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This is the Published version of the following publication

Eilam, Efrat and Garrard, GE (2017) Perception of Space among Children Studying Their Local Grasslands: Examining Attitudes and Behavioural Intentions. *Sustainability*, 9 (9). ISSN 2071-1050

The publisher's official version can be found at
<http://www.mdpi.com/2071-1050/9/9/1660>

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Article

Perception of Space among Children Studying Their Local Grasslands: Examining Attitudes and Behavioural Intentions

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Received: 3 August 2017; Accepted: 3 August 2017; Published: 19 September 2017

Abstract: The study examined children’s perception of space in the context of place-based education. It investigates: the cognitive attitudinal dispositions involved in perceiving space as ‘empty’; and, how students’ attitudes toward one grassland site inform their attitudes and behavioural intentions when applied to similar spaces which are spatially and temporally remote. A group of urban primary students participated in a four-month environmental education program in which the students were immersed in a local grassland reserve through repeated visits and learning about grasslands. Data collection included surveys and a focus group activity concerning future neighbourhood planning. The results indicate that the children perceived as ‘empty’ spaces which were un-built, lacked human activities, or were un-identified on a map of the area. Students presented negative attitudes toward ‘empty spaces’ and were inclined to ‘fill’ them. In regard to future planning of their neighbourhood, high consistency was found between the students’ positive attitudes and their intentions to preserve the studied grassland site. This alignment between attitudes and behavioural intentions became disentangled when applied to remote sites at future times. While attitudes remained positive, behavioural intentions were willing to forsake grassland sites. The implications of the findings to environmental education are discussed.

Keywords: space perception; place-based education; attitudes; environmental planning

1. Introduction

This study focuses on children’s perceptions of the notion of space. It examines how attitudes that are developed toward a specific natural grassland environment impact urban children’s perceptions regarding a space being ‘empty’ versus ‘full’; future utilization of the space; and, transference of attitudes to other similar but geographically remote spaces.

Over the past three decades much research attention has been given to the importance of place in environmental education [1–7]. Place-based education had developed as a powerful pedagogy for connecting students with their immediate surroundings in holistic ways [8]. It has been argued that place-based education enhances students’ ownership and environmental stewardship [9]. Some claims have been made that it may also support development of environmental activism which transcends the immediate locality [5].

The present study builds on this body of research and asks questions regarding primary students’ perceptions of space following an educational intervention designed to create positive attitudes and emotions toward a local grassland reserve. The pedagogical approach placed a small (1000 m²), local patch of native grassland at the centre of the learning. The study examined the students’

perceptions of the grassland following repeated visits, immersions and interactions over a period of four months in one school year.

The specific research questions guiding this study are:

- (1) How is the environment perceived by children, in regard to notions of being 'empty' versus 'full'?
- (2) To what extent are attitudes that were formed in relation to one natural grassland site transferable to other similar sites, when students consider the future needs of their neighbourhood environment?

2. Literature Review

The temperate lowland native grasslands of south-eastern Australia form a landscape that is typically characterised by perennial, mostly tufted or tussock-forming grasses [10]. This monotonous, mostly treeless ecosystem becomes extremely dry in summer but is floristically rich during spring and winter. The grasslands have formerly been amongst the most diverse terrestrial ecosystems [11]. They provide a habitat for many nationally and state listed threatened species, such as the small golden moths orchid, and the striped legless lizard [12]. Nowadays, these grasslands form the country's most threatened ecosystem type, with approximately 99.5% having been wiped out since European settlement [11]. Most of the remaining grasslands are located on private properties, and in remnant patches scattered throughout urban areas [13].

Since 1999, grasslands have been listed as critically endangered ecological communities under the Australian Government's Environment Protection and Biodiversity Conservation Act 1999 [14]. Regardless of this legislation, they are continuing to be destroyed and degraded by urban sprawl and developments; overgrazing; cropping; changes to fire regimes; and competition with invasive species [11,13].

Contributing to these processes is the lack of public appreciation of grasslands. A study conducted by Williams & Cary [15] among rural landholders in south-eastern Australia, reveals that most of the respondents attribute low aesthetic and biodiversity conservation values to the grasslands. Instead, they attribute high agricultural value to this ecosystem.

Grasslands in urban areas are often perceived as 'empty' spaces for development. This perception of the natural environment is particularly prominent in regard to the grasslands. The landscape comprised of treeless low-lying grass often gives the impression of being monotonous, barren, lifeless and unattractive (see for example Figure 1) [15].



Figure 1. A typical Victorian grasslands landscape (Source: Google Images).

The notion of space perception has intrigued researchers from diverse disciplines, such as psychologists, architects, philosophers, and physicists. As early as 1950, James Gibson [16] in his ground-breaking work on visual perception, stated that "there is no such thing as the perception

of space. There is only the perception of textured surfaces and what I call the 'layout' of these surfaces" [17] (p. 295). According to Gibson "the true question is how we perceive all these surfaces with their inclination to one another" [17] (p. 295). Gibson's claim that there is no perception of space inevitably directs attention to the role of cognition in constructing a sense of space.

