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Cohort change and the diffusion of environmental concern: A cross-national analysis

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Abstract

This study explores value change across cohorts for a multinational population sample. Employing a diffusion-of-innovations approach, we combine competing theories predicting the relationship between socio-economic status (SES) and environmentalism: post-materialism and affluence theories, and global environmentalism theory. The diffusion argument suggests that high-SES groups first adopt pro-environmental views, but as time passes by, environmentalism diffuses to lower-SES groups. We test the diffusion argument using a sample of 18 countries for two waves (years 1993 and 2000) from the International Social Survey Project (ISSP). Cross-classified multilevel modeling allows us to identify a non-linear interaction between cohort and education, our core measure of SES, in predicting environmental concern, while controlling for age and period. We find support for the diffusion argument and demonstrate that the positive effect of education on environmental concern first increases among older cohorts, then starts to level off until a bend-point is reached for individuals born around 1940 and becomes progressively weaker for younger cohorts.

Keywords

Diffusion; Environmental concern; Multilevel; ISSP; Affluence hypothesis; Post-materialist hypothesis; Cohort change

For more than two decades, an intense debate has surrounded the impact of socio-economic status (SES) on environmental concern. One side argues that affluent individuals, holding post-materialist values, are most environmentally concerned, whereas the other side argues the opposite, suggesting that poor individuals are similarly or even more concerned about the environment. Empirical studies that examine both individual and cross-national relationships continue to present contrasting findings. One reason for the divergent findings may be that environmental concern has been measured in various ways in different studies (Klineberg, McKeever, and Rothenbach 1998; Stern 2000). But there are also differences in the theoretical concepts used to explain the connection between SES and environmental concern.

In this study, we attempt to bridge the two arguments by allowing the relationship between SES and environmental concern to vary across cohorts. In so doing, we build on a forthcoming study of cohort changes in environmental views within the United States (Pampel and Hunter 2012) that uses the General Social Survey from 1974 to 2008 and a measure of support for environmental spending. Our study similarly examines cohort

changes in environmental views but uses a diverse set of 18 mostly European nations from the International Social Survey Program, two years of data (1993 and 2000), and multiple measures of environmental concern. The next sections review competing theories of environmental concern, present a cohort-based theory and hypothesis based on Pampel and Hunter (2012), and test the theory and hypothesis with the cross-national data and new measures.

Theories predicting the SES-environmentalism relationship

Post-materialism and affluence hypotheses

Ronald Inglehart (1990, 1995) was among the first researchers to develop a theory explaining the SES-environmentalism relationship. Inspired by Maslow's hierarchy of needs, Inglehart suggested that individuals are first concerned about satisfying their material needs to establish economic and physical security. Only after a certain level of economic security (wealth) has been achieved can people attend to post-materialist values for self-expression, personal identity, and quality of life that in turn lead to the support of environmentalism, feminism, and equality (Inglehart 1995). After World War II the economy flourished, providing citizens of industrialized countries with wealth and security. These conditions caused a major cultural shift from materialist to post-materialist values, providing a milieu in which environmentalism and new environmental social movements emerged (Inglehart 1990). Inglehart's post-materialist hypothesis receives empirical support from a number of studies that find a positive relationship between environmentalism and post-materialist values (Abramson 1997; Kidd and Lee 1997).

More recently some authors have developed what they term the affluence or prosperity hypothesis (Diekmann and Franzen 1999). Although it predicts a similar relationship between SES and environmental concern, it suggests a different mechanism to describe the underlying causal link. It treats environmentalism as an amenity good that wealthy individuals can more readily afford than low-SES groups (Franzen and Meyer 2010). The affluence hypothesis postulates that, independently of the development of post-materialist values, high-SES individuals show higher levels of environmental concern because they can afford to pay the cost of reducing pollution, maintaining scenic areas, and using green products such as organic food and bio-degradable detergents (Diekmann and Preisendörfer 2003; Meyer and Liebe 2010). Numerous studies support the affluence hypothesis at the individual-level and find positive relationships between various measures of SES, predominantly education and income, and environmental concern (Franzen and Meyer 2010; Gelissen 2007; Marquart-Pyatt 2008). Also, at the country-level, various authors have observed a positive association between national income and environmental concern (Diekmann and Franzen 1999; Franzen 2003; Franzen and Meyer 2010; Kemmelmeier, Król, and Kim 2002; Kidd and Lee 1997). However, a more recent study using a multilevel modeling approach complicates the picture. Using data from 38 countries, Givens and Jorgenson (2011) observe that at the individual-level social measures of SES (social class and education) are positively associated with environmental concern while at the nation-level the measure for affluence (GDP) is negatively associated with environmental concern. This aggregate-level effect is more in line with another line of research, surrounding the global environmentalism hypothesis.

Global environmentalism hypothesis

The post-materialist and affluence hypotheses have been challenged by a number of scholars (Dunlap, Gallup, and Gallup 1992; Brechin and Kempton 1994, 1997; Brechin 1999; Dunlap and York 2008). These researchers suggest that environmentalism is emerging not only among the rich; rather, environmentalism has become a global phenomenon adopted by poor

and rich alike. Low-SES individuals are likely to be highly environmentally concerned because they depend more on the environment for their livelihoods than do the rich, and therefore benefit more from public efforts to protect the environment. Also, less affluent individuals and countries are directly exposed to pollution and environmental destruction, whereas richer individuals and societies can pay to guard themselves against these exposures (Adeola 2004; Brechin and Kempton 1994; Uyeki and Holland 2000). This notion is grounded in a large literature on environmental justice (EJ), which explores environmental inequalities and concern among the poor and minority groups (see Brulle and Pellow 2006). EJ studies show that the poor develop environmental concern as a response to threats to their health and well-being, and not out of post-materialist values or the desire for amenities. This might explain why strong environmental concern and risk perception related to local environmental problems have been observed among traditionally low-SES minorities (Adeola 2004; Kahn 2002; Whittaker, Segura, and Bowler 2005) and the foreign born (Adeola 2007).

Not only is the mechanism for the development of environmental concern different for the poor, but the type of environmentalism may also be qualitatively different. Brechin (1999) suggests that environmental concern among more disadvantaged groups and nations is best captured by their attitudes towards pollution, sustainability, local resources, global warming, and species protection rather than by measures based on willingness to pay, which are biased toward those with high income. A number of studies at both individual and country levels seem to support the global environmentalism hypothesis and find that SES and national income do not consistently increase environmental concern (Brechin 1999; Dunlap and Mertig 1995, 1997; Jones and Dunlap 1992; van Liere and Dunlap 1981). It has been argued that environmental concern is too complex, involving too many diverse meanings, to relate consistently to a simple measure of post-materialist values or affluence (Brechin 1999; Dietz, Fitzgerald, and Shwom 2005; Marquart-Pyatt 2008; Xiao and Dunlap 2007).

While the global environmental hypothesis and the post-materialist and affluence hypotheses predict opposite tendencies, both predictions rely heavily on findings from cross-sectional data analysis. A different approach is to investigate long-term trends across cohorts.

Cohort change and environmentalism

Belonging to a certain birth cohort is likely to have a substantial impact on a person's values, attitudes, and beliefs. A long tradition among demographers emphasizes the significance of cohorts in producing societal change (Ryder 1965). More specifically, a substantial body of literature highlights the importance of cohort changes for variations in environmental concern (Buttel 1979; Mohai and Twight 1987). Environmental views develop during youth and young adulthood and are relatively stable afterwards (Inglehart 1990). This notion is based on the socialization hypothesis which postulates that adults' basic values reflect the socioeconomic conditions of one's childhood and adolescence (Egri and Ralston 2004). Longitudinal research confirms this notion and has demonstrated that value orientation formed early at early ages remains relatively stable throughout one's lifetime (Inglehart 1997, Lubinski et al. 1996, Meglino and Ravlin 1998).

More recent cohorts should show greater environmental concern, because economic security has increased constantly as measured roughly by per capita GDP since the early 1900s (Inglehart and Abramson 1994, Krausmann et al. 2009). Kidd and Lee (1997) and Inglehart (1990) find that individuals born and raised under conditions of more economic security express on average higher levels of environmental concern. Making a similar observation for the United States, Kanagy, Humphrey, and Firebaugh (1994) anticipate that cohort

replacement will lead to a countrywide increase in environmental support, as less supportive, older cohorts are gradually replaced by more supportive, younger ones.

