THE EFFECTS OF COMPLEX MUSICAL EXPERIENCE ON THE MENTAL REPRESENTATION OF MUSIC

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ABSTRACT

Background: With connectionist theories as the background, this study suggests that musical memory depends on the complexity of musical experiences. It is argued that children who engage in musical activities, which favour varied participation and multiple encoding, tend to preserve stronger images of music than they would do in less complex or more focused activities.

Aims: The study is concerned with the effects of complex musical experiences on the strength and organisation of the mental representation of music. The analysis is focused on the context of listening to recorded music in the classroom, with particular regard to strategies of listening through participation.

Method: An experiment compares two listening conditions with different levels of complexity: (a) listening to recorded music and (b) listening and playing rhythms along with recorded music. After the treatment, both groups are tested on the identification of excerpts from the musical piece.

Results: As shown by the results of a *t-test* used to compare the score means of both groups ($t = 8.79$; $p < .01$), the experimental group identifies more excerpts with statistical significance.

Conclusions: The experiment suggests that complex situations where children have to attend to several tasks tend to favour a differentiated mental representation, which has positive effects on musical memory, both in strength and organisation.

1. INTRODUCTION

I would like to suggest that we are partly dependent on particular contexts, which influence the ways we respond to music and the ways we represent it in our minds. It will be discussed that the musical objects we listen to are mentally represented in meaningful connections with the contextual information of the learning environment and that this complex is determinant in the ways we remember and think about music.

The contextual complexity appears, thus, as determinant condition for the quality of mental representation. In this sense, I would also like to stress the importance of the learning contexts inside the music classroom. Particularly, the present paper focus on a certain type of strategies on listening to recorded music, which have been developed (e.g. Godinho & Morais, 1996 and 1997) and used by music teachers. More specifically, this paper aims to stimulate some reflection on the effects of different contexts, namely *listening in silence* (Audience-listening) and *playing rhythms along with recorded music* (Audience-performing).

By considering *musical object* as the sonorous object that reaches our ears and *context* as the whole ecological setting of experiences (namely the physical objects, the individual actions, the social interactions and the whole complex, which is the interaction of all these dimensions), the present paper includes the presentation of a study (in Godinho, 2000), which allows the conclusion that *audience-performing* may represent a contextual complexity with positive effects on the mental representation of music.

2. THEORECTICAL BACKGROUND

The idea that *playing rhythms along with recorded music* may have positive effects on the acquisition and organisation of mental images has some implications for the ways mental processing is conceived. One main implication refers to (a) the interaction between the individual and the environment since the expectation is that mental representation is determined both by the actions of the environment (e.g. the music being listened to) and by the actions of the individual (e.g. the act of playing the rhythms). Another implication is (b) the idea of having more than one process happening at the same time. In fact, if mental representation of the music being listened to is enhanced and not disturbed by the performing task, it means that at least these two processes are working in parallel and nourishing each other. Finally, there is (c) the need of conceiving mental representation as being constituted by diverse elements of different types of information; otherwise the motor information from playing drums would not affect the auditory input from the musical piece. This implies that the mental representation of a particular musical object might be distributed in the mind and not confined to a single place or modality.

These implications were determinant for the special attention given to *connectionism* (e.g. Rumelhart et al, 1986; McClelland et al, 1986), a developing theory with a surprising explanatory power about learning, memory and human cognition in general (Eysenck & Keane, 1995). As opposed to other classical approaches that tended to favour either the action of the environment on the individual or the action of the individual on the environment, the connectionist theory postulates that knowledge results from the coexistence of the present experience that it is projected in the mind and the past experience that is preserved and reactivated by the individual. This interaction between the environment and the individual and the way these two 'forces' coexist and feed each other seem to satisfy the first two implications as mentioned above.

The idea of simultaneity applies also to the parallel processing of different sensory modes. For example, the knowledge we have from an apple is the result of different types of sensory information acting simultaneously. Its mental image will include links between elements of taste, smell, visual aspect, etc. This diverse information from reality allows the satisfaction of the third implication. In fact, connectionism offers a definition of knowledge, which goes beyond what we can verbally articulate,

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explain or even be aware of. The connectionist interpretation of the mental processing implies that knowledge may include what is perceived, what the environment sends through our sensory channels, what we may feel, what we may imagine. Mental representation is seen as a connected complex of everything lived and remembered, where reality coexists with ourselves (c.f. Damásio, 1994).