When considering the notion of empty space, philosophers such as Bertrand Russell [18] and Brian O'Shaughnessy [19] expressed the view that humans cannot perceive absences, only presences. They distinguished between perceptions and cognitive attitudes. Perceptions cannot be negative. We cannot perceive something not to be the case. In contrast, thoughts, attitudes and beliefs can take either negative or positive propositional objects ([19] (p. 331) in [20] (p. 228)). According to this perspective, the perception of a space being 'empty' is an outcome of cognitive attitude or belief, rather than of direct visual space perception. Molnar [21] adds the cognitive attribute of expectations, as also playing a role in shaping our perception of a space being 'empty' or 'full'.

Richardson [20] expressed the view that the perception of the existence of negative things causes discomfort. Therefore, we tend to perceive the world as 'positivity all the way' (p. 228), meaning full of existences rather than lacking of existences. From this perspective, we can expect that in order to overcome a sense of discomfort, people would be inclined to add things into spaces which they perceive as 'empty'. On the other hand, when people develop emotional attachment to certain places, they would be more inclined to perceive them as being 'full'.

In the context of this study, the notion of 'empty' versus 'full' space is of particular interest in regard to children's perceptions of their local environment. Day & Wager [22] examined the local places that were important to children and young people. In their interviews with children from deprived neighbourhoods, the children described as 'empty space' a derelict school space that they had colonised as a playground. They stated that this was a place that the police allowed them to utilize. When examining this notion of 'empty' in light of the cognitive-attitudinal view of perception, it is reasonable to suggest that by referring to the place as 'empty', children might have been expressing the community's negative attitudes toward this desolated sight.

Few studies examined how children perceive and utilize their environment [22–24]. Research shows that children and young adults utilize local public spaces more than any other community group [22,25,26]. They are constantly involved in actively negotiating space usages in their local environments, with spatial activities often extending quite far and beyond ([27] in [24], [28]).

When examining children's attitudes toward their local environments, Elsley [24] found that urban children mostly express positivity. Children in particular like their local parks and recreational spaces. Young people also value the un-built areas around their communities, such as rivers and woods [22,24].

Research regarding attitude formation and its relationship with behaviour dates back to the early 20th century. Studies in the field of psychology created strong foundations for understanding the constructs of attitudes and behaviours. Later in the 1970s and 1980s, these two constructs became a prime concern of environmental educationists.

Attitudes have often been described as having an affective component and a cognitive component [29]. Various definitions for the term 'attitudes' have been proposed, including three prominent definitions: (i) An enduring combination of motivational, emotional, perceptual and cognitive processes with respect to some aspect of our environment [30]; (ii) learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object [31]; and (iii) a person's overall evaluation of persons (including oneself), objects, and issues [32].

Various models have been proposed for explaining processes that influence attitudinal change. The elaboration likelihood model of attitude change [32,33] provides a theory for explaining the processes through which attitudes and the strength of those attitudes can change [32]. Other explanations include the following: (i) interaction between attention, comprehension, learning, acceptance, and retention of the message and its conclusion [34]; and (ii) a mere exposure effect [35,36].

Most researchers agree that influential processes on attitudes involve complex processes and complex effects [32].

Similarly, research in the field of psychology found highly complex relationships between attitudes and behaviour in which attitudes were not reliable predictors of behaviours. For example, as early as in 1934 LaPiere [37] published the results of an empirical study in which a Chinese couple entered 251 businesses, such as hotels and restaurants, in the United States and asked for service. They were refused service only once. Half a year later, in response to a letter from LaPiere, 118 of the 128 businesses that responded claimed that they would not accept members of the Chinese race as customers. LaPiere concluded that attitudes could be easily and quantitatively measured but were largely irrelevant to the prediction of behaviour. LaPiere's findings were reiterated in further studies [29,38]. By the mid-20th century, researchers came to regard behaviour as an outcome of situational rather than dispositional influences [39–42].

Within the field of environmental education, Hines, Hungerford & Tomera [43] and Bamberg and Moser [44] conducted meta-analyses of the relationships between pro-environmental attitudes and behaviour. They viewed 'intention to act' as a determinant of behaviour, where 'intention to act' itself is described as a composite factor composed of attitudes among other variables.

Not much research has been carried out to examine the effect of age on susceptibility to influencing attitudes and behaviours. Early research in psychology found that children were more susceptible to attitudinal influence than adults [45,46], and that adults' attitudes are more stable over time compared to younger individuals [47]. Similar results were obtained by Eilam and Trop [41]. In addition, they found that among school-children, environmental education that influences behaviour also influences attitudes and vice versa, whereas among adults these aspects are more compartmentalized. Influences on behaviour do not necessarily carry with them influences on attitudes and vice versa. This separation between influences on environmental attitudes and influences on environmental behaviour gradually develops with individuals' maturation. There is currently no theory regarding the mental processes that drive such changes in susceptibility, or regarding the characteristics of these changes.

