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Mindful silence produces long lasting attentional performance in children

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Abstract. Biophilia is affected by the ability to focus on natural stimuli effortlessly, actually to be fascinated by Nature. Exposure to natural environments allows one's directed attention to rest and to restore from a state of mental fatigue. As we have reliably demonstrated in a precedent study (Visions for Sustainability 1, 31-38) mindfulness meditation is an effective intervention that improves children sustained attention through Active Silence Training (AST), a mindfulness-based educational proposal specifically tailored for children of primary school age. The AST is made up of Cooperative Play and Mindful Silence, namely activities to engage children's involuntary attention. This study investigated which component of AST (i.e. Cooperative Play or Mindful Silence) was more effective in improving children's attention. In a mixed research study 72 children (9-11 years) of a primary school in Aosta (Italy) were randomly assigned to one of three different training: i) Mindful Silence only, ii) Cooperative Play only, iii) both Cooperative Play and Mindful Silence, the original AST. At four time-points, sustained attention and physiological parameters were assessed. Results didn't show any change in physiological parameters whereas it emerged that Mindful Silence training alone produced greater and longer-lasting improvements in children's sustained attention than Cooperative Play or Play and Silence; Cooperative Play produced immediate but short-lasting changes. Mindful Silence training was identified as being able to improve children attentional capacities and an effective tool for stimulating biophilia.

Keywords: Biophilia, Mindfulness, Active Silence, Cooperative Play.

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***Perspective**: Research vision*

***Fields**: Human sciences - Earth life support systems*

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1. Biophilia and mindfulness meditation

Biophilia, the human tendencies to love and take care of nature (Wilson, 1984), is affected by attention (Wilson, 2002), i.e. the ability to focus on natural stimuli effortlessly, actually to be fascinated by nature (Barbiero, 2011). According to Stephen Kaplan and his Attention Restoration Theory (1995), fascination is the type of involuntary attention that does not require any effort from the individual's behalf and is resistant to fatigue. Fascination can go toward particular contents or events in the environment (Kaplan, 1995), particularly it arises spontaneously when animals and/or plants are present. Given the engagement of fascination the exposure to natural environments allows one's directed attention (the type of effortful attention) to rest and to be restored from a state of mental fatigue (Berto, 2005). Fascination is learnable; the use of involuntary attention through the ability to be fascinated by nature can be taught and therefore learnt. Mindfulness meditation is a way to teach and learn how to recover from mental fatigue through the engagement of involuntary attention and accordingly to become more sensitive - biophilic - to the natural world, namely the main source of fascination. To keep biophilia up is paramount in children, considering that nowadays contact with nature is scarcer and scarcer, and children risk to loose sensitivity for the natural environments. In a subsequent work, Kaplan (2001) proposed a hypothesis that weaves fascination and meditation:

«Consider an individual with little meditation training attempting to meditate in an environment arranged to have only modest restorative properties. That individual would be expected to experience more recovery of directed attention capacity than either the same person in the same environment who is not attempting to meditate or the same person trying to meditate in an environment that offers fewer restorative properties» (Kaplan, 2001, Hypothesis 6).

The present study is the first report of a broader project aimed to verify the hypothesis that the practice of mindfulness meditation can first improve attentional performance and second enhance biophilia in children (Barbiero, 2009).

Mindfulness meditation is a psychological practice that stems from the spiritual traditions of Buddhism (Siegel, 2007), and from which various stress reducing techniques (Kabat Zinn, 1990), as well as other psychological therapies have been derived (Epstein 1995; Segal, 2002; Germer, 2005). In adults, research demonstrates that mindfulness based training can promote the sensation of well-being (for instance, see Shapiro 1998; Beddoe, 2004; Wall 2005; Horowitz, 2010) and lead to long-lasting changes in cognition and emotion. Specifically, mental training has been found to enhance attentional performance (Semple, 2010) through the recovery of direct attention (Kaplan, 2001). As far as attentional performance is concerned, adult experienced meditators are more adept at tests of sustained attention than non meditators (Valentine, 1999; Chambers, 2008). However, little is known about effects of mindfulness meditation on children’s attention (Black, 2009).

