From interdependence to pro-environmental behavior: Development and validation of the Preference for Explanations in Terms of Interdependence (PETI) scale for children

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ABSTRACT

Interdependence, a mutual dependence between entities, is a key concept to understand interactions occurring in social and natural environments. We argue that understanding social and natural phenomena in terms of interdependence could predict children's pro-environmental behaviors (PEBs). The existing literature reveals a lack of studies promoting PEBs among children. We first reviewed the literature on interdependence to demonstrate why it is a theoretically viable construct to foster PEBs in children. Second, we identified a lack of instruments to measure children's preference for explanations in terms of interdependence. Thus, in study 1, we developed and administered a 9-item vignette-based scale combining pictures and everyday situations with various explanations, the Preference for Explanations in Terms of Interdependence scale—PETI to 351 Swiss pupils (10-12 years old). Exploratory factor analysis revealed a one-dimensional structure. Analyses showed satisfying nomological and predictive validity (on self-reported behaviors). Study 2 ($N = 96$) was conducted at recreational areas and aimed at extending the predictive validity of the PETI scale to actual behaviors. Contrary to our expectations, results revealed no direct effect of the PETI score, but a significant main effect of age, and a significant interaction effect between PETI and age showing that PETI was more positively associated to PEBs for older (10-13 years old) than for younger (6-9 years old) children. Reliability analyses suggested that the PETI scale is better suited for children aged 10 and over. We discuss the utility of the PETI scale in studying the relationship between children's understanding of interdependence and the endorsement of PEBs.

Introduction

Scientists now share a wide consensus about the human impact on natural processes such as climate change (Cook et al., 2016; Lynas et al., 2021), air pollution (Jonson et al., 2017), or biodiversity loss (Johnson et al., 2017). Such acknowledgment is echoed by a call for systemic change in human behaviors at the level of states, organizations, and companies. Individuals could also help mitigate the ecological crises through the adoption of pro-environmental behaviors (PEBs, e.g., Nielsen et al., 2021) at various levels of the social and environmental systems (Amel et al., 2017). Although efforts have been devoted in the past years to study PEBs at the individual and household levels, it remains that these studies mostly targeted adults (with meta-analyses including

many more studies with adults— e.g., Bergquist et al., 2019; Nisa et al., 2019— than studies with children— (e.g., Świątkowski et al., 2024; van de Wetering et al., 2022).

In this article, we thus focus on children and introduce a potential predictor of PEBs that has received only minor attention in the environmental psychology literature, namely the *preference for explanations in terms of interdependence*. Social and natural phenomena are made of highly interconnected, interdependent actors, actions, and forces, whose complexity may be difficult to grasp. We argue that the preference for explaining those in terms of interdependence is a theoretically promising construct to be studied as a predictor of PEBs. Therefore, this article aims at developing an instrument to measure preference for explanations in terms of interdependence and exploring its potential links with

children's PEBs. Firstly, we review the main social psychological theories of interdependence, point out the lack of psychometric tools to measure such a construct in children, and argue that it is important for PEBs. Secondly, we develop and validate a scale to measure the preference for explanations in terms of interdependence among children and test if it is associated with children's PEBs.

Why should research on PEBs' promotion focus on children?

PEBs can be defined as behaviors that benefit or omit to harm the environment (e.g., Steg and Vlek, 2009). Their importance for reducing human impact on the environment notwithstanding, extant research has documented the many obstacles impeding the adoption of PEBs. Gifford (2011) compiled a list of 29 "dragons of inaction", namely factors that limit the degree to which individuals are prone to engage in PEBs. Some of them are structural, such as lack of public transport, but this author mostly referred to social psychological factors. According to Gifford (2011), these factors are both social (e.g., social norms, habits) and personal (e.g., past investments acting as disincentives, belief in free enterprise capitalism). Together, these obstacles impede the translation of environmental concerns into PEBs that could contribute to the preservation of the environment.

The essentialism of some of these arguments (i.e., conceptualizing environmental issues as due to human cognition) has already been criticized (Atkinson and Jacquet, 2022). We further propose that many of these obstacles concern adults rather than children. Indeed, most children are less impacted than adults by various sources of resistance to behavioral change, such as habits, ideological beliefs and sunk costs. Specifically, positive and negative predictors of PEBs are less likely to be firmly established among children. For example, values – biospheric ones in particular, i.e., caring for nature – are related to the understanding of complex ecological systems and their interdependence with social-economic dynamics, and have been found to be important predictors of PEBs (Malone et al., 2010; Steg, 2023). However, although relatively stable among adults, values are still evolving throughout childhood (Döring et al., 2015; Uzefovsky et al., 2016; Vecchione et al., 2020).

A recent meta-analysis, however, showed that surprisingly little research on PEBs promotion has targeted children (Świątkowski et al., 2024). Many interventions focused on knowledge transmission, yet research has provided strong arguments to support the view that knowledge on its own is insufficient to enhance long-term behavior changes (Ajzen et al., 2011; Boyes et al., 2009). Heeren and Singh (2016) suggested that educational institutions should focus on factors that more effectively translate into behaviors, such as social norms, perceived behavioral control, or attitudes (Ajzen, 1991). Other authors also argued for focusing on factors as diverse as agency (Walsh and Cordero, 2019), holistic experiences (Stern et al., 2014), or the relationship between humans and nature (Bonnett, 2007). Overall, it seems that many researchers call for diversifying interventions fostering PEBs, especially interventions and educational training that target children's pro-environmental behaviors.

What is interdependence and why might it be linked to children's PEBs?

We argue that children's engagement in PEBs may be related to their proclivity to explain the social and the natural world in terms of interdependence. An early definition of interdependence drawn from Gestalt theory is that entities in a field are mutually dependent elements that form a system (Koffka, 1935). Entities can be people, commercial actors, organisms, so that this definition is general enough to concern several contexts (social, economic, environmental). Therefore, this definition

may apply to people in a group, international economic exchanges, living organisms in an ecosystem, or forces in a weather system. We propose that explaining the social and the natural world in terms of interdependence – i.e., in their systemic complexity – should enable children to understand the various levels of interconnections between individuals, groups, populations, and ultimately the natural environment. Henceforth, understanding the interdependent relations within human systems, but also larger living and non-living systems, should enable children to understand how their own and others' behaviors impact the environment, and how the environment impacts them in return.

The Social Identity Model of Pro-Environmental Action (Fritsche et al., 2018) argues that PEBs proceed from group processes, in particular social identity, in that environmental issues, problems and crises (1) may only be fully understood if represented as collective phenomena (they result from the joint action of billions of people), and (2) may only be acted upon if one's action can be represented as coordinated with that of others (no single person can have an impact on the environment). Thus, we argue that understanding interdependence in different systems is likely to create an understanding of environmental issues as the result of collective impact, and addressable by coordinated collective action.

Interdependence in psychological literature

The definition of interdependence provided above allowed us to argue for its role in the adoption of PEBs by children. However, as we delve into the relation between interdependence and PEBs, we need to be more precise on what is meant by interdependence. Indeed, the notion of interdependence has received a wealth of definitions from a wide range of theories that we review below. The following literature review clarifies our conceptualization of interdependence in this article, in comparison with the definition of interdependence used in other theoretical fields, and pinpoints why our conceptualization is relevant to environmental issues and children.

Interdependence as goal structure

Early research on interdependence focused on small-group dynamics and studied goal interdependence as a set of structural dependencies between group members' motivations (Deutsch, 1949; Johnson and Johnson, 1989). Positive goal interdependence occurs when members can attain their goal only if their partner(s) also attain their goal. This situation enables promotive interactions owing to compatible interests. On the contrary, negative goal interdependence occurs when members can attain their goal only if the other(s) do not attain their goal (Butera et al., 2024). This situation generates oppositional interactions because of incompatible interests. Thus, goal structure determines the interaction patterns (i.e., which actions are efficient or counterproductive to achieve the goal), which in turn determine the outcomes of the situation.

Based on this distinction, classic social interdependence theory associated positive interdependence with cooperation, negative interdependence with competition, and individualistic efforts with independence (Van Lange and Balliet, 2015). The theory was extended by creating a taxonomy of social interdependence situations (Kelley and Thibaut, 1978; Thibaut and Kelley, 1959). Drawing on this literature, Van Lange (1999) extended the study of goal structure and conceptualized interdependence as a dispositional orientation. Specifically, Van Lange (1999) differentiated between pro-social orientation (interest for maximizing joint outcomes and equity of outcomes), individualistic orientation (interest in maximizing own outcomes), and competitive orientation (maximizing the gap between own's outcomes and others' outcomes).

Interdependence as cultural self-construal

Interdependence is also a core component in major frameworks that attempted to account for cross-cultural variations between Westerners and Asians, such as the individualism-collectivism spectrum (Oyserman et al., 2002)[1]. Individualism and collectivism are cultural orientations to favor either self or collective interest (Rusbult and Van Lange, 2003). In collectivist cultures, individuals are more likely to see themselves as interdependent with their ingroups, prioritize in-group over personal goals, and pay more attention to context while making attributions. Contrarywise, people from individualist cultures tend to see themselves as independent, prioritize personal over collective goals and make more dispositional rather than situational attributions (Triandis, 2001).

In a similar vein, Markus and Kitayama (1991, 2010) used the interdependence-independence spectrum as a characteristic of self-construal. They distinguished between two types of the self. Individuals with an independent construal of the self (independent, autonomous, focused on oneself) and people with an interdependent construal of the self (inherently connected with others). For the latter, interdependence is experienced in interpersonal relationships, and is contextualized and described in relation to others or specific situations.

Interdependence as a mindset

Finally, according to systems thinking theory, interdependence is essential to understand variations in terms of systems of thought (Hamamura and Bettache, 2018; Nisbett et al., 2001). On the one hand, analytic cognition defines an orientation to focus on objects in terms of categories, separately from the context. On the other hand, holistic cognition is a tendency to appraise an object by reasoning in terms of relationships between the object and the field. The holistic perception of the world as a dynamic whole is also a core aspect of systems thinking. It is a cognitive tendency to interpret phenomena as a set of interconnected components creating a dynamic whole (Randle and Stroink, 2012). Systems thinking should foster a better understanding of complex environmental dilemmas, such as resource management (Bosch et al., 2007; Davis and Stroink, 2016).