Audience-performing might, therefore, add contextual complexity to the experience of listening to recorded music in the classroom. Playing rhythms along with recorded music may promote a process of complex sensory-motor information reaching the brain simultaneously. This information will be distributed through different areas of the brain in parallel, which means that the mental representation of the musical piece will include differentiated pieces of information in interconnected patterns of activation, in accordance with the interactions offered by the context of audience-performing. The auditory information offered by the music itself will become meaningful with the support of its relationship with the visual information from the score and from the whole setting (e.g. instruments, other musicians). The mental representation will still have the participation of the motor input from the act of playing percussion instruments as well as the auditory stimulation from their sound.

This multiple information will increase the possibilities of reactivation from the past, which will contribute for the creation of a more meaningful complex. For example, a set of timpani used to play along with the music may re-activate relevant information from the past related with its sound qualities. Expressive descriptors, such as *majestic*, *triumphal*, etc. (or the non-articulated associated feelings), may therefore be meaningfully connected with the music phrase being accompanied and listened to. At the same time, the mental representation of this particular phrase may be associated with a certain location in the visualised score, which in return will feed the whole mental image with re-activated information from the past, such as "at the end" and, accordingly, the associated expectation of "conclusive character". The act of playing the timpani during that musical phrase will still imply the parallel representation of the physical gestures and also the eventual re-activation of related feelings of strength and speed, which will be consequently applied to the music itself.

It is, thus, hypothesised that the complexity of playing rhythms along with recorded music will favour the acquisition of mental representation, since the resulting mental image will be supported by several types of differentiated information. The participation of existing schemata will, at the same time, constitute a meaningful incorporation of this diverse information. Differentiation on one side and incorporation on the other will tend to favour the organisation of particular mental images and mental representation in general.

3. EXPERIMENTAL STUDY

3.1. Aims, Methods and Materials

The purpose of this study was to compare the effect of two main music listening conditions on the acquisition and organisation of mental representation of music: (a) Audience-performing – Playing rhythms and map-reading along with a recorded piece of music (experimental group); (b) Audience-listening – Listening in silence and map-reading along with a recorded piece of music (control group).

The comparison between two conditions and the cause/effect relationship between two variables (playing along with recorded music and mental representation) were strong reasons to develop an experimental design. This technique would allow more easily the immediate comparison between different conditions, as well as the isolation of those variables (Fiske, 1992:83). The design was that described by Campbell and Stanley (1963:25-26) as a 'single natural package' (i.e. a post-test-only, control group design), which involved a treatment phase (different for both conditions) and a post-test phase (identical for both groups).

For the purposes of clarity and practicality (e.g. Taylor, 1989), the hypothesis was not formulated in a null form. Due to the positive expectation in the theoretical discussion, the general hypothesis anticipated that *subjects in the audience-performing group would reveal a greater level of acquisition and organisation of mental representation of music than subjects from the audience-listening group*.

Two different groups of children of 10/11 years old were assigned to the conditions and the discrepancies between groups were diminished by a large sample (Kerlinger, 1970; Bush & Sherbon, 1992). Ten groups of twenty-five children participated in the study: 125 were assigned to the experimental group and 125 to the control group. All the children were from the same Portuguese school and they were all in year five of schooling. Children were not artificially grouped for the study and the experiment was conducted in the normal timetable of music classes. Two classes from each of five teachers were used, in order to have one class from each teacher in both experimental and control groups.

The musical piece used in the experiment was *Rondeau* (AABACA) from *Suite Abdelazer* (Purcell, 1996). The rhythmic accompaniment was very simple and expected to be easily performed by children of year five. The chosen rhythms were induced by the whole character of each part, but mainly given to the global effect of violin II, viola and bass. A musical map was created to support the performance of the experimental group. However, the need to isolate the variable of performing also implied the presentation of the same musical map to the control group. A new code with dots (play) and crosses (do not play) was created to avoid eventual musical literacy differences between children or classes.

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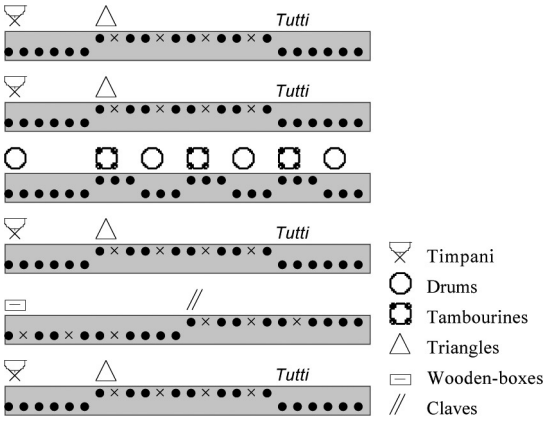

Figure 1: Musical map to accompany Purcell's *Rondeau*.

