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Environmental Awareness and Its Relationship with the Concept of the Living Being: A Longitudinal Study

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Abstract: There is currently a growing theoretical discussion about the foundations that underlie the development of environmental awareness and nature care in early childhood. The aim of this study is to analyze how the environmental concerns of young children emerge and evolve during early childhood and whether these concerns are connected to an understanding of the biological notion of the living being. This study is designed to address methodological limitations of previous studies through a longitudinal axis and an extensive age sample. A sample of 178 children between the ages of four and nine participated at two different testing times for a period of one year. The methodology includes the categorization of various images of living beings and inert entities in order to analyze their understanding of living organisms. Dilemmas involving environmental, moral and socio-conventional situations are presented to examine and compare how young children view transgressions against plant life. The results reveal that young children's judgments about environmental behaviors may arise before the development of an understanding of the concept of the living being. It is therefore proposed that this type of understanding does not support environmental awareness. Previous research indicates that complex biological concepts may be successfully introduced at the preschool age, provided that suitable educational interventions are designed for the initial stages of education. In this regard, there is evidence that a basic understanding of the issue of the ecological interactions among organisms may be achieved in the preschool years.

Keywords: environmental education; concept of living being; moral development

1. Introduction

Given the progressive detrimental impact that humans are causing on the natural habitat due to various activities (fossil fuels, deforestation, urbanization, etc.) there is an undeniable recognition of the importance of environmental education in promoting attitudinal values towards ecology. Clearly, people with pro-environmental attitudes and knowledge of environmental problems are more inclined to act responsibly [1]. There is, therefore, an urgent need for further research into the mental processes involved in developing the concept of the living being [2] and environmental care [3].

The emergence, evolution, and psychological processes underlying environmental consciousness have been the subject of research in recent decades [4]. An important theoretical and methodological basis for these studies has been laid in the work on the development of normative thinking and, more specifically, in the Theory of the Moral Domain [5]. According to this theory, children aged 4–6 years possess patterns of moral thinking related to the need to maintain and promote welfare, justice and rights, and these differ from conventional thinking that depends on social rules and authority [6].

Within the line of research on the development of environmental ethics, a controversy has arisen around the following question: Do young children negatively judge behaviors that cause damage to plant life on a moral basis or do they explicitly learn that plant life deserves to be protected as yet another socio-conventional rule, for example, to keep their room clean?

Thus, it is reasonable to think that if environmental concern is acquired as a socio-conventional rule, its categorization will be valued in the same way by children [5,7]. However, different studies in early childhood hold that judgments about environmental behavior differ from socio-conventional dominance [8,9]. Moreover, other research asserts that due to the severity that children attach to actions that pose a threat to nature, they tend to place transgressions against the environment between moral transgressions and breaches of socio-conventional rules [10,11].

It seems, therefore, that environmental normative thinking implies a sophisticated understanding by children of what natural life is, since they give it greater importance than social rules [9,10]. However, previous research on the understanding of living things in childhood supports the idea that young children have significant limitations in classifying living things and inert entities [12,13]. In fact, young children attribute lack of vitality to some living organisms such as plants, and vitality to inert objects such as means of transport [14,15].

In this regard, the normative assessment of how to treat plants does not correlate with an improvement in young children's ability to distinguish living things from inert entities [8]. This may indicate that the unique ethical state that young children seem to attribute to plant life may initially emerge in early childhood and, more importantly, independently of their conceptual evolution in the biological domain [9].

This conclusion is consistent with other research that holds that children as young as three years of age make judgments or assessments on environmentally harmful behaviors which have a clear moral basis [16]. Furthermore, this idea complements previous research that has shown that childhood is not free from environmental concerns [17,18] and that the interest in preserving the environment emerges before the first conceptual development in the field of biology [8].

A problem with this theoretical discussion lies in the fact that very little research has been carried out on the emergence and development of environmental awareness in early childhood, let alone studies relating this to biological understanding and conceptual development in young children [19]. Furthermore, a constraint shared by much of the existing research is the use of cross-cutting designs to address issues of change in development. In this regard, experimental cross-sectional designs are limited in that it is difficult to make a causal inference in time since all measurements for a sample member are obtained at a single point in time.

In accordance with these ideas, this research aims to gather complementary evidence that may support the assumption that normative thinking related to plant life in early childhood develops independently of the initial understanding of the notion of the living being. To this end, a longitudinal design is proposed to examine the changes that occur, on the one hand, in the understanding of the notion of the living being, and, on the other hand, the evaluation of behaviors that damage plant life.