Numerous studies have pointed to the potential role of place-based education in creating positive attitudes toward the local environment [5,48]. In place-based education, the educational program focuses on all aspects of the locality, including the human and built environments as an integrated context for learning [9,49–52]. From a socio-political perspective, place-based education may be viewed as "community-based efforts to reconnect the process of education, enculturation and human development to the well-being of community life" [8] (p. xvi). Such educational experiences are believed to enhance active environmental citizenship among students [5,53].

Within the place-based education body of research, the question of how positive attitudes developed in relation to one particular space may be transferable in time and space dimensions, has so far drawn limited research attention. In regard to the space dimension, it is not clear how children that develop positive attitudes toward a specific place apply these attitudes to remote, yet similar spaces. In the time dimension, it is not clear how such attitudes impact students' visions of future community development and utilization of spaces. Answering these questions has direct implications for understanding the ways in which place-based education shapes students' dispositions toward space utilization and conservation.

3. The Study

This project was conducted as part of a broader collaboration between a group of primary schools, academic researchers in three universities, and governmental bodies. The collaboration involved various school–community partnership activities, conducted simultaneously in two regions of the state of Victoria. In this study, we report on one specific program that was implemented in one primary school with an aim of meeting this study's objectives.

The learning program was developed with the explicit objectives to: (i) educate students about the grassland ecosystems; and (ii) develop among the participating students positive attitudes toward a local site of grassland reserve, alongside a sense of care for the protection of this local site.

These learning objectives were developed as a means for creating the required conditions for further investigation of the research questions stated above. As a pre-condition for investigating how positive attitudes developed in regard to the local grassland site impacted students' perceptions regarding grasslands beyond the particular site, it was essential to first establish that the participating students have developed positive attitudes toward the studied site. A specifically-designed survey was developed for assessing the achievement of this pre-condition for the study.

An urban primary school in western Melbourne was selected for participation in the study. The school is located in a new suburb in an area that was once dominated by native temperate grasslands. As such, the newly built neighbourhood contains numerous patches of remnant grassland of various sizes, to be protected in perpetuity as part of specified conditions of development of the area. One of these patches is located within five minutes' walk from the school. This specific patch, approximately 1000m² in size, was chosen as the focal point for this place-based educational program.

The grassland educational program was comprised of: (i) four months planning period; and (ii) four months implementation period.

The planning team was comprised of the following participants:

- Primary school representatives, including the environmental education teacher, principal and vice-principal;
- Five academic researchers from two universities in Victoria spanning four faculties and five areas of expertise, including botany and ecological conservation, environmental education, ecology, zoology and tourism;
- The Melbourne Water river health officer responsible for managing the grassland site; and
- A representative from the local council.

The planning committee's meetings aimed to identify and refine the project's goals and set up a framework for its operation.

The implementation phase consisted of weekly meetings between students participating in the school's Green Team and the environmental education teacher. Each session was conducted over two hours and included learning about the grasslands and frequent visits to the local grassland site. The visits involved students' participation in different hands-on activities at the site.

The Green Team was composed of 30 students in Years 3–5 who volunteered to take part in the team. The Green Team was established at the school with the aim of educating students about the environment and encouraging environmental stewardship among their peers. The Green Team was chosen for participation in the study because of the voluntary nature of the students' participation. It was assumed that this group of students were likely to possess positive attitudes towards the environment and were therefore more likely to develop positive attitudes towards the grasslands as a result of the educational program.

The program's curriculum was developed by the academic team in consultation with the environmental education teacher. Additional support was provided through fortnightly, two-hour meetings between the teacher and two of the academics involved in the project. During these meetings, this small team would prepare highly detailed lesson plans for the upcoming learning sessions.

The learning sequence was composed of five units covering various aspects related to the grasslands. Each unit was further subdivided to sub-units. The units' topics were as follows: (i) the plants in the local grassland: seasonality and ecology; (ii) risks and protection measures of grasslands; (iii) meeting with a shy, endangered inhabitant: the striped legless lizard (*Delma impar*); (iv) student small-group independent projects; and (v) a community event to be hosted at the grassland: climax day.

The students' excursions to the grasslands included activities such as: (i) building a herbarium: collecting plants, identifying them, developing an identifier book in which the collected plants are

pasted and described; (ii) planting a buffer zone to protect the grassland from invasive weeds; (iii) observing a live striped legless lizard; (iv) presenting the groups' projects to the broader community in a display at the grassland site; and (v) guiding a tour for community members at the grassland site.

4. Methods

Data collection was collected for two purposes. First, to assess the participants' developed attitudes toward the local grassland site. Second, to evaluate the students' perceptions of space in spatial and temporal dimensions.

4.1. Evaluating Students' Attitudes

Two sets of surveys were applied for evaluating students' attitudes toward the grassland site, as follows:

- Mid-program survey; and
- End-program survey

The surveys were developed to evaluate students' emotions and attitudes toward the grassland mid-way through the program and at the end of the program, close to the time in which the students' perceptions of space was evaluated. The reason for evaluating the students' attitudes twice, was to gain insights regarding possible progression or fluctuations in attitude development. Developing a deep understanding of the students' emotions and attitudes toward the studied site was important since further analysis was done in comparison to these findings. For example, the theoretical review revealed that a perception of 'empty' space may be associated with negative attitudes. Analysis of students' attitudes provided a useful context for interpreting their uses of the terms 'empty' or 'full'.

