

Green versus grey break: children's place experience of recess-time in primary schools' natural and built area

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Abstract

Studies regarding the experience of children in schools' outdoor environments report several benefits of nature on children's cognitive, emotional and physical development; thus, there is the need to systematically assess the characteristics of children's place experience considering their own activities and social interactions. The present study investigated the perceptions of the physical environment and children-environment interactions during recess-time in natural (vs. built) schoolyards. In a between-subjects quasi-experiment in two Italian Primary schools, we collected and analyzed 298 children's drawings and written descriptions regarding the activities they engage during recess time, developing a detailed coding system. Results showed how during the green break (vs. grey) children significantly engaged in more exploratory behaviors, rough and tumble behaviors and active conversation, while in the grey break their play was more structured and left less space for free activities. In drawings, the natural environment (vs. built) is pictured as significantly more green, open and rich in biodiversity and details, compared to the built environment that is depicted as grey, closed and more crowded. Implications are discussed in both theoretical and practical terms on how green (vs. grey) schoolyards can afford different place experiences and play and non-play behaviors in school children, contributing to improve their well-being during school-time.

Keywords

nature, school, children, green areas, drawings, play

47 In recent years, research on the positive effects that contact with nature has on children has
48 flourished (Moll et al., 2022). The relation between exposure to nature and children has been
49 assessed within different life-contexts, predominantly in residential areas (Wells & Evans, 2003)
50 and schools (Bagot, Allen, and Toukhsati, 2015; De Dominicis et al., 2017; van den Berg et al.,
51 2016).

52 Since children spend a large amount of time in daycare settings and schools, many studies
53 have investigated the role of nature in these contexts, comparing the effects of school breaks in
54 “green” (i.e., garden) or “grey”, non-green (i.e., built environments, asphalt and concrete, etc.)
55 schoolyards, where children experience play, non-play activities and social interactions (Chawla et
56 al., 2014).

57 Findings show that spending time in nature at school improves ability to concentrate and
58 attention capacity (Amicone et al., 2018; Kelz, Evans and Roderer, 2015), connectedness to nature
59 (Berto, Pasini and Barbiero, 2015), resilience and stress relief (Chawla et al., 2014) and
60 psychological relaxation (Oh et al. 2019). In particular, green schoolyards offer more varied and
61 more inclusive play opportunities than non-green schoolyards (Root et al., 2017), promote more
62 creative and exploratory play (Zamani, 2016), fewer negative interactions among peers and more
63 social support (van Dijk-Wesselius et al., 2018).

64 However, in literature on children and nature, there is a lack of studies investigating how
65 children experience nature, i.e., how they perceive and/or interact with stimuli from the natural
66 world, through different sensory modalities with different activities and socio-cultural meanings
67 (Bratman et al., 2019; Hartig et al., 2011; Moll et al., 2022).

68 The aim of the current study is thus to examine such a different place experience within
69 natural and built schoolyards, by focusing on children's free and unstructured activities in different
70 school outdoor environments, i.e., green and grey. [Based on the psychological transactional](#)

theoretical perspective, we understand place as a psychological construct that considers the entire individual experience. In this sense, place refers to “the perceptive-cognitive, emotional-affective and behavioral senses, related to specific socio-spatial units of daily life environments” (Bonnes, in press. p. 93). For the purpose of this study, and considering the latest advances in environmental psychology, the terms place and environment will be used interchangeably. Specific tools for accessing children’s experiential levels will be employed, i.e., children's drawings and written descriptions regarding the activities they engage during recess time, in order to better understand children’s perceptions of the physical environment and children-environment interactions during recess-time in natural (vs. built) schoolyards.

Children’s play behavior in green and grey schoolyards

In literature, play is defined as an activity that is self-chosen and self-directed, intrinsically motivated, guided by mental rules and imaginative (Gray, 2017); play involves an active engagement, it is not a serious rendition of a behavior or activity and must comprise non-literality (Rubin, Fein and Vandenberg, 1983). In natural setting, studies conducted through children’s observations, play behavior has been linked to more cooperative and creative social play (Chawla, 2015), as well as to more diverse type of play behavior (Söderström et al., 2004; Luchs & Fikus, 2013). Studies conducted observing children in different school settings, or before and after green setting were introduced to schools, indicate a more imaginative, constructive and sensory play, with children engaging in more socially cooperative play behaviors in natural areas than with asphalt or built play equipment (Blizard & Schuster, 2004; Cloward Drown & Christensen, 2014; Cosco, 2007; Fjørtoft & Sagaie, 2000; Herrington & Studmann, 1998; Grahn et al, 1997; Kirby, 1989; Kuh, Ponte & Chau, 2013; Moore & Wong, 1997; Samborski, 2010; Stanley, 2011).

Natural environments also present affordances, defined as perceived properties of the environment from the viewpoint of a person (Heft, 2012), that can support specific physical activities - e.g., exploration, play, learning - and that can afford specific functions depending on

97 people's perception of what they can do in that specific environment (Gibson, 1979). Children are
98 led to interpret environmental affordances - given by natural elements like trees, bushes, as well as
99 built elements (slides and swings) –in terms of playability (Fjørtoft, 2001; Hendricks, 2001).

100 It is thus crucial to investigate what children report to do in the natural environment when
101 they are left free to play in it and what their experiences look like, i.e., how children experience
102 nature, using methods traditionally used in developmental psychology like observations, checklists,
103 and drawings (Sattler, 2001). Moreover, drawings are an underemployed method for understanding
104 children's experience of nature in this context and even though this technique has a long history for
105 studying children's experience and perceptions (Goodenough, 1926; Corman, 1990; Machover,
106 1949).

107

108 **The use of drawings for investigating children's experience of the environment**

109 Drawing constitutes an easy way to investigate social information about children (King,
110 1995). It allows children to exercise symbolic actions, and helps them to control and analyze the
111 external reality, adapting it to their internal world (Rubin, Fein and Vandenberg, 1983). Research
112 has drawn attention to the procedural aspects and characteristics of drawing, reinforcing its use as a
113 tool to investigate children's representations development (Bombi, Pinto and Cannoni, 2007).
114 Specifically, drawing tasks and tests are often used in the context of children's assessment to
115 address cognitive abilities (Draw-a-Man test, Goodenough, 1926; Harris, 1963), family
116 relationships (Family static drawing, Corman, 1990), and to help investigate difficult experiences
117 such as illnesses (Ferri and Panier Bagat, 2000). Moreover, unprompted drawing is a useful tool to
118 promote communication with children, helping them to express mood and emotions (Crocetti,
119 1986).

