

Spanish version of the Children's Ecological Behavior (CEB) scale

Silvia Collado¹, José A. Corraliza², Miguel A. Sorrel² and Gary W. Evans³

¹ Universidad Autónoma de Barcelona, ² Universidad Autónoma de Madrid and ³ Cornell University (USA)

Abstract

Background: Children's pro-ecological behaviors are usually registered using scales based on the idea of a simple connection between attitudes and behaviors. However, this relationship seems to be more complicated. The Children's Ecological Behavior (CEB) Scale has been proposed as an alternative. Based on the Rasch model, it considers the different efforts needed to conduct a series of behaviors. This paper presents an improved adaptation of the CEB to Spanish population. **Method:** We back-translated the CEB into Spanish, increased the number of behaviors and collected data from 6- to 12-year-olds, using a game format procedure. **Results:** The scale can detect differences in the effort needed to perform various behaviors. Children's pro-ecological attitudes and behaviors are positively related. No relationship was found between parents' and children's pro-ecological attitudes and behaviors. **Conclusions:** The Spanish version of the CEB scale emerges as a reliable tool to measure children's pro-ecological behaviors.

Keywords: Children, pro- ecological behavior, Rasch model.

Resumen

Versión española de la escala de Comportamiento Ecológico para Niños (CEN). Antecedentes: el comportamiento pro-ecológico infantil suele registrarse con escalas basadas en la existencia de una conexión simple entre actitud y comportamiento. Sin embargo, esta relación parece ser más compleja. La escala de Comportamiento Ecológico para Niños (CEN) ha sido propuesta como una alternativa. Basándose en el modelo del Rasch, esta considera que distintas conductas requirieren distinto grado de esfuerzo. Se presenta una adaptación mejorada de la CEN a la población española. **Método:** se realizó una traducción inversa de la CEN, se amplió el número de conductas registradas y se recogieron datos con niños (6-12 años), usando un procedimiento de juegos. **Resultados:** la escala diferencia entre comportamientos que requieren distinto grado de esfuerzo. Existe una relación positiva entre las actitudes y el comportamiento pro-ecológico de los niños. No se encontró relación entre las actitudes y comportamiento pro-ecológico de padres e hijos. **Conclusiones:** la versión española de la escala CEN es un instrumento fiable para registrar conductas pro-ecológicas infantiles.

Palabras clave: niños, comportamiento pro-ecológico, modelo de Rasch.

There is not much information about the factors and developmental patterns that lead children to behave in an environmentally friendly way (Larson, Green, & Castleberry, 2011). One of the reasons for this is the lack of instruments that can be used with young people. Even though there are some tools available, they generally include both environmental attitudes and behaviors, making it difficult to explain the processes that lead to pro-ecological behavior. For instance, Leeming, Dwyer, Porter, and Bracker (1995) designed the Children's Environmental Attitudes and Knowledge scale. It considers youngsters' willingness to perform certain behaviors such as recycling, but it also registers environmental knowledge and attitudes. More recently, Larson et al. (2011) developed the children's Environmental Orientation scale in which, again, attitudes and behaviors are included in the same tool.

Due to the dearth of instruments specifically designed to register children's pro-ecological behaviors, researchers have

usually chosen to use a selection of items from more general scales or to develop ad hoc tools for their own specific goals (Boeve-de Pauw & Van Petegem, 2013). This practice could lead to validity and reliability problems, as well as result in a pool of different instruments that do not allow for inter-study comparisons. In addition, most tools designed to be used with children are primary semantic, which may lead to inattentiveness and comprehension problems, especially in younger children.

On the contrary, there is relatively well-established knowledge about adults' pro-ecological behaviors (Bamberg & Möser, 2007). One of the most widely used instruments, the General Environmental Behavior Scale (GEB; Kaiser, 1998), has only recently been adapted for use with children (Evans et al., 2007a) as the Children's Ecological Behaviors (CEB) scale. The CEB is based on the Rasch model, in which behaviors are seen as a consequence of attitudes in concert with difficulties to implement actions. It considers that endorsement of various behaviors may not have the same underlying frequency distribution, as assumed in classical measurement theory, allowing us to consider the degree of relative difficulty required to engage in a certain behavior, and to order the participants with respect to a continuum (Bond & Fox, 2001). For instance, switching the lights off when leaving a room would not require the same effort as donating money to a pro-environmental organization.