Meditation has the power to preserve attentional capacities by avoiding the expenditure of directed attention, and it is able to recover attention by enhancing the restorative process (Kaplan, 2001). Directed or voluntary attention (James, 1892) is the kind of attention employed when something does not attract attention but is important to attend. All distractions must be inhibited to focus attention and to protect it from competing thoughts (Kaplan, 1995). This operation involves a mechanism that inhibits distractions on which directed attention depends. Unfortunately this mechanism is susceptible to fatigue. Meditation techniques discourage the engagement of directed attention by enabling involuntary attention (James, 1892), otherwise known as fascination (Kaplan 1995; Kaplan 2001) with slow, patterned movements and effortful participation. The engagement of fascination or effortless attention, is essential for recovery of depleted directed attentional capacity (Berto, 2005); fascination can go toward particular contents or events (Kaplan, 1995) and it guarantees that directed attention can rest and be restored (Berto, 2005). As previously said fascination is learnable, i.e. the use of involuntary effortless attention can be taught and therefore learnt; in this way, directed attention is not only recovered, but the subject also becomes more focused on the ongoing task (Kaplan, 2001).

Based on this framework, Dinajara Doju Freire, a Buddhist monk and educator, developed the Active Silence Training (AST), a mindfulness-based educational proposal specifically tailored for children of primary school age (Freire, 2007). Since fascination can be cultivated through meditation (Kaplan, 2001), the AST, being a child-friendly method (Hayes, 2003), is also made up of "fascinating games" devised to engage involuntary effortful attention in children. Indeed, as games are expected to spontaneously engage the attention of children, they can be exploited for providing a source of fascination (Kaplan, 1995). It is precisely the involvement of attention in its involuntary mode (achieved through meditation and/or the playing of games) that allows the voluntary mode to rest and thus recover (Kaplan, 1995).

Specifically, the AST is formed of two components: Cooperative Play (Bello, 2002; Ferrando, 2007), games that develop empathetic behaviour in children (Jelfs, 1982; Bonino, 1987), and Mindful Silence (Freire, 2007), exercises that introduce mindfulness meditation to children. The long-term efficacy of AST depends on the active involvement of the children's parents as well as their school teachers; involving the parents also reduces the risk of misunderstandings and incoherent expectations arising between the school and family (Cankar, 2009; Schonert-Reichl, 2010).

In the present study, we investigated whether a specific component of the AST is more effective in improving directed attention in children. The positive effects of AST upon children's attention are not being questioned here, our aim was to verify whether the each of the two modules of AST (Cooperative Play and Mindful Silence) were also effective when used separately, or whether they were only effective when used together. To this end, a group of primary school children participated in a mixed research study whereby the children underwent the full original AST training programme, or only received the Cooperative Play or Mindful Silence condition.

We assessed attentional performance in the children at four time-points: pre, mid and post-training and a five month follow-up time-point. Since it has previously been shown that AST also involves positive changes in the physiological state of children (Barbiero, 2014), in this study we assessed physiological parameters (blood pressure and heart rate) in addition to the children's attentional capacities.

2. Method

2.1 Participants

A total of 72 primary school children from a school in Aosta (Italy) participated in the study (30 males and 42 females, aged 9-11 years). All parents gave informed consent for their children to participate in the study.

2.2 Measures

2.2.1 Physiological parameters

We measured the heart rate and the systolic and diastolic blood pressure using the M6 Comfort Omron digital blood pressure monitor (Omron Healthcare Co., Ltd., Kyoto, Japan).

2.2.2 Attentional performance

We used the Continuous Performance Test (CPT; Italian version by Cornoldi, 1996) to measure the children's attentional performance. This version of the CPT is a paper and pencil test that measures sustained attention and/or inhibition capacity; it consists in finding three contiguous letters in a very long string. The CPT is made up of three sub-tests that differ in the character order of the string, the character size and the spaces between the characters. The CPT is a brief and conceptually simple test, but nevertheless fatiguing for children of this age. It involves very little in the way of memory load, since only a sequence of three letters needs to be kept in mind and the test is not sensitive to the effects of learning. It is a validated measure of sustained attention and inhibition in non-impaired children (Cornoldi, 1996; Barbiero, 2014). The CPT measures the number of correct responses, the number of omissions and the time (in seconds) taken to perform the task.

