Predicting Environmental Behaviors: The Influence of Self-Determined Motivation and Information About Perceived Environmental Health Risks[1]

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The purpose of the present study is to examine the combined contribution of 2 predictors of environmental behaviors, self-determined motivation and information about a particular environmental issue (viz., perceived environmental health risks). The hypothesized model was tested with 761 participants from the general population using structural equation modeling. Self-determined motivation was found to predict both environmental behaviors and the tendency to seek information on health risks coming from 2 main sources (federal government agencies and public groups), which led to more confidence in those sources of information. In turn, confidence in the different sources of information was found to be significantly associated with perceptions of environmental health risks. Finally these perceptions were also found to be predictors of environmental behaviors. Results are discussed in terms of 2 possible processes that could facilitate environmental behaviors.

Since the 1980s, citizens have become increasingly concerned with the rapidly deteriorating condition of the environment. In an attempt to increase individuals' involvement in environmental issues, researchers have been interested in the conditions conducive to environmental action. Consequently, two broad categories of determinants of environmental behaviors have been investigated over the years. First, pro-environmental attitudes, such as concern for the environment, knowledge about the environment, and perceptions of environmental health risks, have been widely studied as determinants of environmental behaviors. Second, motives for environmental action (e.g., monetary rewards, persuasive communication strategies, motivational orientation) also have been investigated as predictors of environmental action.

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Environmental Attitudes

One of the most investigated environmental attitudes, environmental concern, has been widely assumed to lead to environmental behaviors. It seems logical to expect that people need to be concerned about the environment in order to get involved in environmental issues (Maloney & Ward, 1973; Oskamp et al., 1991; Van Lière & Dunlap, 1980; Weigel & Weigel, 1978). Results of many studies provided support for this association between environmental concern and environmental action (Hamid & Cheng, 1995; Hines, Hungerford, & Tomera, 1986; Karp, 1996; Milbrath, 1984; Vining & Ebreo, 1990). However, results of many other studies failed to support the association between environmental concern and environmental behavior (Gill, Crosby, & Taylor, 1986; Oskamp et al., 1991; Weigel, 1985). These mixed findings seem to suggest that environmental concern, although important, is not sufficient for environmental action to occur (see Chaiken & Stangor, 1987, for a literature review).

In addition to environmental concern, knowledge about the environment has been proposed as another important determinant of environmental behaviors. It is not enough to be concerned about the environment for environmental behaviors to occur, people also need to know what course of action to take in order to protect the environment. However, results of studies investigating the relation between environmental knowledge and behavior appear ambiguous. Whereas some researchers found that environmental knowledge predicted environmental behaviors (Hines et al., 1986; Sia, Hungerford, & Tomera, 1985), results of other studies could not substantiate this relationship (Finger, 1994; Maloney & Ward, 1973; Seligman, 1985).

Some explanations have been proposed to account for the inconsistent influence of environmental attitudes, such as environmental concern or knowledge, on environmental behaviors. First, it is possible that environmental concern and knowledge could represent weak predictors of environmental behaviors because of individuals' low levels of environmental concern and knowledge about environmental issues. However, recent statistics show that individuals are concerned more than ever with the worsening condition of the environment (Angus Reid Group, 1992; Environment Canada, 1991).

Second, environmental attitudes may not always be consistently associated with environmental behaviors because they are usually conceptualized by researchers as general states of concern or knowledge about the environment. In fact, results of recent studies show that when specific environmental attitudes, such as knowledge about recycling, or perceptions of health risks in the environment are considered instead of general environmental attitudes, the strength of the association between environmental attitudes and behavior tends to increase (Chaiken & Stangor, 1987; Gamba & Oskamp, 1994; Oskamp et al., 1991). Based on these findings, it appears possible that in order to effectively predict

environmental behaviors, people's knowledge and concern about a specific environmental issue must be considered.

One class of specific environmental attitudes that has been studied recently as determinants of environmental behaviors is associated with the perceptions of health risks related to environmental conditions. Interest in perceptions of health risks developed following the increasing concern of individuals over the management, assessment, and regulation of environmental health risks. These perceived environmental health risks were generally found to generate strong public concern over health risks and to lead to social actions and environmental behaviors. However, in some other cases, researchers found that people underestimated certain environmental health risks and consequently failed to see the necessity to take environmental actions (Fischhoff, Lichtenstein, Slovic, Derby, & Keeney, 1981; Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Slovic, Fischhoff, & Lichtenstein, 1980, 1981).

