Children’s recognition of their musical performance

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Introduction

Children show non specialized musical abilities even before musical instruction. Such capacities, resulting from both acculturation and innate factors (Sloboda, 1988), are often manifested in musically expressive behaviours.

Research concerning musical productions by children prior to the onset of formal musical instruction examined the processes underlying unrehearsed performances. Moog (1976) assessed how children changed their own spontaneous singing improvisations with advancing age level; Dowling (1984) determined the nature of musical schemata in children’s singing performances; Olivetti Belardinelli et al. (1984) detected the factors implied in children’s spontaneous piano productions; Mialaret (1994) studied the emergence of regularities in children’s instrumental improvisations. All these studies suggest an implicit comprehension of the constraints and characteristics of the musical language by children.

Although the importance of procedural abilities in unskilled children is evident, historically most research concerning musical aptitude used only discrimination and preference tasks particularly focusing attention on perceptive aspects, while the procedural and expressive ones were underestimated. More «active» tasks involving a higher level of musical cognitive processing, such as performance tasks and problem solving tasks, are used only in a few studies, (Karma, 1984; Webster, 2000), probably due to the difficulty of assessing performance abilities in untrained subjects.

In spite of these difficulties Skille (1977) defined musicality as a primary human function in a framework of general functions, which are necessary to give musical expression to musicality. Recently Webster (2000) affirmed that music aptitude represents a set of constructs that relate not only to the ability to "audiate" tonal and rhythmic patterns and to make simple preference choices but also the ability to think with and to manipulate larger musical wholes.

Although Olivetti Belardinelli (1996) found a good correlation between untrained children’s scores to Wing Standardized Tests of Musical Intelligence (Wing, 1948) scoring subject’s answers to auditory items formed by musical material and to Skille’s Musical Behaviour Scale (MUBS) scoring subject’s active music productions, we are convinced that, as musical aptitude refers to the whole behaviour of a person, musical experience cannot be assessed entirely by a task in which subjects analyse music. Moreover tasks demanding subjects to produce music could give information about the ways they implement their own knowledge.

As Rodriguez (1998) pointed out, expression is one of the main aspect of musical aptitudes.

The importance of expression in children’s musicality is evident, but only a little work concerning this aspect of musical aptitude has been done until now. Musically expressive behavior is often regarded as the domain of the mature artist and by this way children's instinctive use of music for a variety of interpretative purposes is underestimated.
In the field of melodic memory research, the literature shows that even young children are able to discriminate among melodies that are identical or very similar to an initial melody over an extended period of time (Madsen, 2000). Although there is considerable evidence of relationships between performance and memory skills in musical development (Snyder, 2000; Temperly, 2001), too few studies with untrained children as subjects have been run.

It is time to look for new ways of assessing musical aptitude procedurally, thanks to new digital technology that could provide different assessment tools. Several commercial software programs already exist that offer children a chance to make music without any previous experience. These programs could afford new means for assessing musical aptitude with performance-based tasks. By computer recording of children’s responses to musical tasks it is possible to analyse their musical behaviour for both products and processes variables. Hickey (1995), Daignault (1997), and Younker (1997) have already used MIDI equipment and computer software to study children's composition in terms of product and process.

In this work a computer allowed our children to try and re-try, hear and re-hear and to make judgments about their musical products.

**Method**

**Aims**

This research is aimed at investigating the mutual influence of perception, production, and memory strategies in children’s music recognition ability. We intend to verify children’s recognition capability in recognizing their own musical products among other similar ones.

In this study we used Rodriguez’s paradigm (Rodriguez, 2001) on a sample of Italian children, maintaining his stimuli and procedures, while varying the retention interval between performance tasks and identification tasks.

A subsidiary aim is to detect eventual influences of different cultural environments. Therefore we tested the Italian sample answers to Rodriguez’s following questions:
- Are children able to recognize their own musical performances?
- Are there age-related tendencies in children’s recognition ability of their own musical performances?
- Which are the cognitive strategies used by children in this recognition task? Are there age-related tendencies in using these strategies?

Moreover, following the variation of the retention interval specifically introduced in this study, we will verify if there is an influence of the retention interval in children’s recognition ability of their own musical performances.
Subjects

238 elementary students from two towns in Southern Italy participated; ages ranged from 6 to 12 with a mean age of 8.67. The sample consisted of 72 first-grade students (38 girls and 34 boys), 82 third-grade students (44 girls and 38 boys) and 85 fifty-grade students (37 girls and 48 boys). See table 1.