Interdependence and attribution

However rich and differentiated, the above literature reveals that the extant psychological research on interdependence does not address the question of how individuals treat interdependence in their *social and natural* environment, let alone the question of how one could measure such a complex construct in children (see Table S1, for a schematic summary of the above literature review). To develop our tool, we relied particularly on social interdependence theory and systems thinking theory, as they are more relevant to our purpose to measure the extent to which children interpret the world in terms of social and natural interdependencies.

We sought to develop an original scale assessing the extent to which children see their social and natural environment as a field made of interdependent actors and actions. The research field that seems highly

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[1] The nature of the relationship between individualism-collectivism, cognition, and self-construals varies in the literature (Vignoles et al., 2016). Many scholars argue that research should go beyond the dichotomy of individualism-collectivism and interdependence versus independence. Indeed, some scholars recommend paying attention to the degrees of interdependence and independence. For example, Uskul and colleagues (2008) showed that communities varying in degrees of social interdependence vary in holistic tendencies, despite living in the same geographic, linguistic, and ethnic area. Vignoles and colleagues (2016) also reject the dichotomy between independence and interdependence and argue that there are multidimensional ways of being interdependent or independent.

relevant in addressing such an issue is that of attribution. Research on attribution seeks to understand how individuals explain social phenomena and the impact of those explanations on outcomes such as self-regulation and relations with others (e.g., Heider, 1958; Weiner, 1985). Importantly, attributions have been thoroughly studied in educational settings with pupils and students (e.g., Abramovitch and Freedman, 1981; Brun et al., 2021; Friedberg and Dalenberg, 1990). Classical research from this literature addressed questions such as how dimensions of locus of causality, controllability, and stability intervene in causal beliefs held by students and how such beliefs impact on their motivations and emotions (e.g., Graham, 1991). Locus allows actors and observers of an event to attribute the cause of the event to personal dispositions or to situational influences; controllability refers to whether or not volition intervenes in the emergence of an event; and stability pertains to the duration of a cause (Weiner, 1985). Locus is particularly important for the present work, as external, situational attributions signal that an observer may be considering the multiplicity of forces that determine behavior, and not just internal dispositions.

This literature has been very prolific and has shown that the way individuals, including children, explain phenomena and events has an impact on their emotional, cognitive, and behavioral reactions (e.g., Brun et al., 2021). Measuring attributions typically involves choosing between several alternative explanations to account for the same event. We drew from this methodology and tailored it for the purpose of the present research: We sought to frame explanations in terms of interdependence (vs. independence) to assess how children would explain events. In other words, we sought to devise a measure of children's preference for explanations in terms of interdependence.

The present research

We conducted two studies to develop and validate a scale of preference for explanations in terms of interdependence adapted to children. We created a vignette-based scale combining pictures and everyday situations with various explanations of these situations. The scale aims at assessing the Preference for Explanations in Terms of Interdependence (henceforth, PETI) in children. In study 1, we assess the psychometric validity of the scale (see Scale Evaluation). We also test the hypothesis that children's preference to explain phenomena in terms of interdependence is positively correlated with the extent to which they report engaging in PEBs. Study 2, conducted at recreational areas, further extends the validity of the scale, explores the impact of children's age, and tests predictive validity with actual instead of self-reported PEBs.

For each study, sensitivity analyses assessing the sample size, data exclusions, all manipulations and measures are reported in the method sections of this manuscript. These studies were not pre-registered. The data, syntax, materials and SOM for the two studies are available at https://osf.io/b3hqz/?view_only=77af67820e9d4d5eb0f4d1bf3c03ca4d

Study 1

The aim of Study 1 is to develop and validate an instrument to measure preference for explanations in terms of interdependence.

Scale Evaluation

Thus, we developed the PETI scale and proposed it to the participants along with a series of other constructs, with the purpose of evaluating the PETI scale's nomological validity. We made the following operational hypotheses:

(H1) Scores on the PETI scale should positively correlate with perceived interdependence with nature. Indeed, both measures are related to interdependence, as interdependence with nature has items that directly refer to interdependence with one's environment

(e.g., reversed item: My personal welfare is independent of the welfare of the natural world.)

(H2a) Scores on the PETI scale should positively correlate with universalism values and (H2b) negatively with power values. Understanding the world in terms of interdependence should be positively associated with universalism, which reflects understanding, appreciation, tolerance, and protection for the welfare of all people and for nature (Döring et al., 2010), that is self-transcendence values. It should be negatively associated with power values, which on the contrary are self-enhancement values.

(H3a) The PETI scale should positively correlate with the inclusion of close peers, (H3b) humans, and (H3c) nature in the self. As the systems-thinking literature suggests, attributing events to interdependence should highlight the interconnections in the world, at different levels.

(H4) Scores on the PETI scale should positively correlate with high perceived intergenerational responsibility for the preservation of the environment. Attributing events to interdependence should highlight the interconnections in the world, but also across time and generations.

(H5) Scores at the PETI scale should be positively related to self-reported PEBs. Because understanding the world in terms of interdependence should lead children to understand that the state of the environment has an impact on them, and that their behaviors impact the state of the environment, they should be motivated to protect it.

As is good practice, we also considered age and gender as control variables, but we had no specific hypotheses.

We assess the properties of the PETI scale based on Boateng and colleagues' (2018) recommendations. Therefore, we use their cut-off criteria (SRMR $\leq$ .08; RMSEA $\leq$ .08; TLI $\geq$.90, $\alpha \geq$ .70).

We test dimensionality, with an exploratory factor analysis to establish the structure of the scale. To test reliability, we assess the internal consistency of the scale with Cronbach's alpha and Mcdonald's omega. We provide the α as readers are usually more familiar with this indicator, but the literature strongly recommends using the ω instead (Béland et al., 2018). We also conduct a test-retest correlational analysis and a t-test to assess the consistency of the scale. As for tests of validity, to assess convergent validity, we use correlations with the instruments presented in the Methods section, namely interdependence with nature, inclusion of the self, values priority, and intergenerational responsibility for the preservation of the environment. We interpret coefficients following Cohen's (1988) guidelines. We also explore the predictive validity of the scale regarding PEBs by testing whether scores on the PETI scale are statistical predictors of PEBs scores (Cohen, 1988).

Scale Development

Developing instruments for children requires cautionary measures. Item-wording must be accessible, the number of response choices limited, and the response format adapted to children's age (Mellor and Moore, 2014). Bearing such constraints in mind, we decided to use pictures in addition to text in our scale. Using picture-based instruments captures interest and attention more easily than standard, text-based support (Döring et al., 2010). More importantly, scales using pictures are especially useful to capture complex constructs that otherwise could be hardly measured in children with text, such as pain (Tomlinson et al., 2010) or values (Döring et al., 2010). It can also help overcome language or reading comprehension difficulties.

Developing instruments for children also begs the question of the target age. We decided to conduct the validation study with children in 5th and 6th grade (10 – 12 years of age) for two reasons: (1) compared to adolescents and older peers (Krettenauer et al., 2020), they are more likely to engage in long-term PEBs (Zelezny, 1999); (2) they are old enough to understand the concept of interdependence because, from a developmental perspective, they should be capable of decentering and perspective taking (e.g., Urberg and Docherty, 1976).

Domain Identification. Our literature review highlighted that an appropriate instrument measuring the preference for explanations in terms of interdependence in children – at least in languages that were accessible to us (English, French and Italian) – is lacking (see above and Table S1). Therefore, the development and validation of an original scale filling this gap was warranted. The PETI scale described below is designed to assess children's dispositional preference for explanations in terms of interdependence. Some authors argue that interdependence covers several subdimensions (Van Lange and Balliet, 2015; Vignoles et al., 2016). However, since we were interested in the extent to which children refer to interdependence when interpreting various situations, we chose to focus on the aforementioned general definition drawn from Gestalt theory (that entities in a field are mutually dependent elements that form a system; Koffka, 1935) and explore it in different situations. Thus, we conceptualize our scale as measuring a unidimensional construct in various situations.

Item generation. The research team aimed to cover various daily situations which children could interpret in terms of interdependence or independence. We considered different entities of interdependence, either people, both primary groups (such as family or friends) and secondary groups (such as one's village inhabitants), or the environment (such as animals and plants). We also considered various sources of interdependence, including personal experiences, descriptive beliefs, and prescriptive beliefs. We then proposed situations varying on those two aspects.

The generated items were the starting point that provided the semantic basis for developing a visual support adapted for children. The team then worked with a visual artist who developed nine black-and-white, gender-neutral pictures. The pictures depict ordinary, daily-life situations, such as a classroom trip, asking for an eraser, or doing groceries, and is accompanied with a short description presenting the situation and the child's action in a way that can be relevant to social interdependence (e.g., a situation where the child decides not to ask for an eraser), economic interdependence (e.g., choosing which type of apple to buy) or environmental interdependence (e.g., a family decides to take bicycles instead of the car; see Appendix for the scale with all the pictures). Each situation comes with four possible explanations accounting for the child's behavior. Among the four explanations, two refer to interdependence – between people, communities, organisms, or economic transaction—(e.g., relative to the above examples, "you do not want to interrupt another pupil"; "you do not want to buy products that come from afar if you have them in your region"; "the bicycles are silent, therefore you will not disturb the neighbors". The two others possible explanations rely on independence (e.g., relative to the above examples, "it is easier to cross out instead"; "you do not want to be disappointed by the apples you do not know"; "cycling requires physical activity and allows to stay in shape"). The interdependent explanations always involve (consequences for) entities other than the child in the decision-making. The independent answers are always centered on the child. Since this scale is intended for children, we tried not to overmultiply the number of items, and considered that these nine items allowed us to assess a sufficiently wide range of situations and entities.