More recently, other studies consistently found that perceived environmental health risks predicted various environmental behaviors, such as recycling, conserving energy, voting for an environmentally oriented government representative, signing a petition in favor of more environmental policies, or educating other people about environmental issues (Flynn, Slovic, & Mertz, 1993; Gardner & Stern, 1996; Johnson & Tversky, 1984; Kasperson et al., 1988; Séguin, Pelletier, & Hunsley, 1998). Environmental attitudes that are specific, such as perceived environmental health hazards, appear to be an important and consistent predictor of environmental behaviors. When people perceive environmental health risks in their environment and become concerned about these health risks, environmental actions seem to follow. Conversely, if people do not perceive environmental health risks, the frequency of their environmental behaviors does not increase.

The increasing importance of perceived environmental health risks as a specific attitude determining environmental behaviors motivated researchers to investigate the factors leading individuals to perceive health risks in their environment. Typically, health risks were found to be experienced either directly or through specific information coming from sources such as the media, governments, activist social organizations, federal government agencies, public groups, or peers. The specific information about environmental health risks that individuals obtained from those various sources was consistently found to predict the level of perceived environmental health risks (Kasperson et al., 1988; Renn, Burns, Kasperson, Kasperson, & Slovic, 1992; Séguin et al., 1998). In addition, some researchers (Kasperson et al., 1988; Renn et al., 1992) suggested that the characteristics of the sources of information (e.g., frequency of information given, trustworthiness, credibility, impartiality) could either amplify or attenuate the perceptions of environmental health risks. For example, the level of confidence people have in these different sources of information on health risks could represent an important characteristic of the information received that would

ultimately influence the level of environmental health risks perceived (Kasperson et al., 1988; Renn et al., 1992). The more confidence people have in a particular source of information on environmental health risks, the more they are likely to perceive health risks in the environment.

In general, it has been found that people have much more confidence in environmentalists, public groups, or scientists as information sources on environmental health risks than they do in municipal or provincial governments (i.e., regional governments) or media sources (Ostman & Parker, 1986; Soden, 1995). Federal government agencies such as Health and Welfare Canada[3] are usually more trusted as sources of information on environmental health hazards than are regional governments. These varying degrees of confidence for different sources of information could be related to the type of information given, the particular mandate of each one of those sources, and how successful they are at fulfilling their respective mandates. For example, environmental groups ordinarily have the mandate to produce and disseminate information about possible and actual environmental health risks (Soden, 1995). Federal government agencies such as Environment Canada or Health and Welfare Canada ordinarily have the mandate to inform people about how to deal with possible environmental health hazards (Soden, 1995). Regional governments ordinarily have the mandate to prevent environmental health risks. Whereas the first two sources of information on environmental health risks (environmental groups and federal government agencies) are usually able to fulfill their mandates, it is often believed that regional governments do not always fulfill their obligation to public safety and health. Over time, regional governments tend to lose the trust of the public, perhaps because they have not been able to deal effectively with environmental issues, even if they routinely express a strong commitment to risk communication and prevention (Chess & Salomone, 1992; Soden, 1995). Consequently, confidence in regional governments should not be strongly associated with environmental health risks, whereas confidence in federal government agencies and public groups should be strongly associated with environmental health risks.

Environmental Motives

Incentives or external motives for performing environmental behaviors represent another class of predictors of environmental action. These motives can be diverse and can range from the provision of rewards to the facilitation of environmental behaviors by removing barriers to action or to the use of persuasive communication strategies. These incentives are generally part of intervention programs designed to stimulate environmental action. However, researchers investigating the usefulness of these environmental programs have found that

[3]Health and Welfare Canada is now called simply Health Canada.

external motives were only effective on a short-term basis and that they were inadequate to promote lasting changes in environmental behaviors (Geller, Winett, & Everett, 1982; Katzev & Johnson, 1984; Winett, Leckliter, Chinn, Stahl, & Love, 1985; Witmer & Geller, 1976). As soon as the incentives were removed, the frequency of environmental behaviors declined and ultimately returned to the level observed before the implementation of the intervention program (Aronson & Gonzales, 1990; De Young, 1986b). Apparently, individuals start to perform environmental action because incentives are present, and consequently, perceive their behavior as dependent on the external sources of motivation. Because the environmental behavior is perceived as being motivated by an external incentive and not performed by choice, the incentive becomes necessary for the maintenance of the environmental behavior (Deci & Ryan, 1985).

Because the provision of incentives fails to ensure enduring changes in environmental behaviors, some researchers turned their attention to sources of motivation for environmental action originating from within the individual. The concepts of intrinsic motivation and self-determined motivation were consequently studied as alternative antecedents of environmental behaviors. For example, De Young (1986a, 1986b, 1989) demonstrated that intrinsic and self-determined motives for performing environmental behaviors (i.e., motives freely chosen by the individual) were significant determinants of recycling. More specifically, individuals who recycle out of choice and personal interest for the environment are also individuals who are able to maintain recycling behaviors on their own, without the presence of extrinsic rewards to motivate them.