120 Drawings have been used both in research and in clinical and assessment contexts, with different
121 approaches in the analysis, going from a projective approach (e.g., Burns & Kaufman, 1970;
122 Koppitz, 1968; Machover, 1949; Thomas and Jolley, 1998), more content-focused one (Merriman

123 and Guerin, 2006), that investigate both quantitative elements (e.g., frequencies), as well as
124 qualitative ones (e.g., themes) within a given verbal text (Silverman, 2001). The use of drawings in
125 psychological research has been proven to be a flexible tool for facilitating communication with
126 children and to aid assessment (Burkitt, 2004): drawings are a popular activity among children
127 (Thomas & Jolley, 1998) and perceived as fun and non-threatening, unlike most testing situations
128 (Rubin, 1984).

129 In environmental psychology research, drawings have been used to address different research
130 questions, such as exploring children's thoughts about nature (Alerby, 2000), specific biodiversity
131 features (Caine, Bowker, Humphrey and Murray, 2012; Neves & Monteiro, 2014) and
132 environmental issues (Barraza 1999; Kalvaitis & Monhardt, 2012). The results of Sobel's (2005)
133 interviews about children's drawings of the outdoor area where they usually play highlight a strong
134 engagement with the environment, specifically with their self-constructed places. Samborski (2010)
135 compared children's experiences in two different primary school outdoor areas (barren playground
136 vs. one with a rich vegetation), combining the use of drawings with surveys, focus groups, and
137 interviews. Specifically, children were asked to recall and draw their playground, and their
138 drawings were evaluated in terms of presence/absence of vegetation (e.g., bushes, lawn, climatic
139 conditions (e.g., sun, rain), human constructions (e.g., nets), people (e.g., self-portrait, group of
140 friends). Results indicated that children had a more complex use of the outdoor environment and a
141 stronger orientation for nature when their school playground was richer in terms of biodiversity, as
142 compared to a barren playground.

143 Extending from these results, in the present study, the use of drawing aims at examining
144 primary school children's place experiences in natural (vs. built) schoolyards, evaluating children's
145 perceptions and representations of the physical characteristics of the school play areas and of the
146 located people-environment interactions. The objective is to test children's differential experience
147 of the environment during recess time in natural and built areas, (1) by comparing their description

148 and representation of all the environmental features, and (2) by comparing their description and
149 representation of people, their play and non-play behaviors.

150

151

Method

152 Participants and context

153 The sample consisted of primary school children from the urban areas of Rome (Central Italy)
154 and Catania (Southern Italy). The schools were selected by expert researchers because they offered
155 two different outdoor areas: a natural and a built area. In Rome (Appendix 3) the two areas (school
156 garden and basketball court) have similar dimensions (around 460 m²) and are close to each other.
157 In Catania (Appendix 4), the natural area is the school garden (476,87 m²), while the built area is
158 the basketball court (782,11 m²).

159 Two hundred and ninety-eight children (average 9.6 years of age; 154 girls; 144 boys)
160 attending 14 classes in the 3rd, 4th and 5th grade participated in the study. Children were randomly
161 assigned to the two experimental conditions by classes: seven classes (for a total of 152 students)
162 were assigned to the natural environment condition, the other seven classes (for a total of 146
163 students) to the built environment one. Two participants that did not receive the consent from the
164 parents participated in the experimental procedure but were not included in the final sample.

165

166 Procedure

167 A quasi-experimental, between-subjects design was employed (Appendix 5). Data were collected
168 during morning school-time, from 8.30 AM till 12.30 PM. At the beginning of the schoolday,
169 students were given information about their participation to the study. To protect confidentiality, a
170 personal identification code was assigned to each child. Children wrote the code on their test paper,
171 together with their birth-date and gender. During time 1, from 8.30 to 10.30 A.M. children had their
172 usual school activities and performed cognitive, emotional, and social tasks (not considered in this
173 paper, see Amicone et al., 2018 for results about these measures). From 10.30 till 11.00 A.M

174 children had their break time. During the 30 minutes' break-time children were told to stay only in
175 the natural (vs. built) environment, being free to do whatever they liked within the school norms.
176 Researchers were present during play time, to ensure children would remain in the allocated
177 condition (green vs. built).

178 Immediately after the break, at time 2, children were asked to provide a drawing of their recess
179 time in a 15 minute period, with the following instructions: *“Now we are going to ask you to make a*
180 *drawing. It does not matter if it is nice or not, and nobody will give you a grade. It is just important*
181 *that all of you draw as you like, and do not copy from the other classmates. You will have a sheet, a*
182 *pencil and a basic set of colored pencils. You will have the necessary time to do it, we are going to*
183 *tell you when the time is over. The drawing we are going to ask you is: draw yourself in the place*
184 *you have played”*.

185 Children received a white sheet of paper A4 format and were allowed to use their regular
186 pencil, rubber and a yellow, orange, red, pink, purple, dark blue, light blue, dark green, light green,
187 black, grey colored pencils. After the drawing task, from 11.15 A.M to 12.15 P.M, the cognitive,
188 emotional and social measures were administered again, together with other measures regarding the
189 perceptions of the environment (not considered in this paper, see Amicone et al., 2018 for results
190 about these measures). Then, from 12.15 to 12.30 P.M., children were asked to provide a verbal
191 written description of the activities they engaged in during recess-time. The instruction was:
192 *“Please describe the activity or the activities that you did today during recess”*. Due to concurrent
193 school activities that were taking place during the morning, in the Rome school the data collection
194 of the two classes belonging to the 5th grade took place during the afternoon, with the same
195 procedure running from 1.00 to 4.30 P.M. Data were gathered at the beginning of May 2016. Spring
196 was chosen in order to have a sufficiently mild temperature to play outside.

197

198 **Coding**

199 *Coding of the verbal written description of the recess time activities*

200 We followed the work of Rubin (2001) to code the play and non-play behaviors described in
201 the children's writing. The Play Observation Scale (Rubin, 2001) combines the social (Parten,
202 1932) and the cognitive (Piaget, 1945) aspects of children's play, and has been successfully used in
203 research to investigate individual, age and gender differences in children's play, effects of
204 ecological setting of play, and the social contexts of the cognitive forms of play (Gredlein &
205 Bjorklund, 2005; Pellegrini and Gustafson, 2005; Rubin, 2001). For the purpose of the present
206 study, each written description has been coded in terms of presence/absence of each one of the
207 following behaviors defined by Rubin (2001): Social play, Cognitive play, Non-Play Behaviors. See
208 Appendix 1 for a detailed description of the thirteen indicators.