<table>
<thead>
<tr>
<th>SEX</th>
<th>male</th>
<th>female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td></td>
</tr>
<tr>
<td>CLASS 1°</td>
<td>34</td>
<td>38</td>
</tr>
<tr>
<td>CLASS 3°</td>
<td>38</td>
<td>44</td>
</tr>
<tr>
<td>CLASS 5°</td>
<td>48</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>119</td>
</tr>
</tbody>
</table>

Table 1: Cross-table between Class and Sex

Apparatus

Equipment used included a Macintosh PowerBook computer, a Roland XP10 digital synthesizer with built-in MIDI interface, a set of two computer speakers and a portable audiocassette recorder. For practicing, recording and storing performances by children we used *Instant Pleasure* music performance software.

Procedure

Performance Task

Subjects were presented with the familiar children’s song «Twinkle, Twinkle, Little Star». The MIDI file contained both the melody and a chordal accompaniment of the song; the timbre used was a grand piano.

Each subject listened to the song at least two times, but the children were allowed to listen as many times as they needed. Subsequently, using the *Instant Pleasure* software, the subjects «practiced» the song by simply pressing any key on the computer keyboard. Each key depression corresponded to the listening of a event by the «Twinkle, Twinkle» MIDI file.
The subjects were able to change the song’s time by *when* the computer keys were depressed (slow, fast, regular, irregular,) and dynamics by *where* the computer keys were depressed (only considering the letters rows of keys, the upper one for louder, middle one for the mezzoforte and the bottom one for the softer). After the practice period, each subject was asked to make a recording of his performance.

Subjects were told:
«Now that you have practiced in playing this song, I will record it so that I can listen to it later.
Any questions? Let’s begin recording.»
The subjects were allowed to re-record as many times as they preferred until they were satisfied.

-Recognition task
In order to control the influence of the retention intervals on recognition we varied the time between performance and recognition task. Therefore, after 4 or 6 or 8 days (according to experimental group) each subject was presented with three different interpretations of the target song.
The participants were asked to recognize which melody was the one they produced among the distractors. Distractor melodies were randomly selected from the list of melodies performed by other same age subjects.
The subjects were allowed to listen to each performance as many times as needed for their identification.

-Interview
After the recognition task each subject was asked how he could recognize his own performance.
Subjects’ answers were recorded with an audiocassette recorder, and then transcribed and stored in a text file.

-Judging task
Three expert judges examined subjects’ answers; they were instructed to code the verbal responses to detect the cognitive strategies used by the subjects. These strategies are belonging to eight categories, subsequently grouped in three macro-categories:

Sensory : Tactile, Aural

Cognitive : Error detection, Elimination strategy

Product : Structure, Tempo, Duration, Dynamics

In order to determine the level of agreement between judges in assigning these categories to the verbal responses we used Cohen’s K statistic.
Results and analysis

Recognition task

Similar to the American sample (Rodriguez, 2001), the Italian sample showed a good rate of correct recognition, 165 correct responses, (69%), versus 74 wrong responses, (31%). In order to verify an eventual age-related improvement of correct recognitions, we compared the frequencies of correct responses between the three age groups (Table 2). The differences are not significant (Chi²=.101) but there is an interesting trend of improvement in the frequencies of correct recognitions as the age increases (59.7% in first class, 70.7% in third class, 75.3% in fifth class).

<table>
<thead>
<tr>
<th>Recognition</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong</td>
<td>Correct</td>
</tr>
<tr>
<td>Total</td>
<td>239</td>
</tr>
</tbody>
</table>

Table 2: Cross-table between Class and Recognition

There is no difference between male and female subjects concerning the recognition task (68.3% males and 69.7% females).

As regards the influences of retention intervals (table 3) the recognition performance is not impaired following an increase in the time intervals between performance and recognition (4, 6, 8 days).

<table>
<thead>
<tr>
<th>Recognition</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong</td>
<td>Correct</td>
</tr>
<tr>
<td>Total</td>
<td>132</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Retention interval</th>
<th>4 days</th>
<th>87</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>34.09</td>
<td>65.91</td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Cross-table between retention interval and recognition

<table>
<thead>
<tr>
<th>Retention Interval</th>
<th>Presence Judgment</th>
<th>Absence Judgment</th>
<th>Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 days</td>
<td>14</td>
<td>40</td>
<td>54</td>
</tr>
<tr>
<td>8 days</td>
<td>15</td>
<td>38</td>
<td>53</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>165</td>
<td>239</td>
</tr>
</tbody>
</table>

We can glean the following consideration by the data: memory of their own musical performances in elementary school children is stable, considering a maximum retention interval of eight days from the moment of performance.