Milbrath (1984) and McKenzie-Mohr and Oskamp (1995) proposed the concept of sustainable change as something resembling the concept of intrinsic motivation defined by De Young (1986a, 1986b). In order to achieve sustainable environmental change, it is necessary for individuals to understand how to surmount the various culturally specific barriers to environmental action and to adopt behaviors that could be maintained and integrated in their lifestyles. This state of change can be reached by individuals if they are willing to modify aspects of themselves, such as the way they think, believe, and act toward the environment (McKenzie-Mohr & Oskamp, 1995).

Similarly, Pelletier and colleagues (Pelletier, Green-Demers, & Béland, 1997; Pelletier, Tuson, Green-Demers, Noëls, & Beaton, 1998) have developed and tested a measure of people's motivation for environmental behaviors, the Motivation Toward the Environment Scale (MTES). This measure is based on the theory of self-determination (Deci & Ryan, 1985), which distinguishes between various types of motivation: intrinsic motivation, self-determined extrinsic motivations (integrated and identified regulation), non–self-determined extrinsic motivations (introjected and external regulation), and amotivation. Within this theoretical framework, behaviors performed for self-determined motives are behaviors that the individual freely chooses to carry out. Therefore, self-determined

environmental behaviors are performed for reasons originating from within the individual and maintained without the need of external incentives or in the presence of barriers to action. This suggests that self-determined environmental behaviors can promote enduring behavioral changes because those behaviors are not controlled by external sources of motivation.

Results of recent studies show that self-determined motivation toward the environment is associated with the frequency of environmental behaviors (Pelletier et al., 1997, 1998). Furthermore, it was found that the strength of the association between self-determined motivation and environmental behaviors increased with the level of difficulty of environmental behaviors (Green-Demers, Pelletier, & Ménard, 1997). In other words, although a minimal level of self-determined motivation is necessary to perform behaviors of low levels of difficulty (e.g., curbside recycling), as the behaviors become more difficult (e.g., recycling away from home), it takes more self-determined motivation to perform them. In combination with the direct influence of self-determined motivation on environmental behaviors, a recent study (Séguin et al., 1998) also found that self-determined motives influenced environmental activism indirectly, through the perceptions of environmental health risks. More specifically, the authors observed that the more individuals were self-determined toward the environment, the more they became aware of potential health risks in their environment. In turn, as discussed previously, perceived environmental health risks were found to influence environmental action.

Goals and Hypotheses

The goal of the present study is to propose and test a model of environmental behaviors in which the combined contribution of self-determined motivation toward the environment and information specifically related to perceived environmental health risks is examined. This model is graphically presented in Figure 1.

In the proposed model, it is hypothesized that self-determined motivation toward the environment will predict both environmental behaviors and the seeking of information on environmental health risks. More specifically, it is hypothesized that self-determined motivation toward the environment will predict the amount of information individuals will obtain from various sources of information (federal government agencies, regional governments, and public groups) on health risks, which will lead to more confidence in these sources of information. In turn, it is hypothesized that confidence in the different sources of information will predict individuals' perceptions of environmental health risks. Finally, it is also hypothesized that these perceptions will be predictors of environmental behaviors. Because of the possible lack of confidence individuals have in regional governments as a source of information on health risks, it is hypothesized that confidence in regional governments will not predict the level of perceived health risks and will not contribute to environmental behaviors.