2.3 Procedure

We randomly assigned the 72 children to one of three experimental conditions (24 subjects each): Cooperative Play, Mindful Silence, AST (Cooperative Play and Mindful Silence). The three groups of children underwent the training at the same time during the school day (1.5 hr/day for 4 weeks), and the time for the training was randomly chosen day by day. We measured the physiological parameters and attentional performances one week before the training commenced (pre-training), two weeks after the beginning of training (mid-training), at the end of training (post-training; i.e. at four weeks) and five months following the end of the training (follow-up). For the pre, mid and post-training tests, we took measures immediately after the completion of the training session. We administered a different version of the CPT (i.e. novel letter strings) each time. All training, measurement of physiological parameters and CPT administration occurred in the classroom.

2.4 Conditions

2.4.1 The AST condition: Cooperative Play and Mindful Silence

This condition reproduces the original AST that comprises two different modules: Cooperative Play and Mindful Silence. Before the training sessions began, the two modules were presented to the in-service teachers and parents by the two trainers involved: a cooperative play expert and a mindfulness meditation instructor. Trainers explained teachers/parents the theory behind each module and suggested they experimented directly the training that would be used in class with the children.

In the Cooperative Play module, the games forming the initial sessions were geared toward facilitating physical contact between the classmates and to encourage them to work together in order to achieve a common goal. Successively, the games were aimed at helping each child become conscious of his/her own contribution to the group and to understanding the atmosphere of empathy and reciprocal attention that was progressively being created within the group.

In the Mindful Silence module, the exercises introduced mindfulness meditation to the children, taking into consideration their age and needs. The first sessions were dedicated to sitting posture and to the observation of their own breath. Successively, the children took part in silent motor mimicry exercises in order to encourage the perception of their emotive states and to associate with those of their classmates.

At the end of training (i.e. after four weeks), the trainers, teachers and parents met to compare observations regarding the reactions of the children both in and outside the school environment (Wolfendale, 1989).

2.4.2 The Cooperative Play condition

This condition only reproduces the Cooperative Play component of the original AST training. For more details, see Barbiero (2014).

2.4.3 The Mindful Silence condition

This condition only reproduces the Mindful Silence component of the original AST training. For more details, see Barbiero (2014).

3. Results

3.1 Pre-training assessment

From here on, the labels “play”, “silence” and “play + silence” will be used to refer to the Cooperative Play, Mindful Silence and Active Silence Training conditions respectively.

In the pre-training assessment (one week before training commenced), we found no significant differences between groups (ANOVA, $p > .05$) for any of the parameters assessed: mean systolic and diastolic blood pressure, mean heart rate, mean number of correct responses and omissions and time taken to perform the CPT. Thus, before the start of training, the three groups were equally matched with regard to their physiological parameters and ability to perform the CPT (see the "pre-training" column in Tables 1 and 2).

3.2 Mid and post-training assessment

We used a three levels repeated measures ANOVA to test for within-subject changes in physiological parameters (mean systolic and diastolic blood pressure, mean heart rate) and CPT performance (mean number of correct responses and omissions, mean time [in s] to complete the test) across the three assessments (pre, mid and post-training); the group condition (3 levels: play, silence, play + silence) was the fixed factor.

To verify specific differences between groups in the mid and post-training assessments, we ran a univariate ANOVA (fixed factor: condition) on the physiological parameters and on the CPT means.

3.2.1 Physiological parameters

From the repeated measures ANOVA, only the interaction Systolic Blood Pressure*Condition was significant, $F(4, 122) = 6.10$, $p < .001$. Heart rate exhibited significant differences both within, $F(2, 122) = 23.39$, $p < .001$, and between conditions, $F(1, 61) = 7.14$, $p < .001$; post-hoc comparisons showed that this resulted from a significant difference between the play and silence conditions, $p < .001$ (see the "mid-training" and "post-training" columns in Table 1).

Univariate ANOVA showed heart rate to differ significantly between conditions in the mid-training assessment, $F(2, 70) =15.73$, $p < .001$; using Fisher's least significant difference (LSD) post-hoc comparisons, all comparisons turned out to be significant, $p < .001$ (see the "mid-training" and "post-training" columns in Table 1).

Table 1: Mean systolic and diastolic blod pressure (bp) and heart rate in the children from the three conditions (play, silence, play + silence) in the pre-, mid- and post-training assessments and five-month follow-up. Standard deviations are shown in brackets.