Because we were interested in the extent to which children prefer interdependent rather than independent explanations, we decided to use a ranking system of the possible explanations. The ranking systems allowed us to measure the children's preference between the four possible explanations. Therefore, children were asked to rank the four explanations according to their preferences by linking them to more or less happy smiley faces. We calculated a score for each item according to the ranking position of the two interdependent responses. The more

interdependent answers were preferred (by linking them to the happiest smileys), the more points were scored. If an interdependent explanation was ranked in first position (i.e., it was linked with the most smiling face), four points were scored. Three points were scored if it was ranked in second position, two points for the third position, and one point for the fourth position. Stated differently, children's scores vary from three (the two interdependent explanations have been ranked in the last and before-last positions and get respectively 1 and 2 points) to seven points (the two interdependent explanations have been ranked first and second and get respectively 4 and 3 points) per item. The score for the whole scale is the average of the scores obtained for each of the nine pictures. The higher the score, the greater the preference for explanations in terms of interdependence.

Self versus other attributions. We created two versions of the scale to control whether asking children to make self-attributions (explain their own behavior, e.g., "you are looking for a present for your little cousin") or other-attributions (explain another child's behavior, e.g. "the character is looking for a present for their little cousin") made a difference (Jones and Nisbett, 1971). Indeed, these authors have fueled a long-lasting debate regarding people's tendency to attribute their own performance to situational factors, and others' performance to dispositional factors. Such difference is not directly relevant in the present research, as attribution does neither concern performance neither internal/external causes strictly speaking (but rather causes involving or not interdependence); however, to be on the safe side, both versions were created. In the "actor" version (self-attribution), children are asked to imagine they *are* the child represented in the picture. In the "observer" version (other-attribution), children are asked to give reasons explaining the behavior of the child represented. For each version, wordings of the descriptions and the four explanations were adapted to the 1st or the 3rd person accordingly with the version.

Method

Participants

Participants were 5th and 6th graders from various schools situated in two French-speaking cantons in Switzerland. They participated in a larger project aimed at developing a pedagogical intervention fostering PEBs in children[2]. The study was approved by the authors' university ethics committee, both cantons' research committees, the schools' principals, the teachers, the parents, and the pupils. The first cohort of pupils ($N = 363$) participated during the school year 2019–20. They belonged to 18 classes. Initially, there were seven 5th grade classes ($N = 134$) and 11 6th grade classes ($N = 229$). Since the schools were closed due to the COVID-19 lockdown, six classes abandoned the project. Twelve classes remained ($N = 220$), but three teachers did not return the legal authorizations to use the children's data and so they were removed from the analyses. Therefore, we obtained a final sample of $N = 164$ for the first cohort. A second cohort of different pupils ($N = 198$) participated during the school year 2020-21, when schools re-opened. They were enrolled in 10 classes. There were four classes of 5th grade ($N = 80$)

Table 1
Descriptive statistics of the sample (Study 1).

	1st cohort		2nd cohort	
	Classes	Pupils	Classes	Pupils
Initial	18	363	10	198
5th grade	7	134	4	80
6th grade	11	229	6	119
Total after attrition	9	164	10	187
% of females after attrition		49.39		47.37
M_{age} after attrition		10.99		11.03

and six classes of 6th grade ($N = 119$). All teachers returned the legal authorizations. Some pupils were absent for one of the questionnaire completions, hence the final sample of 187 pupils for the second cohort (see Table 1). In sum, the final sample was $N = 351$ (153 girls, 163 boys, and 35 who did not indicate their gender) who completed the reported measures. The mean age was 11.01 years, $SD = 0.67$. The original nature of this study, combined with limited resources due to the COVID-19 lockdown, implied a convenience sample. We conducted a sensitivity analysis ($\alpha = .05$, power $= .80$, $N = 351$) and showed that our design was sensitive to detect a small effect size ($\eta^2_p = .02$).

Survey administration. The scale was presented in a paper-and-pencil questionnaire[3] with measures detailed below. As our population is French-speaking we created and tested the scale in French (even though we provide a translation in English[4]). The questionnaire was administered by the teachers of each class. Pupils completed the questionnaire at the beginning of the school year (pre-test measure). They filled the same questionnaire – with additional questions – at the end of the school year (post-test measure). Participants from the school year 2019-20 did not fill the post-test questionnaire because schools were shut down due to COVID-19 restrictions.

Instruments

To assess the PETI scale's convergent, divergent, and predictive validity, we included the following instruments. The intercorrelations across all measures are presented in Table 2.

Interdependence with nature. We adapted the scale of connectedness to nature (Mayer and Frantz, 2004), which measures the extent to which people feel emotionally connected to and feel being part of the natural world. We translated the scale and kept 9 items out of 14, as the other five were not relevant for children. This scale had not yet been validated with children. Each item (e.g., "I feel connected to the Nature that surrounds me") was presented on a 4–point Likert scale (ranging from "*Absolutely not true* (1)" to "*Absolutely true* (4)"), with the possibility to choose the option "I do not know/I do not want to answer". We averaged

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[3] Although research shows that graphical scales provide good results, especially with children (Brauner, 2023; Döring et al., 2010), smileys could be subject to social desirability effects, To avoid such effects, the instructions were explicit about the fact that researchers were interested in children's actual thoughts and not what they thought researchers were expecting. The written instructions before the PETI scale started with "Explain your preferences". We gave an example before the scale with a random situation "i.e., you're out for a walk on a summer's day and you're very thirsty. You'd like to have a Popsicle, but you don't ask because….." and then four possible explanations in the same format as the PETI scale, but mentioning "if it is your 1st favorite reason" next to the happiest smiley, "if it is your 2nd favorite reason" next to the smiley below and so on. Teachers also orally stated that children should answer according to what they actually believe.

[4] We used a translation/back-translation method to turn the scale from French to English. We asked two bilingual colleagues to each do one part of the process. One was provided with the French version of the scale and translated it in English. We then gave the English version to the second colleague who translated it back in French. Overall, the two versions were equivalent, and we made a few adjustments to the English version to improve fit.

Table 2
Intercorrelations matrix (study 1).

		PETI	Interdependence with nature	Inclusion in the self - close ones	Inclusion in the self - humans	Inclusion in the self - nature	Inter-generational responsibility	Purchases PEBs	Waste PEBs	Energy PEBs	Water PEB	Universalism value 1	Universalism value 2	Power value 1
1	PETI	1	2	3	4	5	6	7	8	9	10	11	12	13
2	Interdependence with nature	0.31***												
3	Inclusion in the self – close ones	-0.01	0.13**											
4	Inclusion in the self - humans	0.04	0.12*	0.29***										
5	Inclusion in the self - nature	0.21***	0.44***	0.08	0.21***									
6	Inter-generational responsibility	0.06	0.16*	0.12*	0.00	0.08								
7	Purchases PEBs	0.35 ***	0.30***	-0.03	0.00	0.34***	0.16**							
8	Waste PEBs	0.23***	0.28***	-0.01	-0.05	0.21***	0.03	0.40***						
9	Energy PEBs	0.32***	0.30***	-0.04	-0.02	0.23***	0.15	0.44***	0.37***					
10	Water PEBs	0.22 ***	0.23***	-0.03	-0.01	0.17**	0.12*	0.24***	0.25***	0.30 ***				
11	Universalism 1	0.22 ***	0.01	-0.03	0.04	-0.05	-0.01	0.10	0.08	0.17 **	-0.02			
12	Universalism 2	0.33 ***	0.23***	-0.03	-0.04	0.33***	0.03	0.34***	0.23***	0.21 ***	0.25 ***	0.01		
13	Power 1	-0.30 ***	-0.28***	-0.03	-0.02	-0.28***	-0.02	-0.24***	-0.25***	-0.19 ***	-0.13 *	-0.22 ***	-0.38 ***	
14	Power 2	-0.26***	-0.07	-0.18*	0.06	-0.07	-0.09	-0.11*	-0.14*	-0.13**	-0.12 *	-0.18 **	-0.16 **	0.24***

Note. All measures refer to the pre-test questionnaire. PETI = Preference for Explanations in Terms of Interdependence; PEB = Pro-Environmental Behavior (self-reported); Universalism 1 = to make friends with strangers; Universalism 2 = to take care of Nature; Power 1 = to be rich and powerful; Power 2 = to be the boss. * $p < .05$; ** $p < .01$; *** $p < .001$.

the nine items to obtain a scores for Interdependence with nature ($M =$ 2.95 $SD = 0.55$, α = .71, ωh = 0.73, ωt = 0.85).

Inclusion in the self. We used the technique developed by Aron et al. (1992) in the same way as Davis and colleagues (2009) did: They adapted it to measure the degree of inclusion of close peers (e.g., "choose the image below that best describes your relationship with the people closest to you (friends, family, peers)"; $M = 4.30$, $SD = 0.86$), humans ($M = 2.92$, $SD = 1.02$), and nature ($M = 3.78$, $SD = 1.03$) in the self. This scale had not yet been validated with children. Each of the three items presents a series of five paired circles (one for the self, one for the other entity) with increasing overlap. Participants choose the one that best represented their relationship with the entity. The greater the overlap, the greater the inclusion in the self.

Values priority. We used the validated picture-based value survey for children (PBVS-C) developed by Döring and colleagues (2010), based on Schwartz and colleagues' framework (Schwartz, 1992; Schwartz et al., 2010). Participants were given a series of stickers, each with a drawing and a short text representing a value. The children were instructed to stick the drawings on a hierarchical grid, from the most important to them to the least important. Each value thus received a score between 5 (most important) and 1 (least important), which therefore indicated the extent to which each value is a priority for the child. Children ranked all values on the grid but we were actually interested in the ranking of two specific values. First, the value of universalism, composed of two pictures: "to make friends with strangers" ($M = 3.00$, $SD = 0.80$) and "to take care of Nature" ($M = 3.52$, $SD = 0.96$). Secondly, the value of power, composed of "to be rich and powerful" ($M = 2.12$, $SD = 1.31$) and "to be the boss" ($M = 1.99$, $SD = 0.78$).