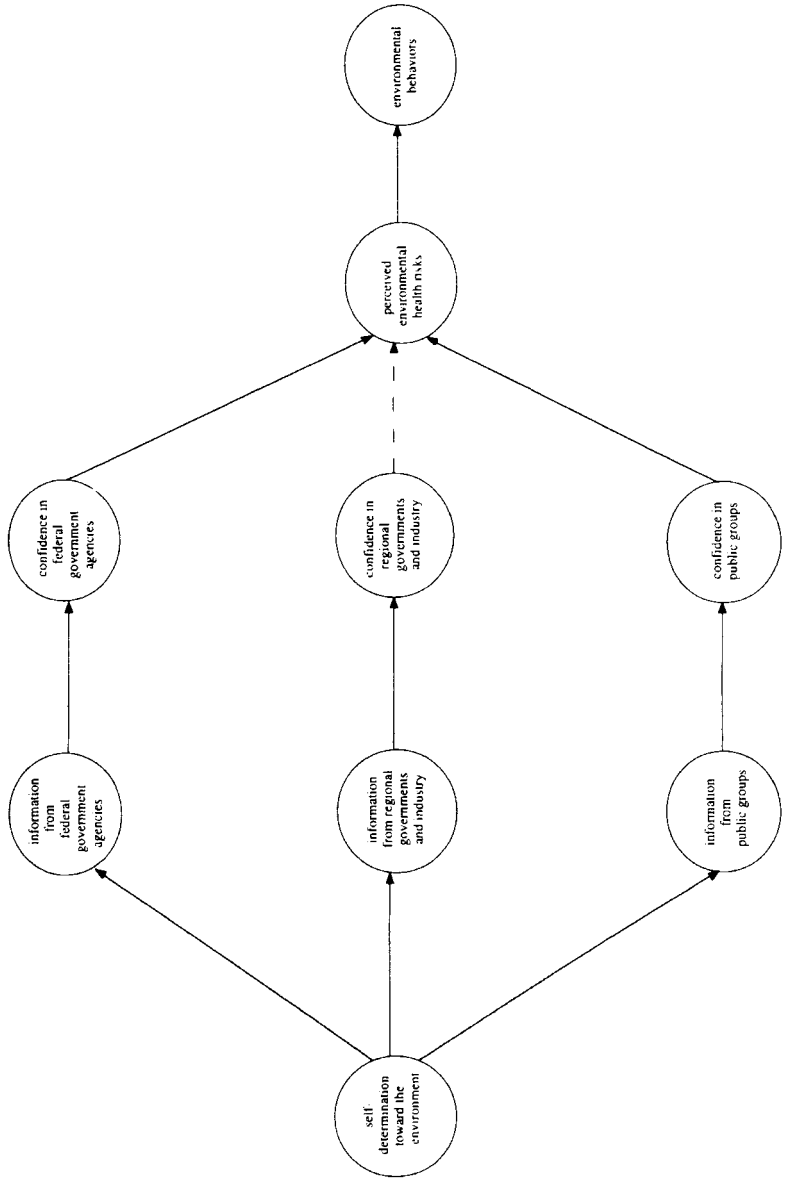

Figure 1. Hypothesized predictive model of environmental behaviors. The hypothesized nonsignificant path is identified with a dashed line.

Method

Participants

A sample of 761 residents of the Cornwall area (Ontario, Canada) participated in the study. The sample included 237 men and 496 women, and 28 participants who did not indicate their gender. The average age of the participants was 49 years, with a range of 14 to 92 years; 9.1% (69) were 30 years old or younger, 64% (487) were from 31 to 60 years of age, the remaining 22.7% (173) were older than 60 years, and 4.2% (32) of the participants did not answer this question. Close to 74.4% (566) of the respondents were married; 12.2% (93) were divorced, separated, or widowed; approximately 9.1% (69) were single; and 4.3% (33) of the data were missing on this question. Almost all of the participants (98%, 746) had children (an average of two children per participant). Approximately 44% (335) of the participants had a high-school education, 54% (411) had at least some college or university education, and 2% (15) of the participants did not provide us with this information. The average annual income (in Canadian dollars) was about $30,000; 22.9% (174) of the participants made less than $20,000; 50.7% (386) made between $20,000 and $59,999; 9.1% (69) of the participants made between $60,000 and $80,000; 2.5% (19) made more than $80,000; and 14.8% (113) of the participants did not answer this question. Finally, the majority of the participants (555) lived in the city (72.9%), 14.3% (109) lived in the country, 8.3% (63) lived in a suburban region, and 4.5% (34) of the data were missing on this item. Approximately 82.8% (630) of the participants had access to a recycling program at home, and 54.1% (412) had access to a recycling program at work.

Procedure

Data were obtained from a questionnaire package mailed to 3,000 residents of the Cornwall area, who were randomly selected from a telephone list of the region. Questionnaires were mailed to these individuals with no prior contact. The questionnaire was introduced as part of a major multidisciplinary research program on the recovery of the St. Lawrence River ecosystem (Pelletier, Hunsley, Green-Demers, & Legault, 1996). Participation involved completing and returning the questionnaire in a postage-paid envelope. The questionnaire assessed participants' environmental attitudes and behaviors. Participation in the study was voluntary, and responses were anonymous and confidential. To ensure a maximum of returned questionnaires, a postcard asking the participants for their cooperation in completing the survey was mailed a week after the questionnaire was sent. The return rate of completed questionnaires was 25.4% (761).

Measures

MTES. This scale is composed of 24 items designed to represent the motivational constructs identified by Deci and Ryan (1985). The MTES consists of six subscales (four items each) which measure an individual's level of motivation toward environmental behaviors. These constructs are, from the highest to the lowest level of self-determined motivation, intrinsic motivation (IM; e.g., "For the pleasure I experience when I find new ways to improve the quality of the environment"); extrinsic motivation by integrated regulation (INTEG; e.g., "Because being environmentally conscious has become a fundamental part of who I am"); extrinsic motivation by identified regulation, that is, consistent with one's values (IDEN; e.g., "Because it's a sensible thing to do in order to improve the environment"); extrinsic motivation by introjected regulation (INTRO; e.g., "Because I would feel guilty if I didn't"); external regulation (ER; e.g., "Because my friends insist that I do it"); and amotivation (AMO; e.g., "I don't really know; I can't see what I'm getting out of it"). For the purpose of testing the structural model, indexes of self-determined motivation (SDI [self-determined index]) were created, which represent the combined score of one item on each of the six subscales. For illustrative purposes, the first index was computed with the first item of each of the six subscales:

$$(3*IM1) + (2*INTEG1) + (IDEN1) - (INTRO1) - (2*ER1) - (3*AMO1)$$

(see Blais, Sabourin, Boucher, & Vallerand, 1990, and Ryan & Connell, 1989, for more information on the SDI). Because there are four items per subscale, it was possible to generate four indexes of self-determined motivation. These indexes assess individuals' general level of autonomous motivation. Participants had to answer each item on a 7-point scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*).

