CHILDREN PLAYING WITH SOUNDS: AN INTERACTIVE TOY TO TEST CONSONANCE AND DISSONANCE IN YOUNG LISTENERS

N. Di Stefano*, V. Focaroli*, A. Giuliani**, D. Formica*, F. Taffoni* and F. Keller*

* Università Campus Bio-Medico di Roma
** Istituto Superiore di Sanità, Roma

INTRODUCTION

Consonance and dissonance perception has been widely investigated in infants and children over the past 25 years. Recent studies suggest that both the results and the methods adopted need to be revisited in order to have a consistent measure of differential perception of consonance and dissonance. In the present study, we introduce a procedure to test consonance and dissonance perception in infants and children, utilizing a musical toy that emits sounds according to the way it is manipulated. This behavioral method aims to minimize the experimenter's role in the procedure since the data are produced by the participants themselves while playing with a toy.

METHODS

Subjects

Participants were 22 Italian children between 19 and 40 months of age.

Procedure

Each child received a single experimental session in which the participant had to freely explore the toy producing sounds as they like. The experimental session was administered by two experimenters, one interacting with the child and one operating the remote laptop. The experimental session was video recorded. At the beginning of each session, the researchers invited the child to play with a new toy, showing him/her how it worked: one of the experimenters moved the handle producing both consonant and dissonant sounds according to the orientation. To ensure the free exploration of the participant, no verbal instruction was given. Each session lasted 7 minutes and consisted of three phases:

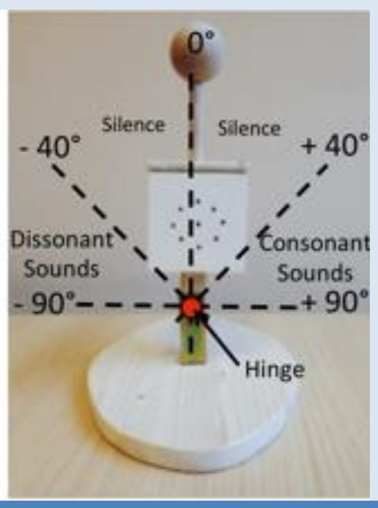
Phase 1: duration 3 minutes. The aim of this first step was to allow the children to familiarize both with the toy and the musical stimuli by moving the lever. During this phase, the device is in playing mode, and emits the experimental stimuli according to its rotation. Children had to understand that by moving the lever a sound was emitted. *Phase 1* was the first contact of children with both toy and sounds. Therefore, it served as baseline for the evaluation of children musical discrimination and preference in the following phases.

Phase 2: duration 2 minutes. During this phase the toy was muted (data from the device were recorded anyway). This phase was fundamental as an interval of time in which children make experience of the toy without sounds. The primary goal of this phase was to control if sounds emission actually influenced children manipulation of the toy. In this phase, we expected to have a significant decrease of interest about the musical toy.

Phase 3: duration 2 minutes. In the last phase the device was switched in playing mode again. The aim of this phase was to verify if children distinguished between the two kinds of stimuli, and if there was a prevalence of consonant or dissonant sounds, by comparing the durations of the two classes of sound produced by the child.

The musical toy

The musical toy has been designed to produce acoustic stimuli according to its orientation. It is a simple handle allowing +/- 90° rotations with respect to the rest position (vertical orientation at 0°). When children grasp the handle they can rotate it around the hinge at its base. When children leave the handle, a spring brings it back to the rest position. Rotations exceeding the [-40° +40°] interval produce, respectively, dissonant and consonant sounds. In the interval between -40° and +40°, the device is silent.



Data analysis and Results

Total consonance and dissonance time in each phase was recorded for each participant. Times were then normalized over the total time of each phase (total time=consonance time + dissonance time + silence time). To verify that sound emission influenced children manipulation of the toy, we compared mean manipulation time in *Phase 2*, when the device is muted, and in *Phase 1* and *3*, when the device is in playing mode. Figure 1 represents the mean manipulation time (consonance time + dissonance time) for each phase. To investigate the effect of sound in children's use of the toy across the three phases, we computed a repeated-measures ANOVA with phase and type of sound. We found a significant effect of phase (F(2,20)=9.54, p=.001) and a significant interaction between phase and type of sound (F(2,20)=8.16, p=.003). No significant effect of sound was found when considered as separated from phase. These results indicated that participants' performance varied across phases and was actually influenced by the type of sound, i.e. consonant or dissonant (Figure 2). We also performed a video analysis that aimed at evidencing any possible side-bias in manipulation of the toy, at assessing any hand preference, and at excluding any boredom effects during the procedure. Comparison of the average number of times that the child moved the handle toward the left vs. right side during *Phase 1* and *Phase 3* showed that there is no significant difference between the number of left or right movements neither in *Phase 1* nor in *Phase 3* (p=.80 and p=.39, respectively), thus suggesting the absence of any side-bias (Figure 4). Finally, we found that, on average, children grasped the toy with the right hand about twice as often as with the left hand (p=.0009) (Figure 5).