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Corresponding author: Silvia Collado
Faculty of Psychology
Universidad Autónoma de Barcelona
08193 Barcelona (Spain)
e-mail: silvia.collado@uab.cat

The CEB scale has three main advantages: It is based on the Rash model and, therefore, considers the different effort needed to perform various behaviors; it registers behaviors as an independent measure from attitudes; and it is based on an interactive game format. Evans et al. (2007a) proved, through several qualitative and quantitative phases, that the scale has high reliability and validity. However, it could not detect the difference in effort needed to perform different behaviors. Moreover, no relationship was found between children's environmental attitudes and behaviors. The same results were obtained in a cross-cultural study (Evans, Juen, Corral-Verdugo, Corraliza, & Kaiser, 2007), which led the authors to encourage improving the scale (Evans et al., 2007a, 2007b) by including behaviors that require more effort.

The aim of the current study is to adapt the CEB to the Spanish population and examine its psychometric properties. As a way of evaluating its criterion validity, several variables that have previously been linked to children's pro-ecological behaviors will be considered. First, the affective and cognitive dimensions of environmental attitudes have been both pointed out as being positively related to children's pro-ecological behaviors. For instance, Corraliza, Collado, and Bethelmy (2013) found a weak but positive correlation between children's ecological beliefs (cognitive dimension) and switching the lights off when leaving a room. Considering the affective dimension, Müller, Kals, and Pansa (2009) showed that youngsters' emotional affinity toward nature predicts their willingness to perform pro-ecological behaviors. Similar results were found in a sample of children (Collado, Staats, & Corraliza, 2013).

A second factor that appears to impact children's pro-ecological behavior is direct exposure to natural environments. Spending time in nature increases children's willingness to behave in a pro-ecological way (Cheng & Monroe, 2012; Collado et al., 2013).

Finally, parents play a role in children's pro-environmentalism, although the findings are mixed. Family values positively influence children's interest in carrying out pro-ecological behaviors (Cheng & Monroe, 2012). Similarly, Matthies, Selge and Klöckner (2012) showed that parents' recycling behaviors predicted those of their children but no relationship was found between parents' and children's re-using practices. Similarly, Evans et al. (2007a) concluded that no link existed between parents' and children's pro-ecological behaviors. Identical results were achieved in a cross-sectional study conducted with the same instruments (Evans et al., 2007b).

Given the need for access to reliable instruments that measure ecological behaviors in populations of Spanish children, and to deepen our understanding of how such behaviors are developed, the present study aims to adapt to Spaniards the game set designed by Evans et al. (2007a) to register children's ecological behavior, and to improve it by including a wider range of behaviors. We have four specific objectives. First, to study the internal validity of the measure, by evaluating its dimensionality. Second, to assess its criterion validity. For this purpose, the relationship between children's emotional affinity toward nature, ecological beliefs, frequency of contact with nature and pro-ecological behaviors will be studied. Third, to evaluate the relationship between parents' pro-ecological attitudes and behaviors and those of their children. Forth, to check whether the CEB scale can detect differences in the effort required to perform different behaviors.

Participants

One-hundred and seven 6- to 12-year-olds (54.9% boys; M age = 9.35, $SE = 1.52$) from medium socioeconomic background participated in the study. We focused on this age range because the ecological behaviors of children younger than 6 years old cannot be reliably evaluated with the games used (Evans et al., 2007a) and these are too childish for early adolescents (older than 12 years old; Brainerd, 1978).

Procedure

Data were collected in two urban camps in Spain. Children were asked whether they wanted to participate in the study and none of them refused. Parents gave their consent by signing an authorization letter and one of them (mother or father) filled in a questionnaire about their own environmental attitudes and behaviors, as well as the frequency with which they brought their child to natural areas.

The data collection took place in a room in which each child individually interacted with a qualified researcher for 45 minutes.

Instruments

Children's environmental attitudes and pro-ecological behaviors were registered using three scales administrated in the form of a set of four games developed by Evans et al. (2007a). The scales were translated and adapted to Spanish. These were re-translated into English by a native speaker. In this paper, we focus on the adaptation of the CEB scale, in its jumping game format. Based on a four-point Likert scale, the words *never* (1), *sometimes* (2), *most of the time* (3) and *always* (4) were placed on the floor and the participant had to jump in next to the word that indicated how frequently he/she performed a certain behavior. The original scale consisted of eight behaviors (Items 1, 3, 6, 7, 8, 9, 10, and 11 in Table 1). Aiming at including more challenging behaviors, but not too difficult for young children to engage in, five new behaviors were included. These were: (a) Talk to parents about nature, (b) visiting a zoo or aquarium, (c) telling another child not to litter, (d) being driven to a place nearby, and (e) littering because there are no trash cans nearby.