209

210 *Coding of the drawings of the place experience*

211 In order to analyze children's drawings of the place experience, we developed a coding manual to
212 analyze children's perceptions of the physical environment and of self and others, the children-
213 environment interactions, and their activities during recess. We defined a first coding scheme
214 following the main coding categories established by the literature in terms of human figure drawing
215 (Goodenough, 1926), then identified new indicators that could specifically address the person-
216 environment experience by following the environmental psychology literature (Samborski, 2010).
217 In order to organize and refine the coding scheme we then conducted a pilot analysis on a small
218 representative sample of drawings, balanced for school (Rome/Catania), condition (natural/built),
219 and school grade (3rd, 4th and 5th). This pilot study resulted in few discrepancies among the two
220 observers involved which were resolved through discussion. Drawings were then coded in terms of
221 presence/absence and frequencies of each indicator for every child's drawing by four observers,
222 divided in two couples, so that each drawing was coded by two observers. Cohen's K was run to
223 determine if there was agreement between the two couples of judges on 60 drawings (30 per
224 condition). Since Cohen's K can only be calculated on mutually exclusive variables, the analyses
225 were run on six variables with this feature (Light green, Grey, Writings, Interaction between people,

226 Contact between person and the natural environment, Environment open vs. closed). Cohen's K was
227 always found to be $>.90$ thus suggesting a very high inter-rater agreement. Coders were blind to the
228 condition the drawings belonged, held a psychology degree and were previously trained to be
229 familiar with the coding system. The presence of erasure marks in the drawing was not considered
230 or coded in any way.

231

232 We completed the final coding scheme along three main dimensions: general characteristics of
233 the drawing, person's characteristics, environment/person characteristics. Here follows a description
234 for each dimension (for a detailed description of each of the fifty-four indicators, see Appendix 2):

235 a) General characteristics of the drawing: this dimension was constructed considering all the
236 depicted elements in the drawings that could be used by the children to represent the
237 environment where they had spent their recess. For instance, we found recurring elements to
238 represent the natural environment such as flowers, grass, trees. We also found recurrent
239 elements to represent the built environment (benches, walls etc.), as well as elements
240 representing people and animals. Also, we included in this dimension all the useful general
241 elements of the drawing, such as presence of the different colors (yellow, red, etc.).

242 The presence of details in the elements pictured in a drawing indicates that the element is more
243 valued (Bombi & Pinto, 1993). Given this, we included a measure for "details", and another one
244 for "types" to address the value children give to the elements representing biodiversity (i.e.,
245 different types of natural elements). A total of 36 indicators were used:

246 a) Person's characteristics: this dimension was constructed considering various facets. We
247 defined the indicators for facial expressions and body position following the instructions
248 from Bombi & Pinto (1993) and Castellazzi & Nannini (1992) for the characteristics and
249 movements of the figures. The codes for the activities were defined after the first analysis on
250 a small sample of drawings, and were named according to the categories defined in the Play
251 Observation Scale (Rubin, 2001). We included sixteen indicators.

b) Environment/person's characteristics:

This dimension was constructed considering various facets.

Contact between person and environment identifies if a clear representation of a contact between the person and the depicted environment (natural vs. built) is present. Importance measures the dimension of the people represented in relation to the space of the sheet. This indicator was included because the dimension of the figure in relation to the environment is an indicator of the relevance that the represented person has for the child (Corman, 1990). Two indicators were used.

Data analyses

Comparing the two conditions

We performed comparison analyses (chi square and ANOVA), to test the association between the condition (natural vs. built) and each indicator (derived from the written descriptions and from the drawings).

For the written descriptions of play and non-play behaviors, Chi-square statistics were used to test the association of the condition variable (natural vs. built) with each one of the play and non-play indicators measured in terms of presence/absence (Solitary play, Parallel play, Group play, Functional play, Constructive play, Dramatic play, Games-with-rules play, Exploratory play, Unoccupied, Onlooker, Active Conversation, Aggression, Rough and Tumble).

When the indicators were not categorical, i.e., not presence/absence, but numeric, i.e., counting, one-way ANOVAs were used to test the difference between condition (natural vs. built): Elements and Details for People, Animals, Plants, Built, Atmospheric, Objects and toys, Other; Types of Animals, Plants, Built, Atmospheric, Objects and toys, Other; Body Motion; Distance between people.

Discriminant analyses

278 We then combined the indicators deriving both from children's drawings and written
279 descriptions to perform two discriminant analyses on the Environment description related variables
280 (as a manipulation check, Aim 1) and on the Person-activity description related variables (Aim 2).

281 The first discriminant analysis was employed to test Aim 1, namely to examine whether
282 significant differences existed between the natural environment and built environmental conditions
283 in terms of the Environment description related variables. In this analysis, a selection of drawings
284 variables, "general characteristics of the drawing," was included since these are the variables
285 specifically accounting for children's environment description and representation: Colors, Animals
286 types, Plants types, Built Elements types, Atmospheric types, and Objects/toys types.

287

288 We retained for the second analysis only the participants whose drawings were consistent
289 with the experimental condition (i.e., the predicted group was the correct one).

290 A second discriminant analysis was conducted to test Aim 2, namely to check whether
291 significant differences existed between the natural environmental and built environmental
292 conditions in terms of the Person-activity related variables, i.e., the total number of elements (sum
293 of the total number of Elements in People, Animals, Plants, Built elements, Atmospheric, Objects
294 and toys, Other, Writings), the total number of activities (sum of the total number of Play with ball,
295 Play with rules, Gymnastics, Chat, Walking, Other), total number of details (sum of the total
296 number of Details in People, Animals, Plants, Built elements, Atmospheric, Objects and toys,
297 Other), the Importance, Body Motion, Contact between Person and the natural environment,
298 Contact between Person and the built environment, Facial expression (Sad, Happy, Angry, Neutral);
299 Solitary play, Group play, Functional play, Exploration, Game of rules, Onlooker, Active
300 conversation, Rough and tumble. Participants with missing values were excluded from the analyses,
301 and the final sample was formed by 131 children.

302

303

Results

304 **Written descriptions of play and non-play behaviors**

305 Table 1 provide a summary of Chi-square analyses for the overall sample. We summarized the
306 significant associations between the Written descriptions of play and non-play behavior indicators
307 and the condition (natural vs. built) as following: in the natural environment condition, there are
308 significantly more Exploratory behaviors, Active conversation, and Rough and Tumble behaviors.
309 In built environment condition, instead, there are significantly more Dramatic play behaviors and
310 Games-with-rules behaviors. No other significant difference was found between the two conditions.

311

312 **Drawings of the place experience**

313 Table 2 and Table 3 respectively provide a summary of Chi-square and one-way ANOVA results
314 for the overall sample. In the following, we present only significant associations between the place
315 experience indicators and the condition (natural vs. built). As reported in Table 2, Chi-square
316 analyses show that in the drawings of the green environment condition there are significantly more
317 Light green color, Environment as Open, No activity; on the other hand, in the drawings of the built
318 environment condition, there are significantly more Grey color, Writings, Environment as Closed,
319 Sad faces, Interaction between people, Play with ball, Play with rules.