However, neither Inglehart nor Kanagy and colleagues examine how the SES distribution of environmental concern changes across cohorts. Investigating the cohort-change dynamic might elucidate why studies find different relationships between SES and environmental concern, as the relationship may change direction across cohorts. A study by Jones and Dunlap (1992) investigated the association between SES and environmental concern for a longer period (1973–1990) but observed only weak relationships and no major change across the two decades. However, if a changing cohort-based association characterizes the SES-environmentalism relationship, Jones and Dunlap might have been measuring a period in which the strength of the relationship already started to decline. Some evidence exists that in earlier decades the SES-environmentalism relationship was strong and positive (e.g. Buttel and Flinn 1974). Unfortunately, no surveys of environmental concern are available before the 1970s, and thus, a conventional comparison across years is not possible. Cohort comparisons, however, allow the study of the SES–environmental concern relationship for almost a century. Even surveys conducted in 1993 and 2000 (as in our study) include individuals of a broad age range, with birth years dating back to the early 1900s. Since we can assume that attitudes and values are formed early in the life-cycle (Inglehart 1990, Inglehart and Abramson 1994), cohort data might be used to capture long-term changes in environmental concern.

Cohort changes do not merely emerge randomly, without structure; rather, a causal pattern can be identified. To describe this pattern, we draw on the diffusion-of-innovation literature (Rogers 2003), which helps to explain differences in adoption of ideas and values among high- and low-SES groups (Fischer and Hout 2006; Pampel and Hunter 2012).

Diffusion of innovations and environmentalism

Diffusion takes place “when the adoption of innovative ideas (and corresponding behavior) by some individuals influences the likelihood of such adoption by others” (Montgomery and Casterlin 1993:458). Such a dynamic can be described as an endogenous feedback mechanism in which individuals look to their reference group for information and adopt changes in attitudes and behavior patterns with a certain lag in time.

Typically, diffusion initially occurs horizontally among individuals of higher SES groups, since they are often the first to adopt innovations (Fischer and Hout 2006; Rogers 2003), and through their social networks and connections, attitudes and behavior patterns spread to peers (Strang and Meyer 1993). Vertical diffusion sets in later as lower-ranking groups emulate the practices and adopt the attitudes and ideas of higher social classes (Fischer 1978; Strang and Soule 1998; Wejnert 2002). This adoption of values and beliefs through class emulation and social learning has already been highlighted in classical sociological theory (Weber 1958; Bourdieu 1984). In this process, the difference between high- and low-SES groups in the level of adoption of the innovative behavior first expands and then narrows until it disappears (Fischer and Hout 2006). Once a critical mass of innovation adopters has been reached, the new attitude becomes self-sustaining (Casterline 2001; Rogers 2003). In fact, as soon as a majority supports a particular value, belief, or attitude, opposition becomes increasingly harder since non-adopters are frequently viewed as deviant.

The diffusion-of-innovations theory can be applied to explain changes in the SES-environmentalism relationship. The diffusion process is likely to occur in two stages. In the first stage people are in general not very concerned about the environment, but a few high-SES individuals start to adopt the new pro-environmental attitudes. Post-materialist values and the demand for amenity goods should accelerate the adoption of these views within

high-SES groups. Education, a major component of SES, plays an important part in the initial adoption because education reflects a modern scientific orientation, openness to change, and cognitive skills to comprehend the reasons for supporting the environment (Rogers 2003). As the innovative environmentalist attitude becomes more popular among high-SES groups, a positive relationship emerges between SES and environmental concern.

In the second stage, environmentalism is likely to spread vertically from high- to low-SES groups (Buttel and Flinn 1978; Morrison 1986; Uyecki and Holland 2000). The low-SES groups start to adopt the attitudes and behavior patterns of prestigious high-SES groups, broadening the base of environmentalism and diluting its association with SES. The vertical diffusion does not require post-materialism or affluence. As influential high-SES innovators become more concerned about environmental issues and the media increasingly report about topics such as environmental degradation, pollution, climate change, or the health advantages of organic food, the publicity starts to affect other SES groups. Indeed, the increase in available information will disproportionately raise environmental concern among disadvantaged low-SES groups as they become aware of the harmful consequences of environmental degradation for their health and well-being. This response will ultimately lead to a weak or insignificant association between SES and environmental concern, as the global environmentalism hypothesis predicts.

In summary, the diffusion-of-innovations argument combines aspects of the affluence, post-materialist, and global environmentalism hypotheses, and it suggests a non-linear relationship between SES and environmentalism that unfolds over time (Pampel and Hunter 2012).¹ Similar to the affluence and post-materialist hypotheses, the diffusion arguments suggest a positive relationship between SES and environmentalism, but primarily among older cohorts; in line with the global environmentalism hypothesis, a weak or slightly negative association between SES and environmentalism can be anticipated primarily among younger cohorts.

Hypotheses

This study tests whether the diffusion-of-innovations argument can be employed to explain the relationship between SES and environmentalism. More precisely, the research hypothesis can be stated as follows: A positive relationship between SES and environmentalism emerges for cohorts born early in the twentieth century, which first increases in strength and then weakens or becomes insignificant for cohorts born later in the century. In statistical terms we expect to observe a significant, non-linear interaction between cohort and SES that shows a concave shape in predicting environmental concern. As graphically visualized in Figure 1, the post-materialist and affluence hypotheses are well suited to describe the upward sloping part of the curve, while the modernization hypothesis best describes the descending part.

¹A diffusion process of environmental values, attitudes and concerns has also been hypothesized to take place across countries. According to world society theory, international organizations embody, reinforce, and diffuse world cultural norms to regional, national, and local levels (Meyer et al. 1997, Knight and Messer 2012, Schofer and Hironaka 2005). For example, the activities of international environmental and scientific associations, both governmental and nongovernmental, have led nations to adopt environmental treaties and establish environmental ministries and laws (Frank, Hironaka, and Schofer 2000). As such, greater integration into world society has been shown to impact environmental policy and outcomes in countries around the world (Frank, Longhofer and Schofer 2007, Knight and Messer 2012, Schofer and Hironaka 2005, Shandra, Shor, and London 2009). Thus, over the past decades the institutionalization of environmentalism in a global regime and an increase in pro-environmental discourse has led to the diffusion of environmentalism from the West to less affluent nations (Longhofer and Schofer 2010). However, the focus of this literature on cross-national diffusion differs from our focus on within-nation diffusion across cohorts and cannot be tested with data and approach.

The alternative hypothesis can take two main forms, both depicted in Figure 1. First, we might find a non-significant interaction term. For example, the effect of SES on environmentalism may not change once it has fully emerged but remains strongly positive, as the post-materialist/affluence hypothesis predicts. Or an enduring weak or negative association between SES and environmentalism would lend support to the global environmentalism hypothesis. Second, a significant (positive or negative) interaction term might be linear in shape. Such a finding would suggest that the relationship between SES and environmentalism steadily increases in strength as the divide widens between post-materialists and materialists, in line with the post-materialist/affluence hypothesis, or as the divide widens between affluent groups protected from pollution and disadvantaged groups most exposed to pollution, which would provide evidence for the global environmentalist hypothesis.

Methods

Data

Testing the hypotheses requires data on individual-level attitudes towards environmental protection and measures of SES for a wide range of birth cohorts. Moreover, we aim to test our research hypothesis across nations to see whether the results can be generalized. The International Social Survey Program (ISSP) data module on environmental issues seems to be a good fit for these goals.² Two waves are available, one for 1993 and one for 2000. Merging these data sets generated 43,310 cases for 18 countries.³ We included only those countries surveyed in both waves, to allow for age, period, and cohort analysis.