The surveys included questions asking students to describe how they feel about the grassland and what they know about the grassland. They were also asked to report whether they ever visit the grassland outside of school time and if so, for what purposes. Ten ($n = 10$) students completed the first survey and twenty-one ($n = 21$) students completed the second. Though the Green Team consisted of thirty students, the number of participants was limited by the number of 'consent for participation' forms that we were able to obtain from the children's parents. Ten forms were obtained prior to the mid-program survey, and 21 forms were obtained prior to the end-of-program survey. The responses were matched for those students who completed both surveys. The students' anonymity was retained using number coding.

4.2. Evaluating Students' Perceptions of Space

A focus group activity was developed for obtaining data regarding the students' perception of the grassland space being 'full' or 'empty'; and transference of attitudes toward remote grassland sites when considering future development needs.

Twenty-one ($n = 21$) students participated in the focus group. The students were divided into five sub-groups of four to five students. Special attention was given to creating heterogeneous groups with respect to age and gender. Each group included at least one student from each year level between years 3–5.

Each group received a laminated A3 size map of their neighbourhood in which the local grassland sites were marked and highlighted. The map highlighted the borders of the neighbourhood and also included some external grassland sites that bordered the neighbourhood from the outside. Each group received a set of permanent markers in different colours and a notebook for writing answers to questions.

The students were given the following instruction:

'You are now about to plan what your community will look like in 10 years' time. In groups, you will discuss your plan and then draw your plan on the map that is in front of you.'

We will guide your planning by asking you questions and then giving you instructions for drawing’.

The focus group activities were sequenced as follows:

- (1) An activity to familiarize students with reading, interpreting and drawing representations of new structures on the map.
- (2) Students were asked to discuss their community’s needs in 10 years.
- (3) Students were told to assume that in 10 years their community will need 100 more houses. They were asked to find places on the map to put those houses and draw them on the map.
- (4) Students were asked to discuss and justify their choices in their groups. Following their discussions, they were asked to write an explanation in a notebook.
- (5) Students were asked to consider whether any other changes would be required in their community in 10 years’ time. If so, to apply the changes by drawing them on their maps. They received a variety of prompts for possible changes.
- (6) Students were asked to discuss and justify their decisions. Following their discussions, they were asked to write an explanation in a notebook.
- (7) Each group presented their maps and future planning to the rest of the class.
- (8) Finally, a class discussion was held regarding the differences between the maps and the implications for the grasslands.

The focus group discussions were recorded and transcribed. The analysis consisted of examining all three data sources in relation to each other: the transcripts of the group discussions, the neighbourhood maps, and the written explanations.

The analysis of the question regarding children’s perceptions of the grassland as being ‘full’ versus ‘empty’ consisted of analysing every excerpt in which the term ‘empty’ or ‘full’ was mentioned in the transcripts.

The analysis of the question regarding the extent to which attitudes that were formed in relation to one natural site are transferable to other similar sites, when considering the future needs of the neighbourhood, consisted of evaluating the children’s drawings on the maps, the transcripts and the written explanations.

5. Results

The results are presented in accordance to the respective research questions.

5.1. *To What Extent Does Students Studying the Grassland through a Place-Based Approach Develop Positive Attitudes and Affective Relationships with Their Local Grassland?*

5.1.1. Responses to Mid-Program Survey

All ten participants expressed positive attitudes toward the local grassland site. When asked about thoughts and feelings that come to mind in relation to the site, students responded with expressions such as ‘happy’, ‘peaceful’, ‘awesome’, ‘curious and good’, ‘excited to help the grassland’, and other similar positive expressions.

All the students expressed awareness of the fact that urban development poses an ongoing threat to the grasslands.

Finally, when asked how often they visit the grassland and for what purposes, the responses ranged from one to more than seven times a year, for purposes such as walking and picnicking. None of the students stated that they never visit the grassland outside of school hours.

5.1.2. Responses to End-Program Survey

The responses of the 21 participants to the end-of-program survey were more elaborate, as compared with the mid-term survey. All students expressed positive emotions toward the

grasslands, yet, in comparison to the first survey, the students showed deeper emotions and concerns regarding the fate of the grassland. Examples of students' responses include 'I think it's sad that grasslands are getting destroyed every time'; 'I feel proud and thankful, because not everyone has them [the grassland] and we do'; '[the grasslands are] unprotected, not safe for rare plants'; 'sad, because lots of people are building on top of it and destroying it'; 'they are beautiful, amazing'; 'lucky and happy because grasslands help us live'; 'they are a wonderful bunches of plants with me just staring at every area of the grassland'; 'how are animals going to survive in the grassland when people are destroying their habitat?'; 'sad, disappointed because this [the destruction] has been going on for years and I never knew'.

When asked to describe what they learned, students presented detailed descriptions, including for example: 'The Legless Lizards are called like this because through their evolvement they used to have legs but now they don't'; 'the Blue Devil flower changes colours'; 'I learnt how plants can grow multiple versions of themselves'; 'Legless Lizards have normal tongues and holes on the side of them for listening'; 'I learned about plants and animals that I never knew existed'; 'grasslands were around the world and now there is only 2% left'.