There were three attitudinal games. The first one consisted of building two alternative environmental story scenarios using felt boards (e.g., people are equal to other animals versus people are superior). Once constructed, the participant indicated which scenario more closely depicted how he/she felt and whether he/she was a little sure or *very sure* about the given answer. Another game was a "worry thermometer" showing four faces placed vertically, indicating "not worried", "a little bit worried", "quite worried" and "very worried". The child indicated how worried he/she was about various local environmental issues (e.g., air pollution). The last game consisted of a board game in which the participant "competed" against the researcher. On several occasions, the child had to choose the preferred option out of two possibilities (e.g., being driven somewhere or walking). Then, the participant indicated how sure he/she was about the chosen option.

The three attitudinal games described above include items of two scales registering the affective and cognitive (ecological

beliefs) dimensions of environmental attitudes. Both are based on a four-point Likert scale. Children's ecological beliefs were measured using the New Environmental Paradigm (NEP; Dunlap & van Liere, 1978) scale. It relies on the idea that people's worldviews are shifting, from anthropocentric to ecocentric. It is formed by 16 items and the internal consistency was $\alpha = .69$, which is similar to the one found in previous studies (Evans et al., 2007a, 2007b).

Children's affective dimension of environmental attitudes was registered by the Emotional Affinity toward Nature (EAN) scale (Müller et al., 2009). Three items previously used in studies with children (Collado et al., 2013) were included (e.g., "Sometimes, when I'm unhappy, I find solace in nature"). The reliability of the scale was $\alpha = .79$.

Parents' filled in a questionnaire including: (a) Children's frequency of contact with nature, registered by asking parents the following question: How frequently do you bring your child to natural areas? Ranging from *never* (1) to *always* (4); (b) parents' ecological beliefs, registered using the NEP scale. It is made up of 15 items and its reliability was $\alpha = .77$; and (c) parents' pro-ecological behaviors, measured using the GEB scale. It consists of 48 items ($\alpha = .67$).

Data analyses

Given that the CEB scale was proposed as unidimensional (Evans et al., 2007a), our first approach to study its validity was to evaluate its dimensionality with an Exploratory Factor Analysis (EFA) using the Generalized Least Squares estimator in SPSS. The fit of the unidimensional model to the data was checked with the following fit indexes: Chi-square test and the root mean square error of approximation (RMSEA). Cutoff values of 2:1 for ratio χ^2/df and .07 for RMSEA were used as indicators of good fit (Steiger, 2007).

In order to assess the item quality, the discrimination indexes (point-biserial correlations) were calculated. They describe the correlation between each item and the rest of the scale, considering correlations of .20 as adequate.

Within the framework of the Item Response Theory (IRT), a partial credit Rasch model known as Graded Response Model (GRM on wards; Samejima, 1997) was applied to the subset of items identified as unidimensional using the software IRTPro (Cai, du Toit, & Thissen, 2012). Partial credit refers to the four-level scale of behavioral options (never, sometimes, most of the time, always). To check whether the items fitted the model, the S-X2 fit indexes were calculated (Orlando & Thissen, 2000). Following, the independence assumption among pair of items was checked calculating the LD X2 standardized statistics.

A final approach to the validation of the scale was to assess the relationship between children's pro-ecological behaviors and the following criterion variables: Ecological beliefs, EAN, parent's ecological beliefs and behaviors and frequency of contact with nature. In doing so, Pearson correlations were obtained.

As a measure of reliability, we analyzed on which levels of latent trait the test is more informative.

The next step was to evaluate whether some behaviors took more effort to perform than others and, if so, which ones. Based on the GRM, a participant's response to a certain item can be described as a value in a continuum. The probability of responding in category k or higher is defined as:

$$P^*(x \geq k) = \frac{1}{1 + \exp[-a(\theta - b_{k-1})]}$$

where k is any of the categories presented from 1 to K , a is the item discrimination parameter and b_{k-1} is the latent trait level at which the probability of the response being in category k or above is equal to .5.

We checked whether some behavior took more effort to perform than others and, if so, which ones by analyzing the parameters of the items in the GRM. For this, latent trait scores (θ) for participants' pro-ecological behaviors were obtained ($M = 0$, $SE = 1$).