Measures

Dependent variable—The sociological literature considers environmental concern to consist of three components, a cognitive component, an affective component, and a conative (or intentional) component (Maloney et al. 1975). In this study we used nine items reflecting these three components (see Table 1). Items one to four measure willingness to pay for environmental protection, which reflects the conative component (Franzen and Meyer 2010). Items six and seven tap into people's feelings (worries) about the environment and thus, reflect the affective component. Finally, items five, eight, and nine mirror rational considerations of the likely influence of science, economy, and the individual on environmental quality and hence represent the cognitive component. To incorporate these three components in one measure, Franzen and Meyer (2010) constructed an environmental concern scale. However, Dunlap and York (2008) draw attention to the problem of the multidimensionality of scales. Using scales that include multiple dimensions may reduce the sensitivity of the measure and bias the estimates. Rather than employing either a one-dimensional or a multi-dimensional measurement, we pursue both approaches. First, we constructed an "environmental concern" (EC) scale ($\alpha = 0.706$) using all nine items,

²Albeit a number of scholars have used data from the World Value Survey (WVS) (e.g., Dunlap and York 2008, Givens and Jorgenson 2011, Kight and Messer 2012) to study environmental concern, we follow another line of research (e.g., Franzen 2003, Franzen and Meyer 2010, Mostafa 2011) which has used data from the International Social Survey Project (ISSP). Even though the WVS covers more poor developing countries, the narrower focus of the ISSP sample on countries in the middle to upper range of the income spectrum guards against issues of cultural bias of the employed environmental measures (e.g. willingness to pay). For example, it has been argued that in poor countries individuals may not have the ability to pay for environmental reforms, yet exhibit concern and sacrifice for the environment in other ways (Brehin and Kempton 1997). By using data from more affluent countries we avoid this and other cultural, political, and economic complexities that come with a sample of both industrialized and developing nations.

³The 18 countries include the following nations: Great Britain, Northern Ireland, United States, West Germany, East Germany, Netherlands, Norway, Czech Republic, Slovenia, Bulgaria, Russia, New Zealand, Canada, Philippines, Israel, Japan, and Spain. We treat West Germany and East Germany as separate countries due to differences in the historical political context, and exposure to vastly different educational systems and socioeconomic conditions.

similar to Franzen and Meyer (2010). The items were recoded so that high values reflect higher levels of environmental concern (1=low environmental concern, 5=high environmental concern).

Second, we identified underlying dimensions, using an exploratory factor analysis (rotated factor matrix with a threshold of 0.40). The conative “willingness to pay” items (items 1–4) form a separate category, but the cognitive and affective items combine into a single second category. Thus, we constructed two additional scales, one for each of these two dimensions (see Table 1).

The items of the first factor were used to create a “willingness to pay” (WTP) scale ($\alpha = 0.768$).⁴ The second factor consists of two affective and three rational consideration items, which all seem to relate to the need for action. Thus, we call the third composite measure the “need for environmental action” (NEA) scale ($\alpha = 0.624$).⁵

Independent variables

Cohort: The cohort variable was constructed by subtracting the age of an individual from the survey year. The age of respondents ranged from 16 to 96 years with a mean of 45 years, and data were collected for two waves, 1993 and 2000; thus we include cohorts born between 1900 and 1984.⁶

SES: Measuring socioeconomic status is difficult due to its multidimensionality (Oakes and Rossi 2003). Frequently SES is approximated by determinants of education, income, and occupation (Winkleby et al. 1992). Defining SES through these three dimensions has historically developed over nearly a century. Based not on any specific theory but rather on a (normative) sense of social structure, census workers used the occupations of household heads for the first widely appreciated socioeconomic analyses (Nam and Terrie 1982). An alternative approach was to define SES through educational levels and income associated with occupations (Nam and Powers 1965). The rationale was that education is a prerequisite for a certain occupation, while income is the reward obtained from an investment in education (Oakes and Rossi 2003). Accordingly, education is crucial to SES and allows an individual to take on a certain occupation and associated monetary rewards. In addition to this theoretical rationale, health researchers have found education to be the best and most reliable measure to approximate an individual’s socio-economic status (Winkleby et al. 1992). In the study of environmental concern education shows a consistent positive association with pro-environmentalist attitudes, intentions, and behaviors (e.g., Franzen and Meyer 2010, Givens and Jorgenson 2011) and has been interpreted as a proxy for SES (e.g., Gelissen 2007). Aside from the measurement validity, education seems to be particularly well suited for our study of cohort change, for a number of reasons:

Education is related directly to the past experience of cohorts, since it is determined early in life. The education of an individual is likely to be the same whether measured at age 75 or measured 50 years ago at age 25. Other measures of social position such as income have the

⁴A number of studies have employed a willingness-to-pay scale to analyze environmental concern (Kemmelmeyer et al. 2002; Marquart-Pyatt 2008). Willingness to pay taps deep-seated beliefs and values, more than views approving of general environmental protection (Inglehart 1995). However, others like Brechin and Kempton (1994) and more recently Dunlap and York (2008) have voiced concern regarding the use of a “willingness-to-pay” scale on the ground that it reflects a western economic measure of worth. However, since our sample constitutes largely of middle to high income nations and does not include really poor countries (with the exception of the Philippines) the willingness-to-pay measure represents a meaningful reflection of individual’s environmental concern.

⁵To investigate the psychometric properties of the three dependent variables we constructed each scale separately by country.

Although, there is some variation in Cronbach’s alpha values (most notable, low values for Russia on the NEA scale and for the Philippines on the EC scale), the internal consistency is moderate to strong for most countries across scales.

⁶Some individuals in our sample were born before 1900, with birth years starting as early as 1897. However, because of the small numbers we combined individuals of the cohorts 1897 to 1900 in the 1900 cohort.

drawback of changing over the life-course. It is likely that for members of the older cohorts occupation and income will have changed substantially since they adopted their environmental attitudes. Education was recorded in categories of highest degree completed, ranging from 1=none to 7=university degree. On average, individuals had completed secondary school (mean=4.6). However, the educational system has changed over time and the average levels of school years completed as well as the access to education has increased substantially across cohorts (Wilson and Gove 1999). To purge our measure from this biasing influence we chose to z-standardize the education measure within cohorts and use this standardized measure in all models.

Despite their limitations for cohort studies, we employed measures of income and occupation. Some studies find a strong positive relationship between income and environmental concern (Franzen and Meyer 2010), whereas others report no consistent associations (Jones and Dunlap 1992). Since family income is reported in nation-specific currencies, we used z-scores to standardize income within countries, after adjusting the measure for family size (c.f. Franzen and Meyer 2010). The occupation measure was categorized as white-collar and blue-collar. Unfortunately, income information was missing for 11 out of 18 nations in 1993 and occupation data was not reported for 7 out of 18 nations for the same period. We therefore used income and occupation status for the robustness checks.

Control variables—We included a number of control variables that have been found to be important in predicting environmental concern.

Gender: Females have been found to be more environmentally concerned than men (Xiao and Dunlap 2007; Hamilton, Colocousis, and Duncan 2010), a finding that might be explained by women's higher assessment of personal and family dangers in relation to environmental threats (Hamilton et al. 2010; Davidson and Freudenburg 1996). We therefore included a dummy variable for gender (coded 1=male).

Post-materialism: Following Inglehart (1990), we constructed a measure of post-materialist value orientation. In response to two survey questions, individuals could mark no, one, or two post-materialist items.⁷ On average, people chose less than one post-materialist item (mean = 0.82) across the 18 nations included in our study. Besides showing the means for the predictors and controls mentioned in the text above, Table 2 illustrates that individuals were moderately concerned about the environment, with a mean of 3 that falls exactly on the midpoint of the scale ranging from 1 to 5. The willingness-to-pay measure shows the largest variation (SD= 0.90), indicating a certain measure of disagreement among the respondents.⁸

Estimation strategy

We employed a mixed-model approach that allows for the analysis of age, period, and cohort effects (Yang and Land 2006). The three outcome measures of environmental concern (composite measures) are approximately normal distributed. As such we employ linear multilevel models that use education, cohort, cohort squared, the interaction between education and cohort, and the control variables (gender, post-materialism, etc.) as predictors

⁷The survey question asked people: "Looking at the list below, please tick a box next to the one thing you think should be your country's highest priority." The answer options were as follows: 1. Maintain order in the nation, 2. Give people more say in government decisions, 3. Fight rising prices, 4. Protect freedom of speech. In the following question people were asked to pick the next highest priority and were given the same four answer choices. Both options 2 and 4 represent post-materialist values.

