefore, a complementary stimulus can disinhibit them, favoring attention and memory.

**B. Depressive subjects** have heterogeneous reactions to the influence of independent variables, compared to healthy subjects who had homogeneous results, this aspect being related to their mental dynamics, explained by the polymorphism of psychological mechanisms prevailing in this patients and the intensity of depression, illustrated by:

diminished interest, reduced emotional tonus, fatigability, bradykinesia, bradypsychia, etc.

**1. Baroque music** particularly influences visual memory obtaining the highest difference of the average rates and semantic memory – to a lesser degree, and in focused attention the scores of the coefficients are homogeneous, but compared to other methods the accuracy and the mnemonic coefficient of focused attention is higher, indicating an optimal alternation of inspection-exploration operations.

**2. Rhythmic music** has favorably influenced semantic memory and focused attention – the effectiveness coefficient obtaining the highest score, but other coefficients recorded small differences – the speed of perception increases, but precision and clarity are superficial. Distributed attention records a decrease of the effectiveness coefficient and an increase of the other coefficients. This highlights that hyperprosexic polarization to a particular domain is associated with hypoprosexia for the rest of the domains. It would be a decrease in commutativity with an increase of concentration or the opposite way.

**3. The placebo effect** records significant results in visual memory, but does not generate significant improvements compared to the control group. It does not have an impact on the overall community, as there are big changes in each individual, especially women obtaining significant positive differences. For work memory (contextual) negative significant results have been recorded, both in the case of listening to baroque music and rhythmic music, some of the subjects being disturbed by the sound stimuli, highly disturbing for them when they had to memorize (record) a text, expressing their wish to work quietly. However, compared to the other methods and compared to the control group, where results were negative at the second test, the placebo effect managed to obtain a constant score on the work memory, albeit insignificant from a statistical point of view.

This research confirms the data in the literature, both in terms of music therapy and the placebo effect, being performed according to the EBM requirements, through a rigorous process of evaluation and objective data recording.

In conclusion, after an overall evaluation, taking into account the results that had the most powerful effect, we can state that:

**1.** At the first hypothesis the answer is affirmative, statistically validated, both for **baroque music**, which has proven its superiority through its action on improving semantic memory (healthy subjects) and visual memory (depressive subjects) – placing on the first positions, some of the secrets of music being the power to slow down brainwaves to the  $\alpha$  level, and also for **rhythmic music**, improving focused attention (healthy and depressive subjects), the tasks being performed faster and more accurately under the influence of this music that determines the brain to resonate on  $\beta$  waves.

**2. The placebo effect** activates almost all components in healthy subjects, especially in the case of work memory, with the exception of depressive subjects, where there is a large

dissemination of answers from an individual to another, determined by the polymorphism of mental disorders present in these patients.

**3.** Results revealed in healthy subjects that the placebo effect increased distributed attention, more exactly the effectiveness coefficient (involving the posterior cingulate cortex and the reticular formation of the middle brain), and in depressive subjects rhythmic music increased focused attention (involving the anterior cingulate cortex). Also, in healthy subjects, distributed attention records high values in the effectiveness coefficient and low values in other coefficients – the process of excitation prevails characteristic to a *mobile nervous system*, but unbalanced, with difficulties in channeling and focusing the nerve energy, which may also indicate some superficiality or a lack of interest in performing the tasks, regardless of the method used, and in depressive subjects the effectiveness coefficient of distributed attention is low compared to the other coefficients (accuracy and mnemonic), meaning that in their case, a *type of inertial nervous system* and major difficulties in forming a perceptual strategy predominates, indicating difficulties in overcoming the state of emotional inhibition.

There is a significant difference of the placebo effect in depressive subjects compared to healthy subjects (who obtained significant differences in almost all components) which are explained by the characteristics of symptomatology illustrated by lack of hope and interest, negative expectations, anhedonia, likely to generate reduced chances of producing the placebo effect.

As a general appreciation, the results obtained reveal the beneficial role of music therapy and the placebo effect in cognitive processes (especially memory and attention). The examples presented, we hope to incite both to an extension of the indications of these therapeutic methods, and to the research of new possibilities of application and refinement of the observations regarding the brain's responses to external influences.

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