More specifically, the objectives proposed are the following:

1. To study how the competence of children from four to eight years old to correctly classify living and inanimate entities evolves during the period of one year.
2. To analyze whether there is any significant change after one year in the pattern of responses that the children in the sample express when classifying the most negative behavior among actions that violate moral norms, socio-conventional rules, and behaviors that harm plant life.
3. To examine to what extent the evidence collected in the above objectives is consistent with the assumption that normative thinking related to plant life in early childhood is independent of understanding the concept of the living being.

Finally, this research aims to provide new data on how normative thinking determines our behavior towards the environment and whether it relates to the biological domain of conceptual development during early childhood.

2. Method

2.1. Sample

The final sample included a total of 178 participants between the ages of four and nine. The participants were taken from two medium-sized state-run educational centers, which based in the same urban area in the province of Biscay (the Basque Country, Spain). The distance between the schools is less than three kilometers. The educational centers were chosen under the criterion of proximity and accessibility to the researchers.

For some of the analyses that follow, children are classified by year of birth in the following cohorts: Generation 2011 (20.8%), Generation 2010 (25.8), Generation 2009 (23.6%), and Generation 2008 (29.8%). 52.2% of the selected sample were female and 47.8% were male. Furthermore, this distribution remains approximately homogeneous in each generation cohort. The following Table 1 shows data on the composition of each of the above-mentioned cohorts.

Table 1. Composition of the sample according to year of birth or cohort, age, and educational level.

| Cohort | N | First Testing Time | | Second Testing Time | |
|--------|----|--------------------|---|---------------------|-----------------------------------|
| | | Age | Level | Age | Level |
| 2011 | 37 | 4–5 | Penultimate year of childhood education | 5–6 | Final year of childhood education |
| 2010 | 46 | 5–6 | Final year of childhood education | 6–7 | First year of primary education |
| 2009 | 42 | 6–7 | First year of primary education | 7–8 | Second year of primary education |
| 2008 | 53 | 7–8 | Second year of primary education | 8–9 | Third year of primary education |

The Ethics Committee for Research on Human Beings of the University of the Basque Country tracked and approved the procedure of the study (CEISH/214/2013/Villarroel Villamor). The board of directors of every school as well as the families whose children were involved in the study gave written permission to allow the children to be engaged in the research activity.

2.2. Interview

The procedure for conducting the investigation was based on a two-stage interview: a test to measure the understanding of the concept of the living being called The Living/Non-Living Distinction Test [9] and a reasoning test on environmental issues called The Environmental Judgment Test [9]. Given the longitudinal design of this research, this same procedure was carried out in two different testing sessions during a one-year period with the purpose of examining the change of the target research variables over time.

All individual interviews were conducted by the same researcher and lasted approximately 20 min. The initial contact with the students took place in their normal classroom and various steps were taken to ensure their comfort and well-being, such as the use of stuffed animals. They have been used in previous studies [20,21] with similar accommodation and preparatory sessions to support the participation of very young children in a research activity. Below is a description of the background to these phases, an explanation of the material used and the procedure followed.

2.2.1. Phase 1: The Living/Non-Living Distinction Test

The first task consists of a categorization test using images to analyze the capacities of young children to understand the biological concept of the living being and to differentiate living beings from other, inert entities. This design is in line with that proposed by Leddon et al. [12] and Villarroel et al. [9] to analyze the understanding of living and inert organisms.

During the course of the meeting, the children are given a set of eight colored images (18 × 10 cm) representing four different categories (Table 2). They are shown this first set of photographs randomly and consecutively and are asked to classify each photograph as a living or non-living being.

Table 2. List of entities shown in the Living/Non-Living Distinction Test.

| Status Category | Category | Entity |
|-------------------|-------------------|-------------------|
| Non-living things | Vehicle | Car Motorcycle |
| | Atmospheric agent | Cloud The sun |
| Living things | Animal | Dog Bird |
| | Plant | Tree Flower |

2.2.2. Phase 2: The Environmental Judgment Test

The second phase consists of the presentation of 12 images of examples of moral, socio-conventional, and environmental violations that are chosen from different educational children's literature books. Four represent moral transgressions from children's daily life; four others illustrate socio-conventional family transgressions and the last four show harmful actions against plant life. The 12 images are first presented randomly one by one, while the researcher describes the context of the image in order to ensure that children understand the meaning of the image displayed.

After finding this common approach, the same previously introduced images are used to compare two different types of transgressions, encouraging participants to choose which of the two situations presented is the most serious. More detailed information on the order of comparisons (dilemmas), situation descriptions and corresponding domains is shown in Table 3. Finally, the researcher records which of the two types of transgressions presented is considered the most serious. This method is based on Turiel's Moral Domain Theory [4,6] and follows the procedure used by Hussar and Horvath [10], Villarroel et al. [9], and Villarroel [8].