⁸A number of additional control variables not listed in Table 2 are available in the ISSP data set. However, including variables such as church attendance, political ideology, or community size would have reduced the number of countries used in the analysis due to missing values. We also did not use measures for marital status and employment status in the models because these variables have been shown to be unrelated to environmental concern (Franzen and Meyer 2010).

for environmental concern. The individual data are nested within a cross-classification of period and age.⁹ By measuring age in five-year categories, this approach eliminates the dependence of cohort on age and period.¹⁰ Following Yang and Land (2006), the level-1 or within-cell model takes the following form:

$$y_{ijk} = \beta_{0jk} + \beta_1 * \text{Cohort}_{ijk} + \beta_2 * \text{Cohort}_{ijk}^2 + \beta_3 * \text{Education}_{ijk} + \beta_4 * \text{Cohort}_{ijk} * \text{Education}_{ijk} + \beta_5 * \text{Cohort}_{ijk}^2 * \text{Education}_{ijk} + \sum \beta_m * X_{mijk} + e_{ijk},$$

where y_{ijk} represents the environmentalism outcome measures EC, WTP, and NEA; i refers to individuals within j age groups and k years (1993 and 2000); X refers to m control variables; and e refers to a normally distributed error with a mean of zero and variance of σ^2 . The product terms allow for nonlinear changes in the effect of education across cohorts. With the intercept assumed to vary randomly, the level-2 or between-cell model takes the following form:

$$\beta_{0jk} = \gamma_0 + u_{0j} + v_{0k},$$

where γ_0 is the model intercept or adjusted mean outcome; u_{0j} is the residual random effect of age group j on β_{0jk} averaged over all periods, which is assumed to be normally distributed with mean 0 and variance σ_u^2 ; and v_{0k} is the residual random effect of period k on β_{0jk} averaged over all ages, which is assumed to be normally distributed with mean 0 and variance σ_v^2 . The model thus allows for estimation of cohort effects on EC, WTP, and NEA with random effect controls for age group and period. The slope coefficients β_1 through β_m are treated as fixed. Dummy variables for each of the 18 countries were included in the fixed part of the model. Thus, we were able to capture variation in environmental concern between countries that stem from unobserved influences such as varying environmental policies, overall environmental conditions, country-level wealth, or technological advancement. The cross-classified random mixed effect models were estimated using STATA 11's (StataCorp LP, College Station, Texas) *xtmixed* procedure.

If our hypothesis is verified we would expect to see significant interaction terms between education and cohort, and education and cohort squared. Reflecting the initial positive effect of education across older cohorts, the education by cohort coefficient β_4 should be positive. Reflecting the weakening or negative effect of education across new cohorts, the education by cohort squared coefficient β_5 should be negative.

Results

We plotted the three environmental concern scales by cohort to get a general sense of possible attitudinal changes over time (see Figure 2).

As Figure 2 shows, only modest changes occurred in mean environmental concern across the cohorts measured. Willingness to pay (WTP) remained stable between 2.8 and 3.0, whereas need for environmental action (NEA) increased slightly, starting at a low value of about 2.5 for the 1910 cohort, reaching a high of 3.2 for the 1965 cohort, and dropping thereafter to 3.0 for the youngest cohorts. However, this graph shows only the bivariate relationship between cohort and environmental concern. Analyzing the interaction between

⁹See Yang and Land (2006: Table 2) for a visual depiction of a two-way cross-classified data structure.

¹⁰We estimated the final models with the continuous, single-year, age variable instead of the 5-years categories. The estimates of the random and fixed effects were similar for both specifications.

cohort and education in predicting environmental concern requires the use of multivariate regression models.

Table 3 examines the effects of the level-1 additive determinants of the three scales for environmental concern. The coefficients reflect the effect of each variable, net of random effects for year and age, and controlling for country fixed effects. On average people are moderately environmentally concerned, with a grand mean ranging from 2.5 to 2.7, depending on the composite measure used. Of the control variables, the strongest positive effect emerges for post-materialist value orientation, lending support to Inglehart's (1990, 1995) hypothesis. Gender has a significant effect only on the environmental concern (EC) and need for environmental action (NEA) scales (models 2 and 3). In both cases males appear to be less environmentally concerned than females, a phenomenon well established in the literature (Xiao and Dunlap 2007, Hamilton et al. 2010, Givens and Jorgenson 2011).

Of main concern for this study are the effects of cohort and education. Education shows a strong positive effect on all three environmental concern scales, confirming findings by a number of authors (Hamilton et al. 2010; Gelissen 2007; Jones and Dunlap 1992). In addition, environmental concern seems to change with birth cohort in a non-linear way. The positive coefficient of the cohort term and negative coefficient of the squared term suggest that environmentalism first increases for older cohorts, but then levels off and declines (starting with the 1963 cohort for the EC scale).

To fully test our hypothesis we included a non-linear interaction between cohort and the measure for SES in all models.¹¹ The results (see Table 4) reveal consistently significant coefficients for the interaction terms ($\text{Education} \times \text{Cohort}$; $\text{Education} \times \text{Cohort}^2$), verifying our hypothesis and providing evidence that the effect of education on environmental concern varies with birth cohort.¹²

The significant coefficient for the $\text{Education} \times \text{Cohort}$ interaction term indicates that for earlier cohorts the positive effect of education in predicting environmental concern grows in strength. The significant, negative coefficient for the $\text{Education} \times \text{Cohort}^2$ interaction term indicates that the observed relationship is non-linear with a concave shape. We can thus infer that the association between education and environmental concern weakens for younger cohorts. This relationship can be best visualized graphically.

As Figure 3 shows, the slope of education predicting environmental concern is positive for older cohorts. This association suggests that groups of high and low educational levels differ in their environmental concern and that the difference between educational groups increases from the oldest cohorts to those born several decades later. Thus, we observe a divergence or polarization between well-educated high-status groups and less educated, lower-status groups, as the affluence and post-materialist hypotheses predict (Inglehart 1995; Franzen and Meyer 2010). However, the increase in the difference levels off until a bend-point is reached for individuals born around 1940, after which the gap starts to close. The weakening of the positive relationship between education and environmentalism reflects the vertical spread of environmentalism from high-educated to low-educated groups (Buttel and Flinn 1978; Morrison 1986; Uyecki and Holland 2000). For younger cohorts the relationship becomes increasingly negative, suggesting that low educated (low-SES) groups are

¹¹To facilitate the interpretation of the interaction coefficients, we grand-mean centered all variables.

¹²Our analysis can be considered stringent because we use a control variable for post-materialism in all models. When post-materialism is removed, the effect of education becomes stronger. We also reran the interaction models including household income as a control variable. The interaction terms remain significant except for the willingness-to-pay scale, for which the $\text{Education} \times \text{Cohort}$ interaction drops below the significant level ($b=.027$; $z=1.31$), while the $\text{Education} \times \text{Cohort}^2$ interaction remains significant ($b=-.005$; $z=-2.32$), consistently demonstrating a concave shape of the investigated relationship.

becoming gradually more environmentally concerned compared to high educated (high-SES) groups. For the youngest cohorts the difference between the education groups almost disappears, and the association between environmental concern and education fits the global environmentalism hypothesis (Dunlap and York 2008).¹³

Figure 3 also displays some differences in the trajectories for the three environmentalism measures. The EC, NEA, and WTP curves show different slopes for the oldest cohorts, converge for the 1950 cohort, and then follow similar trajectories for the youngest cohorts. The slope for the need-for-environmental-action scale starts lower and grows more quickly than the slope for the willingness-to-pay composite. This indicates that horizontal diffusion within the educated class was much stronger for awareness of the need-for-environmental-action than it was for willingness-to-pay. Among the oldest cohorts only a few highly educated individuals supported the notion that more environmental action was needed and substantial polarization followed.

For willingness to pay, the diffusion process was less radical. Already for the earliest cohorts a much larger fraction of highly educated than poorly educated individuals were willing to make some financial sacrifices to improve the environment. This fraction further increased, but more slowly than did awareness of the need for environmental action. After a number of decades however, awareness of need caught up with willingness to pay among highly educated (high-SES) groups (the slopes of NEA and WTP had converged). Then, for cohorts born after 1950, less educated individuals began to adopt the environmental attitudes of highly educated groups as a package, viewing willingness to pay and the idea that more environmental action was needed as two facets of the same holistic pro-environmentalist attitude and lifestyle.

Robustness tests

To test the strength of the observed relationship we conducted a number of robustness checks that can be conceptually grouped in regional-specific and measurement-specific tests.