320 Table 3 reports the results provided by one-way ANOVA analyses, showing that in the
321 natural environment condition, drawings have a significantly higher presence of Plants, Animals'
322 types, Plants' types, People's details, Plants details and Atmospheric details; in drawings of the
323 Built environment condition instead, there are more People, Built elements, Built types, Object and
324 toys types, Objects and toys details and Motion.

325

326 **Classification of Environment description and Person-activity description**

327 The first discriminant analysis, performed as a manipulation check on the Environment-
328 description related variables (Aim 1), shows that presence of Light green, Plants, Built elements
329 Types, and Animals Types were the most discriminant variables between natural and built

environment conditions (Table 4). The discriminant analysis correctly classified 73.2% of original grouped cases (i.e., $N = 218$ out of 298). Only participants whose drawings were consistent with the experimental condition (i.e., the predicted group was the correct one), were retained for further analysis.

The second discriminant analysis (Aim 2), performed on the Experience related variables, shows that the Total number of play and non-play activities, the presence of Active conversation, Motion and the presence of Details in the drawing were the most discriminant variables between the two conditions (Table 5).

Children in the natural environmental condition (vs. children in the built environmental condition) reported a lower number of Play and non-play activities, less Motion, more Active conversation and represented more details in their drawings. The discriminant analysis correctly classified 67.9% of original cases (i.e., $N = 89$ out of the 131 that were originally included in the analysis).

Discussion

The present study investigates school children's place experiences and their play and non-play behaviors in natural and built schoolyards through their drawings and their written descriptions after an environmental quasi-experimental manipulation. The use of both written and pictorial children's representation of the environment allows the exploration of how children perceive the physical environment, how they interact with it, and their play and non-play behaviors during their recess in natural (vs. built) schoolyards. Results of written descriptions show differences between the two experimental conditions. In line with previous literature (Chawla et al, 2014; Samborski, 2010; Zamani, 2016), in the natural environmental condition children describe more exploratory behaviors, while in the built environmental condition, children describe more games with rules. Children often mention games like tag and dodgeball when describing of their recess in qualitative terms. In line with affordance theory (Gibson, 1979), these results show how different

356 environmental features support various types of children's play (Myers, 2012): the natural
357 environment encouraged exploration, a non-play behavior, while the built environment afforded
358 game with rules, a structured type of play that requires children to define a delimited area to play. In
359 the built environment condition, children report more dramatic play than in the natural environment
360 condition. Dramatic play is intended as a structured and planned type of play, which is situation and
361 context-dependent (Baumgartner, 2002). Our result is in contrast with Zamani (2016), who reports
362 more dramatic play in natural school areas compared to built and mixed areas. However, while our
363 research considers primary school children, Zamani (2016) considered preschoolers, an age in
364 which dramatic play reaches a peak since it allows children to gain understanding of the world
365 (Smilansky, 1968).

366

367 The written descriptions also show how children in the natural environment are depicted as
368 more engaged in non-play behaviors (following Rubin's classification; 2001), like exploration,
369 rough and tumble behaviors, and active conversation. This is consistent with previous studies
370 reporting that natural areas afford exploration and offers opportunities to learn social abilities and to
371 share emotions with peers (Denham, 2006; Zamani, 2016). So, nature in schools does not only
372 enhance children's active physical play (Myers, 2012), but it also provides opportunities for being
373 alone, feeling at peace, and not feeling worried (Chawla et al., 2014), dedicating less time to
374 structured games and more resting and observing the natural environment alone.

375 Results of the drawings of place experience in the natural environment show that children
376 depicted more people that were not engaged in any specific activity; while, in the built environment
377 condition, children represent more games with rules, play with ball and dramatic play.

378 Moreover, children clearly express their perceptions of the natural and built schoolyards in
379 their drawings. In the natural environment condition, children use the green color more frequently,
380 and pictured more biodiversity, specifically plants, with a higher variety of types and more details,

381 and more different types of animals. In drawings of the built environment condition, instead, the use
382 of grey color is higher, as well as the number and the variety of built elements (e.g., benches,
383 buildings, baskets) and objects and toys (e.g., ball, rope, puppets). These results are in line with the
384 findings of Samborski (2010), showing that children in the green school represent over three times
385 more plants and animals in their drawings than children from the grey school.

386 Another interesting result is provided by the indicator on the environment as “open/closed”.
387 In fact, in children’s drawings the natural environment is represented as significantly more open,
388 consistent with what Attention Restoration Theory (Kaplan and Kaplan, 1989; 1995), that is,
389 defined as a sense of extent, intended as the coherence regarding the experience of the environment
390 (Staats, 2012). In this case, the natural environment was perceived as an open space rather than as
391 closed whereas the built space was more depicted as closed (Appendix 6).

392 The [presence](#) of details in the drawings constitutes another important element to consider, as
393 in the natural environment children drew people, atmospheric elements and [plants](#) as more detailed.
394 Generally, in the drawing literature, an element represented with more details indicates that it is
395 more valued by the children (Bombi & Pinto, 1993; Bombi, Pinto and Cannoni, 2007); [this suggest](#)
396 [that children were paying more attention, in the moment they played in that specific environment, to](#)
397 [those elements depicted with more details](#). Therefore, we can interpret that after a “green break”
398 children [represent](#) natural elements - plants and atmospheric elements - as more important elements
399 that characterize a natural environment. On the other hand, children after a built break, depict with
400 more details (i.e., value more) object and toys. This suggests that children in the natural environment
401 may have a [high](#) motivation to visually explore the [natural elements in the natural environment \(as](#)
402 [shown by the high number of details\); on the contrary, children in the built environment focused](#)
403 [more their attention to their play activities \(as shown by the high number of details on object and](#)
404 [toys\)](#).

405 The results provided by the additional categories that emerged from the classification Environment
406 Description and Person-activity Description give us a clear idea of the main elements that describe

407 and differentiate children's recess in the natural (vs. built) environment. Concerning the
408 Environment description related variables, the discriminant analysis results show that the presence
409 of plants, animal types, built elements types and light green in children's drawings are the most
410 discriminant variables between natural and built environment conditions. Moreover, concerning the
411 Experience related variables, derived both from children's written descriptions and drawings,
412 results show that the total number of play and non-play behaviors, the presence of active
413 conversation, movement and the presence of details in the drawing are the most discriminant
414 variables between the two conditions (natural vs. built environment). Specifically, children in the
415 natural (vs. built) environmental condition report a lower total number of play and non-play
416 behaviors, less motion, more conversation and they represent more details in their drawings.
417 The value of nature experiences for mental health involves different facets of the environment's
418 features and of the experience of the environment (Bratman, 2019). This value is represented for
419 instance by the various physical elements that characterize that environment (Sandifer, Sutton-Grier
420 and Ward, 2015), the modalities of people-nature interaction (Kahn et al., 2010), and the way
421 people make experience of environments, intended as people's perceptions, evaluations, meanings
422 and interaction with the different stimuli of the natural environment (Clark & Uzzell, 2002; Hartig
423 et al., 2011; Lucas & Dymont, 2010). Present results from primary school children drawings and
424 verbal accounts contribute in highlighting the different ways in which people can make experience
425 of the environment. In particular, these results highlight the priority of nature contemplation and
426 partly of nature social sharing via interpersonal communication: these results together differentiate
427 the experience made by pupils during a 30 minute school break in a natural schoolyard, compared
428 to a built schoolyard. This associates with a more fine-grained remembering of natural elements
429 features and with a greater psychological importance attributed to them.