	Pre-training	Mid-training	Post-training	Follow-up
SYSTOLYC BP				
Play	90,95 (12,60)	90,50 (13,37)	91,68 (5,95)	90,70 (7,55)
Silence	92,14 (11,62)	92,66 (8,49)	90,76 (7,40)	93,04 (8,27)
Play + Silence	86,68 (8,99)	85,97 (16,79)	96,66 (9,75)	91,25 (12,73)
DIASTOLIC BP				
Play	61,50 (11,18)	58,27 (12,86)	59,86 (5,70)	60,16 (8,54)
Silence	58,85 (7,56)	63,61 (6,11)	57,19 (4,52)	61,50 (15,80)
Play + Silence	59,86 (5,70)	60,19 (7,56)	61,85 (10,29)	82,31 (11,94)
HEART RATE				
Play	85,09 (12,45)	78,90 (10,41)	72,63 (7,08)	83,00 (18,69)
Silence	75,52 (12,87)	65,90 (6,35)	71,04 (8,95)	82,31 (11,94)
Play + Silence	82,19 (10,92)	73,50 (7,04)	74,30 (8,00)	91,70 (14,05)

Table 2: Number of correct responses, omissions and performance time of the children the three conditions (play, silence, play + silence) in the pre-, mid- and post-training assessments and five-month follow-up. Standard deviations are shown in brackets

	Pre-training	**Mid-training**	**Post-training**	**Follow-up**
CORRECT RESPONSES				
Play	16,00 (1,28)	17,19 (0,74)	17,51 (0,49)	15,86 (1,52)
Silence	16,05 (1,19)	17,56 (0,64)	17,10 (0,95)	17,31 (1,86)
Play + Silence	16,00 (1,25)	17,51 (0,43)	16,62 (0,76)	16,91 (1,07)
OMISSIONS				
Play	2,00 (1,28)	0,80 (0,74)	0,48 (0,49)	2,15 (1,53)
Silence	1,95 (1,19)	0,43 (0,64)	0,90 (0,95)	0,68 (0,86)
Play + Silence	2,01 (1,30)	0,46 (0,42)	1,37 (0,76)	1,08 (1,07)
PERFORMANCE TIME (s)				
Play	164,42 (39,12)	113,37 (27,69)	84,52 (17,38)	66,93 (12,34)
Silence	142,56 (35,27)	82,06 (25,25)	87,80 (33,16)	102,00 (33,00)
Play + Silence	168,55 (48,31)	99,38 (30,10)	132,58 (38,14)	114,49 (77,59)

Although the changes in systolic blood pressure were significant within each condition, we observed a substantial increase in the post-training assessment with respect to pre-training in children undertaking the play + silence condition. Although heart rate decreased significantly across assessment time-points within each condition, the play condition resulted in the biggest change in mean heart rate. However, we saw no significant differences in the physiological parameters with respect to pre-training values.

3.2.2 Continuous Performance Task

Repeated measures ANOVA revealed three significant interactions: Correct Responses*Condition, $F(2, 126) = 77.00$, Omissions*Condition, $F(4, 126) = 5.13$, and Time*Condition, $F(4, 126) = 12.76$, all $p < .001$. Between the pre and post-training assessments, both the mean number of correct responses, $F(4, 126) = 5.01$, $p < .001$, and mean number of omissions, $F(2, 126) = 78.86$, $p < .001$, changed significantly within each condition. The mean performance time (time required to complete the CPT) changed significantly within, $F(2, 126) = 163.92$, $p < .001$, and between conditions, $F(2, 63) = 5.50$, $p < .001$; post-hoc comparisons showed a significant difference between silence and play + silence conditions, $p < .001$ (see the "mid-training" and "post-training" columns in Table 2).

Univariate ANOVA revealed that the biggest effect of training condition was upon mean number of correct responses, which differed significantly between the conditions in the post-training assessment, $F(2, 67) = 7.58$, $p < .001$; in particular, between cooperative play and play + silence, LSD post-hoc comparisons, $p < .001$ (see the "mid-training" and "post-training" columns in Table 2). Accordingly, the number of omissions also differed significantly between conditions in the post-training assessment, $F(2, 67) = 7.58$, $p < .001$; in particular, between play and play + silence, LSD post-hoc comparisons, $p < .001$ (see the "mid-training" and "post-training" columns in Table 2).