Intergenerational responsibility for the preservation of the environment. We assessed perceived intergenerational responsibility through three items. Participants ranked how much they believed different generations (their own, their parents', and their grandparents') have the responsibility to act for the environment (e.g., "It is my generation's responsibility to act for the environment"; Sarrasin et al., 2022). This scale has not been validated with children. Each item was presented on a 4–point Likert scale, ranging from *"Absolutely not true"* to *"Absolutely true"* with the possibility to choose the option "I do not know/I do not want to answer". We recoded each item dichotomously (1 if the response was ≥ 3; 0 if ≤2), to represent whether participants attributed the targets some responsibility or not. Then, we summed the three items; therefore the higher the score, the higher the perceived joint responsibility ($M = 1.83$, $SD = 0.97$, α = .49, ωh = 0.05, ωt = 0.55).

Self-reported pro-environmental behaviors. We adapted the 25-item scale developed by Krettenauer (2017) to the Swiss context (for the full scale in French, see Supplementary Online Material (SOM) 1). Each item was presented on a 6–point Likert scale, ranging from *"I never do this"* to *"I always do this"* with the possibility to choose the option "I do not know/I do not want to answer". This scale has been used in one of Krettenauer's study with children ($M_{age} = 12.12$) but not formally validated. Because of the modifications, we tested if we obtained the same structure and performed a principal component analysis (PCA) with an oblique rotation (oblimin). KMO index (.84) and Bartlett's test of sphericity, χ^2 (300) = 1130.849, $p < .001$ confirmed the sampling adequacy for the analysis. An initial analysis displayed seven components with eigenvalues above 1. However, the scree plot justified retaining four components, in line with the literature (see SOM2). Thus, we retained four components.

After rotation, we obtained four clusters, which differed from the original scale. The structure suggested that component 1 represents behaviors concerning purchases (7 items, e.g, "at the store, I insist on buying products with little or no packaging", α = .85, ωt = 0.90, $M = 3.29$, $SD = 1.24$), component 2 represents behaviors concerning waste (6 items, e. g., "I always dispose of paper and cardboard waste in the appropriate garbage cans", α = .70, ωt = 0.75, $M = 4.74$, $SD = 0.92$), component 3 represents behaviors concerning energy conservation (5 items, e.g, "I turn off the TV or computer screen when I'm not using it" α = .62, ωt = 0.72, $M = 4.45$, $SD = 0.94$) and component 4 represents behaviors concerning water usage (2 items, e.g, "I turn off the tap when I brush my teeth", α = .39, Spearman-Brown ρ = 0.45, $M = 5.24$, $SD = 1.05$). This last component has less theoretical meaning and internal validity, which is not surprising as it is composed of only two items. For each component, we created a composite score by averaging answers to the respective items. Higher scores represent more PEBs.

Results

Preliminary analyses

The following analyses were conducted on the pre-test questionnaire (as noted above, some children did not fill in the post-test.) First, we centered the Peti scale to allow for interaction analyses and we conducted a Welch's *t*-test and a Pearson chi-square to check whether pupils confronted to each version of the PETI scale differed in age and gender. Pupils who filled the "Observer" version were slightly younger ($M = 10.88$, $SD = 0.66$) than pupils who filled the "Actor" version ($M = 11.17$, $SD = 0.66$), $t = -3.81$, $df = 303.97$, $p < .001$. There were more girls in the "Observer" group ($N = 89$) than in the "Actor" group ($N = 64$), whereas the difference was smaller for boys (respectively $N = 83$ and $N = 80$), but the difference was not significant, χ^2 (1) = 1.39, $p = .238$. Then, we verified whether pupils differed between the two cohorts (between the school year 2019-20 and 2020-21). They did not significantly differ in age, $t = -0.52$, $df = 312.99$, $p = .606$, nor in gender proportions, χ^2 (1) = 0.06, $p = .805$.

Moreover, we analyzed whether pupils within the "Actor" version ($N = 157$) and pupils in the "Observer" version ($N = 194$) differed in their responses at the PETI scale. The questionnaire version yielded no statistically significant effect on the PETI score, $t(309.52)= 1.14$, $p = .257$. We then tested whether the questionnaire version mediated the impact of PETI on PEBs. We obtained no statistical effect for any of the PEBs subdimensions ($B = [0.02;0.21]$, $SE = [0.14;0.19]$, $p = [.268;.907]$). Finally, again as far as the PETI score was concerned, we tested the effect of age and gender. A linear regression displayed no effect of age ($B = 0.01$, $SE = 0.06$, β = 0.01, $p = .903$) and a significant effect of gender ($B = 0.30$, $SE = 0.08$, β = 0.21, $p < .001$) on the PETI score. This suggests that girls on average scored 0.30 points higher than boys at the PETI scale. Consequently, in the subsequent analyses we merged the data of pupils from both versions and cohorts, and we controlled for gender when necessary.

Extraction of factors

Second, we conducted an EFA using minimum residuals extraction (i. e., the "minres" method in the "psych" package in R). The KMO index was .78 (a "good" value; Hutcheson and Sofroniou, 1999) and all values for individual items were > .63. Bartlett's test of sphericity, $\chi^2(36) = 364.93$, $p < .001$, because significant, indicated sufficient correlations between items. The parallel analysis and scree plot justified retaining one factor (see SOM3 for the scree plot). The one factor solution provided satisfactory indices according to Boateng et al.'s (2018) guidelines

(SRMR = .05; TLI = .924; RMSEA = .049). Consequently, we considered that our scale consisted of a single factor, as intended.

Reliability

We then tested the reliability of the scale and obtained satisfying internal consistency (α = .68, $ω_h$ = 0.55, $ω_t$ = .72). Although the α value is slightly below the usual cut-off of .70, the literature suggests that $ω_t$ is a better estimator of internal consistency than α (Béland et al., 2018; McNeish, 2018).

Test-retest

We conducted a test-retest analysis between the PETI score at the beginning of the year (pre-test), and the same score at the end of the year (post-test), while considering the experimental condition designed for the broader study. However, due to the school shutdowns in 2020, we only have results at time 2 for the second cohort (N = 147). Within this cohort, we regressed the score of the PETI scale at T1, the condition and their interaction, and controlled for gender on the score of the PETI scale at T2, R^2 = .32. We obtained a significant effect of the pre-test PETI scores (M = 5.31, SD = 0.71) on post-test PETI scores (M = 5.18, SD = 0.85), B = 0.56, SE = 0.12, p < .001. We observed neither an effect of the experimental condition, B = 0.13, SE = 0.14, p = .340, nor of the interaction between PETI at T1 and the condition, B = 0.16, SE = 0.21, p = .463, nor of gender, B = 0.08, SE = 0.14, p = .552. We also conducted a within-participants t-test, which showed that the score at T1 (M = 5.306; SD = 0.71) does not differ from the score at T2 (M = 5.183; SD = 0.85), $t(108)$=0.46, p=.649. Taking this into consideration, participants' scores seem to be consistent across time, although one should keep in mind that the sample size is rather small for the test-retest analysis.

Convergent validity

We tested our first four hypotheses by analyzing the intercorrelations matrix (see Table 2). We obtained significant correlations between the PETI scale and Interdependence with nature, r = .31. We also obtained a significant correlation, r = .22, with universalism 1 (i.e., "*to make friends with strangers*") and universalism 2 (i.e., "*to take care of Nature*"), r = .33. As predicted, we obtained a negative correlation with the values of power 1 ("to be rich and powerful"), r = -.30, and power 2 ("to be the boss"), r = -.26; see Table 2. However, we obtained a non-significant correlation between the PETI score and the inclusion of close peers in the self, r = -.01, and of humans in the self, r = .04, and a significant

correlation with the inclusion of nature in the self, r = .21. Moreover, the intergenerational responsibility towards the environment did not significantly correlate with PETI, r = .06.

Predictive validity

Correlation analysis suggested that PETI is associated with the four components of self-reported PEBs. We further tested whether the PETI scale predicted scores on the four components of self-reported PEBs controlling for age and gender. The PETI score predicted three of the PEBs components (see Table 3) thus suggesting that the PETI scale resulted as a statistical predictor of self-reported PEBs. The higher the score on the PETI scale, the higher the score on PEBs. We also analyzed whether we could observe an interaction effect between PETI and gender. We observed no interaction effect, though gender was associated with half the PEBs dimensions, with girls reporting more PEBs associated with purchases and water (see Table 3). This result demonstrates good predictive validity of the PETI scale.

Discussion

Overall, the results of Study 1 suggest a one-factor structure and good reliability of the PETI scale. The variety of everyday-life situations and the proposed explanations in terms of interdependence seem to have captured a coherent and uniform construct. As for convergent validity, the PETI scale was significantly and positively associated with a validated scale of connectedness to nature (Mayer and Frantz, 2004), H1, both items of adherence to universalist values, H2a, and negatively with both items of the power value, H2b. The PETI scale was also associated with inclusion of nature in the self, H3c (but not with inclusion of peers and humans).The correlations between PETI and interdependence with nature, values and inclusion of nature in the self were small to medium (Cohen, 1988), which is not surprising as they do not reflect the same construct. As for test-retest consistency, this analysis suggests that the scores were constant over time, even if for the post-test measure we did not have the whole sample.

However, we did not obtain a significant correlation with inclusion of peers (H3a) and humans in the self (H3b), which limits the support to H3. The items of inclusion of others in the self probably best represent the concept of interdependent self (Markus and Kitayama, 1991), rather than the preference for explanations in terms of interdependence. This could explain why we obtain a significant result only for nature, and not for peers and humans. Regarding the link between the PETI scale and

Table 3

Regressions analyses of the effect of the PETI scale, gender and their interaction on each component of PEBs (Study 1).