430

431

Limitations

457 In this research, we employed coded children's writings and drawings about their experience in
458 the schoolyard, and this allowed us to have a glance on how children perceive, give meaning, and
459 interact with the natural environment, integrating both a qualitative and quantitative point of view.
460 We focused on understanding the differences, in terms of written descriptions and drawings of play
461 and non-play behaviors and place experience, between two different outdoor environments. The
462 results show children's perceptions of their outdoor experiences: what children like to do in their
463 natural and built schoolyards and the type of play and non-play behaviors afforded, as well as their
464 positive evaluation and appreciation of nature, their sensibility in distinguishing natural and built
465 environment, and nature benefits on pupils' well-being during school-time.
466 In sum, the present research offers five main reflection points. a) It contributes in covering the lack
467 of research about how school children aged 9-11 perceive and represent their green and grey
468 schoolyards, and how they describe their play and non-play behaviors. (b) It provides an assessment
469 of children in a real-life situation: our data collection was embedded in school recess in the outdoor
470 environments of children's own school, leaving them free to play. c) It compares two different
471 outdoor environments in a field study with a between-subjects design. d) It addresses children's
472 experience and play and non-play behaviors during, collecting data through two different qualitative
473 methods, coding them in pre-existent categories, and further analyzing them through quantitative
474 analyses. e) It develops a novel coding method for analyzing children's drawings of their
475 schoolyard, that could be useful for further research in this realm.

476 This research provides evidence about how both natural and built schoolyards can afford
477 different experiences and play and non-play behaviors in school children, allowing them to feel free
478 to choose what to do in their recess. This freedom of choice could contribute to children's well-
479 being during school-time, allowing children to express themselves in different ways. In terms of
480 practical implications, school buildings could be designed to include both a natural and a built
481 schoolyard, considering evidence-based design provide by research in this field. School managerial
482 practices should then be open to a greater use of the outdoor spaces. We believe it is relevant to

483 inform school officials teachers and parents about the benefits of contact with nature during school
484 time, so that the barriers that may preclude children to spend time outdoors during school hours are
485 overcome.

486 **Ethics statement**

487 This study was carried out in accordance with the recommendations of the Ethic Committee
488 Guidelines of Sapienza Università di Roma. All participants' parents gave written informed consent
489 in accordance with the Declaration of Helsinki. The protocol was approved by the Ethic Committee
490 Guidelines of Sapienza Università di Roma.

491

492 **Funding**

493 The present contribution partially benefited from the two grants of the first author within the
494 Sapienza Erasmus call for the academic year 2015–2016 and from the first author's research project
495 grant "The positive effects of nature in schools: increasing attention restoration and scholastic
496 performance of young students" (Sapienza University Research Start-up Funding 2015). In
497 addition, the last author benefited from the research project grant "The positive effects of nature in
498 schools: increasing attention restoration, positive emotions and pro-social behavior of young
499 students" (Sapienza University Grants 2016, DR No. 3210/16 of 16/12/2016).

500 **Acknowledgments**

501 We thank the headmasters, teachers, children and parents of the involved primary schools for their
502 collaboration in the study. We acknowledge Mrs. Maria Grazia Afferni, Mr. Jacopo Bruni, Mrs.
503 Floriana Siracusa and Mrs. Patrizia Spagnoli for their contribution in the drawings' coding
504 procedure. [Authors are grateful to Dr. Conrad Baldner for the English language revision.](#) The
505 authors declare that they do not have any competing interests.

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Table 1. Chi-square comparisons between natural and built environment conditions for play and non-play behaviors

Play categories	Play behaviors	Frequencies	Natural	Frequencies	Built	Chi ²	<i>p</i>
			environment		environment		
Social play behaviors	Solitary	8	66,70%	4	33,30%	1.28	ns ^a
	Parallel	1	100,00%	0	0,00%	.97	ns
	Group	142	50,00%	139	50,00%	1.09	ns
Cognitive play behaviors	Functional	38	54,70%	33	45,30%	.64	ns
	Constructive	3	75,00%	1	25,00%	.96	ns
	Dramatic	15	28,30%	22	71,70%	12.83	<.001
	Games-with-rules	15	31,30%	17	68,80%	8.58	<.05
	Exploratory	15	83,30%	3	16,70%	8.17	<.05
Non-play behaviors	Unoccupied	5	45,50%	4	54,50%	.12	ns
	Onlooker	9	80,00%	2	20,00%	3.56	ns
	Active conversation	21	78,30%	3	21,70%	16.52	<.001
	Aggression	0	0,00%	0	0,00%	/	/
	Rough and tumble	10	75,00%	4	25,00%	4.00	<.05

^a. Non-significant

Table 2. Chi-square comparisons between natural and built environment conditions for drawing indicators

Dimensions	Aspects	Indicators	Natural			Built		
			F	environment	F	environment	Chi ²	<i>p</i>
General characteristics	Colors	Yellow	50	48,10%	54	51,90%	.54	ns ^a
		Orange	18	45,00%	22	55,00%	.66	ns
		Red	32	45,10%	39	54,90%	1,31	ns
		Purple	25	58,10%	18	41,90%	1.02	ns
		Pink	61	45,20%	74	54,80%	3.34	ns
		Dark blue	51	53,70%	44	46,30%	.40	ns
		Light blue	31	49,20%	32	50,80%	.10	ns
		Dark green	54	49,50%	55	50,50%	.14	ns
		Light green	68	64,20%	38	35,80%	11.3	<.001
		Brown	80	51,00%	77	49,00%	.00	ns
		Black	32	47,80%	35	52,20%	.36	ns
		Grey	22	35,50%	40	64,50%	7.54	<.05
		Not coloured	35	50,00%	35	50,00%	.03	ns
	Elements	Writings	20	33,30%	40	66,70%	9,41	<.05
	Environment	Open	93	65,00%	33	27,30%	37,46	<.001
		Close		35,00%		72,70%	37,46	<.001
Person	Facial expression	Sad	4	25%	12	75%	4.76	<.05
		Happy	103	53,60%	89	46,40%	.03	ns
		Angry	4	80%	1	20%	1.63	ns