Results

Validity and reliability of the scale

Two out of the 13 proposed items had a low factor loading ($<.10$; Table 1), and the unidimensional model was not supported (p -value χ^2 test = .008). Taking a look at the discrimination index, these same two items do not fit the criterion, showing correlations lower than .20. Therefore, items 3 and 4 were eliminated for further analyses.

Once done, all the estimated factorial loadings remained over .30. The following coefficients demonstrate the global goodness of fit of the unidimensional model: $X^2 = 66.65(44)$, $X^2 / df = 1.51$, RMSEA = 0.075.

Within the item response theory framework, a GRM was applied to the 11-item unidimensional version of the scale. According to the S-X2 fit indexes, the items fitted the model ($p > .05$; Table 1).

The independence assumption among pairs of items was checked using the LD X2 standardized statistics. All the items pairs obtained values lower than 10, indicating that the response to one item does not depend on the response to another one.

The final approach to validation entailed exploration of potential relationships between children's pro-ecological behaviors and the criterion variables. Children's pro-ecological behaviors were significantly and positively correlated to their ecological beliefs, $r = .34$, $p < .001$, as well as to their EAN, $r = .29$, $p < .01$. A positive and significant relationship was found between children's frequency of contact with nature and their EAN, $r = .19$, $p < .01$, and between EAN and pro-ecological behavior, $r = .27$, $p < .01$.

No relationship was found between children's ecological behaviors and parents' pro-ecological beliefs neither with their pro-ecological behaviors.

In relation to the scale reliability, we found that the test is more informative for low levels of trait, around $\theta = -1.50$. For levels of trait between -2 and -0.5 the standard error of measurement is below 0.50, which can be considered optimal from a practical perspective. A typical error of 0.5 can be translated into a conditional reliability of 0.75 ($1 - 0.5^2$).

Effort needed to perform different behaviors

In order to evaluate whether some behaviors took more effort to perform than others, the a and b parameters were calculated with the GRM applied to the scale. The a parameter (discrimination) is approximately 1 for all the items ($M = 0.99$, $SE = 0.25$; Table 2). All b_k parameters are negative and, in general, high. This means

that the effort required to carry out pro-ecological behaviors is low. Nevertheless, children perform some behaviors more frequently than others (Table 2). For instance, closing the tap while brushing one's teeth is performed by most of the children. Moreover, this behavior does not require a high latent trait level to be performed (see *b* parameters in Table 2).

Taking a look at the graph corresponding to closing the tap while brushing one's teeth (Figure 1a), it can be observed that even when the estimated level of pro-ecological behaviors is low (-1), the option *always* is chosen with a higher probability than the rest. In other words, it is easy to agree with carrying out this behavior, even when a child's overall level of pro-ecological behaviors is low. It appears that closing the tap while brushing

one's teeth is a generalized behavior and not very high degrees of pro-environmentalism are needed in order to endorse it. A similar interpretation can be obtained with recycling, picking up the trash left in a picnic by others, not ordering too much food in a restaurant, closing the fridge door while choosing what to eat/drink and not littering.

The scale also includes ecological behaviors that require more effort. This means that the child needs to be more pro-ecological in order to engage in these kinds of behaviors (e.g., telling another child not to litter). A very different pattern appears when comparing the graph that corresponds to telling another child not to litter to the one just described (Figure 1b). The level of ecological endorsement required to answer *always* or *almost*