Regional-specific tests

First we separated the 18 countries into western states, eastern states, and others. Countries that have been using a capitalist free-market system were categorized as “western” and included northern and western European countries, the U.S., New Zealand, and Japan. Categorized as “eastern” were former communist nations, including most Eastern European countries and Russia. Categorized as “other” were the Philippines and Israel. Running the models shows that for all three subsets of countries the interaction coefficients remain significant for the environmental concern scale and the need for environmental action scale but not for the willingness-to-pay scale, though the shape of the curve is similar.

An interesting pattern in the size of the relationship is revealed in Table 5, comparing the coefficients for the three regions. For both the NEA and EC scales, the slope of the *Education × Cohort* term is steeper (has larger values) for the eastern than for the western nations. A steeper slope is associated with stronger initial increase in difference between low and high education groups in environmental concern. However, the size of the *Education × Cohort*² coefficient is very similar and in all cases negative, indicating a concave relationship that follows a similar trajectory across regions for later cohorts.

¹³In order to test the reliability of our findings for each item, we ran fully adjusted interaction models for each of the nine environmentalism measures separately. For 7 (78%) out of the 9 items the interactions stayed significant. However, no significant interaction effects were obtained for items 4 and 8 (see Table 1 for a detailed item description).

In addition, it might be argued that the various countries in our analysis have unique educational systems which might impact the comparability of values across countries. To explore the impact of potential cross-national variations on our results, we z-standardized education within countries and re-estimated the models. As Panel D in Table 5 shows the two interaction terms remain significant for all three environmental concern scales.

As a further sensitivity analysis we checked for influential nations. We employed a jack-knife type procedure for estimating the models, leaving out one country at a time from the group of nations (cf. Ruiter and DeGraaf 2006). Whatever country was excluded, the two interaction terms remained significant for the models predicting WTP, NEA, and EC.

Measurement-specific tests

For a final robustness check we investigated whether the observed relationship for education holds for other measures of SES. To this end we reran the models with interactions between cohort and family income as well as with occupation (see Table 6 below).

Panel A of Table 6 reveals a significant and positive main effect of family income on all three outcome variables, thus providing additional support for the affluence hypothesis (Franzen and Meyer 2010). However, the interaction of income with cohort was not significant. This lack of significance may result from a truncated sample of nations and measurement error in reporting income.

A significant interaction between the dummy variable for occupation with cohort and its squared term became evident for the NEA scale (but not WTP or EC). The change in the difference between white-collar and blue-collar workers on the NEA scale follows the same non-linear trajectory observed for education.

In a subsequent step we combined education, occupation, and income and created a standardized SES scale (Chronbach's $\alpha = 0.613$). As shown in Panel C of Table 6, the interaction between cohort and the SES scale produces strong significant results for all three environmental concern measures, closely resembling the findings for the *cohort $\times$ education* interaction. As such, our findings can be generalized to SES more broadly. Finally, we tested whether the impact of post-materialism on environmentalism changes across cohorts in a non-linear way. Similar to education, post-materialist values are formed during early adulthood and remain relatively unchanged throughout the life course (Inglehart 1990, Inglehart and Abramson 1994). Panel D of Table 6 demonstrates that the impact of post-materialism for both the EC and NEA measures (but not for the WTP scale) first increases among older cohort, then levels off, and subsequently decreases among younger cohorts similar to the curvilinear progression found for education. In summary, the performed robustness checks provide partial evidence for a non-linear relationship between SES (and associated measures such as post-materialism) and environmental concern that changes across cohorts.

Conclusion

In this study we have explored the effect of education on environmental concern for a sample of 18 countries. The results verified our hypothesis that the effect of education on environmental concern is non-linear: the effect first increases with cohorts born early in the twentieth century, then levels off and peaks for cohorts born around 1940, and subsequently becomes increasingly weaker for younger cohorts. Thus, the results show that a diffusion-of-innovation approach (Fischer and Hout 2006, Rogers 2003) is well suited to explain the complex relationship between education or SES more broadly and environmental concern.

This approach includes aspects of post-materialism and the global environmentalism hypothesis but also extends both arguments.

The concave relationship that we observed cautions against basing a theory on a presumed linear change in the social distributions of environmental concern as frequently done by the post-materialist and affluence hypotheses. Although the relationship between education and environmental concern is strong and positive in our additive models, the Bayesian Information Criteria (BIC) statistic indicates a better model fit for a non-linear interaction. Thus, the relationship between SES and environmental concern appears to be complex and “simplistic [linear] explanations are inadequate to fully understand the diverse and complex sources of environmentalism” (Hunter, Strife, and Twine 2010: 527). Our findings further suggest that the frequently found positive association between SES and environmentalism holds most clearly among older cohorts. As future studies use data sets with higher proportions of younger cohorts, predictions based on the post-materialist and affluence hypothesis of a strong positive SES environmentalism relationship should receive less support. The global environmentalism hypothesis is likely to do better in explaining the relationship between SES and environmentalism for younger cohorts in the future.

This study demonstrated the usefulness of the diffusion-of-innovation approach not only for a single country but across 18 nations. These countries are comprised largely of middle- and high-income nations and include only few less affluent countries and no really poor countries (such as Nigeria, Nicaragua, or India). Nevertheless, our sample comprises of nations of differing socio-political backgrounds. We found that former communist countries and western nations alike witnessed a largely similar transition from environmentalism as part of a high-SES lifestyle to environmentalism as equally important to low-SES individuals. It is interesting to observe that a similar cohort change in the effect of SES on environmental concern took place in countries as diverse as Great Britain, Russia, and Israel, which differ substantially in their environment-related “objective problems and subjective values” (Inglehart 1995). Further research is warranted to explore the root causes of this cross-national diffusion of environmental concern.

The results confirm and extend results found by Pampel and Hunter (2012) for the United States. They used a longer period of study but only one country and a narrowly defined measure of support for environmental spending. That the results here held for a set of diverse European nations suggests both the generality and limitations of the results. They are general in applying across multiple nations and measures, but they are limited in not applying to European nations. Processes of change in other parts of the world may differ and deserve more study. Arguments about changes in the relationship between SES and environmental concern need to be applied to low and middle-income nations.

A few other limitations of our study deserve mention. We used education as the primary measure for SES in this study. Education has the advantage of being determined early in life, at the time when environmental attitudes are formed. However, education effects are sometimes interpreted as resulting from cognitive skills needed to understand the seriousness of environmental effects rather than as an influence of SES (van Liere and Dunlap 1980; Jones and Dunlap 1992). Using a composite SES measure that combines education, income, and occupation information indicates that the results observed for education can be extended to SES in general. However, problems of data availability in the alternative SES measures pose some limitations and future studies should try to replicate our findings with more robust measures for income and occupation.

A further limitation is the use of an environmental concern scale. A composite measure might define a particular concept either too broadly or too narrowly – a topic hotly debated

among scholars of environmental concern (Dunlap and York 2008). To address this problem and to guard against multidimensionality we employed three different composite measures in this study. The largely similar findings observed for all three composite measures lend a certain level of confidence to our results.

In the present analysis we employ cross-classified multilevel models to address the age-period-cohort dependence in combination with repeated cross-sectional data. This approach is the best possible option to explore cohort effects across a time span of about 80 years. Of course, data on additional cohorts would allow for a more precise test of the hypotheses and future research should aim to replicate our findings with data for more recent cohorts. In addition, the employed methodology is not without statistical limitations. A problem that might impact the accuracy of the estimates is the varying sample size within the level-2 units (Yang and Land 2006). However, this problem is likely to bias the random effects but not the fixed parameter estimates, which are of main concern in this study. In addition, we guard against small numbers within level-2 clusters by using five-year age categories instead of the single-year age information, which increases the number of cases in each level-2 cell, defined jointly by age and period.

Despite these limitations, the results demonstrate a robust pattern of change across cohorts in the socioeconomic determinants of environmental concern. The approach employed here provides new insights in the process of value changes over long periods of time as well as across multiple nations. Future research may exploit this approach for more focused studies of contemporary issues such as support for nuclear energy (Pampel 2011), or views on climate change (McCright and Dunlap 2011a, 2011b) and its social determinants.