	Neutral	18	50%	18	50%	.04	ns
Body orientation	Face to face	2	28,60%	5	71,40%	1.05	ns
	Side by side	12	44,40%	15	55,60%	1.06	ns
	Both	2	28,60%	5	71,40%	1.07	ns
	Figures in different parts of the space	9	42,90%	12	57,10%	1.08	ns
Body	Interaction between people	13	30,20%	30	69,80%	6.80	<.05
	Similarity between people	25	41,70%	35	58,30%	.72	ns
Activity	No activity	104	55,60%	83	44,40%	4.26	<.05
	Play with ball	3	13,60%	19	86,40%	13.27	<.001
	Play with rules	1	4,50%	21	95,50%	20.51	<.001
	Gymnastic	15	65,20%	8	34,80%	2.01	ns
	Chat	4	40,00%	6	60,00%	.50	ns
	Walking	8	53,30%	7	46,70%	.03	ns
	Other	24	58,50%	17	41,50%	1.07	ns
Person/Environment	Contact person/environment	109	50,00%	109	50,00%	.85	ns
	Contact	t					

Importance (dimension)	Small	4	50,00%	4	50,00%	.00	ns
	Medium	119	50,40%	117	49,60%	.00	ns
	Big	23	50,00%	23	50,00%	.00	ns

^a. Non-significant

Table 3. One-way ANOVA comparisons between natural and built environment conditions for drawings indicators

Indicators		Condition		
		Built		
		Natural Environment	Environment	<i>p</i>
		M ^a (SD ^b , N)	M (SD, N)	
General characteristics	People	1.49 (1.38, 152)	2.32 (3.25, 146)	<.05
	Animals	0.58 (1.74, 152)	0.25 (1.65, 146)	ns ^c
	Plants	4.73 (5.66, 152)	2.84 (4.13, 146)	<.001
	Built	1.01 (1.84, 152)	1.77 (1.49, 146)	<.001
	Atmospheric	0.87 (1.61, 152)	0.65 (0.9, 146)	ns
	Object and toys	0.36 (2.26, 152)	0.38 (1.16, 146)	ns
	Other	0.18 (0.49, 152)	0.41 (2,47, 146)	ns

Types	Animals	0.21 (0.51, 152)	0.05 (0.22, 146)	<.001
	Plants	2.24 (1.12, 152)	1.23 (1.17, 146)	<.001
	Built	0.8 (0.17, 152)	1.5 (1,13, 146)	<.001
	Atmospheric	0.78 (0.96,152)	0.62 (0.81, 146)	ns
	Object and toys	0.14 (0.41, 152)	0.25 (0.50, 146)	<.05
	Other	0.14 (0.34, 152)	0.22 (0.80, 146)	ns
Details	People	5.39 (4.85,145)	4.18 (5.02, 146)	<.05
	Animals	1.58 (1.98, 26)	0.14 (0.37, 7)	ns
	Plants	2.19 (3.81, 142)	0.71 (0.99, 99)	<.001
	Built	1.74 (3.06, 68)	1.23 (1.39, 123)	ns
	Atmospheric	1.01 (0.54, 72)	0.77 (0.56, 73)	<.001
	Object and toys	78.24 (40.13,146)	88.72 (30.08,152)	<.05
	Other	85.45 (33.94, 152)	82.86 (36.52,146)	ns
	Body	Motion	0.39 (0.60, 127)	1.14 (2.64, 111)
Distance between people		27.07 (33.41, 26)	22.79 (27.47, 36)	ns

^a Mean value

^b Standard deviation

^c Non-significant

Table 4. Estimates of spatial-description-related variables in discriminant analysis on belonging to natural or built environment condition (only significant variables are reported)

	Estimate	<i>F</i> (1,296)
Plants types	.714	52.50***
Built elements types	-.514	27.27***
Light green	.338	11.75**
Animals types	.333	11.42**
Light green	-.274	7.69**
Objects/toys types	-.194	3.87(*)

Table 5. Estimates of experience-related variables in discriminant analysis on belonging to natural or built environment condition (only significant variables are reported)

	Estimate	<i>F</i> (1,129)
Total number of activities	-.629	27.23***
Active conversation	.320	7.04**
Movement	-.302	6.29*
Total number of details	.301	6.22*

Appendix 1. Coding indicators for play behaviors, (adapted from Rubin, 2001)

Play categories	Play behaviors	Description
Social play	Solitary	To engage in an activity entirely alone, usually more than three feet (one meter) away from other children
	Parallel	To engage in activity beside (but not with other children, usually at a distance of three feet or less)
	Group	To engage in an activity with another child or children, in which cognitive goal or purpose is shared amongst all group members
Cognitive play	Functional	To experience sensory stimulation through simple, repetitive muscular movements
	Constructive	To create or construct something
	Dramatic	To dramatize life situations or bring life to an inanimate object
	Games-with-rules	To engage in a competitive game- type activity following pre- established rules and limits
	Exploratory	To obtain visual or auditory information from an object
Non-Play Behaviors	Unoccupied	There is complete lack of goal or focus during this behavior
	Onlooker	To watch (or to listen to) the behaviors and activities of other children
	Active conversation	To communicate verbally with others
	Aggression	To express displeasure, anger, disapproval through hostile means
	Rough and Tumble	Playful physical activity

Appendix 2. Coding indicators for drawings

Dimensions	Aspects	Indicators	Description	Measures
General characteristics	Colors	Yellow	The drawing contains parts or elements colored in yellow	Presence/absence
		Orange	The drawing contains parts or elements colored in orange	Presence/absence
		Red	The drawing contains parts or elements colored in red	Presence/absence
		Pink	The drawing contains parts or elements colored in pink	Presence/absence
		Purple	The drawing contains parts or elements colored in purple	Presence/absence
		Dark blue	The drawing contains parts or elements colored in dark blue	Presence/absence
		Light blue	The drawing contains parts or elements colored in light blue	Presence/absence
		Dark green	The drawing contains parts or elements colored in dark green	Presence/absence
		Light green	The drawing contains parts or elements colored in light green	Presence/absence
		Brown	The drawing contains parts or elements colored in brown	Presence/absence
		Black	The drawing contains parts or elements colored in black	Presence/absence
		Grey	The drawing contains parts or elements colored in grey	Presence/absence
		Non-colored	The drawing is just drawn with pencil and it is not colored	Presence/absence
	Elements	People	Number of human figures drawn, including very small figures and stick figures representing people	Total number of elements
		Animals	Number of animals drawn (e.g. cats, dogs, bees, insects, butterflies, lizards etc.) including very small figures of animals and stick figures representing animals (e.g., stick figures of birds)	Total number of elements
		Plants	Number of plants drawn (e.g. lawn, grass, trees, flowers, bushes, etc.) including very small drawings of plants and stick figures representing plants	Total number of elements
		Built	Number of built elements drawn (e.g., benches, floor, buildings, stairways, doors, windows, floor lamps, elements of the basketball court etc.) including very small drawings and stick figures representing built elements	Total number of elements