The MTES possesses very acceptable levels of reliability and validity. In terms of validity, the results of exploratory factor analysis support the six-factor structure of this scale. Also, correlations between the subscales and between the subscales and various related constructs supported the continuum of self-determined motivation proposed by Deci and Ryan (1985). In terms of reliability, the MTES subscales showed satisfactory test–retest reliability over a 5-week period and high levels of internal consistency ($\alpha = .92$).

Sources of Information Concerning Health Risks and Health Issues (Pelletier et al., 1996). This scale is composed of eight items. Each item represents a different source of information on health risks and health issues (e.g., federal government agencies, provincial government, public-interest groups or environmental groups). Participants indicated the amount of information they were obtaining from each of these sources on a 7-point scale ranging from 1 (*almost no information*) to 7 (*a lot of information*).

Results of an exploratory factor analysis revealed a stable three-factor solution that explained 76.6% of the variance. All eight items loaded significantly on their target factor (loadings above .30), with none of the items displaying cross-loadings. Factor 1 reflects information on environmental health threats obtained from public groups (e.g., public-interest groups or environmental groups, and friends and relatives). This factor is composed of organizations or groups who are generally recognized as having the mandate of informing people about possible environmental issues and health threats. Factor 2 reflects information on environmental health threats obtained from regional governments and industry (e.g., municipal government, provincial government, private industry). This factor is composed of organizations who are generally recognized as having the responsibility to prevent possible environmental health threats and hazards. Factor 3 reflects sources of information on environmental health threats obtained from federal government agencies (e.g., Environment Canada, Health and Welfare Canada, Agriculture Canada). This factor is composed of organizations who are generally recognized as having the mandate of informing people about how to deal with environmental health threats. Correlations between the factors were moderate, ranging from .34 to .61. These results suggest that the factors are moderately related and share a certain amount of common features, but are also independent from each other.

Confidence in the Sources of Information Concerning Health Risks and Health Issues (Pelletier et al., 1996). This scale is composed of eight items. Each item represents a different source of information on health risks and health issues (e.g., Health and Welfare Canada, provincial government, public-interest groups or environmental groups). Participants indicated how much confidence they had in each of these sources of information on health risks on a 7-point scale ranging from 1 (*almost no confidence*) to 7 (*a lot of confidence*).

For the purpose of the present study, those eight items were regrouped in a way that paralleled the factorial structure of the Sources of Information Concerning Health Risks and Health Issues Scale. As indicated previously, Factor 1 reflects confidence in the information obtained from public groups (e.g., public-interest groups or environmental groups, and friends and relatives). Factor 2 reflects confidence in the information obtained from regional governments and industry (e.g., municipal government, provincial government, private industry). Factor 3 reflects confidence in the information obtained from federal government agencies (e.g., Environment Canada, Health and Welfare Canada, Agriculture Canada). Correlations between the factors were moderate, ranging from .30 to .63. These results suggest that the factors are moderately related and share a certain amount of common features, but are also independent from each other.

Perceptions of Environmental Health Risks (Pelletier et al., 1996). This scale is composed of 21 items. Each item represents a health threat related to the environmental conditions (e.g., nuclear waste, fish caught in the St. Lawrence River, out-

door air quality, pesticides in food). Participants answered each item on a 7-point scale ranging from 1 (*almost no health risk*) to 7 (*high health risk*). Those items were selected following interviews with a multidisciplinary team of experts (e.g., biologists, chemists, biochemists, hydrologists, engineers) who were working on the research program for the recovery of the St. Lawrence River's ecosystem.

Results of an exploratory factor analysis using maximum likelihood extraction procedure revealed a stable four-factor solution that explained 57.6% of the variance in the data. All 21 items loaded significantly on their target factors with the exception of two items that presented cross-loadings (loadings ≥ .30 on two factors; Gorsuch, 1983; Tabachnick & Fidell, 1996). These two items were removed from further analyses. In Factor 1, the emphasis is on environmental health risks associated with technologies or situations that generate toxic waste. Examples of items composing this factor are the perceived health risks from PCBs or dioxin, and the perceived risk from nuclear power plants. Factor 2 represents the perception of environmental health risks associated with the contamination of fish.