	R^2	B	SE	p
PEB Purchases	0.16			<.001
PETI		0.53	0.13	<.001
Gender		0.44	0.13	<.001
Age		.05	0.10	.588
PETI * Gender		0.03	0.19	.867
PEB Waste	0.06			.001
PETI		0.33	0.10	<.001
Gender		0.04	0.10	.680
Age		.09	.08	.262
PETI * Gender		-0.08	0.15	.608
PEB Energy	0.11			<.001
PETI		0.38	0.10	<.001
Gender		0.07	0.10	.522
Age		-.01	.08	.883
PETI * Gender		0.06	0.15	.683
PEB Water	0.07			<.001
PETI		0.21	0.12	.078
Gender		0.30	0.12	.011
Age		-.07	.09	.439
PETI * Gender		0.14	0.17	.391

Note. Gender coding is -1 for boys and +1 for girls. The PETI scale was centered for these analyses.

intergenerational responsibility, H4, no significant correlation was observed. As a speculative explanation, this measure was developed by Sarrasin et al. (2022) for adolescents and young adults, and it might not be appropriate for younger children. We also observed an effect of gender on the PETI scores with girls scoring higher than boys at the PETI scale. There was no interaction effect between PETI and gender on PEBs. As we had no hypotheses on gender, this result needs to be replicated and further explored with *ad hoc* studies. Furthermore, we did not observe any effect of age, which could be due to a small range of age in our sample. These results suggest that the PETI scale is not limited to the environmental domain, as we do not observe a large correlation with the interdependence with nature scale, and observe correlations in the social domain (i.e., a positive association with universalism and a negative one with power).

It should be noted that we used two different versions of the scale (i.e., responding for oneself in the actor version; or for another child in the observer version) to test whether one would be more suitable for children. We observed no differences and concluded that children were equally capable to answer in both conditions, and that both elicited the same levels of preference for explanations in terms of interdependence. As noted above, the differences between self-attribution and other-attribution studied by Jones and Nisbett (1971) are not directly relevant in the present research, and we had introduced the two versions as a form of precaution. Yet, the scale presented in Appendix assesses behaviors enacted by the self, which should be highlighted.

Finally, there is initial support for the hypothesis that the PETI scale could be a statistical predictor of PEBs, as suggested by the results on predictive validity. Scores on the PETI scale predicted to some extent the scores of three out of four factors organizing the 25 self-reported behaviors, namely behaviors related to purchases, waste, energy and conservation (but not to water usage). These results are in line with H5 and promising, but we share Lange and Dewitte's (2019) view about self-reported PEBs measures. Indeed, one cannot assume that the effects obtained in the present self-reported PEBs would generalize to PEBs frequency in real life. Study 2 was designed to address this issue using a field observation measure of PEBs. Furthermore, we further investigated the role of gender and age on children's responses on the PETI scale.

Study 2

Method

Participants

Participants were children living in the French-speaking part of Switzerland. They were recruited in recreational areas either by flyers, microphone announcements, or directly by the experimenters. We only included children who could read, and whose legal supervisor was present to sign a consent form. The legal supervisors were asked not to intervene during the experiment but were present the whole time. The sample includes 96 children aged from 6 to 13 years ($M = 9.76$, $SD = 1.93$), of which 53.13% were females. We conducted a sensitivity analysis ($\alpha = .05$, power $= .80$, $N = 96$) and showed that our design was sensitive to detect a small to medium effect size ($\eta^2_p = .08$).

Material and procedure

Firstly, children filled in a questionnaire including the PETI scale ($M = 5.19$, $SD = 0.65$, $\alpha = .60$, $\omega_h = 0.54$, $\omega_t = 0.72$; the score was later centered for the analyses) and several sociodemographic questions including age and gender. Then, the design of the study was inspired by Huffman and colleagues (2014). Two experimenters went in two local

Fig. 1. Photograph of the stand used for study 2.

Table 4
Results of the regression of Age, Score at PETI, and the interaction of age and score at PETI on the averaged recycling behavior score (Study 2).

	R^2	B	SE B	β	p
	0.12				.009
Age		0.10	0.04	0.26	.011
PETI score		-0.04	0.13	-0.03	.738
Age*PETI score		0.14	0.07	0.21	.043

recreational areas – a park and an outdoor swimming pool – and offered the opportunity to participate in a "funny challenge". Children were then asked to complete an obstacle course (e.g., go through a slalom, jump over two ropes) according to specific instructions. Each instruction (e.g., "*walking backwards*", "*keeping a ping-pong ball in a spoon*") was written on a paper sheet and placed inside a plastic bottle wrapped in a piece of aluminum. Therefore, children had to unwrap the different layers of materials to discover the instruction. While explaining the rules of the challenge to the children, the experimenters made the following comment "please, before you start the course, throw away all the waste from the packaging so we do not have to do it ourselves". While saying so, they pointed at four distinct disposal containers that were intended for recycling. Three recycling cans corresponded to one of three components used to wrap the written instructions the children received, namely aluminum, plastic, and paper. The fourth bin was for non-recyclable waste (see Fig. 1). Thus, children's recycling behaviors were the actual dependent variable of interest. The "funny challenge" was a cover story used to motivate the children to participate and to conceal the actual research interest. For each waste component and for every child, experimenters coded 1 if the waste was littered; 2 if it was disposed in the wrong can or in the non-recycling can; 3 if it was disposed to the intended recycling can. Therefore, scores could range from 1 to 3 for the aluminum waste ($M = 2.43$, $SD = 0.80$), plastic bottle waste ($M = 2.46$, $SD = 0.86$), and paper waste ($M = 2.40$, $SD = 0.86$). We averaged the three scores to create a general PEBs score ($M = 2.43$, $SD = 0.79$, α = .92). After participation, the children were thanked and gifted with a locally-grown apple.

Results and discussion

Firstly, we tested whether age or gender affected the scores at the PETI scale. As for Study 1, we observed a significant effect of gender (i.e, girls scoring higher, $B = 0.26$, $SE = 0.13$, $p < .048$, $R^2 = 0.04$) but no effect of age ($B = -0.004$, $SE = 0.03$, $p = .894$), although we had a wider range of ages. We also tested whether the date of the experiment influenced PEBs. Indeed, the experimenters noticed that some days were windier, which could have influenced the recycling behaviors (because the wastes were carried away by the wind). However, we did not observe such an effect, $R^2 = .003$, $B = -0.06$, $SE = 0.11$, $β = -0.06$, $p = .573$, perhaps because using the day of the experiment did not reflect precisely enough the impact of the wind.

Then, we analyzed whether the PETI score predicted the general PEBs score, also including gender and age as possible predictors and moderators of the effects of PETI. The inclusion of gender and age as predictors and moderators was exploratory. Gender did not yield any main or interaction effects and was trimmed from the model. The model revealed no direct effect of the PETI score, contrary to our expectations, but a significant main effect of age, and a significant interaction effect between PETI and age (see Table 4). The interaction effect showed that PETI became an increasingly positive predictor of PEBs as age increased.

The interaction effect was not predicted, but we noted above that in Study 1 we chose to work with children aged 10 to 12 because they are more likely than older children to engage in long-term PEBs and old enough to understand the concept of interdependence, because, from a developmental perspective, they should be capable of decentering and perspective taking. Thus, we decided to explore this result in greater detail, and divided the sample in two categories, corresponding to a median split: younger children of 6, 7, 8 and 9 years old ($N = 44$, $M_{age} = 8.02$, $SD = 1.02$), and older children of 10, 11, 12 and 13 years old ($N = 52$, $M_{age} = 11.23$, $SD = 1.11$). First, we recalculated the Cronbach's alpha of the PETI scale for each subgroup of children. We obtained α = .23 $ω_h = 0.32$, $ω_t = 0.70$, for younger children, and α = .73, $ω_h = 0.42$, $ω_t$
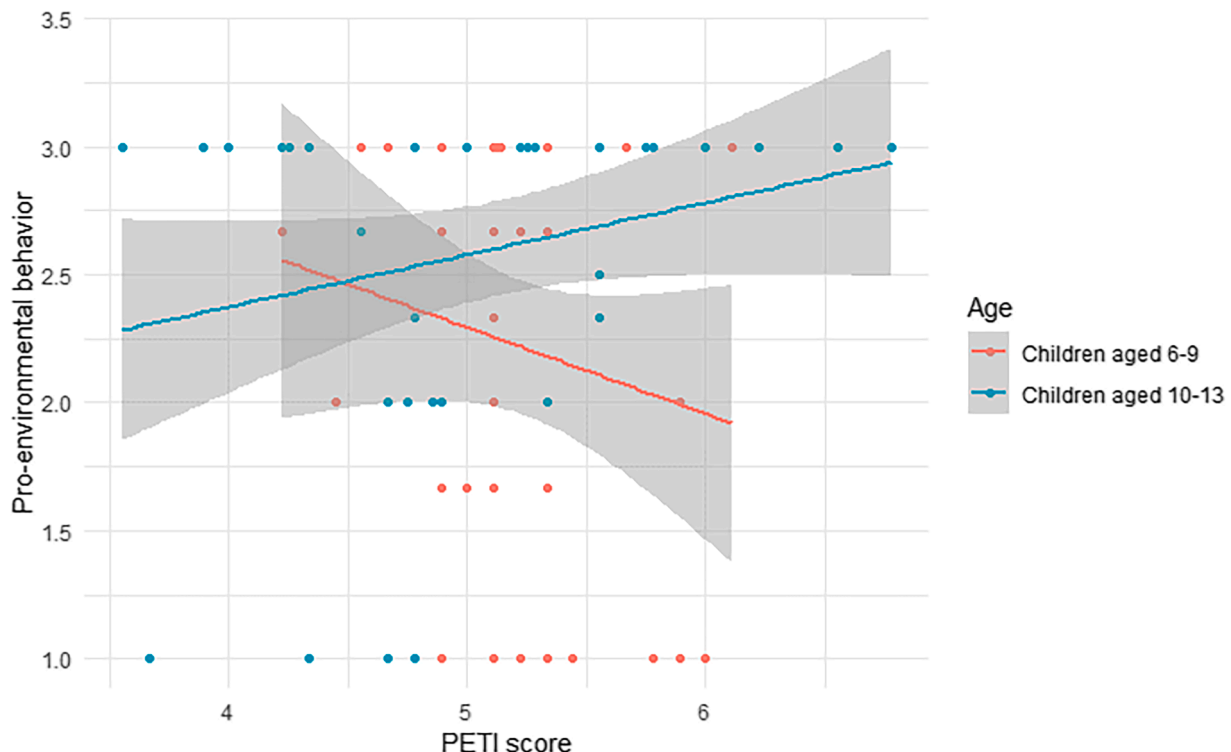

Fig. 2. Correlation between the PETI score and PEBs for each subgroup of children (Study 2).