Another significant effect of condition was upon CPT performance time: times differed significantly between conditions in the mid-training assessment, $F(2, 68) = 7.39$, $p < .001$, in particular, play vs. silence, $p < .001$; and in the post-training assessment, $F(2, 67) = 18.10$, $p <$

.001, silence + play vs. silence, p < .001, and play + silence vs. play, LSD post-hoc comparisons, p < .001 (see the "mid-training" and "post-training" columns in Table 2).

Measures of directed attention (correct responses and omissions in the CPT) in the children that underwent the silence and play conditions improved significantly from the pre through to the mid and then to the post-training assessments, with the children that received the silence condition being the fastest to perform the task at the mid-point assessment. In contrast, the performance of the children undertaking the play + silence condition was significantly worse in the post-training assessment: not only did they give the lowest number of correct responses in this assessment, and consequently the greatest number of omissions, but they were also the slowest to complete the test.

3.3 Follow-up assessment

Five months following the completion of the four-week training programme, the children underwent a follow-up assessment. We assessed the differences in CPT performance and physiological parameters between the groups again using ANOVA on the mean number of correct responses, omissions, performance time, mean systolic and diastolic blood pressure and mean heart rate, with condition (play, silence, play + silence) as the fixed factor.

To investigate changes between the beginning and the end of the experimentation, we compared the follow-up assessment to the pre and post-training assessments respectively using paired-sample t-tests within each condition.

3.3.1 Physiological parameters

We found no significant differences in physiological parameters in the follow-up assessments between conditions, p > .05 (see "follow-up" column in Table 1).

Paired-sample t-tests we performed on the physiological data between post-training and follow-up assessments showed heart rate to be the only parameter that differed significantly between assessments in all conditions: Play, t(21) = -3.25, silence, t(20) = -6.36, play + silence, t(21) = -8.01, all p < .001. In the pre-training vs. follow-up comparisons, heart rate was the only parameter found to change significantly in the silence + play condition, t(22) = -4.23, p < .001 (see Figure 1).

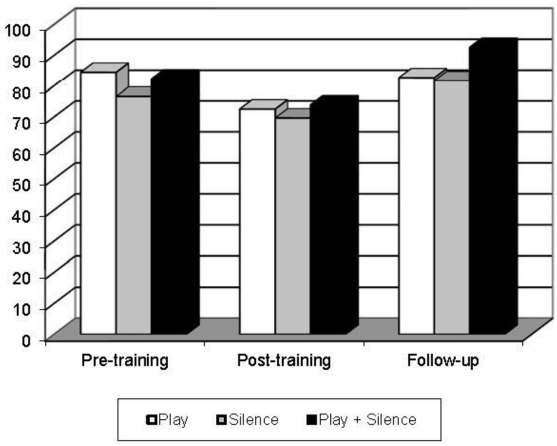

Figure 1: Mean heart rate in each of the three groups (play, silence, play + silence) plotted as a function of assessment time: pre-training, post-training and follow-up.

3.3.2 Continuous Performance Task

ANOVA showed that the number of correct responses differed significantly between training conditions in the follow-up assessments, F(2, 65) = 8.65, p < .001; LSD post-hoc comparisons: play vs. silence and play vs. play + silence, p < .001. Training condition also had a significant effect upon number of omissions, F(2, 65) = 8.75, and the LSD post-hoc comparisons showed that all comparisons differed significantly, p < .001; for performance time, F(2, 65) =5.41, p < .011, in particular play vs. play + silence, LSD post-hoc comparisons, p < .001 (see the "follow-up" column in Table 2).

Paired-sample t-tests we performed between the post-training and follow-up assessments only showed significant differences in the play condition (see Figure 2, 3) for number of correct responses, $t(20) = 4.99$, $p < .001$, number of omissions, $t(20) = -4.99$, $p < .001$, and performance time, $t(20) = 3.79$, $p < .001$.