Students' responses regarding their frequency of visits to the grasslands and purposes of visits were consistent with their responses to the first survey.

The two surveys' results indicated that the participants had positive attitudes and emotions toward the grassland and that they were intimately familiar with the fauna and flora of the local studied site. The emotions presented in the first survey had deepened throughout the learning process and developed into a sense of care. For some students the positive emotions toward the local site were broadened to include the grasslands as an ecosystem type, wherever it exists.

The results obtained from the two surveys provided affirmation regarding the students' positive attitudes toward the studied grassland-reserve site. These findings provided the required foundation for further investigations of the relationships between the students' positive attitudes and their space perceptions (e.g., 'empty' versus 'full'), as well as attitude transference in the temporal and spatial dimensions.

5.2. How Is the Environment Perceived by Children, in Regard to Notions of Being 'Full' versus 'Empty'?

The theoretical analysis regarding space perceptions guided the analysis of the transcripts. In particular, we were interested in examining the philosophical idea that perception of 'empty space': (i) is a cognitive attitudinal disposition [19]; (ii) is more likely to be associated with a negative attitude; (iii) causes discomfort [20], and therefore may elicit a need to fill in the space; and (iv) is shaped by expectations [21].

The transcripts of the five focus groups were analysed. The word 'full' did not appear in any of the transcripts. All excerpts that included the word 'empty' were analysed in regard to the following questions:

- (1) What type of places are perceived by children as being 'empty'?
- (2) What is the children's attitudinal valance (positive or negative) in regard to 'empty spaces'?
- (3) How do children respond to 'empty space'?
- (4) How do children wish to fill in the 'empty spaces'?
- (5) What further insights may be drawn from students' conversations about space?

5.2.1. What Type of Places Are Perceived by Children as Being 'Empty'?

Places that were perceived as empty were: (i) un-built; (ii) lacked human activity; or (iii) un-identified on the map.

Examples of excerpts addressing the un-built environment as 'empty', are as follows:

Group 1: 'I think we put some stuff [shops] around here because it's always empty, yeah? So where else? The places were empty'.

Group 2: 'Ok so places that seem like no houses or like . . . when I was having a trip in this area, we were having a rest here in these two areas, and it was basically emptyand this area that I went with my dad and my mum and my sister, this place was like completely empty with no houses there.'

Group 3: 'So the black areas [drawn on the map] . . . where we thought to put some shops and some other places, umm . . . we chose to put them in these areas because we thought that they looked a bit empty, or that they needed something.'

Examples of excerpts addressing the lack of human activity as 'empty', are as follows:

Group 1: 'Those are the empty areas, kind of parkland. Yeah that was the park that . . . I said wasn't really that active. It was like at the afternoon, so I was expecting a lot of people, but it was like the opposite. Wasn't much people. I barely see people walking around . . . that's why I thought to put houses in those areas.'

Group 3: 'there was just like an empty place, not much active stuff going on.'

Group 5: 'we reduced this grassland and put some public facility because there is not much happening there, and it's pretty empty.'

Examples of excerpts addressing the un-identified spaces on the map as 'empty', are as follows:

Group 4: 'What's that? I don't know, it doesn't have a name. That's an empty one'.

Group 5:

Student 1: 'Here, here'

Student 2: 'No'

Student 1: 'That's empty'

Student 2: 'That's a shopping mall'

Student 1: 'That's empty space.'

Student 4: 'It was a park there'

Student 3: 'There are already houses there, you are drawing on houses you can't have two houses on the one ground'

Student 1: 'We will do it here'

Student 4: 'Nooo, I want park land'

Student 2: 'Ok I know, so why did you chose these places?'

Student 1: 'Because nothing is there'

Group 5 was debating where on the map the new houses should be placed. It seems that there was controversy within the group about how to read the map. Student 1 perceived a space for which she could not identify its uses on the map, as an empty space.

5.2.2. What Is the Children's Attitudinal Valance (Positive or Negative) in Regard to 'Empty Spaces'?

Whenever attitudes were expressed toward empty spaces, they were always negative. In one excerpt, a student referred to emptiness in an emotional context.

Group 1:

Teacher: 'so you added parks to the neighbourhood?'

Student: 'Yeah because our life will just be empty, and no kids will have fun'.

In one conversation, a student expressed a negative attitude that was shaped by her expectation.

Group 1: 'Those are the empty areas, kind of parkland . . . I was expecting a lot of people, but it was like the opposite. Wasn't much people. I barely see people walking around. Most of the houses weren't really that active'.

This excerpt aligns with Molnar's [21] perception that a sense of 'empty space' may be formed by expectations. When certain things that are expected to be in a space are lacking, the space may be perceived as empty. Such expectations form part of the cognitive attitudinal dispositions that shape perception of emptiness.

5.2.3. How Do Children Respond to 'Empty Space'?

In all cases students perceived the empty spaces as needing to be filled. This finding is in line with the hypothesis that stems from Richardson's [20] claim that a sense of emptiness causes discomfort. It is suggested that students' decisions to build on what they perceived as 'empty' spaces may be associated with an attempt to reduce discomfort.