Table 1
Discrimination index, EFA loading weights, and S-X2 fit indexes

	Discrimination index	EFA	S-X2 item level diagnostic statistics		
			X ²	d.f.	p-value
1. Miro un libro sobre medio ambiente (naturaleza, árboles, animales) [Look at a book about environment (nature, trees, animals)]	.42	.57	17.18	25	.87
2. Hablo con mis padres sobre naturaleza [Talk to my parents about nature]	.33	.44	27.74	29	.53
3. Paseo o juego al aire libre [Walking or playing outdoors]	.11	<.10			
4. Visito un zoo o acuario [Visiting a zoo or aquarium]	.04	<.10			
5. Le digo a otro niño que no tire basura al suelo [Telling another child not to litter]	.50	.60	29.57	25	.24
6. Reciclo [Recycling]	.31	.40	31.36	27	.25
7. Me olvido de apagar las luces cuando salgo de la habitación [Forget to turn the lights off when leaving a room (reverse)]	.22	.39	18.23	23	.74
8. Recojo la basura que han dejado mis amigos después de hacer un picnic [Pick up the trash left behind by your group of friends when exiting picnic table]	.32	.40	14.04	16	.59
9. Pido demasiada comida en un restaurante y hay que tirar la que sobra [Order too much food at restaurant and had to leave extra food (reverse)]	.31	.39	23.5	27	.65
10. Me olvido de cerrar el grifo mientras me lavo los dientes [Forget to turn off the water while brushing my teeth (reverse)]	.24	.36	42.7	34	.14
11. Dejo la puerta del frigorífico abierta mientras decido qué comer [Leave refrigerator door open while deciding what to eat]	.28	.43	16.38	20	.69
12. Para ir a lugares cercanos, me llevan en coche [Being driven to places nearby]	.24	.36	17.18	25	.87
13. Cuando no hay una papelera cerca, tiro la basura al suelo [Littering because there are no trash cans nearby]	.33	.50	27.74	29	.53

Note: Items 3 and 4 were not included in the IRT analyses, as they did not meet the unidimensionality criteria

Table 2
Relative frequencies and item parameters estimated for the GRM

Item	% Scoring				Item parameters							
	Never	Sometimes	Most of the time	Always	a	s.e.	b ₁	s.e.	b ₂	s.e.	b ₃	s.e.
1	14.02	39.25	33.64	13.08	1.13	0.31	-1.94	0.46	0.14	0.2	2.05	0.5
2	17.76	45.79	22.43	14.02	0.92	0.27	-1.91	0.53	0.77	0.29	2.32	0.63
5	31.78	38.32	15.89	14.02	1.3	0.33	-1.31	0.3	0.3	0.2	0.91	0.27
6	23.36	64.49	10.28	01.87	0.81	0.28	-2.2	0.72	-1.06	0.4	-0.39	0.27
7	21.50	37.38	13.08	28.04	0.56	0.25	-4.42	1.87	-3.5	1.48	0.29	0.37
8	16.82	14.95	11.21	57.01	0.91	0.29	-2.49	0.72	-1.34	0.41	-0.27	0.24
9	08.41	04.67	40.19	46.73	0.9	0.29	-3.71	1.12	-1.77	0.53	-0.36	0.24
10	12.15	14.02	18.69	55.14	1.12	0.35	-2.72	0.74	-2.39	0.63	-1.04	0.3
11	57.01	23.36	14.95	04.67	1.06	0.31	-2.82	0.74	-1.48	0.39	-0.19	0.21
12	07.48	02.80	18.69	71.03	0.77	0.26	-2.26	0.72	-0.85	0.36	0.75	0.35
13	07.48	14.95	24.30	53.27	1.43	0.42	-2.41	0.54	-1.72	0.37	-0.48	0.18

always is high. Participants with a medium level of endorsement tend to respond *sometimes*. As the level of pro-environmentalism increases, the tendency to respond *always* quickly increases, but when the level of pro-environmentalism is low, children tend to respond *never* or *almost never*. A similar pattern is observed for talking to parents about nature.

Finally, there are a series of behaviors, such as forgetting to switch the lights off, that require less effort than the ones just described (e.g., talking to parent about nature), but that are more difficult to perform than the first ones (e.g., closing the tap while brushing one's teeth). Overall, children with a medium level of pro-environmentalism tend to answer that they *almost never* forget to switch off the lights and when the level of pro-environmentalism is high, the most probable answer is *never* (Figure 1c). A similar trend is observed for being driven somewhere nearby.

Discussion

The present study conveys an adaptation of the CEB scale for Spanish children, evaluating its psychometric characteristics through several perspectives and improving its sensitivity to pick up the true range of engagement in pro-ecological behaviors. This scale is formed on the basis of the Rasch model what represents an added value to this work.

The EFA's results support the idea of a single dimension, in consonance with the authors of the scale. Two items (visiting a zoo or aquarium and walking or playing outdoors) had to be eliminated, leading to a final 11-item version of the scale. These two behaviors highly depend on parental decisions, which could be why they do not work as expected.