References

- Abramson PR. Postmaterialism and environmentalism: A comment on an analysis and a reappraisal. *Social Science Quarterly*. 1997; 78:21–23.
- Adeola FO. Environmentalism and risk perception: Empirical analysis of black and white differentials and convergence. *Society & Natural Resources*. 2004; 17:911–939.
- — —. Nativity and environmental risk perception: An empirical study of native-born and foreign-born residents of the USA. *Human Ecology Review*. 2007; 14:13–25.
- Bourdieu, P. *Distinction: A social critique of the judgment of taste*. Nice, Richard, editor. Harvard University Press; Cambridge, MA: 1984.
- Brechin SR. Objective problems, subjective values, and global environmentalism: Evaluating the postmaterialist argument and challenging a new explanation. *Social Science Quarterly*. 1999; 80:793–809.
- Brechin SR, Kempton W. Global environmentalism: A challenge to the postmaterialism thesis. *Social Science Quarterly*. 1994; 75:245–269.
- — —. Beyond postmaterialist values: National versus individual explanations of global environmentalism. *Social Science Quarterly*. 1997; 78:16–20.
- Brulle RJ, Pellow DN. Environmental justice: Human health and environmental inequalities. *Annual Review of Public Health*. 2006; 27:103–124.
- Buttel FH. Age and environmental concern: A multivariate analysis. *Youth & Society*. 1979; 10:237–256.
- Buttel FH, Flinn WL. The structure of support for the environmental movement, 1968-1970. *Rural Sociology*. 1974; 39:56–69.
- — —. Social class and mass environmental beliefs: A reconsideration. *Environment and Behavior*. 1978; 10:433–450.
- Casterline, JB. Diffusion processes and fertility transition: Introduction. In: Casterline, John B., editor. *Diffusion processes and fertility transition: Selected perspectives*. National Academy Press; Washington, DC: 2001. p. 1-38.

- Davidson DJ, Freudenburg WR. Gender and environmental risk concerns: A review and analysis of available research. *Environment and Behavior*. 1996; 28:302–339.
- Diekmann A, Franzen A. The wealth of nations and environmental concern. *Environment and Behavior*. 1999; 31:540–549.
- Diekmann A, Preisendörfer P. Green and greenback: The behavioral effects of environmental attitudes in low-cost and high-cost situations. *Rationality and Society*. 2003; 15:441–472.
- Dietz T, Fitzgerald A, Shwom R. Environmental values. *Annual Review of Environment and Resources*. 2005; 30:335–372.
- Dunlap, RE.; Gallup, G.; Gallup, A. The health of the planet survey: A preliminary report on attitudes toward the environment and economic growth measured by surveys of citizens in 22 nations to date. Gallup International Institute; Princeton, NJ: 1992.
- Dunlap RE, Mertig AG. Global concern for the environment: Is affluence a prerequisite? *Journal of Social Issues*. 1995; 51:121–137.
- — —. Global environmental concern: An anomaly for postmaterialism. *Social Science Quarterly*. 1997; 78:24–29.
- Dunlap RE, York R. The globalization of environmental concern and the limits of the postmaterialist values explanation: Evidence from four multinational surveys. *Sociological Quarterly*. 2008; 49:529–563.
- Egri CP, Ralston DA. Generation cohorts and personal values: A comparison of China and the United States. *Organization Science*. 2004; 15(2):210–220.
- Fischer CS. Urban-to-rural diffusion of opinions in contemporary America. *American Journal of Sociology*. 1978; 84:151–159.
- Fischer, CS.; Hout, M. Century of difference: How America changed in the last one hundred years. Russell Sage Foundation; New York: 2006.
- Frank DJ, Hironaka A, Schofer E. The nation-state and the natural environment over the twentieth century. *American Sociological Review*. 2000; 65(1):96–116.
- Frank DJ, Longhofer W, Schofer E. Wold Society, NGOs, and environmental policy reform in Asia. *International Journal of Comparative Sociology*. 2007; 48(4-5):275–295.
- Franzen A. Environmental attitudes in international comparison: An analysis of the ISSP surveys 1993 and 2000. *Social Science Quarterly*. 2003; 84:297–308.
- Franzen A, Meyer R. Environmental attitudes in cross-national perspective: A multilevel analysis of the ISSP 1993 and 2000. *European Sociological Review*. 2010; 26:219–234.
- Gelissen J. Explaining popular support for environmental protection - A multilevel analysis of 50 nations. *Environment and Behavior*. 2007; 39:392–415.
- Givens JE, Jorgenson AK. The Effects of Affluence, Economic Development, and Environmental Degradation on Environmental Concern: A Multilevel Analysis. [Article]. *Organization & Environment*. 2011; 24(1):74–91.
- Hamilton LC, Colocousis CR, Duncan CM. Place effects on environmental views. *Rural Sociology*. 2010; 75:326–347.
- Hunter LM, Strife S, Twine W. Environmental perceptions of rural South African residents: The complex nature of environmental concern. *Society & Natural Resources*. 2010; 23:525–541. [PubMed: 20514147]
- Inglehart, R. Culture shift in advanced industrial society. Princeton University Press; Princeton, NJ: 1990.
- — —. Public support for environmental protection: Objective problems and subjective values in 43 societies. *PS: Political Science and Politics*. 1995; 28:57–72.
- — —. Modernization and postmodernization: Cultural, economic, and political change in 43 societies. Princeton University Press; Princeton, NJ: 1997.
- Inglehart R, Abramson PR. Economic-security and value change. *American Political Science Review*. 1994; 88(2):336–354.
- Jones RE, Dunlap RE. The social bases of environmental concern: Have they changed over time? *Rural Sociology*. 1992; 57:28–47.

- Kahn ME. Demographic change and the demand for environmental regulation. *Journal of Policy Analysis and Management*. 2002; 21:45–62.
- Kanagy CL, Humphrey CR, Firebaugh G. Surging environmentalism: Changing public opinion or changing publics? *Social Science Quarterly*. 1994; 75:804–819.
- Kemmelmeier M, Krol G, Kim YH. Values, economics, and proenvironmental attitudes in 22 societies. *Cross-Cultural Research*. 2002; 36:256–285.
- Kidd Q, Lee A-R. Postmaterialist values and the environment: A critique and reappraisal. *Social Science Quarterly*. 1997; 78:1–15.
- Klineberg SL, McKeever M, Rothenbach B. Demographic predictors of environmental concern: It does make a difference how it's measured. *Social Science Quarterly*. 1998; 79:734–753.
- Knight KW, Messer BL. Environmental concern in cross-national perspective: The effects of affluence, environmental degradation, and world society. *Social Science Quarterly*. 2012; 93:521–537.
- Krausmann F, Gingrich S, Eisenmenger N, Erb KH, Haberl H, Fischer-Kowalski M. Growth in global materials use, GDP and population during the 20th century. *Ecological Economics*. 2009; 68(10): 2696–2705.
- Longhofer W, Schofer E. National and Global Origins of Environmental Association. *American Sociological Review*. 2010; 75(4):505–533.
- Lubinski D, Schmidt DB, Benbow CP. A 20-year stability analysis of the study of values for intellectually gifted individuals from adolescence to adulthood. [Article]. *Journal of Applied Psychology*. 1996; 81(4):443–451.
- Maloney MP, Ward MP, Braucht GN. Psychology in action - Revised scale for measurement of ecological attitudes and knowledge. *American Psychologist*. 1975; 30:787–790.
- Marquart-Pyatt ST. Are there similar sources of environmental concern? Comparing industrialized countries. *Social Science Quarterly*. 2008; 89:1312–1335.
- McCright AM, Dunlap RE. Cool dudes: The denial of climate change among conservative white males in the United States. *Global Environmental Change-Human and Policy Dimensions*. 2011a; 21(4): 1163–1172.
- — —. The politicization of climate change and polarization in the American public's views of global warming, 2001-2010. *Sociological Quarterly*. 2011b; 52(2):155–194.
- Meglino BM, Ravlin EC. Individual values in organizations: Concepts, controversies, and research. *Journal of Management*. 1998; 24(3):351–389.
- Meyer JW, Boli J, Thomas GM, Ramirez FO. World society and the nation-state. [Review]. *American Journal of Sociology*. 1997; 103(1):144–181.
- Meyer R, Liebe U. Are the affluent prepared to pay for the planet? Explaining willingness to pay for public and quasi-private environmental goods in Switzerland. *Population and Environment*. 2010; 32:42–65. [PubMed: 20835384]
- Mohai P, Twaight BW. Age and environmentalism: An elaboration of the Buttel model using national survey evidence. *Social Science Quarterly*. 1987; 68:798–815.
- Montgomery MR, Casterline JB. The diffusion of fertility control in Taiwan: Evidence from pooled cross-section time-series models. *Population Studies*. 1993; 47:457–479. [PubMed: 11613198]
- Morrison, DE. How and why environmental consciousness has trickled down. In: Schnaiberg, A.; Watts, N.; Zimmermann, K., editors. *Distributional conflicts in environmental-resource policy*. St. Martin's Press; New York: 1986. p. 187-220.
- Nam CB, Powers MG. Variations in socioeconomic structure by race, residence, and the life-cycle. *American Sociological Review*. 1965; 30(1):97–103.
- Nam, CB.; Terrie, WE. Measurement of socioeconomic status from United States census data. In: Powers, MG., editor. *Measures of socioeconomic status*. Westview; Boulder, CO: 1982. p. 29-42.
- Oakes JM, Rossi PH. The measurement of SES in health research: current practice and steps toward a new approach. *Social Science & Medicine*. 2003; 56(4):769–784. [PubMed: 12560010]
- Pampel FC. Support for Nuclear Energy in the Context of Climate Change: Evidence From the European Union. *Organization & Environment*. 2011; 24(3):249–268.