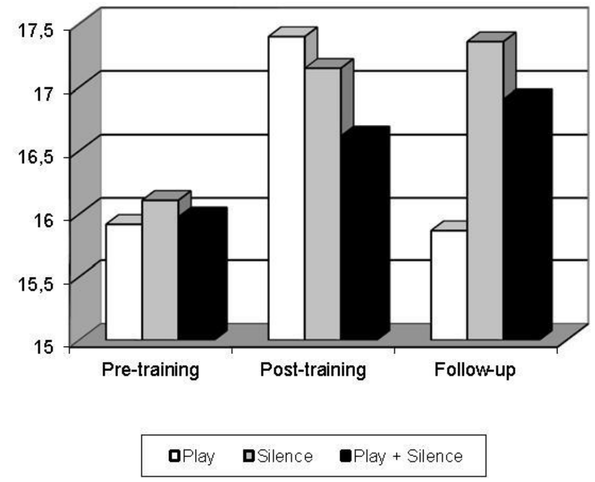

Figure 2: Mean number of Correct Responses for each of the three groups (play, silence, play + silence), plotted as a function of assessment time: pre-training, post-training and follow-up.

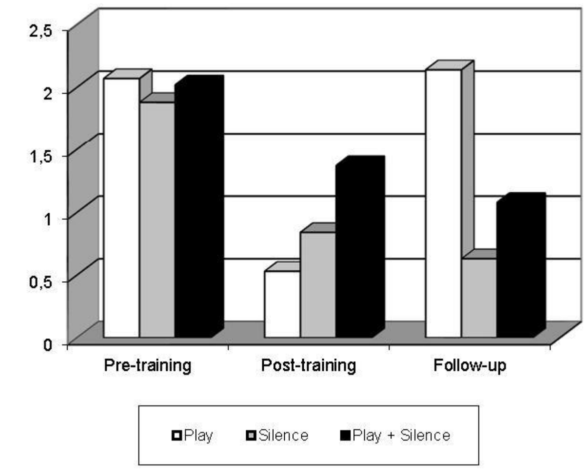

Figure 3: Mean number of Omissions for each of the three groups (play, silence, play + silence), plotted as a function of assessment time: pre-training, post-training and follow-up.

The comparisons between pre-training and follow-up assessments showed significant differences for correct responses, $t(20) = -4.73$, and omissions, $t(20) = 4.73$, $p < .001$, in the silence condition and correct responses, $t(22) = -4.34$, omissions, $t(22) = 4.48$, $p < .001$, in the play + silence condition; whereas, performance time differed significantly in all conditions: play, $t(21) = 11.72$, silence, $t(20) = 7.47$ and play + silence, $t(22) = 3.97$, all $p < .001$.

In the follow-up assessment, significant differences were restricted to the CPT, with no significant changes found in physiological parameters, as was also the case for the post-training assessments.

As far as the CPT was concerned, the play group's performance was significantly worse five months after the end of training, whereas the attentional performance of the children in the silence and play + silence groups improved significantly compared with the pre-training assessments. Although all children became faster in performing the task, the improvement was only real for the silence and play + silence groups; in fact, for the play group, their increased speed in completing the task was paralleled with less correct responses and more omissions. However the improvements in the other two groups cannot be attributed to the effect of learning since we administered different versions of the CPT each time, thus, the children could become familiar with the instruction but not with the version of the task.

4. Discussion

The aim of this exploratory study was to investigate whether the two components of the Active Silence Training (AST) programme (Barbiero, 2014) differentially affected the performance of primary school children in a test of directed attention (the Continuous Performance Task; Cornoldi, 1996). Thus, we devised a protocol to assess the potential effects upon directed attention, as well as physiological parameters, when children underwent a four-week training programme composed of either one of the two Active Silence Training components (i.e. Mindful Silence or Cooperative Play) or both combined (i.e. the original Active Silence Training). In the pre-training assessment, no statistically significant differences were evident between the performances of the children in the CPT and their physiological parameters; thus any changes we observed following the commencement of training can be attributed to the training children underwent.