Our results have confirmed a positive link between children's ecological beliefs and pro-ecological behaviors. Contrary to previous studies in which no relationship was found (Evans et al., 2007a, 2007b), the correlations were medium and significant, providing validity support to the scale. As a novelty in this study, children's affective dimension of environmental attitudes (EAN) was included in the analyses. A positive and significant link was found between children's ecological behaviors and their EAN. These findings uphold with previous studies concluding that both, cognition are affect, are important when trying to predict pro-ecological behavior (Pooley & O' Connor, 2000). However, frequency of contact with nature was not related to children's pro-ecological behaviors. Nevertheless, a positive relationship was found between spending time in nature and EAN, as in previous

studies (Mayer & Frantz, 2004). A partial mediation between spending time in nature and children's pro-ecological behaviors has been previously found (Collado et al., 2013). Therefore, it could be that contact with nature influences children's pro-ecological behaviors by a total mediation through EAN. This possibility remains for future studies.

Similarly to previous authors' findings (Evans et al., 2007a, 2007b), no relationship seems to exist between parents pro-ecological attitudes and behaviors and those of their children. One possibility for these findings is that the behaviors included in the scale are not learned by modeling. It could also be that other variables such as parents' sanctions (Matthies et al., 2013) or family values (Cheng & Monroe, 2012) are more significant when predicting children's behaviors. It may also be that other agents like friends or teachers have a stronger influence. Future research will clarify these issues.

In regards to ecological behaviors, children showed medium to high levels of endorsement. In addition, some behaviors were found to require more effort to perform to than others, which is in concordance with precedent studies (Stern, 2000). For instance, Collado et al. (2013) classified children's pro-ecological behaviors into two groups, daily conservation actions and environmental citizenship behaviors, the latter requiring more effort. This interpretation is consistent with our own results in which behaviors such as recycling are performed by most children whereas others, like talking to parents about nature, require the child to be, overall, more pro-environmental. To the best of our knowledge, this is the first time that an effort to distinguish among different kinds of ecological behaviors has been empirically proven in children populations. Moreover, while previous researchers have used different summarized scales for each type of behavior, the present study introduces an improved, single scale.

Our findings have implications for the design of Environmental Education (EE) programs. Children's engagement in ecological behaviors differs regarding the effort required to endorse them. Some behaviors are performed only by children who are, overall, highly committed to pro-environmental practices. Therefore, children's starting point should be considered, as well as the behavioral outcome the EE program aims to achieve.

In sum, the study of children's environmental attitudes and behaviors still remains an under-researched topic partly due to the dearth of reliable instruments to be used with this population group. This paper presents an improved scale to register children's pro-ecological behaviors through a set of interactive games, and increases our understanding of how children come to behave in

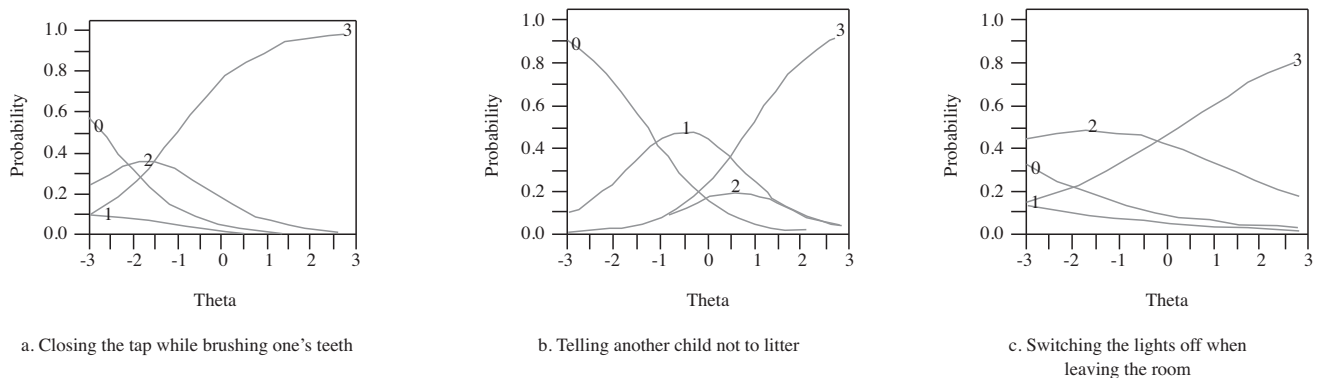


Figure 1. Examples of behaviors that require different effort to be performed. Note: 0: Never, 1: Almost never, 2: Almost always, 4: Always

a pro-ecological way. In order to generalize these results, further research with children from different socio-cultural contexts and backgrounds as well as with analyses that permit establish causality is needed.

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