- Pampel FC, Hunter LM. Cohort Change, Diffusion, and Support for Environmental Spending. *American Journal of Sociology*. 2012 forthcoming.
- Rogers, EM. Diffusion of innovations. Free Press; New York: 2003.
- Ruiter S, De Graaf ND. National context, religiosity, and volunteering: Results from 53 countries. *American Sociological Review*. 2006; 71:191–210.
- Ryder NB. The cohort as a concept in the study of social change. *American Sociological Review*. 1965; 30:843–861. [PubMed: 5846306]
- Schofer E, Hironaka A. The effects of world society on environmental protection outcomes. *Social Forces*. 2005; 84(1):25–47.
- Shandra JM, Shor E, London B. World Polity, Unequal Ecological Exchange, and Organic Water Pollution: A Cross-National Analysis of Developing Nations. *Human Ecology Review*. 2009; 16(1):53–63.
- Stern PC. Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*. 2000; 56:407–424.
- Strang D, Meyer JW. Institutional conditions for diffusion. *Theory and Society*. 1993; 22:487–511.
- Strang D, Soule SA. Diffusion in organizations and social movements: From hybrid corn to poison pills. *Annual Review of Sociology*. 1998; 24:265–290.
- Uyeki ES, Holland LJ. Diffusion of pro-environment attitudes? *American Behavioral Scientist*. 2000; 43:646–662.
- Van Liere KD, Dunlap RE. Environmental concern: Does it make a difference how it's measured? *Environment and Behavior*. 1981; 13:651–676.
- Weber, M. From Max Weber: Essays in sociology. Gerth, HH.; Mills, C. Wright, editors. Oxford University Press; New York: 1958. Translated, edited and with an introduction by
- Wejnert B. Integrating models of diffusion of innovations: A conceptual framework. *Annual Review of Sociology*. 2002; 28:297–326.
- Whittaker M, Segura GM, Bowler S. Racial/ethnic group attitudes toward environmental protection in California: Is “environmentalism” still a white phenomenon? *Political Research Quarterly*. 2005; 58:435–447.
- Wilson JA, Gove WR. The intercohort decline in verbal ability: Does it exist? *American Sociological Review*. 1999; 64(2):253–266.
- Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic-status and health - how education, income, and occupation contribute to risk-factors for cardiovascular-disease. *American Journal of Public Health*. 1992; 82(6):816–820. [PubMed: 1585961]
- Xiao CY, Dunlap RE. Validating a comprehensive model of environmental concern cross-nationally: A US-Canadian comparison. *Social Science Quarterly*. 2007; 88:471–493.
- Yang Y, Land KC. A mixed models approach to the age-period-cohort analysis of repeated cross-section surveys, with an application to data on trends in verbal test scores. *Sociological Methodology*. 2006; 36(1):75–97.

**Diffusion-of-innovation hypothesis:
Significant interaction, concave shape**

a: Post-materialist hypothesis
Affluence hypothesis
b: Modernization hypothesis

**Alternative hypothesis 1:
Non-significant interaction**

**Alternative hypothesis 2:
Significant interaction, linear shape**

Fig. 1.
Graphical depiction of hypotheses, testing the relationship between cohort and socio-economic status in predicting environmental concern

Fig. 2.
Cohort trends in environmental concern (EC), need for environmental action (NEA), and willingness to pay (WP)

Fig. 3. Slope for influence of education on environmental concern (EC), need for environmental action (NEA), and willingness to pay (WTP) by cohort

Table 1

Survey items from ISSP 1993 and 2000 used to form the environmental concern scales

Items	Survey item	Factor
1	How willing would you be to pay much higher prices in order to protect the environment? (very unwilling to very willing)	1 ^a
2	How willing would you be to pay much higher taxes in order to protect the environment? (very unwilling to very willing)	
3	How willing would you be to accept cuts in your standard of living in order to protect the environment? (very unwilling to very willing)	
4	I do what is right for the environment, even when it costs more money or takes more time (very unwilling to very willing)	
5	Modern science will solve our environmental problems with little change to our way of living (strongly disagree to strongly agree)	2 ^b
6	We worry too much about the future of the environment and not enough about prices and jobs (strongly disagree to strongly agree)	
7	People worry too much about human progress harming the environment (strongly disagree to strongly agree)	
8	In order to protect the environment the country needs economic growth (strongly disagree to strongly agree)	
9	It is just too difficult for someone like me to do much about the environment (strongly disagree to strongly agree)	

Note: the range of answer options is given in parentheses;

^a Items 1 to 4 load highly on factor 1 and were used to create the standardized willingness-to-pay (WTP) scale;

^b Items 5 to 9 load highly on factor 2 and were used to construct the standardized need for environmental action (NEA) scale; All items 1 to 9 were used for the combined environmental concern (EC) scale. *Source:* International Social Survey Program, Environment I (1993) & Environment II (2000)

Table 2

Summary statistics of selected variables employed for the analysis of cohort related changes in environmental concern for the combined ISSP 1993 and 2000 data set

	Nation N by wave						
	Obs	Mean	(S.D.)	Min	Max	1993	2000
<u>Outcomes</u>							
WTP ^a	42,912	3.00	(0.90)	1	5	18	18
NEA ^a	43,028	3.03	(0.77)	1	5	18	18
EC ^a	43,162	3.01	(0.66)	1	5	18	18
<u>Predictors & Controls</u>							
Cohort	42,917	1952	(17)	1900	1984	18	18
Age	42,917	45	(17)	16	96	18	18
Period	43,310	1996	(3)	1993	2000	18	18
Education (standardized)	42,989	0.00	(1.00)	−3.41	2.94	18	18
Family income (standardized)	23,185	0.00	(1.00)	−2.11	24.82	7	18
White-collar (ref: blue-collar)	26,694	0.46	(0.50)	0	1	13	18
Post-materialism	39,479	0.82	(0.62)	0	2	18	18
Male (ref: female)	43,273	0.46	(0.50)	0	1	18	18

^aWTP=Willingness to pay scale; NEA= need for environmental action scale; EC=environmental concern scale;

Source: International Social Survey Program, Environment I (1993) & Environment II (2000)

Table 3

Unstandardized coefficients for the additive random intercept model predicting willingness to pay, need for environmental action, and environmental concern

Parameter	WTP ^a			NEA ^a			EC ^a		
	b	z		b	z		b	z	
Male	0.012	1.34		-0.041	-5.95	***	-0.016	-2.71	**
Post-materialism	0.180	23.95	***	0.124	20.82	***	0.150	29.39	***
Cohort	0.151	8.11	***	0.235	15.03	***	0.201	19.35	***
Cohort ²	-0.015	-7.68	***	-0.016	-9.80	***	-0.016	-14.83	***
Education	0.140	30.03	***	0.129	35.00	***	0.134	42.51	***
Intercept	2.659	26.94	***	2.447	56.44	***	2.526	44.06	***
Random effects ^b									
Age	0.023	-10.81	***	0.022	-9.73	***	0.007	-5.44	***
Period	0.123	-2.95	**	0.029	-4.86	***	0.071	-3.72	***
Within cohorts	0.856	-43.33	***	0.678	-108.29	***	0.583	-150.32	***
N	38,656			38,751			38,823		
BIC ^c	98,073			80,244			68,701		