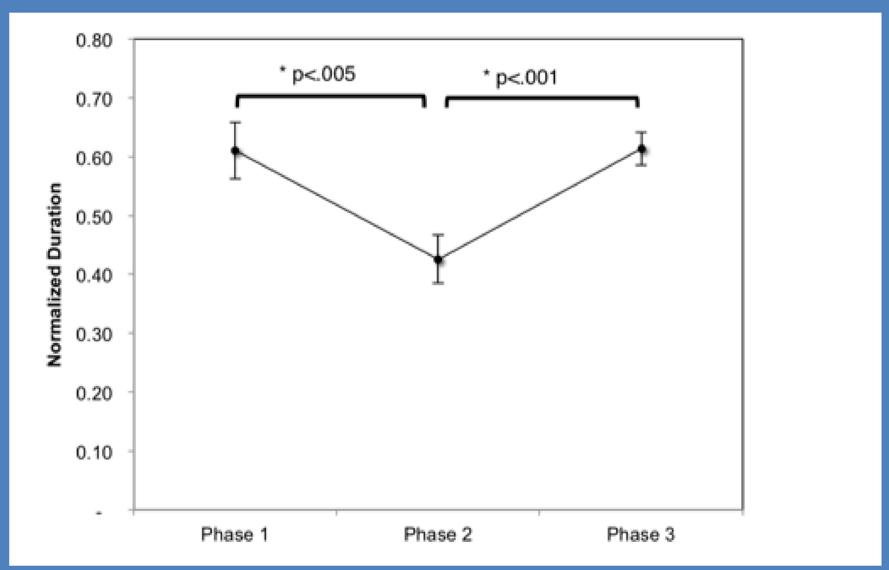


Figure 1. Manipulation Time

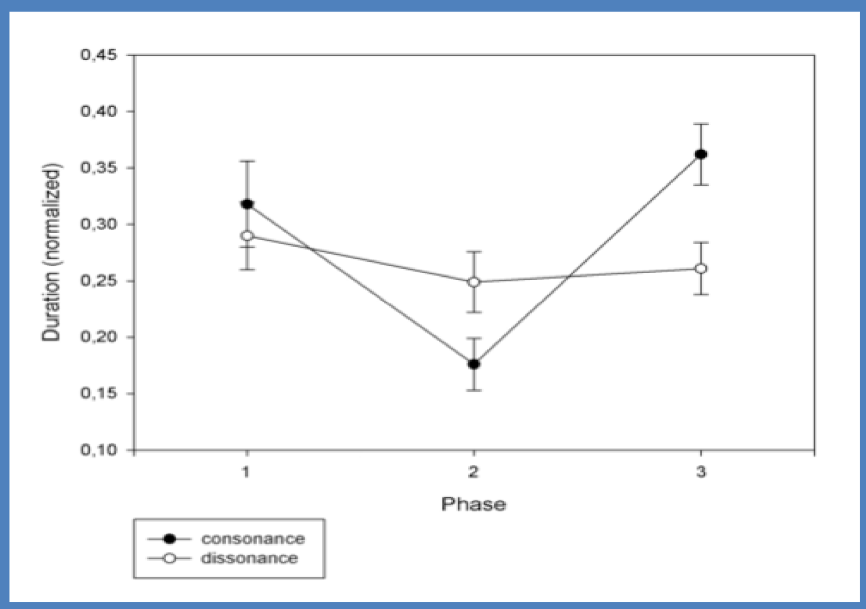


Figure 2. Consonance and Dissonance duration across phases

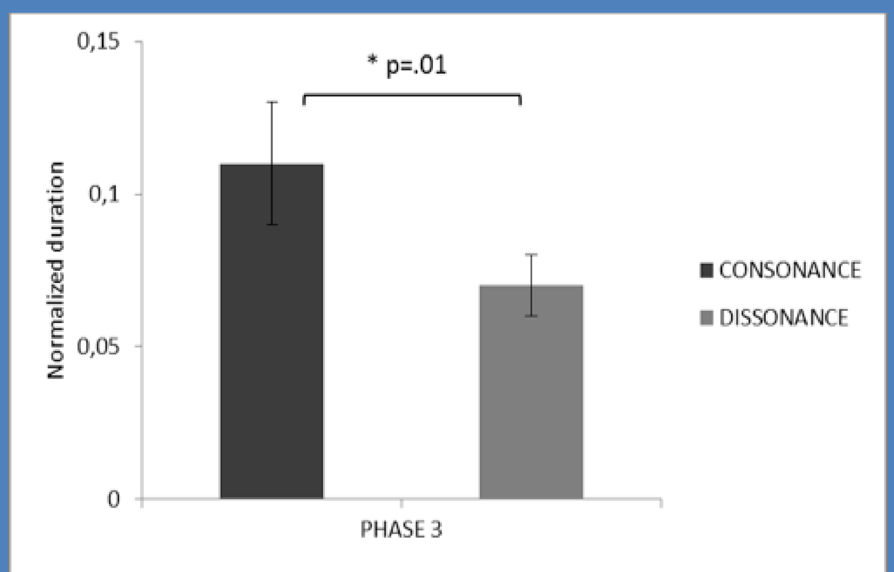


Figure 3. Consonance and dissonance duration in phase 3

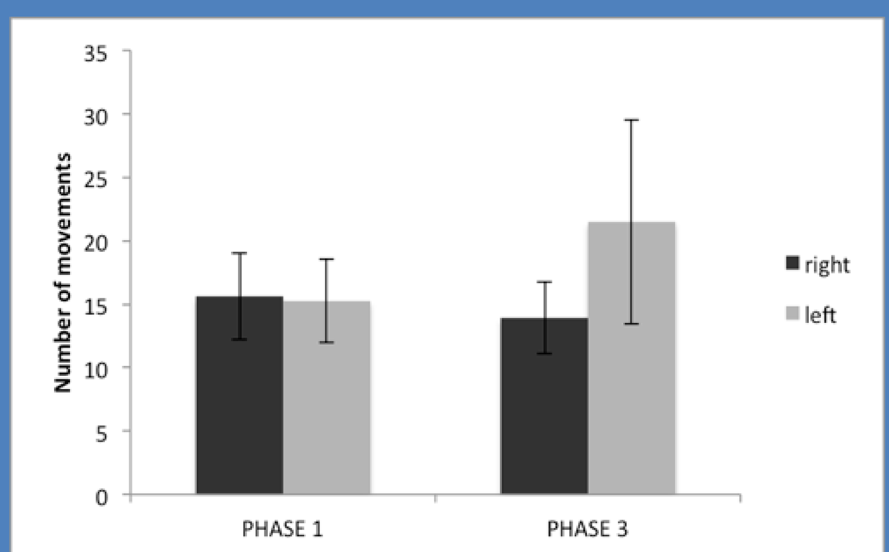


Figure 4. Number of movements toward right and left side

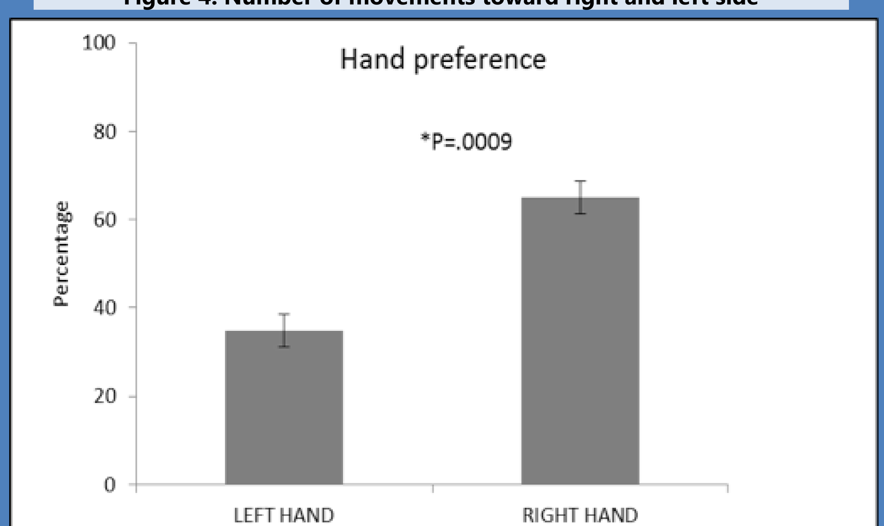


Figure 5. Hand preference

Discussion

The goal of this research was to test a novel protocol to assess music perception in young children, based on their interaction with a musical toy. Results show that the device can be adopted to test sound perception in infants and children. Mean manipulation time in *Phase 2* (mute) was significantly shorter than in *Phase 1* (p<.005) and in *Phase 3* (p<.001). Participants actively interacted with the toy in sounding mode during the experimental session. Children learned to discriminate between consonant and dissonant sounds. In fact, while in *Phase 1* there is no significant difference between consonance and dissonance time (p=.57), in *Phase 3* consonance and dissonance mean duration significantly differ (p<.05). Discrimination between consonance and dissonance is a fundamental aspect of western musical harmony and language, which is essentially grounded on the different role of consonance and dissonance and on their mutual relationship.

Data show a significant change in children average behavior during the three experimental phases, which concerns the amount of time spent in consonant position, while mean dissonant time remains almost identical across the three phases. Further analysis of consonance vs. dissonance mean values also gave an indication of the behavior of the participants. *Phase 3* asymmetry towards consonance evidenced the preference for producing consonant intervals over dissonance, which may be in line with the preference for consonance reported in literature (Schellenberg & Trehub, 1996; Trainor & Heinmiller, 1998; Trainor et al, 2002; Zentner & Kagan, 1998).

References

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2.Trainor & Heinmiller, 1998; The Development of Evaluative Responses to Music: Infants Prefer to Listen to Consonance Over Dissonance. *Infant Behavior and Development*.
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