An example of an item from this factor is the perceived health risks from mercury in the water or in the fish. In Factor 3, the emphasis is on the perception of environmental health risks related with the water quality and with the outdoor and indoor air quality. Examples of items forming this factor are the perceived health risks from tap water and the perceived health risks from outdoor air quality. Finally, Factor 4 represents the perception of environmental health risks associated with chemical products found in food or in the environment. Examples of items composing this factor are perceived health risks from bacteria in food and perceived health risks from chemical pollution in the environment. For the purpose of testing the structural model, the four identified factors were used as indexes of perceived environmental health risks. Each factor showed an acceptable level of internal consistency, ranging from .82 to .88. Correlations between the factors were moderate, ranging from .43 to .69. These results suggest that the factors are moderately related and share a certain amount of common features, but are also independent from each other.

Frequency of Environmental Behaviors (Green-Demers et al., 1997; Pelletier et al., 1998). This scale is composed of four subscales that measure the frequency with which individuals engage in four categories of environmental behaviors. They are recycling (e.g., recycle nondeposit glass jar/bottles), conserving resources (e.g., reduce the water-heater temperature), purchasing environmentally safe products (e.g., avoid buying products with excessive packaging), and seeking out and sharing environmental information (e.g., pass along information to friends regarding how they can help the environment). For the purpose of testing the structural model, the four subscales were used as indexes of environmental behaviors. Participants answered each item on a 7-point scale ranging from 1 (*not very often*) to 7 (*very often*). Each factor showed acceptable levels of internal consistency (αs = .73, .62, .80, and .85, respectively). Correlations between the

factors were moderate, ranging from .40 to .63. These results suggest that the factors are moderately related and share a certain amount of common features, but are also independent from each other.

Results

Overview of Analyses

Data were preliminary examined for the adequacy of the fit between their distribution and the assumptions of multivariate analysis. Then, a model predicting environmental behaviors was estimated using LISREL VIII (Jöreskog & Sörbom, 1996).

Descriptive statistics of all indexes under study were first examined in order to assess the normality of the data. Results reveal that the data were normally distributed with values for skewness and kurtosis within an acceptable range of -1 and +1. Finally, there was no evidence of multicollinearity or singularity: All correlations between the indexes were below .65 (Tabachnick & Fidell, 1996).

Comparisons of Amount of Information Obtained From Various Organizations

A series of t tests, with the application of the Bonferonni correction, were performed to determine if participants' amount of information obtained from different organizations differed. (For the following two paired comparisons, a desired level of significance of $p < .01$ is equivalent to an obtained level of significance of $p < .005$.) A significant difference was found between participants' amount of information obtained from public groups ($M = 3.83$) and participants' amount of information obtained from regional governments and industry ($M = 2.94$), $t(729) = -16.30$, $p < .005$. Also, a significant difference was found between participants' amount of information obtained from federal government agencies ($M = 3.76$) and participants' amount of information obtained from regional governments and industry ($M = 2.94$), $t(728) = -17.54$, $p < .005$.

Comparisons of Confidence in Various Sources of Information

A series of t tests, with the application of the Bonferonni correction, were performed to determine if participants' level of confidence differed for specified organizations. (For the following two paired comparisons, a desired level of significance of $p < .01$ is equivalent to an obtained level of significance of $p < .005$.) A significant difference was found between participants' levels of confidence in the information obtained from public groups ($M = 4.42$) and participants' level of confidence in the information obtained from regional governments

and industry ($M = 3.19$), $t(714) = 20.62$, $p < .005$. Also, a significant difference was found between participants' level of confidence in the information obtained from federal government agencies ($M = 4.45$) and participants' level of confidence in the information obtained from regional governments and industry ($M = 3.19$), $t(706) = 28.21$, $p < .005$.

Predictive Model of Environmental Behaviors

Structural equation modeling was performed by means of LISREL VIII (Jöreskog & Sörbom, 1996). Estimation was performed using maximum likelihood fitting function.

The statistical hypotheses corresponding to the structural portion of the model are described next (Figure 1). First, the regression coefficients of environmental behaviors on self-determined motivation toward the environment and perceived environmental health risks were hypothesized to be positive and significant. Second, the regression coefficients of perceived environmental health risks on confidence in federal government agencies and public groups, as sources of information, were hypothesized to be positive and significant, whereas the regression coefficient on confidence in regional governments and industry was hypothesized to be nonsignificant. Third, the regression coefficients of confidence in the different sources of information on the amount of information obtained from each one of these sources were hypothesized to be positive and significant. Fourth, the regression coefficients of amount of information from federal government agencies, regional governments and industry, and public groups on level of self-determined motivation toward the environment were hypothesized to be positive and significant. Also, the error of estimation of the latent construct was expected to be significant and of moderate magnitude. Finally, all cross-loadings and item error covariances were fixed to 0.