= 0.80 for older children. Responses at the PETI scale thus resulted in a more coherent pattern for older than for younger children.

We plotted the association between PETI and PEBs for both younger and older children in Fig. 2. This Figure depicts that, as suggested by the significant PETI × Age interaction, PETI is more positively associated to PEBS for older than for younger children. To further explore the effect of PETI on PEBS in the different age groups, we tested the simple slopes in each category, for the 6-9 years old, B = -0.34, SE = .27, p = .221, and the 10-13 years old, B=0.20, SE = .12, p = .104. The significant interaction notwithstanding, the slopes are not significant, which is not surprising as the sample had not been designed for this post-hoc analysis and the sub-samples in both categories are probably too small (N = 44 and N = 52, respectively). A power analysis (with α = .05, power = .80) showed that we would need a sample of 121 children to detect the effect size observed with older children.

General Discussion

The present work grew out from the realization that explaining the social and the natural world in terms of interdependence might be a key factor in predicting the endorsement of PEBs in children. We reviewed the literature on interdependence and identified a wealth of conceptualizations of interdependence, but also a lack of tools to measure preference for explanations in terms of interdependence adapted to children. We hypothesized that preference for explanations in terms of interdependence could be instrumental to engage in PEBs, which are indeed behaviors whose efficacy requires the coordinated endeavor of multiple actors (Fritsche et al., 2018). Therefore, we created the PETI scale, containing 9 items that represent various situations of a child's everyday life that can be explained by causes involving interdependence. In study 1, we observed satisfying reliability, as well as satisfying test-retest, convergent and predictive validity. An exploratory factor analysis analysis revealed a one factor structure. In line with our main hypothesis, Study 1 indicated that the PETI score predicts self-reported PEBs among children.

In Study 2, we designed a study to measure observable PEBs. We also surveyed children of a wider range of age, from 6 to 13 years old, to determine whether our scale was adapted to younger and older children. The results revealed that the responses of the older children at the PETI scale have higher reliability as compared with younger children. A coherent preference for explanations in terms of interdependence may develop as children realize the complicated network of forces that influence most social and natural events. As mentioned earlier, perception of interdependence requires decentering and perspective taking. As with systems thinking, these mechanisms rely on children's ability to interpret phenomena in relation with their environment. It is possible that the cognitive skills required for understanding interdependence or developing a preference for explanations in terms of interdependence are not fully developed below 10 years among most children in Switzerland. If so, this could further explain why younger children act less sustainably than older children in social dilemmas (Ebersbach et al., 2019). Considering these results, it appears that the PETI scale is reliable for children starting from 10 years old and has provided good results up to 13 years old (although more research with older children would be needed to identify whether there is an upper boundary).

It is worth acknowledging that, contrary to what was hypothesized, in Study 2 we did not observe a main effect of the PETI scale on the children's PEBs. In this study we managed to observe a set of precise recycling behaviors, whereby the participating children had to throw paper, plastic, and aluminum in the appropriate bin. Although the children in our sample were quite good at recycling (they recycled more than two items out of three on average), a post hoc analysis considering the interaction between PETI and age suggested that they did so to a higher extent as they were older and as they scored higher on the PETI scale. The non-significant simple slopes do not allow us to conclude on the specific effect of PETI on PEBs in the two age subgroups, as these post hoc analyses have insufficient statistical power.

The present research contributes by providing a tool, the PETI scale, that conceptualizes interdependence at the level of interpersonal, group, and environmental relationships, instead of focusing on only one dimension. This contribution is important as preference for explanations in terms of interdependence may be a potential predictor of PEBs that could be fostered through education in the last years of elementary school. The scale uses pictures that propose everyday situations with various explanations of these situations and attributions as a proxy for preference for one type of explanations, which allow us to measure that construct among young children.

Limitations and Future Research

More research would be beneficial for delving into the properties and predictive power of the PETI scale. Firstly, one should consider the scale's ranking format that forced children to choose between different explanations. This classic format has been traditionally used to measure attributions, and indeed we were interested in children's explanation rather that what children would actually do. However, this format proposes a set of statements that may not be the ones children would have spontaneously come up with. Asking children to provide an answer could be closer to a child's actual preference, but also more cognitively demanding and difficult, especially in unfamiliar situations. Suggesting multiple explanations and asking children to select only one was also considered, but it would have probably undermined the discriminant properties of the scale. Furthermore, although we tried to use only common and familiar situations, they may not be so to every child. If the situation or the explanations suggested are unfamiliar, it is possible that the answer will reflect another construct than the PETI. This shortcoming should be especially considered if one intends to use the scale in a different cultural context. Still, the one-factor structure and the homogeneity of responses suggest that this was not a problem in the present samples.

Secondly, both studies measured the PETI scale and self-reported (Study 1) and observed (Study 2) PEBs within a very short time span. In future research, longitudinal studies could allow to clarify how children develop their preference for explanations in term of interdependence, and to what extent the PETI scale may be able to predict behaviors that are stable across time. Thirdly, the design of Study 2 was original in that it allowed us to observe actual recycling behavior in a playful way, which allowed the researchers to attract a number of children, with a greater variety of ages than Study 1. Although the present sample was sufficient to study the interaction between PETI score and age on PEBs, future research should aim at recruiting more participants in order to study in more detail the specific variations in the structure of the PETI scale and its predictive power that may depend on age. Fourthly, all our participants lived in the French-speaking part of Switzerland. This is an area where the diversity of population is significant, due to various waves of immigration; however, greater diversity in culture, countries, and language should be aimed for in future research. This is why we translated and provided here the English version of the scale (see Appendix and SOM4 for the original French version). Future studies could examine whether our results replicate both in WEIRD (Henrich et al., 2010) and non-WEIRD countries. Specifically, it would be interesting to analyze whether children from more or less collectivistic societies or with a more or less interdependent self display similar results to the ones reported here, or if they display consistent results with the PETI scale at a younger age.

Fifthly, it is often beneficial to define PEBs more finely. Thinking

about the different dimensions by which one defines PEBs allows us to understand under what conditions different predictors have an effect. It may therefore be interesting to classify behaviors according to different criteria. Among them, one could mention their effectiveness (Nielsen, Cologna, et al., 2021), their frequency (Lavelle et al., 2015), the private or public nature of the behavior (Stern, 1999), its individual or collective dimension (Ando et al., 2010), or the extent to which it challenges social order (Feygina, 2013).

Conclusions

Overall, the PETI scale shows satisfying psychometric properties among children from and above ten years old. Furthermore, it seems to be a reliable predictor of self-reported PEBs. We believe further research should analyze the impact of age and gender on this relationship, especially regarding actual (and not self-reported) PEBs. More importantly, it would be interesting to test whether some understanding and perception of interdependence can be enhanced through primary education. Indeed, if the preference for explanations in terms of interdependence is positively associated with PEBs, teaching pupils about social, economic, and environmental interdependences could be a powerful tool for Environmental Education.

Ethics statement

Study 1
The study was approved by the authors' university ethics committee, both cantons' research committees, the schools' principals, the teachers, the parents, and the pupils.
Study 2
We only included children who could read, and whose legal supervisor was present to sign a consent form.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data, syntax, materials and SOM for the two studies are available at https://osf.io/b3hqz/?view_only=77af67820e9d4d5eb0f4d1bf3c03ca4d

Appendix

Preference for Explanations in Terms of Interdependence (PETI) Scale for children. The interdependent explanations are written in bold.
You would like to erase something out, but you forgot your eraser. The student beside you has an eraser, but you do not ask them for it because:

You do not want to lose time on your exercise •   • 🙂

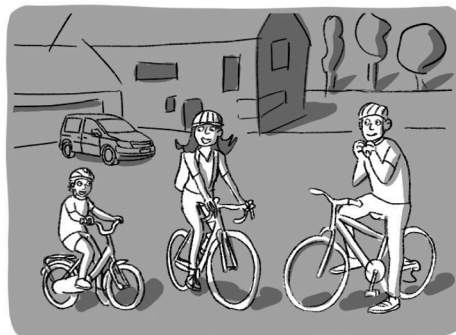It is easier to cross out instead •   • 🙂

You do not want to interrupt the student in their work •   • 🙂

It is going to create noise in the classroom •   • 😐

Your family is in front of the house. Your car is parked in front of the house, but you are getting ready to leave by bike, because:

Bikes take up little space, therefore you will be able to park it easily. •   • 🙂

**The route has a cycling lane, therefore you will not increase the road traffic** •   • 🙂

The bike does not make much noise, therefore you will not disturb the neighbours. •   • 🙂

Cycling requires physical activity and allows to stay in shape. •   • 😐

You are getting a present for your younger cousin. You find two toys, but one is bigger than the other. You propose to your parents to buy the smaller one, because

:
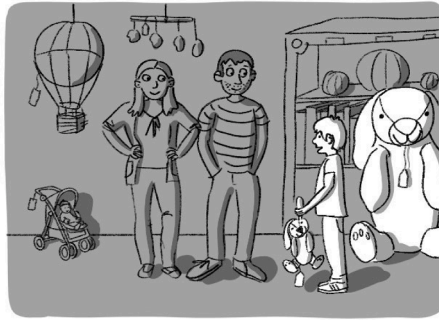
You think that your cousin will like that one better • • ☺

The production of the bigger toy requires more
material • • ☺

A smaller toy is easier to transport for you • • ☺

You think that the smaller toy is prettier • • 😐

You throw a piece paper while running past the bin, but the piece of paper falls on the ground. You pick it up and put it in the bin because:
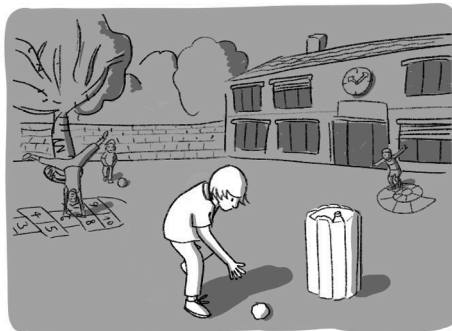
You do not want to litter • • ☺