Further investigation is required for examining whether the impetus to fill 'empty' spaces, persists under different study conditions in which students are not required to consider future development.

5.2.4. How Do Children Wish to Fill-In the Empty Spaces?

Students changed empty spaces to full by drawing on their maps houses, shops, recreational facilities, grasslands, or parks. The choice of ways for filling the emptiness varied among the groups. However, it was apparent in all the groups that their choices were driven by their values. All five groups held lively discussions about what to put in spaces that were perceived as empty.

Following is an example of a decision made by Group 5:

'We made a national park here because we thought it would be nice to . . . because there is only like one green place here, so we thought we would expand that and make it a national park where there will be like playgrounds and there is grassy areas [grasslands]. And we made a gym here . . . The reason why we build an ice cream store and a slushy store . . . if you finished going to a gym you can come out here . . . and walk to the slushy shop to buy a slushy . . . You know it's getting hot in Australia, so we decided to put this in there, so everyone can cool down a bit'.

5.2.5. What Further Insights May Be Drawn from Students' Conversations about Space?

Some philosophers (e.g., O'Shaughnessy [19]; Richardson [20]; Russell [18]) expressed the view that perception of empty space doesn't exist. Humans cannot perceive absences, only presences. A student in Group 2 expressed a view that perfectly echoes this idea. The student stated:

'I don't actually think nothing is a place with nothing is possible, I don't think it's possible because everything has something, like this room, if this room was empty it would still have like stuff . . . like air, or you would be in it . . . '

This same student continues and highlights the role of cognitive attitudes in shaping our perception of emptiness, as follows:

'If you think of yourself as a nothing and you were in a room that has [you, and it is] empty, then I guess you could say it's nothing. But I don't think of myself as a nothing, so I wouldn't say: it's nothing.'

The findings regarding children's perceptions of space as being 'empty' versus 'full', indicate that perception of emptiness is driven by an apparent negative cognitive attitudinal disposition toward the space. Students tend to see as empty an un-built environment, or an environment that is lacking human activity. On a two-dimensional map, emptiness is perceived when the structures on the map are unidentified. Children proposed a wide range of suggestions for filling the empty spaces, including

grasslands, and shopping areas. The various choices were driven by what students valued as useful and contributing to their neighbourhood.

5.3. To What Extent Are Attitudes that Were Formed in Relation to One Natural Grasslands Site Transferable to Other Similar Sites, When Students Consider the Future Needs of Their Neighbourhood Environment?

During the focus group session, students were asked on three different occasions to consider the future developmental needs of their neighbourhood. They received prompts (see clause 3 below) that closely resemble 'real world' developmental pressures presently experienced in Melbourne. With Victoria's rapid growth of approximately one million people in 10 years, the city's future planning is oriented toward increasing the built environment at the expense of nature conservation. Within this sphere of intense development, we were interested in finding out the extent to which students' positive attitudes toward the studied site would be preserved when considering future developmental needs.

The specific questions were phrased as follows:

- (1) Do you think that your community will need more or less houses in ten years' time?
- (2) Let's assume that the community will need 100 more houses. Where will you build them? Draw on the map the new houses.
- (3) Think now about other things that your community might need in ten years' time. For example: shops, places for business like offices or car repairs, grasslands, natural spaces, sports grounds and facilities; public facilities like schools, clinics, libraries; parks. Draw on the map any changes that you would like to plan.

In each of these iterations, students' transcripts, maps and written explanations were analysed in regard to decisions pertaining to (i) the studied grassland site; and (ii) other remote grassland sites.

The findings reveal that throughout students' conversations, time after time, the grasslands surfaced as spaces bearing high value. Their attitudes to the grasslands were consistently positive, even among students who were willing to forsake grasslands areas, due to pragmatist reasoning, such as the need to provide houses for a growing population.

This overarching consensus regarding the value of the grasslands can be exemplified by the following excerpt by a student from Group 1.

'[We can put the houses] around this grass area because it's not a park or anything. It's just a bunch of grasslands ... ohh that's a grassland ... I forgot about that. Save the grasslands!'

The analysis revealed that none of the groups decided at any stage to build on the local studied grassland site. This site was not mentioned as an option for change by any of the groups and it remained intact in all five maps. However, the picture became more complex in regard to other grassland sites. The complexity was expressed mainly by the inconsistencies that appeared at times between the students' positive attitudes toward the grasslands and their development plans. These inconsistencies may be regarded as gaps between attitudes and behavioural intentions, where attitudes may be regarded as the students' predispositions toward the grasslands, and behavioural intentions may be regarded as what they were willing to do (their actual planning decisions). The complexity of these relationships is presented below in the summary of results obtained from each of the groups.

- *Group 1.* In addition to 100 new houses, the students decided to build more shops, sports facilities, and parks. Most of the new shops and houses were placed over already built-up streets. However, some shops were placed over a golf course and a grassland nature reserve, both external to the neighbourhood boundaries. To compensate for the loss of green spaces, the students created two new grasslands within their neighbourhood and added a recreational park over one corner of a large patch of grassland site. When explaining their decision to build over grassland areas located at the edges of their neighbourhood, the children wrote: 'Places were empty in southern and eastern areas. Some places are far away from the neighbourhood shopping centre.'