The adequacy of the hypothesized model was unsatisfactory as revealed by all of the fit indexes, $\chi^2(339) = 2{,}711.29$, $p < .001$, GFI = .80, AGFI = .77, CFI = .82, IFI = .82, and PGFI = .67. Also, the regression coefficient of information from regional governments and industry on self-determined motivation toward the environment was found to be nonsignificant. Based on theoretical and statistical criteria, an alternative model comprising three additional structural links was proposed and is presented in Figure 2.

First, because regional government and industry should play a central role in the prevention of environmental health risks, we believe that individuals would seek out information about the involvement of these organizations from other sources of information. In the present model, information obtained from federal government agencies and public groups could be used by individuals to assess the quality of the information provided by regional governments and industry. Based on this rationale and also because the estimations of these structural links

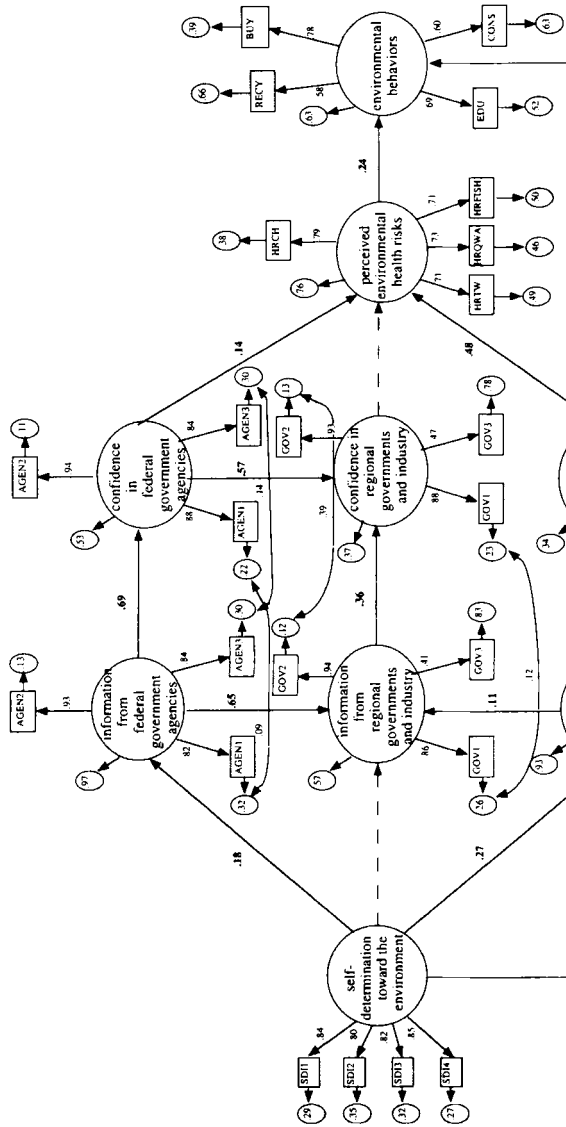

Figure 2. Alternative predictive model of environmental behaviors. All parameters are significant at $p < .05$. The nonsignificant paths are identified with dashed lines.

were associated with large modification indexes in the chi-square value, the regression coefficients of the amount of information obtained from regional governments and industry on federal government agencies and public groups were expected to be positive and significant.

Second, based on the high possible similarities in terms of structure between regional governments and federal government agencies, it is also possible to expect a relationship between individuals' levels of confidence in these organizations as sources of information on health risks. The comparison of the information obtained from federal government agencies to the one obtained from regional governments could influence the individuals' levels of confidence in regional governments as a source of information. Based on this rationale and also because the estimation of this structural link was associated with a large modification index in the chi-square value, the regression coefficient of confidence in regional governments and industry on confidence in federal government agencies was expected to be positive and significant.

Although the adequacy of the model was improved by these modifications, it remained unsatisfactory. Inspection of the modification indexes revealed that the fit of the model could be improved by estimating some error covariances. Specifically, covariances between errors associated with items measuring information obtained from the various organizations and errors associated with items measuring confidence in these various organizations were significant. These error covariances were not unexpected, since the constructs of information obtained from various organizations and confidence in these organizations are measured by very similar items. Five covariances between measurement errors were consequently estimated in order to improve the adequacy of the model.

The fit indexes of the resultant final model revealed that the correspondence between the model and the sample covariance was satisfactory, χ^2 (331) = 1,266.74, $p < .001$, GFI = .90, AGFI = .87, CFI = .93, IFI = .93, and PGFI = .73. All estimated parameters were significant and of acceptable magnitude, with the exception of one structural link. The level of self-determined motivation toward the environment did not predict, as expected, the amount of information obtained from regional governments and industry.