Table 3. Description of the comparisons between the different images presented in the Environmental Judgment Test.

| Dilemma | Description of the Images in Comparison | Domain |
|-----------------|---|--------------------|
| First dilemma | A boy deliberately wets another with a water hose | Moral |
| | A girl leaves her desk dirty and messy | Socio-conventional |
| Second dilemma | A girl grabs another girl by the collar with the intention of hitting her | Moral |
| | A boy hurriedly eats a bowl of soup and gets everything dirty | Socio-conventional |
| Third dilemma | A girl steals a sweater from another's rucksack | Moral |
| | A boy picks his nose | Socio-conventional |
| Fourth dilemma | Three boys laugh at a fourth who has fallen on the ground | Moral |
| | A boy farts in a library | Socio-conventional |
| Fifth dilemma | A boy hangs on a tree branch with the intention of breaking it | Environmental |
| | A girl leaves her desk dirty and messy | Socio-conventional |
| Sixth dilemma | A cartoon character is pulling up a tree with a crane | Environmental |
| | A boy hurriedly eats a bowl of soup and gets everything dirty | Socio-conventional |
| Seventh dilemma | A cartoon character is about to step on a flower | Environmental |
| | A boy picks his nose | Socio-conventional |
| Eighth dilemma | A cartoon character is pulling up a tree with a crane | Environmental |
| | A boy farts in a library | Socio-conventional |

2.3. Data Analysis

With regard to data analysis, a specific score was developed for the following dependent variables considered in the study:

- Understanding the concept of a living being: whether the entities presented in the Living/Non-Living Distinction Test were correctly classified or not. The correct classification of the two entities shown for each category is used as a criterion so that a single error in either of the two entities leads to incorrect classification of the category. Therefore, it is a discrete variable that takes an integer in the range 0–4.
- Understanding plants as living beings: whether the two entities that appear in the plants category of the Living/Non-Living Distinction Test categorization test have been correctly classified or not. It is a categorical dichotomous variable that takes two possible values: correct or incorrect.
- The Environmental Judgment Test: the total number of times in which the transgression of social norms and behaviors against plant life has been considered more serious than the breaking of socio-conventional rules in the dilemmas presented. These are two discrete variables that take an integer in the range 0–4.

Given the longitudinal nature of the present study, a repeated measures analysis based on performance was carried out in the two phases mentioned above. The Wilcoxon signed-rank test was used to analyze the relationship between discrete variables, while McNemar's test was used for dichotomous variables. The execution of non-parametric tests is given by the sample configuration that is not consistent with a normal distribution. The Pearson r parameter is used as a measure of size effect as suggested by Pallant [22] for discrete variables and the odds ratio parameter for dichotomous variables as proposed by Rovai, Parker, and Porton [23].

3. Results

The results are presented in two sections. First, the data linked to the analysis of the responses to the Living/Non-Living Distinction Test are introduced, followed by the results related to the choices made in the dilemmas of the Environmental Judgment Test.

Table 4 shows the analysis of the differences that each cohort presents between the two testing times when it comes to differentiating between living and inert beings. The improved understanding of the biological concept of the living being is statistically significant in all cohorts and the effect size recorded suggests a medium level of association between the variables.

Table 4. Statistical descriptors and non-parametric tests of the correct classification of each of the categories in the Living/Non-Living Distinction Test.

| Cohort | Test Time | Me | M (SD) | Z | R |
|------------------|-----------|----|-------------|----------|------|
| 2011 (N = 37) | Time 1 | 2 | 2.11 (0.77) | 2.61 ** | 0.43 |
| | Time 2 | 2 | 2.51 (0.65) | | |
| 2010 (N = 46) | Time 1 | 2 | 2.22 (0.66) | 2.57 *** | 0.53 |
| | Time 2 | 3 | 2.80 (0.91) | | |
| 2009 (N = 42) | Time 1 | 3 | 2.69 (0.87) | 2.52 ** | 0.39 |
| | Time 2 | 3 | 3.02 (0.87) | | |
| 2008 (N = 53) | Time 1 | 3 | 3.02 (0.93) | 3.32 *** | 0.46 |
| | Time 2 | 3 | 3.40 (0.71) | | |

Note: The answers are on a five-point scale (0–4). Me = Median M = Mean SD = Standard deviation. The Wilcoxon test is significant at ** $p < 0.01$ and *** $p < 0.001$.