- *Group 2.* In addition to 100 new houses, the students decided to build more shops, schools, grassland sites, and parks. The students decided to build houses over grassland areas, particularly over the larger patches within the neighbourhood. They decided to compensate for that by creating other grassland spaces instead. Their reasoning for creating these alternative patches was the need to provide more natural habitat for the animals to move into.
- *Group 3.* In addition to 100 new houses, the students decided to build more sports grounds and facilities, a medical clinic, libraries, and parks. Their development plan included building over small patches of grassland. The larger patches were preserved. When explaining their decision to build over the small grassland sites and preserve the big sites, the students wrote: ‘because they are smaller and do not do much damage. In ten years we are trying to keep it [the development] away from the Nature Conservation [a large grassland site within the neighbourhood]’.
- *Group 4.* The students decided to build 100 new houses outside the neighbourhood’s boundaries. In addition, they would build a national park, sports facilities, ice-cream shop, and a slushy shop. The national park is planned to be developed over an area which is currently residential. The students explained that the houses that will be put down will be re-built in a neighbouring community. When explaining their decision to build a national park, the students explained that each neighbourhood requires a national park. They stated: ‘There is only like one green place here, so we thought we would expand that and make it a national park where there will be like playgrounds, and there is grassy areas [grasslands].’
- *Group 5.* In addition to 100 new houses, the students decided to build more sports grounds and facilities, shops, parks and natural places. Some of the new constructions are planned on grasslands. The students explained: ‘We reduced this grassland and put some public facility because there is not much happening there . . . but we still left a park there. And the one hundred houses will also be in the same grassland.’ The students compensated for some of the loss, by creating a new grassland site on the map.

The relationships between students’ attitudes and their behavioural intentions, as expressed by their decisions are summarised in Table 1.

The findings indicate that there was high consistency between students’ attitudes and planning decisions in regard to the local studied grassland site. All five groups expressed positive attitudes toward the local sight and unanimously, without any conversation taking place, decided to keep the site intact. Its endurance in the neighbourhood was unquestioned.

In regard to planning the future of remote sites, high consistency was found in regard to attitudes, but high variation was found between the groups in regard to future planning decisions.

In regard to attitudes, they all expressed awareness to the value of the grasslands. These positive attitudes were expressed in multiple ways. The grasslands’ fate was always at the centre of the discussions. Every building project that was proposed was accompanied by consideration of the implications on the grasslands. These positive attitudes were also expressed in the planning decisions. Students compensated for grassland losses, at least to some extent.

In regard to behavioural intentions, four groups decided to build over grasslands while one group decided to create a grassland over residential houses. There was also high variation between the four groups who decided to build over grasslands. One group built on grasslands outside the neighbourhood, one group chose to build over the large patches in the neighbourhood and one group decided to build over the small patches only. Finally, the fifth group built randomly over grasslands.

Table 1. Students' attitudes and behavioural intentions in regard to future development on grassland sites, by studied site versus non-studied sites, and by group.

	Group	Studied Site		Other Grassland Sites	
		Attitudinal Valance	Evidence	Attitudinal Valance	Evidence
Attitudes	1	Positive	No discussions of changes to the site	Positive	Compensated for the loss by creating two new grassland sites in the neighbourhood.
	2			Positive	Compensated for the loss by creating new grassland sites in the neighbourhood.
	3			Positive	Attempts to preserve the large patches of grassland sites.
	4			Positive	Plan to replace houses with grassland sites.
	5			Positive	Compensated for the loss by creating new grassland sites.
Behavioural Intentions (BI)		BI Valance	Evidence	BI Valance	Evidence
	1	Positive	Remain intact.	Negative	Built over a large grassland reserve outside the neighbourhood.
	2			Negative	Built over the large patches of grassland within the neighbourhood and conserved the small patches.
	3			Negative	Built over small patches of grassland within the neighbourhood and conserved the large patches.
	4			Positive	Built a new grassland national park over existing residential houses.
5	Negative			Built over some grasslands.	

6. Discussion

The study examined children's perceptions of space in the context of place-based education. It examined the cognitive-attitudinal dispositions involved in perceiving space as 'empty'; and how students' attitudes toward one grassland site inform their attitudes and behavioural intentions when applied to spaces which are spatially and temporally remote.

The results confirm the idea that perception of 'empty space' carries a negative attitudinal valance. The findings suggest that this may create discomfort, leading to attempts to fill in the space. Though the findings are limited to a group of primary school children, they may have some implications for the conservation of natural spaces, particularly in urban areas. The study provides an additional lens for viewing the phenomenon of urban sprawl, by directing attention to the dangerous outcomes of perceiving open spaces at the urban fringes as 'empty'. Such perceptions may be responsible for eliciting the need to fill the empty spaces by building on them. From this perspective, urban sprawl may be viewed as value-driven, by which negative attitudes toward the space provide the moral legitimacy for excessive development on the fringes of cities.