You take the opportunity to throw it from far away as
if you were playing basketball • • ☺

It is frustrating to have missed the bin • • ☺

Otherwise someone else will have to do it • • 😐

You have put aside some clothes that are in good condition but too small and you are going to sell them at the next garage sale, because:
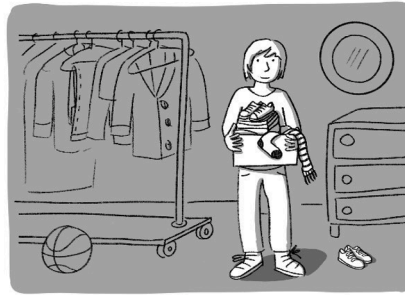
That will get you a bit of pocket money • • 🙂

**That will allow other children to buy themselves
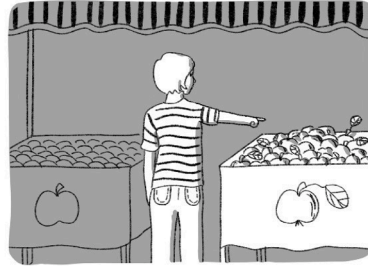clothes at a good price** • • 🙂

Last time round, you had good fun there • • 🙂

Your clothes will appeal to other children • • 😐

Your parents ask you if you want classic apples grown locally or exotic apples grown in warm countries. You choose the apples grown locally because:

**Local apples are fresher than those that come from
afar** • • 🙂

You do not want to be disappointed by the apples you
do not know • • 🙂

You love classic apples • • 🙂

**You do not want to buy produce that come from
afar if you have them in your region** • • 😐

You dropped your water bottle in the lake. You retrieve the water bottle, because:

You do not want to leave objects that are not part of nature in   •   • 🙂

the lake

You do not want to pay for a new water bottle   •   • 🙂

You do not want to disturb the animals that live in the lake   •   • 🙂

You want to keep your water bottle   •   • 😐

On a school trip, your class passes a snow-covered "caution, deer crossing" sign. You clear the sign with your hand, because:

You want to make a snowball   •   • 🙂

You want the drivers to see the sign   •   • 🙂

You want to see the sign   •   • 🙂

You think that road signs should not be hidden   •   • 😐

At the restaurant, your family has two options: an option with one fish fillet per person or an option with 4 fish fillets per person. You propose to get the 1 fish fillet option because:

To be healthy, one should eat only what their body needs •   • 😊

You want to spare some space for dessert •   • 😊

To make sure there is enough for everyone, you want to order only what you can eat. •   • 🙂

You think to yourself that if everyone eats too much, in a few years there will be no more fish in the ocean •   • 😐

References

Abramovitch, R., Freedman, J.L., 1981. Actor-observer differences in children's attributions. Merrill. Palmer. Q. Behav. Dev. 27 (1), 53–59.

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50 (2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T.

Ajzen, I., Joyce, N., Sheikh, S., Cote, N.G., 2011. Knowledge and the prediction of behavior: the role of information accuracy in the theory of planned behavior. Basic Appl. Soc. Psych. 33 (2), 101–117. https://doi.org/10.1080/01973533.2011.568834.

Amel, E., Manning, C., Scott, B., Koger, S., 2017. Beyond the roots of human inaction: Fostering collective effort toward ecosystem conservation. Science (1979) 356 (6335), 275–279. https://doi.org/10.1126/science.aal1931.

Ando, K., Ohnuma, S., Blöbaum, A., Matthies, E., & Sugiura, J. (2010). *Determinants of individual and collective pro-environmental behaviors: comparing Germany and Japan.*

Aron, A., Aron, E.N., Smollan, D., 1992. Inclusion of Other in the Self Scale and the structure of interpersonal closeness. J. Pers. Soc. Psychol. 63 (4), 596–612. https://doi.org/10.1037/0022-3514.63.4.596.

Atkinson, Q.D., Jacquet, J., 2022. Challenging the idea that humans are not designed to solve climate change. Perspect. Psychol. Sci. 17 (3), 619–630. https://doi.org/10.1177/17456916211018454.

Béland, S., Cousineau, D., Loye, N., 2018. Utiliser le coefficient omega de McDonald à la place de l'alpha de Cronbach. McGill. J. Educ. 52 (3), 791–804. https://doi.org/10.7202/1050915ar.

Bergquist, M., Nilsson, A., Schultz, W.P., 2019. A meta-analysis of field-experiments using social norms to promote pro-environmental behaviors. Global Environ. Change 59, 101941. https://doi.org/10.1016/j.gloenvcha.2019.101941.

Boateng, G.O., Neilands, T.B., Frongillo, E.A., Melgar-Quiñonez, H.R., Young, S.L., 2018. Best practices for developing and validating scales for health, social, and behavioral research: a primer. Front. Public Health 6, 149. https://doi.org/10.3389/fpubh.2018.00149.

Bonnett, M., 2007. Environmental education and the issue of nature. J. Curriculum Stud. 39 (6), 707–721. https://doi.org/10.1080/00220270701447149.

Bosch, O.J.H., King, C.A., Herbohn, J.L., Russell, I.W., Smith, C.S., 2007. Getting the big picture in natural resource management—systems thinking as 'method' for scientists, policy makers and other stakeholders. Syst. Res. Behav. Sci. 24 (2), 217–232. https://doi.org/10.1002/sres.818.

Boyes, E., Skamp, K., Stanisstreet, M., 2009. Australian secondary students' views about global warming: beliefs about actions, and willingness to act. Res. Sci. Educ. 39 (5), 661–680. https://doi.org/10.1007/s11165-008-9098-5.

Brauner, J., 2023. A scoping review of rankings, smileys, and other survey item formats. Metode Forskningsdesign 5 (5), 1–33. https://doi.org/10.54337/ojs.mf.2023.5.8223.

Brun, L., Pansu, P., Dompnier, B., 2021. The role of causal attributions in determining behavioral consequences: A meta-analysis from an intrapersonal attributional perspective in achievement contexts. Psychol. Bull. 147, 701–718. https://doi.org/10.1037/bul0000331.

Butera, F., Dompnier, B., Darnon, C., 2024. Achievement goals: a social influence cycle. Annu. Rev. Psychol. 75, 527–554. https://doi.org/10.1146/annurev-psych-013123-102139. Volume 75, 2024.

Cohen, J., 1988. Edition 2. Statistical Power Analysis for the Behavioral Sciences. Hillsdale. L. Erlbaum Associates.

Cook, J., Oreskes, N., Doran, P.T., Anderegg, W.R., Verheggen, B., Maibach, E.W., Carlton, J.S., Lewandowsky, S., Skuce, A.G., Green, S.A., 2016. Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. Environ. Res. Lett. 11 (4). https://doi.org/10.1088/1748-9326/11/4/048002.

Davis, A.C., Stroink, M.L., 2016. The relationship between systems thinking and the new ecological paradigm. Syst. Res. Behav. Sci. 33 (4), 575–586. https://doi.org/10.1002/sres.2371.

Davis, J.L., Green, J.D., Reed, A., 2009. Interdependence with the environment: Commitment, interconnectedness, and environmental behavior. J. Environ. Psychol. 29 (2), 173–180. https://doi.org/10.1016/j.jenvp.2008.11.001.

Deutsch, M., 1949. A theory of co-operation and competition. Human Relations 2, 129–152.

Döring, A.K., Blauensteiner, A., Aryus, K., Drögekamp, L., Bilsky, W., 2010. Assessing values at an early age: the picture-based value survey for children (PBVS–C). J. Pers. Assess. 92 (5), 439–448. https://doi.org/10.1080/00223891.2010.497423.

Döring, A.K., Schwartz, S.H., Cieciuch, J., Groenen, P.J., Glatzel, V., Harasimczuk, J., Janowicz, N., Nyagolova, M., Scheefer, E.R., Allritz, M., 2015. Cross-cultural evidence of value structures and priorities in childhood. Br. J. Psychol. 106 (4), 675–699. https://doi.org/10.1111/bjop.12116.

Ebersbach, M., Malkus, D., Ernst, A., 2019. Factors that affect primary school children's sustainable behavior in a resource dilemma. J. Exp. Child Psychol. 184, 18–33. https://doi.org/10.1016/j.jecp.2019.03.007.

Feygina, I., 2013. Social justice and the human–environment relationship: common systemic, ideological, and psychological roots and processes. Social Justice Res. 26 (3), 363–381. https://doi.org/10.1007/s11211-013-0189-8.

Friedberg, R., Dalenberg, C., 1990. Causal attributions in young children. Child Study J.

Fritsche, I., Barth, M., Jugert, P., Masson, T., Reese, G., 2018. A social identity model of pro-environmental action (SIMPEA). Psychol. Rev. 125 (2), 245–269. https://doi.org/10.1037/rev0000090.

Gifford, R., 2011. The dragons of inaction: psychological barriers that limit climate change mitigation and adaptation. Am. Psychol. 66 (4), 290–302. https://doi.org/10.1037/a0023566.

Graham, S., 1991. A review of attribution theory in achievement contexts. Educ. Psychol. Rev. 3 (1), 5–39. https://doi.org/10.1007/BF01323661.

Hamamura, T., Bettache, K., Xu, Y., 2018. Individualism and collectivism. In: Zeigler-Hill, V., Shackelford, T.K. (Eds.), Individualism and collectivism. The SAGE handbook of personality and individual differences: Origins of personality and individual differences 365–382. https://doi.org/10.4135/9781526451200.n20. Reference.

Heeren, A.J., Singh, A.S., Zwickle, A., Koontz, T.M., Slagle, K.M., McCreery, A.C., 2016. Is sustainability knowledge half the battle? An examination of sustainability knowledge, attitudes, norms, and efficacy to understand sustainable behaviours. Int. J. Sustain. Higher Educ. 17 (5), 613–632. https://doi.org/10.1108/IJSHE-02-2015-0014.