In addition to this, Table 5 shows the data related to the analysis of the frequencies found when correctly classifying plants as living beings in the two testing times for each of the cohorts. The 2008

cohort is the only one with a statistically significant improvement. However, the low effect size found suggests that this data should be regarded with caution when drawing conclusions.

Table 5. Statistical descriptors linked to the comparative analysis between the two measurement sessions in relation to the correct classification of the ‘plants’ category in the Living/Non-Living Distinction Test.

| Cohort | Test Time | % | McNemar Test | Odds Ratio |
|------------------|-----------|----|--------------|------------|
| 2011 (N = 37) | Time 1 | 43 | 2.78 | 1.31 |
| | Time 2 | 57 | | |
| 2010 (N = 46) | Time 1 | 65 | 2.67 | 2.83 |
| | Time 2 | 74 | | |
| 2009 (N = 42) | Time 1 | 67 | 1.28 | 2.80 |
| | Time 2 | 76 | | |
| 2008 (N = 53) | Time 1 | 70 | 4.50 * | 4.88 |
| | Time 2 | 81 | | |

Note: The answers are on a five-point scale (0–4). Me = Median M = Mean SD = Standard deviation. The McNemar Test test is significant at * $p < 0.05$.

Children’s judgements of different dilemmas are divided into two different types, on the one hand, moral versus conventional social dominance and, on the other hand, environmental versus conventional social dominance. That is why each participant received a general score depending on the type of transgressions they consider most serious (see data analysis section for more information).

When faced with the moral and socio-conventional domains as a dilemma, statistically significant differences were found between the two measurement sessions in the different age cohorts. Table 6 shows the statistical descriptors and differential statistics linked to these types of dilemmas.

Table 6. Descriptive statistics of the comparison between moral transgressions and the violation of socio-conventional rules by each cohort in the two measurement sessions.

| Sample | Testing Time | Me | M(SD) | Wilcoxon Test Z | Pearson R |
|--|--------------|----|-------------|-----------------|-----------|
| Generation 2011 ⁽¹⁾ (N = 37) | 1 | 2 | 2.51 (1.04) | 2.36 * | 0.39 |
| | 2 | 3 | 2.84 (0.83) | | |
| Generation 2010 ⁽²⁾ (N = 46) | 1 | 3 | 2.54 (1.31) | 3.32 *** | 0.50 |
| | 2 | 3 | 3.11 (0.88) | | |
| Generation 2009 ⁽³⁾ (N = 42) | 1 | 3 | 2.88 (1.33) | 2.58 ** | 0.40 |
| | 2 | 3 | 3.33 (0.76) | | |
| Generation 2008 ⁽⁴⁾ (N = 53) | 1 | 3 | 3.29 (1.00) | 3.32 *** | 0.46 |
| | 2 | 4 | 3.49 (0.72) | | |

Note: Responses are on a five-point scale (0–4). Me = Median M = Mean SD = Standard deviation. Wilcoxon Test Z is significant at * $p < 0.05$; ** $p < 0.01$ and *** $p < 0.001$.

In relation to the dilemmas concerning the socio-conventional and environmental domains, Table 7 breaks down the analysis of the number of times that children indicate that actions involving damage to plants are more severe than the transgression of socio-conventional rules in each of the cohorts.

Table 7. Descriptive statistics of the comparison between behaviors that damage plant life and the violation of socio-conventional rules by each cohort at the two testing times.

| Cohort | Test Time | Me | M (SD) | Z | R |
|------------------|-----------|----|-------------|--------|-------|
| 2011 (N = 37) | Time 1 | 3 | 2.54 (1.07) | 1.70 | 0.279 |
| | Time 2 | 3 | 2.73 (1.08) | | |
| 2010 (N = 46) | Time 1 | 3 | 3.09 (0.98) | 2.14 * | 0.315 |
| | Time 2 | 3 | 3.26 (0.80) | | |
| 2009 (N = 42) | Time 1 | 3 | 3.14 (0.93) | 1.65 | 0.254 |
| | Time 2 | 3 | 3.31 (0.74) | | |
| 2008 (N = 53) | Time 1 | 4 | 3.36 (0.98) | 1.72 | 0.236 |
| | Time 2 | 4 | 3.51 (1.09) | | |

Note: The answers are on a five-point scale (0–4). Me = Median M = Mean SD = Standard deviation. The Wilcoxon test is significant in * $p < 0.05$.

As reflected in Table 7, young children in any of the cohorts are likely to report that harmful behaviors towards plant life are more unacceptable than the breaking of socio-conventional laws. Interestingly, this belief remains unchanged over the course of an entire year in three of the four selected cohorts, and for the 2010 cohort, the low effect size found ($r = 0.315$) indicates a weak association between the target variables.