^aWTP=Willingness to pay scale; NEA= need for environmental action scale; EC=environmental concern scale;

^bRandom effects are reported in standard deviation units;

^cBayesian Information Criteria; lower values suggest a better model fit; all models control for country fixed effects;

* p .05;

** p .01;

*** p .001

Source: International Social Survey Program, Environment I (1993) & Environment II (2000)

Table 4

Unstandardized coefficients for the interaction between cohort and education in predicting WTP, NEA, and EC

	WTP ^a		NEA ^a		EC ^a			
Parameter	b	z		b	z		b	z
Male	0.010	1.12		−0.043	−6.17	***	−0.018	−3.01
Post-materialism	0.176	23.18	***	0.120	19.98	***	0.146	28.34
Cohort	0.148	8.07	***	0.234	15.05	***	0.201	19.80
Cohort ²	−0.014	−7.62	***	−0.016	−9.82	***	−0.016	−15.20
Education	0.140	29.99	***	0.128	34.71	***	0.134	42.30
× Cohort	0.036	2.60	**	0.082	7.43	***	0.062	6.57
× Cohort ²	−0.005	−3.88	***	−0.009	−7.78	***	−0.007	−7.64
Intercept	3.000	34.51	***	3.027	146.36	***	3.012	60.62
Random effects ^b								
Age	0.022	−10.89	***	0.022	−9.57	***	0.006	−4.54
Period	0.122	−2.96	**	0.028	−4.90	***	0.070	−3.74
Within cohorts	0.855	−43.20	***	0.677	−107.86	***	0.582	−149.69
N	38,151			38,243			38,313	
BIC ^c	96,794			79,157			67,743	

^aWTP=Willingness to pay scale; NEA= need for environmental action scale; EC=environmental concern scale;

^bRandom effects are reported in standard deviation units;

^cBayesian Information Criteria; lower values suggest a better model fit; Models control for country fixed effects; All variables were grand mean centered to guard against issues arising from multi-collinearity;

* p .05;

** p .01;

*** p .001

Source: International Social Survey Program, Environment I (1993) & Environment II (2000)

Table 5

Unstandardized coefficients for interaction terms predicting WTP, NEA, and EC for various alternative specifications

	WTP ^a			NEA ^a			EC ^a		
	b	z		b	z		b	z	
<u>Panel A: Western capitalist nations ²</u>									
Cohort	0.189	8.01	***	0.290	13.01	***	0.255	18.32	***
Cohort ²	-0.020	-8.10	***	-0.021	-8.84	***	-0.021	-14.78	***
Education	0.145	24.30	***	0.160	32.94	***	0.154	35.95	***
× Cohort	0.025	1.48		0.072	5.21	***	0.051	4.17	***
× Cohort ²	-0.004	-2.24	*	-0.008	-5.58	***	-0.006	-4.85	***
<u>Panel B: Easter former communist nations ⁴</u>									
Cohort	0.164	5.19	***	0.061	2.62	**	0.108	5.55	***
Cohort ²	-0.014	-4.30	***	0.001	0.52		-0.005	-2.76	**
Education	0.137	14.02	***	0.109	14.79	***	0.123	19.94	***
– Cohort	0.053	1.71		0.093	3.92	***	0.075	3.77	***
× Cohort ²	-0.007	-2.36	*	-0.009	-3.77	***	-0.008	-4.14	***
<u>Panel C: Other nations ⁴</u>									
Cohort	0.045	0.82		0.121	3.42	***	0.067	2.29	*
Cohort ²	-0.004	-0.80		-0.010	-2.96	**	-0.005	-1.88	
Education	0.131	10.93	***	0.058	6.67	***	0.091	12.56	***
× Cohort	0.068	1.78		0.084	2.98	**	0.077	3.33	***
× Cohort ²	-0.008	-2.23	*	-0.008	-2.95	**	-0.008	-3.66	***
<u>Panel D: Education standardized within countries</u>									
Cohort	0.087	3.99	***	0.187	13.04	***	0.138	10.11	***
Cohort ²	-0.010	-4.65	***	-0.013	-8.86	***	-0.011	-8.08	***
Education	0.102	3.07	**	0.014	0.54		0.052	2.35	*
× Cohort	0.031	2.18	*	0.058	5.27	***	0.047	4.89	***
× Cohort ²	-0.004	-2.93	**	-0.006	-5.54	***	-0.005	-5.55	***

^aWTP=Willingness to pay scale; NEA= need for environmental action scale; EC=environmental concern scale; Models in Panel A to D control for country fixed effects, gender, and post-materialism; All variables were grand mean centered to guard against issues arising from multi-collinearity;

²West (11 countries): West Germany, Great Britain, Northern Ireland, U.S.A., Ireland, Netherlands, Norway, New Zealand, Canada, Japan, Spain;

³East (5 countries): East Germany, Czech Republic, Slovenia, Bulgaria, Russia;

⁴Other (2 countries): Philippines, Israel;

* p .05;

** p .01;

*** p .001

Source: International Social Survey Program, Environment I (1993) & Environment II (2000)

Table 6

Unstandardized coefficients for interaction terms predicting WTP, NEA, and EC for various measures of SES

	WTP ^a			NEA ^a			EC ^a		
	b	z		b	z		b	z	
<u>Panel A: Interaction of cohort with family income</u>									
Cohort	0.128	6.11	***	0.191	8.74	***	0.180	12.87	***
Cohort ²	-0.013	-6.59	***	-0.012	-5.51	***	-0.014	-10.47	***
Income	0.045	6.83	***	0.039	7.66	***	0.042	9.66	***
× Cohort	0.003	0.15		0.001	0.05		0.001	0.10	
× Cohort ²	-0.002	-0.93		-0.001	-0.52		-0.001	-0.95	
<u>Panel B: Interaction of cohort with occupation</u>									
Cohort	0.186	6.45	***	0.184	8.79	***	0.184	10.64	***
Cohort ²	-0.019	-6.38	***	-0.011	-5.18	***	-0.014	-8.13	***
White-collar ^b	0.116	8.67	***	0.106	9.99	***	0.112	12.30	***
× Cohort	-0.032	-0.77		0.115	3.51	***	0.041	1.44	
× Cohort ²	0.001	0.15		-0.012	-3.56	***	-0.006	-1.97	*
<u>Panel C: Interaction of cohort with composite SES measure</u>									
Cohort	0.129	7.32	***	0.229	16.20	***	0.186	19.83	***
Cohort ²	-0.013	-7.16	***	-0.016	-10.68	***	-0.014	-15.33	***
SES	0.161	30.16	***	0.149	35.23	***	0.155	42.85	***
× Cohort	0.052	3.26	**	0.096	7.61	***	0.077	7.08	***
× Cohort ²	-0.007	-4.53	***	-0.010	-7.99	***	-0.009	-8.21	***
<u>Panel D: Interaction of cohort with post-materialism</u>									
Cohort	0.145	7.75	***	0.242	16.22	***	0.201	19.10	***
Cohort ²	-0.014	-7.33	***	-0.016	-10.70	***	-0.016	-14.59	***
Post-materialism	0.178	23.57	***	0.121	20.29	***	0.148	28.78	***
× Cohort	-0.003	-0.14		0.094	5.27	***	0.054	3.53	***
× Cohort ²	-0.001	-0.48		-0.009	-5.23	***	-0.006	-3.94	***

^aWTP=Willingness to pay scale; NEA= need for environmental action scale; EC=environmental concern scale;^bReference category: Blue-collar; Models in Panel A to F control for country fixed effects, gender, and post-materialism; Models in Panel A, B & D control also for education; All variables, except for occupation, were grand mean centered to guard against issues arising from multi-collinearity;

* p .05;

** p .01;

*** p .001

Source: International Social Survey Program, Environment I (1993) & Environment II (2000)