The verbal responses: Children’s recognition strategies

An important aspect of this research is the analysis of the children’s verbal responses. The Kappa rates of agreement among judges are generally good, ranging from 0.37 to 0.80, but they seems rather heterogeneous among categories (table 4).

<table>
<thead>
<tr>
<th>Response Categories</th>
<th>Presence Judgment</th>
<th>Absence Judgment</th>
<th>Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tactile</td>
<td>66</td>
<td>651</td>
<td>0.46323</td>
</tr>
<tr>
<td>Aural</td>
<td>83</td>
<td>634</td>
<td>0.60171</td>
</tr>
<tr>
<td>Elimination strategy</td>
<td>150</td>
<td>567</td>
<td>0.53735</td>
</tr>
<tr>
<td>Error detection</td>
<td>95</td>
<td>622</td>
<td>0.87793</td>
</tr>
<tr>
<td>Structure</td>
<td>110</td>
<td>607</td>
<td>0.37671</td>
</tr>
<tr>
<td>Tempo</td>
<td>68</td>
<td>649</td>
<td>0.56642</td>
</tr>
<tr>
<td>Duration</td>
<td>40</td>
<td>677</td>
<td>0.45374</td>
</tr>
<tr>
<td>Dynamics</td>
<td>331</td>
<td>386</td>
<td>0.80962</td>
</tr>
</tbody>
</table>

Table 4. Kappa Statistics for Judges.

Analyzing the two first columns of the above table, we can see that children used some categories more than others. The categories more used are: Elimination Strategy, Structure and above all Dynamics. The last result may be a consequence of the prominence of dynamic changes as a performance option in the MIDI software (three rows of keys with three different loudness). For the same reason it is strange that categories like tempo and duration are not very frequently considered.

In order to verify a possible influence of different cultural environments we compared our data to the data obtained by Rodriguez (2001) from American children (table 5).
Table 5. Cross-cultural comparison between cognitive strategies.

The graph shows primarily a more balanced distribution of the strategies in the American sample. Dynamics responses are the most used by both samples, but in Italian children this strategy seems to be predominant in comparison to other strategies.

In order to detect age-related tendencies in the verbal responses, the Chi square test was used. Three categories showed a significant difference in the distribution of frequencies among the three age groups: in particular Error detection \( \chi^2 (df=2) = 29.6, p < .001 \), and Tempo \( \chi^2 (df=2) = 7.8, p < .05 \), show an improvement between the first and the fifth grade while Dynamics \( \chi^2 (df=2) = 21.6, p < .001 \), differently from all other categories reaches a significantly higher level in the third class. In the following figure we noticed the age-related tendencies in the verbal responses (table 6):
Table 6. Age-related tendencies of response categories.

The general trend of the answers categories is similar to the American one and in our case too in quite generally non linear.

The increased presence of Error detection and Tempo responses in function of age, could be interpreted as a consequence of the attainment of higher level cognitive processes by the older group. Vice versa, the peculiar trend of the Dynamics category and in particular the maximum level attained in the third class, could be interpreted as an attempt to meet, by emotional contrast, cognitive requests that eight years old children can understand but are not ready to satisfy by means of cognitively abstract strategies.

Discussion

Our results confirm that children in all age groups succeed in recognizing their own performances and the only influence of the cultural environment seems to be limited to the recognition strategies. These data can provide us with several indications of the development of musical abilities in children. Although differences between the three age groups are not statistically significant there is a trend of improvement in recognition performances with advancing age level. Children’s recognition abilities are not impaired with increasing retention interval: this result suggest that children’s memory for their own musical performance is «strong» and stable. Children used prevalently the Dynamics strategy to discriminate their performance among the other ones but the recourse to higher level strategies gradually improves with age. Both a qualitative and quantitative analysis of data suggest an age-related improvement of «precision» responses, in fact older children provide more «technical» responses than the younger ones.

Conclusion

By means of performance tasks we can arrive at a better understanding of musical potential in children. These kind of procedures seems to be more direct and punctual than the traditional ones in estimating musical aptitudes and expressive musical performances in unskilled children and involve important implications for music teaching and learning. In this perspective we will extend the present research in assessing relations between quantitative characteristics of products (analysis of MIDI files containing children interpretations), recognition performances and verbal responses.
References