4. Discussion of Results

The data obtained in the two tests carried out reveal three fundamental pieces of evidence that underpin the present investigation.

First, the competence of the children in the sample to correctly distinguish between living beings and inert entities improved during the year between the first testing time and the second. The results obtained in the Living/Non-Living Distinction Test show that young children clearly improved and generated more correct responses when categorizing the different identities presented into living beings and inert entities. These results are consistent with other research highlighting the fact that children's understanding of the concept of being alive gradually evolves [12,13].

Second, despite the improvement in understanding the concept of the living being mentioned in the previous point, the data collected around the plant category show no obvious progress between the first and the second testing time. This point might be in line with the assumption that the improvement the children in this study experience in terms of the concept of the living being is not linked to their better understanding of plants as living beings [24]. Similar findings have been presented in previous research and it is considered that this is a consequence of the difficulties that young children find when it comes to attaching living status to plants [8,9].

Although pre-schoolers show signs of possessing some kind of conceptual knowledge, as mentioned above, it is not until the ages of 7 to 8 that they begin to show great improvement by distinguishing plants as living beings. The development that age brings with it is a fundamental factor in achieving an understanding of the concept of the living being, and more specifically, in understanding that plants are beings with vitality and not mere inert objects [14]. In general, this information supports the hypothesis that the conceptualization of living things in young children is far from being fully understood by adults [25,26].

Third, the results obtained confirm that the children in the sample almost unanimously believe that human behavior against plant life is much more serious than violations of social and conventional norms, as is also the case with moral norms. Thus, a strong parallel can be drawn between the development of the assessment of harmful behaviors towards plant life and the development of moral transgressions when compared to the breaking of socio-conventional norms. The tendency to assess this damage to plants more seriously is similar to the moral judgments expressed by students themselves when they have a choice between harmful moral behavior and the violation of social rules [16].

The data obtained in this study support preliminary research in the field of environmental policy thinking that suggests that environmental awareness begins to evolve in early childhood in a manner similar to the moral domain [8,11]. These findings are consistent with those studies that propose that environmental judgment and care for the natural world have a unique moral status from a very early stage in children's development [10,27].

Interestingly, the results obtained in the different age groups indicate that the judgment of moral transgression is developed gradually. These findings are consistent with the findings of other authors who have analyzed the moral judgments expressed by children of different age groups [7,28]. However, unlike moral assessments, no differences have been found in the development of environmental awareness over the same period of time. This issue may be the result of a greater increase in moral dominance as there are more morally based experiences in children's daily lives, while purely environmental experiences are scarcer [29].

5. Conclusions

The presented data in this study indicates that the children in the sample find it difficult to distinguish living beings from inanimate entities and this evidence leaves little room for the belief that the severity that they attach to transgressions against plant life might be founded on an initial understanding of biological concepts. Although this may seem contradictory, this idea is supported by other cross-cutting research that analyzes the relationship between environmental transgressions against plants and their biological understanding of them [8,9].

In light of this finding, we can see that an ethical view of nature may emerge before the understanding of the living being concept. Environmental concern may emerge at a very early stage of infancy and precede the understanding of biological concepts such as the distinction between living and non-living entities. Consequently, if the understanding of biological concepts does not sustain environmental consciousness, one might wonder what kind of psychological or mental process might be behind it. In other words, what is the basis for environmental judgments if biological understanding does not underlie environmental awareness when young children assess behaviors against plant life?

A potential answer to this question can be found in emerging research in the field of moral normative development that focuses on the affective and emotional component in explaining what moral decisions are based on [30]. This paradigm holds that the main components of moral judgment are a series of emotional processes rather than cognitive reasoning [31]. These intuitions are related to aesthetic appraisals that make one reflect spontaneously on any moral dilemma. This argument directly challenges the thread of historical moral research in which moral reasoning is supported by the development of cognitive skills [32].

Obviously, this theoretical paradigm is not clear and requires more detailed analysis [19]. So far, research has been very limited in terms of analyzing the connection between the development of the biological notion and environmental awareness [9]. In fact, it would be interesting to further explore this issue and to trace in future research the trajectory of environmental awareness development in other possibly relevant processes such as language development, context, and cultural diversity. Moreover, future research should focus on an extended longitudinal study to further analyze the nature of development change. While the number of testing sessions and the age of the sample should be expanded in future studies, the data obtained leads to the conclusion that young children's environmental awareness may be independent of their conceptual understanding of being alive.

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