	Atmospheric	Number of atmospheric elements drawn (e.g., sun, rain, clouds, snow, wind, sky drawn as a line or area etc.) including very small drawings and stick figures representing atmospheric elements	Total number of elements
	Objects and toys	Number of object and/or toys drawn (e.g., ball, dolls, small cars, jumping rope etc.) including very small drawings and stick figures representing objects or toys.	Total number of elements
	Other	Number of other elements present in the drawing that cannot be included in none of the previous categories	Total number of elements
	Writings	Presence of writings, including every word or number written in the drawing	Presence/absence
	Content of writings	Exact content of each writing (e.g., “this is my friend and I playing in the garden” / “smash the ball!” / “let’s play” etc.)	Written content
Types			Total number of
	Animals	Number of types of animals drawn in terms of biodiversity (e.g. one cat, one lizard a group of birds etc.)	different types of each element
	Plants	Number of types of plants drawn in terms of biodiversity (e.g. one tree, two bushes, a lawn, a group of flowers etc.)	Total number of different types of each element
	Built	Number of types of built elements drawn (e.g., a window, two benches, a basketball hoop, concrete floor, etc.)	Total number of different types of each element
	Atmospheric	Number of types of atmospheric elements drawn (e.g., a sun, three clouds, wind etc.)	Total number of different types of each element

	Objects and toys	Number of types of object and toys drawn (e.g., one ball, two dolls, six small cards etc.)	Total number of different types of each element
	Other	Number of types of other elements present in the drawing that cannot be included in none of the previous categories	Total number of different types of each element
Details	People	Number of details in each one of the human figure represented, as defined by Bombi and Pinto (1993): clothes (e.g. shirt, trousers, dress etc.), embellishments (e.g., jewelry, decorations of the clothes, buttons, shoe laces, collar, bow, etc., accessories (e.g., hats, belts, glasses), small objects hold (e.g., ice cream, flowers etc.)	Total number of details of each element
	Animals	Number of details in each one of the animals' figures represented (e.g., butterfly drawn with wings and antennae, cat drawn with fur and whiskers, birds drawn with eyes and beak, etc.)	Total number of details of each element
	Plants	Number of details in each one of the plants represented (e.g., tree drawn with leaves, branches and fruits, lawn drawn with grass blades, flowers drawn with stem, pistil and petals, etc.)	Total number of details of each element
	Built	Number of details in each one of the built elements represented (e.g., bench drawn with boards, basketball court drawn with the basket, football field drawn with the goal area, door drawn with the doorknob, etc.)	Total number of details of each element
	Atmospheric	Number of details in each one of the atmospheric elements represented (e.g., thunderstorm drawn with raindrops and lightning, sun drawn with sunrays, or with sunrays and a smiley face, etc.)	Total number of details of each element
	Objects and toys	Number of details in each one of the objects and toys represented (e.g., ball drawn with leather seams, dolls drawn with eyes and mouth, etc.)	Total number of details of each element

		Other	Number of details of potential other elements present in the drawing that cannot be included in none of the previous categories	Total number of details of each element	
		Environment	Open vs. closed	Identifies if the environment drawn (natural or built) is represented as an open or a closed space. An environment drawn as circumscribed, limited by a barrier, that gives the perception of closure, oppression is categorized as "closed" (e.g., a basketball court represented with a rectangular area, the people represented are surrounded by buildings etc.). An environment represented with no barriers and circumscriptions, that gives the perception of openness, is categorized as "open" (e.g., people drawn as not framed in a circumscribed area, buildings and built elements are not represented as barriers etc.)	Categorical - 2 levels
Person		Sad	The person or people represented are drawn with al least of one of the following indicators of sadness, as defined by Bombi and Pinto (1993): teardrops, frown, lip pouted, downturned mouth, brows with arches down, eyes with large or dilated pupils, with the outside corners turned down; also, the following elements may be present: injured body part, asterisks or starburst above the head, writings communicating pain or sadness (e.g., "I'm sad", "I don't feel well" etc.)	Presence/absence	
	Facial expression	Happy	The person or people represented are drawn with al least of one of the following indicators of happiness as defined by Bombi and Pinto (1993): smile, winking or joyful eyes, symbols like hearts, writings communicating happiness (e.g. "I'm happy" etc.)	Presence/absence	
		Angry	The person or people represented are drawn with al least of one of the following indicators of anger as defined by Bombi and Pinto (1993): frowning or downturned eyebrows, angry eyes, teeth grinding, sneering mouth, grimace; symbols like smoke or skulls above the head, writings (e.g., “I’m angry”, "Grrr" etc.)	Presence/absence	
		Neutral	As defined by Bombi and Pinto (1993), the person or people drawn with none of the graphical elements representing sadness, happiness and anger, are considered neutral	Presence/absence	
	Body	Orientation	It identifies if the he people represented are drawn face to face, side by side, or both. If the people are in different areas of the drawing, orientation cannot be measured	Categorical - 3 levels	

	Motion	It identifies the number of people represented in the drawing that are in motion. Motion is defined as: body position bent forward, bent arms and knees, lifted tiptoe, different position of the legs and arms, addition of elements that evoke motion (e.g., lines around arms and legs, ball or other toys, etc.)	Scale
	Distance between people	The minimum distance between two people represented in the drawing, measured in millimeters. If there are more than two people drawn, the required measure is the minimum distance between two people	Scale (mm.)
	Interaction between people	It identifies if the people represented in the drawing interact with each other. The interaction is present when the figures are facing each other, are doing a common activity or the same movement, are moving in the same direction, are playing together, hold hands	Presence/absence
	Similarity between people	It identifies if the people represented in the drawing present similar characteristics. Similarity between people is expressed by figures with a similar height and width, figures that are in the same body position, have the same body and face shape and color, have the same details (as defined by Bombi and Pinto, 1993, see the indicator "people details").	Presence/absence
Activity	No activity	The people represented in the drawing are standing still or sitting, not doing any identifiable activity	Presence/absence
	Play with ball	The people represented in the drawing are clearly playing with a ball	Presence/absence
	Play with rules	The people represented in the drawing are clearly doing a game with rules (e.g., football, hide and seek., etc.)	Presence/absence
	Gymnastic	The people represented in the drawing are clearly doing gymnastic (e.g., handstands, cartwheels, etc.)	Presence/absence
	Chat	The people represented in the drawing are clearly engaged in a conversation or are chatting: (e.g., sitting or standing face to face, interacting, with a written content of chat)	Presence/absence
	Walking	The people represented in the drawing are clearly walking or running, with an addition of elements that evoke motion (e.g., lines around arms and legs)	Presence/absence
	Other	The people represented in the drawing are doing an activity that cannot be included in the previous enlisted activities	Presence/absence