A test on the aural identification of excerpts from the *rondo* was specially created for the present study. The correct identification of a particular musical phrase would mean that the mental image of the excerpt would be strong enough and that the mental image of the whole music would have a high level of differentiation and organisation. The operational hypothesis was then formulated: *Subjects in the audience-performing group would recognise and identify more excerpts from the musical piece previously listened to than subjects in the audience-listening group*. In this sense, six excerpts from *Rondeau* were taped. On a test sheet with six numbered musical maps, which were identical to the one used in the treatment phase, the children were invited to circle the locations of the fragments they would listen to. Each excerpt was played three times.

Both the treatment and the testing phase took place in the morning during a session of 50 minutes for each group. The researcher himself conducted all sessions, in order to ensure equal procedures for both conditions. In order to avoid further interference, both control and experimental groups were asked to do the unexpected individual written test, immediately following the treatment phase. Children had not been previously informed about the test in order to avoid disturbing effects during the learning process, such as anxiety and sensitivity to the test, or even the use of mnemonic strategies (Cohen & Manion, 1989: 202). The idea was to centre children's attention on the present experience itself and give it the most natural environment as possible, with no special constraints from the future.

3.2. Results

In the analysis, each of the six items of the test was considered either correct or incorrect. Children received one point for each correct answer, which means that the final marks could vary from a minimum of zero (no correct answers) to a maximum of six (six correct answers). Having data at the ratio level and a large sample, a parametric test was applied (Cohen & Holliday, 1996). The means of the children's marks of both groups were therefore compared with a *t-test* in order to analyse the statistical significance of the differences.

Children from the Audience-Performing group scored higher than children from the control group. The majority of children in the Audience-Listening group scored below 2 (less than two correct answers) and only a minority reached 3 or 4 correct answers. However, only 5 children in the Audience-Performing group scored zero and some children reached 5 correct answers (There is also an isolated case of six correct answers). The majority of children scored between 2 and 3.

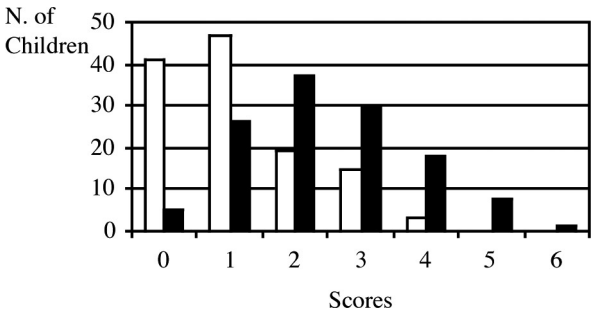

Figure 2: Purcell Test: Frequency of Scores. Audience-Performing children (black columns) get higher scores than Audience-Listening children (white columns).

Audience-listening children scored a mean of 1.136 and the experimental group scored a mean of 2.464 (Table 1). A *t*-test for independent samples was used to compare the means of both groups. The mean score for children in the Audience-Performing group was significantly higher, $t = 8.79$, $p < .01$ (Table 2).

	N	Means	Variance
Audience-Listening	125	1.136	1.1668
Audience-Performing	125	2.464	1.6862

Table 1

Variances	*t* value	D. F.	*p*
Different	8.79	240	.0001

Table 2

4. CONCLUSION

The empirical research gave significant evidence that playing rhythms along with recorded music may have positive implications on the way children mentally represent music they listen to. Playing rhythms along with recorded music in a classroom situation allows the establishment of a complex context, which has a high probability of facilitating the acquisition and organisation of mental images. It has been suggested that during an experience the mental patterns of activation depend on the contextual stimulus as well as on the individual's reactivation of knowledge from the past. The audience-performing group had more contextual information reaching the brain and thus a more differentiated and complex system of patterns was activated. This differentiation allowed the reactivation of the related patterns from the past, but by being complex (in number and diversity) each reactivation or expectation from the past gained a relative strength and meaning. This negotiated strength and meaning

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allowed the plasticity necessary for further adjustments, i.e. the activated system was open to learning and to adopting new connection strengths between the activated patterns.

By its own nature, the present study might have an immediate applicability in the classroom. Playing rhythms along with recorded music will most probably affect children's mental representation in positive ways. Therefore, the use of rhythmic maps as accompaniments to recorded music is suggested by the present research to be a beneficial exercise. Consequently, eventual arguments against this kind of active participation of children during listening situations loose strength. The study has shown that neither attention was deviated from the musical object nor the mental representation of the music destroyed. On the contrary, they were both favoured by the active participation of children with rhythmic accompaniments as opposed to the more passive way of listening in silence.

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