Heider, F., 1958. The Psychology of Interpersonal Relations. Wiley, New York.

Henrich, J., Heine, S.J., Norenzayan, A., 2010. Most people are not WEIRD. Nature 466 (7302). https://doi.org/10.1038/466029a. Article 7302.

Huffman, A.H., Van Der Werff, B.R., Henning, J.B., Watrous-Rodriguez, K., 2014. When do recycling attitudes predict recycling? An investigation of self-reported versus observed behavior. J. Environ. Psychol. 38, 262–270. https://doi.org/10.1016/j.jenvp.2014.03.006.

Hutcheson, G.D., Sofroniou, N., 1999. The multivariate social scientist: Introductory statistics using generalized linear models. SAGE Publications, p. 288.

Johnson, C.N., Balmford, A., Brook, B.W., Buettel, J.C., Galetti, M., Guangchun, L., Wilmshurst, J.M., 2017. Biodiversity losses and conservation responses in the anthropocene. Science (1979) 356 (6335), 270–275. https://doi.org/10.1126/science.aam9317.

Johnson, D.W., Johnson, R.T., 1989. Cooperation and Competition: Theory and Research. Interaction Book Company.

Jones, E.E., Nisbett, R.E., 1971. The Actor and the Observer: Divergent Perspectives on the Causes of Behavior. General Learning Press, Morristown. NJ.

Kelley, H.H., Thibaut, J.W., 1978. Interpersonal Relations: A Theory of Interdependence. Wiley, New York.

Koffka, K. (1935). Principles of gestalt psychology. 14.

Krettenauer, T., 2017. Pro-environmental behavior and adolescent moral development. J. Res. Adolesc. 27 (3), 581–593. https://doi.org/10.1111/jora.12300.

Krettenauer, T., Wang, W., Jia, F., Yao, Y., 2020. Connectedness with nature and the decline of pro-environmental behavior in adolescence: a comparison of Canada and China. J. Environ. Psychol. 71, 101348. https://doi.org/10.1016/j.jenvp.2019.101348.

Lange, F., Dewitte, S., 2019. Measuring pro-environmental behavior: review and recommendations. J. Environ. Psychol. 63, 92–100. https://doi.org/10.1016/j.jenvp.2019.04.009.

Lavelle, M.J., Rau, H., Fahy, F., 2015. Different shades of green? Unpacking habitual and occasional pro-environmental behavior. Global Environ. Change 35, 368–378. https://doi.org/10.1016/j.gloenvcha.2015.09.021.

Lynas, M., Houlton, B.Z., Perry, S., 2021. Greater than 99% consensus on human caused climate change in the peer-reviewed scientific literature. Environ. Res. Lett. 16 (11), 114005. https://doi.org/10.1088/1748-9326/ac2966.

Malone, K., Hartung, C., Percy-Smith, B., Thomas, N., 2010. Playing with power: children's participation in theory. A Handbook of Children and Young People's Participation. Routledge, Oxon, UK.

Markus, H.R., Kitayama, S., 1991. Culture and the self: implications for cognition, emotion, and motivation. Psychol. Rev. 92 (2), 224–253. https://doi.org/10.1037/0033-295X.98.2.224.

Markus, H.R., Kitayama, S., 2010. Cultures and selves: a cycle of mutual constitution. Perspect. Psychol. Sci. 5 (4), 420–430.

Mayer, F.S., Frantz, C.M., 2004. The connectedness to nature scale: a measure of individuals' feeling in community with nature. J. Environ. Psychol. 24 (4), 503–515. https://doi.org/10.1016/j.jenvp.2004.10.001.

McNeish, D., 2018. Thanks coefficient alpha, we'll take it from here. Psychol. Methods 23 (3), 412–433. https://doi.org/10.1037/met0000144.

Mellor, D., Moore, K.A., 2014. The use of Likert scales with children. J. Pediatr. Psychol. 39 (3), 369–379.

Nielsen, K. S., Cologna, V., Lange, F., Brick, C., & Stern, P. (2021). The case for impact-focused environmental psychology [Preprint]. PsyArXiv. https://doi.org/10.31234/osf.io/w39c5.

Nisa, C.F., Bélanger, J.J., Schumpe, B.M., Faller, D.G., 2019. Meta-analysis of randomised controlled trials testing behavioural interventions to promote household action on climate change. Nat. Commun. 10 (1), 1–13. https://doi.org/10.1038/s41467-019-12457-2.

Nisbett, R.E., Peng, K., Choi, I., Norenzayan, A., 2001. Culture and systems of thought: Holistic versus analytic cognition. Psychol. Rev. 108 (2), 291. https://doi.org/10.1037/0033-295X.108.2.291.

Oyserman, D., Kemmelmeier, M., & Coon, H. M. (2002). Cultural psychology, a new look: Reply to Bond (2002), Fiske (2002), Kitayama (2002), and Miller (2002).

Randle, J.M., Stroink, M.L., 2012. Systems Thinking Cognitive Paradigm and its Relationship to Academic Attitudes and Achievement. Lakehead University. Unpublished Honors Thesis).

Rusbult, C.E., Van Lange, P.A., 2003. Interdependence, interaction, and relationships. Annu. Rev. Psychol. 54 (1), 351–375.

Sarrasin, O., Crettaz von Roten, F., Butera, F., 2022. Who's to act? Perceptions of intergenerational obligation and pro-environmental behaviours among youth. Sustainability. 14 (3), 1414.

Schwartz, S.H., 1992. Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. Advances in Experimental Social Psychology. Elsevier, pp. 1–65. https://doi.org/10.1016/S0065-2601(08)60281-6. Vol. 25.

Schwartz, S.H., Caprara, G.V., Vecchione, M., 2010. Basic Personal Values, Core Political Values, and Voting: A Longitudinal Analysis. Polit. Psychol. 31 (3), 421–452. https://doi.org/10.1111/j.1467-9221.2010.00764.x.

Steg, L., 2023. Psychology of climate change. Annu. Rev. Psychol. 74, 391–421. https://doi.org/10.1146/annurev-psych-032720-042905. Volume 74, 2023.

Steg, L., Vlek, C., 2009. Encouraging pro-environmental behaviour: an integrative review and research agenda. J. Environ. Psychol. 29 (3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004.

Stern, M.J., Powell, R.B., Hill, D., 2014. Environmental education program evaluation in the new millennium: what do we measure and what have we learned? Environ. Educ. Res. 20 (5), 581–611. https://doi.org/10.1080/13504622.2013.838749.

Stern, P.C., 1999. Information, incentives, and proenvironmental consumer behavior. J. Consum. Policy. (Dordr) 22 (4), 461–478. https://doi.org/10.1023/A:1006211709570.

Świątkowski, W., Surret, F.L., Henry, J., Buchs, C., Visintin, E.P., Butera, F., 2024. Interventions promoting pro-environmental behaviors in children: a meta-analysis and a research agenda. J. Environ. Psychol., 102295 https://doi.org/10.1016/j.jenvp.2024.102295.

Thibaut, J.W., Kelley, H.H., 1959. The Social Psychology of Groups. Routledge.

Tomlinson, D., Von Baeyer, C.L., Stinson, J.N., Sung, L., 2010. A systematic review of faces scales for the self-report of pain intensity in children. Pediatrics. 126 (5), e1168–e1198.

Triandis, H.C., 2001. Individualism-collectivism and personality. J. Pers. 69 (6), 907–924. https://doi.org/10.1111/1467-6494.696169.

Urberg, K. A., & Docherty, E. M. (1976). Development of role-taking skills in young children.

Uzefovsky, F., Döring, A.K., Knafo-Noam, A., 2016. Values in middle childhood: social and genetic contributions. Social Development 25 (3), 482–502. https://doi.org/10.1111/sode.12155.

van de Wetering, J., Leijten, P., Spitzer, J., Thomaes, S., 2022. Does environmental education benefit environmental outcomes in children and adolescents? A meta-analysis. J. Environ. Psychol. 81, 101782. https://doi.org/10.1016/j.jenvp.2022.101782.

Van Lange, P.A., 1999. The pursuit of joint outcomes and equality in outcomes: an integrative model of social value orientation. J. Pers. Soc. Psychol. 77 (2), 337.

Van Lange, P.A.M., Balliet, D., 2015. Interdependence theory. In: Mikulincer, M., Shaver, P.R., Simpson, J.A., Dovidio, J.F. (Eds.), APA handbook of personality and social psychology, Volume 3: Interpersonal relations. American Psychological Association, pp. 65–92. https://doi.org/10.1037/14344-003.

Vecchione, M., Schwartz, S.H., Davidov, E., Cieciuch, J., Alessandri, G., Marsicano, G., 2020. Stability and change of basic personal values in early adolescence: a 2-year longitudinal study. J. Pers. 88 (3), 447–463. https://doi.org/10.1111/jopy.12502.

Vignoles, V.L., Owe, E., Becker, M., Smith, P.B., Easterbrook, M.J., Brown, R., González, R., Didier, N., Carrasco, D., Cadena, M.P., Lay, S., Schwartz, S.J., Des Rosiers, S.E., Villamar, J.A., Gavreliuc, A., Zinkeng, M., Kreuzbauer, R., Baguma, P., Martin, M., Bond, M.H., 2016. Beyond the 'east–west' dichotomy: global variation in cultural models of selfhood. J. Experiment. Psychol.: General 145 (8), 966–1000. https://doi.org/10.1037/xge0000175.

Walsh, E.M., Cordero, E., 2019. Youth science expertise, environmental identity, and agency in climate action filmmaking. Environ. Educ. Res. 25 (5), 656–677. https://doi.org/10.1080/13504622.2019.1569206.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. 26.

Zelezny, L.C., 1999. Educational interventions that improve environmental behaviors: a meta-analysis. J. Environ. Educ. 31 (1), 5–14. https://doi.org/10.1080/00958969909598627.