Person/ Environment	Contact	<p>Contact between person and the natural environment</p> <p>It identifies if it is present a clear representation of a contact between the person and the natural environment. For instance, the human figure lies on the lawn, climbs a tree, touch the grass, picks up a flower, touch a cat, etc.)</p>	Presence/absence
	Contact	<p>Contact between person and the built environment</p> <p>It identifies if it is present a clear representation of a contact between the person and the built environment. For instance, the human figure lies on the basketball court, sit on a bench, climbs the stairs, etc.)</p>	Presence/absence
	Importance	<p>Dimension of the person's body in relation to the environment</p> <p>It measures the dimension of the people represented in relation to the space of the sheet. For instance, if the people drawn are very small figures lost in a very big space, the identified dimension is "small"; on the other hand, if the figure is drawn like a "giant" (e.g., if it is bigger than the sun), the identified dimension is "big". If the figure present normal dimensions in relation of the other elements in the drawing, the identified dimension is "medium"</p>	Categorical - 3 levels

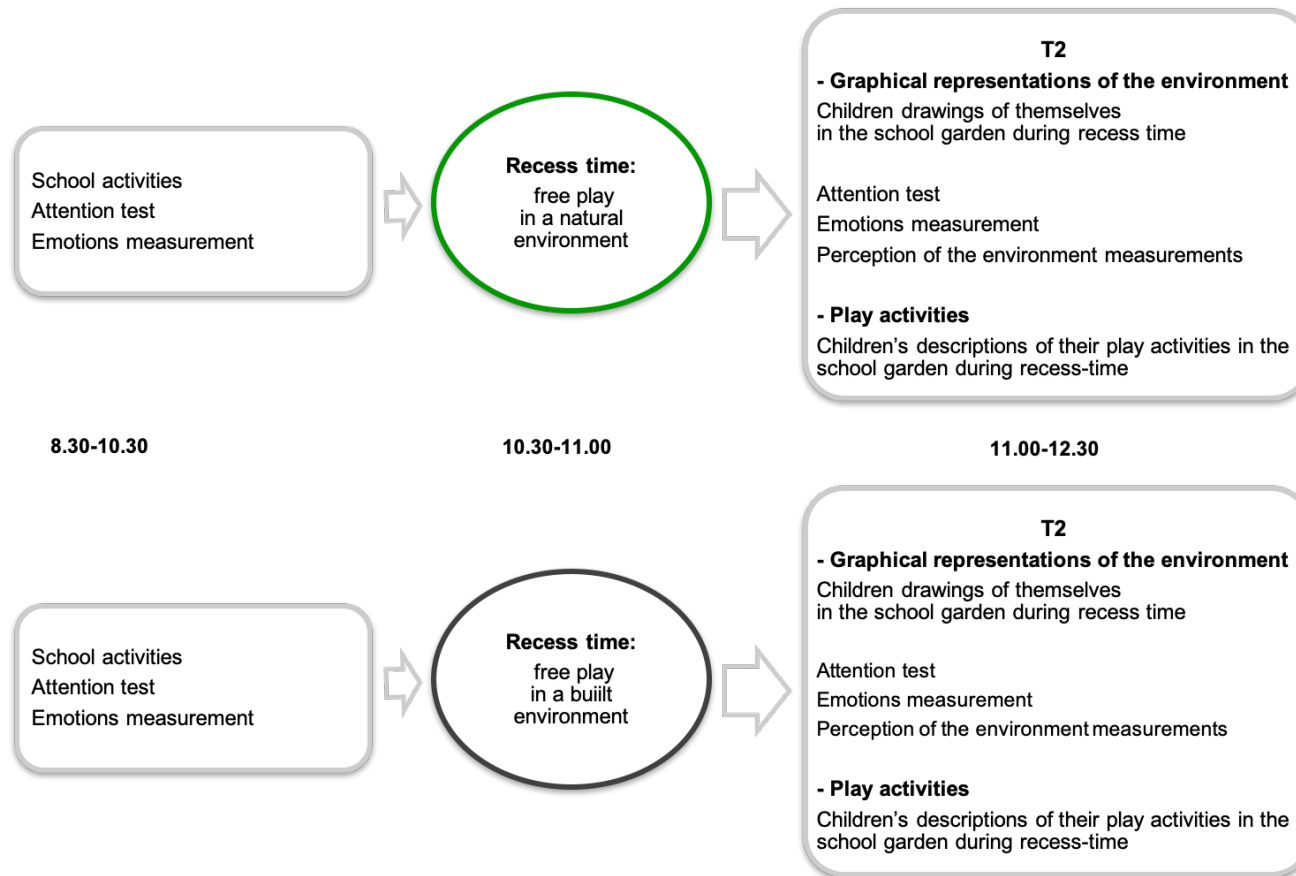
Appendix 3. Pictures of natural environment (on the left) and built environment (on the right) in the Rome school



Appendix 4. Pictures of natural environment (on the left) and built environment (on the right) in the Catania school



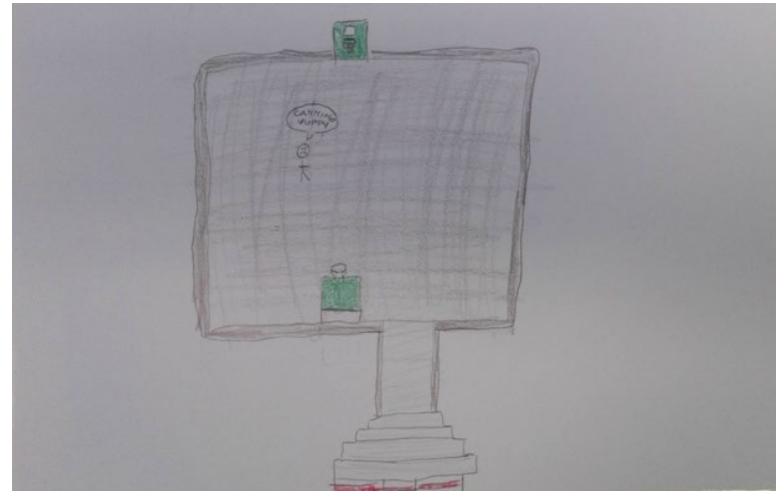
Appendix 5. Between-subjects procedure



Appendix 6. Drawing of natural environment (A;C) and built environment (B;D). Natural environment represented as open (A) and built environment represented as close (B); children in the natural environment doing a handstand (C); verbalizations: children in the built environment say: “I’m bored! I’m sad! I don’t know what to play!” (D);



A



B



C



D