Concerning the physiological parameters, only the heart rate exhibited significant changes within each condition. A significant difference was also evident between conditions at the mid-training point, with children of the Mindful Silence condition having the lowest mean heart rate. Heart rate can be used as an index of self-regulation, since an anatomical overlap exists between brain structures associated with self-regulation and autonomic inhibition (Central Autonomic Network). A high heart rate is an index of agitation and of high self-regulatory effort (Segerstrom, 2007). Moreover, heart rate is also an index of the level of activation of the parasympathetic-mediated inhibitory system that acts to restore energy lost by activation of the sympathetic system and which can also influence attention and restoration of attention (Ulrich, 1981; Segerstrom, 2007). From this perspective, the Mindful Silence training calmed the children down more than the other two training conditions; this does not mean that the children of the Mindful Silence condition were "inattentive": the Mindful Silence training made children more relaxed, but at the same time more alert, as the results of the Continuous Performance Task showed. If heart rate and self-regulation are associated, the reduction we observed in heart rate suggests that children in the Mindful Silence condition underwent the Continuous Performance Task without any specific effort.

Although it might be that significant improvements in sustained attention are not mediated by relaxation (see e.g. Semple, 2010) however, the fact that we observed no significant changes in systolic and diastolic blood pressure is also important. This result shows that the children became familiar and confident with the new people attending the classrooms (i.e. the trainers) and the material involved in the investigation. Thus, the familiarity and ease of the children was reflected in the lack of any change in blood pressure for all of the groups concerned.

As far as the Continuous Performance Task is concerned, looking carefully at the post-training and follow-up results, it turns out that the Mindful Silence condition was the most effective of the three training conditions. The effect of Mindful Silence practice was less immediate than the other two, but longer-lasting. This might be partly due to the effect of Mindful Silence on heart rate that, in turn, affected the children's attentional performance: the children had recovered from their school mental activities and were ready to face a new task; they were relaxed and at the same time alert such that they were able to apply themselves to the new attentional task. Furthermore, it is interesting to note that the positive effects of mindfulness meditation seem to be accumulative with respect to time and they appear to be much more stable the longer that meditation is practiced (Davidson, 1976; Kabat Zinn, 1990; Valentine, 1999). For this reason, both the teachers and parents of the children were directly involved in the study, so that environments that sustain the practice of Mindful Silence could be created at school and at home; this had the added bonus of encouraging teacher-parent cooperation and participation regarding the prospects of the children (Cankar, 2009; Schonert-Reichl, 2010)

This result concerning the Mindful Silence component of the Active Silence Training (Freire, 2007) is also in accordance with Stephen Kaplan (2001), who considers mindfulness meditation to be a way by which directed attention can be restored. The ability to meditate can encourage the acquisition of novel thought patterns and movements, and foster cognitive activities that contrast with those typically occupying the mind, even if the environments in which the meditator finds himself do not encourage attention restoration (Kaplan, 2001). In fact, silence, as a meditative practice is the ability to focus and sustain attention on an intended object without distraction, which means disengaging attention from the source of distraction and redirecting it to the intended object (Lutz, 2008). In our study, Mindful Silence led the children to become more responsive to the attentional task.

The importance of practicing Mindful Silence was also demonstrated by the results of the play + silence condition, i.e. the original AST, that fell between those of silence and play. On the contrary, the effects of Cooperative Play on children's attention were immediate; indeed when playing, children are more responsive to environmental stimuli - they continuously allocate attention to new incoming stimuli - but at the same time they are more vulnerable to distractions (see e.g. Berto, 2010). Distractions negatively affect attentional performance (James 1892; Kaplan 1995) because children are not usually able to ignore them. On the contrary, the practice of Mindful Silence teaches children to concentrate only on their own feelings, and they accordingly learn to focus on the ongoing task only. Learning to ignore distractions/competing stimuli (Bishop, 2004) and irrelevant cognitive processes (Rubia, 2009) is the best way to use attentional resources.

In summary, children exposed to the Cooperative Play condition were more prepared for directed attention, but their attention was not "educated". In contrast, in the Mindful Silence condition, the children learnt how to use attention in the most efficient way; this obviously took more time, but it was longer-lasting. These results clearly showed the positive effects of Mindful Silence practice upon directed attention in children.

Accordingly Mindful Silence practice may legitimately be considered an effective tool not only to stimulate children's attentional performance/recovery but also to enhance children's biophilia, in particular when they live in environments poor of natural elements. In the next studies, parts of the same project, we will investigate the relationship between mindfulness meditation and nature more in deep, comparing the effect Mindful Silence practice and immersion in nature have on the perception of the restorative qualities of the environment (natural and built) and on children's the biophilic attitude, i.e. of their being connected with Nature.

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