The results suggest that a sense of 'empty space' is created among children primarily due to a lack of human-made structures or human activities. From an educational perspective, this highlights the need to develop educational programs which assist students in perceiving the 'fullness' of open spaces, spaces which are teeming with non-human lives and activities. By developing students' appreciation of other forms of life and activities, this sense of 'emptiness' might be reduced, leading to greater

appreciation of natural spaces. In turn, this may lead to increased comfort and a reduced need to fill in the spaces with human structures. Overall, the study directs attention to the importance of changing the attitudinal valance regarding the unbuilt environment from negative to positive, and thus increasing its value and appreciation by the public.

The implied relationship between urban expansion and perceptions of emptiness merits further investigation. Research is required for examining perceptions of 'emptiness' among adults. It would be interesting to find out what spaces they perceive as empty, and what attitudes are provoked by the perception of emptiness. Of particular interest would be to examine and compare perceptions among specific population segments such as policy makers, urban planners, and stakeholders, who take part in decision-making regarding natural spaces. One way of evaluating stakeholders' perceptions of space may be through content analysis of urban planning documents, taken from council planning committees.

The examination of the ways in which students planned to fill in the 'empty spaces' draws attention to the role of emotions in cognitive attitudinal dispositions. In many cases, students filled the spaces, merely on the basis of what they personally liked. This could range from an ice-cream shop, to sport facilities or grasslands. In the context of the present study, such feelings of 'liking' was expressed in multiple ways toward the studied grassland site. In some cases, it led students to place grasslands on sites that were perceived as 'empty'.

The findings regarding the students' future planning of their neighbourhood confirm previous reports regarding urban children's preferences [22,24,27]. Similarly, this study found that children equally value the built environment and the natural spaces in their neighbourhood. All five groups added to their maps shops, sports grounds, recreational areas, as well as grasslands of varying sizes. These findings highlight the role of children in actively negotiating space usages in their local environments [22,25,26].

In regard to the question of how students' attitudes toward one grassland site informed their attitudes and behavioural intentions toward remote grasslands, the study revealed interesting and complex relationships. The findings indicate that in regard to the studied site, there was complete alignment between the children's positive attitudes and their behavioural intentions to preserve the site intact. When moving to remote sites, this alignment became disentangled. While the students' attitudes were positive, four of the five groups were willing to forsake some of the remote grassland spaces to accommodate new houses and facilities in their neighbourhood. Only one group demonstrated complete alignment between their attitudes and their behavioural intentions.

The findings regarding the studied grassland site align well with previous findings by Eilam and Trop [40,41]. These studies compared the two constructs of attitude and behaviour between children and adults, in regard to concrete issues occurring at the present time. They found that attitudes and behaviours were highly aligned among children and considerably less so among adults. The present study reveals that this perfect alignment does not hold when children's attitudes and behavioural intentions are applied to future scenarios and are spatially remote. This temporal and spatial shifting seems to affect mainly the behavioural intentions of children. While the attitudes toward the grasslands seemed stable over time and space, the behavioural intentions were more susceptible to impact.

Similar to findings regarding adults, children in our study showed a degree of compartmentalization between attitudes and behaviours when these two constructs were applied beyond the immediate time and space. In addition, the acquired attitudes seemed more stable over time, as compared to behavioural intentions, thus confirming previous findings in regard to adults [41,54].

The implications of these findings for place-based education are two-fold. First, educators cannot assume that active citizenship and environmental stewardship will automatically emerge among children studying through the place-based approach. The development of such learning outcomes may be expected to be limited in both space and time. Second, the finding regarding the fragility of the alignment between environmental attitudes and behavioural intentions, suggests a need for the further examination of strategies for strengthening such connections over the time and space dimensions.

Finally, the present study highlights the important role of affect in creating positive attitudes toward a space, a sense of caring and a perception of the 'space's fullness'. These strong emotions led to unquestionable attachment between the students and the studied site. More research is required for examining this powerful emotional bond as a foundation for developing an extended appreciation of place beyond the concrete space and time.

The Study's Limitations

The study was conducted as a case study among a small group of primary children in years 3–5. Students in the project were volunteers from different year levels, rather than an existing classroom group. This forms a limitation in regard to the generalizability of the results. The study's results are thus generalizable to students in the selected age group who present positive dispositions toward the environment. While the study elicited insights into children's space perceptions and attitudinal transference, further research is required in order to substantiate these findings and examine the scope of generalizability to other groups of children. In addition, the discussion above highlighted the effect of age on the two constructs of attitudes and behaviour. This further limits the applicability of the findings beyond the specific age group.

7. Conclusions

The ways in which space is perceived by its viewers may have high impact on its utilization. In light of the rapid expansion of urban developments into 'empty' grasslands and other ecosystems [10,55,56], it is important to develop understanding regarding people's conception of space. Such an understanding can inform the development of future environmental education programs.

Author Contributions: E.E. and G.G. conceived and designed the educational project; the research design; and, the data collection. E.E. wrote the paper.

Conflicts of Interest: The authors declare no conflict of interest.

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