The more individuals were self-determined toward the environment, the more they performed environmental behaviors ($\gamma = .53$). In addition, the more people were self-determined toward the environment, the more they obtained information from federal government agencies ($\gamma = .18$) and public groups ($\gamma = .27$). The information obtained from federal government agencies and public groups predicted the amount of information obtained from regional governments and industry ($\beta = 0.65$ and 0.11, respectively). In turn, the amount of information obtained from federal government agencies, regional governments and industry, and public groups predicted the level of confidence in the respective source of information ($\beta = 0.69$, 0.36, and 0.81, respectively). In addition, confidence in federal

government agencies predicted the level of confidence in regional governments and industry ($\beta = 0.57$). The more individuals had confidence in federal government agencies and public groups, the more environmental health risks they perceived ($\beta = 0.14$ and 0.48, respectively). However, confidence in regional governments and industry did not predict the level of perceived environmental health risks. Finally, perceptions of environmental health risks predicted the frequency of environmental behaviors ($\beta = 0.24$).

Discussion

The purpose of the present study was to test a model of environmental behaviors with participants from the general population in which the combined contribution of self-determined motivation for the environment and information about perceived environmental health risks would be examined. Our results suggest that there are two possible processes that could facilitate environmental behaviors. On the one hand, environmental behaviors (e.g., recycling, conserving resources, or purchasing environmentally safe products) were found to be predicted by self-determined motivation for the environment. The more individuals acted out of choice and personal interest in environmental issues, the more they were likely to perform environmental behaviors. This result is consistent with the reviewed literature on intrinsic motivation and self-determined motivation toward the environment (De Young, 1986a, 1989; Pelletier et al., 1997, 1998) and a vast literature on motivation and outcomes (Ryan, 1995; Vallerand, 1997).

On the other hand, self-determined motivation toward the environment was found to lead individuals to seek out information on environmental health risks from federal government agencies and public groups. The present findings are consistent with the results of a recent study (Koestner, Losier, Vallerand, & Corducci, 1996) in which researchers found that self-determined motivation was associated with the active search of information about political events. In the initial model, we hypothesized that self-determined individuals would also seek information from regional governments and industry. However, this hypothesis was not supported by our results. Our results suggest that the absence of a relation between self-determined motivation toward the environment and seeking information from regional governments and industry could be related to individuals' lack of confidence in these organizations as sources of information. In fact, our results show that confidence in regional governments and industry as sources of information on environmental health risks was generally low.

The amount of information obtained from federal government agencies, regional governments and industry, and public groups predicted individuals' levels of confidence in these sources of information. Confidence in regional governments and industry was also found to be predicted by the level of confidence in federal government agencies. Although not proposed in the initial model, this

link could be explained by the possibility that regional governments may share many similarities, in terms of structure, with federal government agencies. Because individuals were found to have more confidence in federal government agencies than in regional governments and industry, a comparison of the information provided by the two sources could have made them aware of the shortcomings of the latter and affected confidence in regional governments and industry.

In turn, the more individuals had confidence in federal government agencies and public groups as sources of information on health risks, the more they became specifically concerned about potential health risks in their environment, which motivated them to perform environmental behaviors. Thus, a specific type of concern for the environment (viz., awareness of environmental health risks), rather than a general concern for the environment was also found to effectively increase individuals' environmental behaviors. This relationship has been consistently found in the literature on environmental health risks and is quite robust (Slovic et al., 1980, 1981). This finding is also in accord with studies reporting that specific environmental attitudes (e.g., perceived health risks) are more strongly and consistently associated with environmental behaviors than are general environmental attitudes (Chaiken & Stangor, 1987; Gamba & Oskamp, 1994; Oskamp et al., 1991). However, individuals who perform environmental behaviors primarily because they perceive health risks in their environment may not continue to perform the behaviors in the absence of health risks.

In contrast, self-determined motives for the environment can stimulate environmental action in the absence of external sources of motivation, and for this reason they appear to complement perceptions of environmental health risks as a determinant of environmental action. In addition, self-determined motivation toward the environment was found to promote the search for information on environmental health risks, which in turn also led to more frequent environmental behaviors. It appears that self-determined motivation for the environment could represent an important determinant of environmental actions. A strong sense of autonomy toward environmental issues could increase the frequency of environmental behaviors, both directly and indirectly by increasing the amount of information on health risks individuals will seek from various organizations. In sum, our results suggest that in combination, self-determined motivation and information about perceived environmental health risks represent important predictors of environmental behaviors.

One interesting finding from our study was the fact that the information individuals obtained from regional governments and industry was predicted by the information provided by federal government agencies and public groups. These results could be explained by the preventive role played by the government in environmental issues. Because of the potential importance of regional governments and industry in the prevention of environmental health risks, we believe that the information obtained from federal government agencies and public groups is

used by individuals to evaluate the quality of the information provided by regional governments and industry. Based in part on the information obtained from federal government agencies and public groups, individuals could then become more or less confident in regional governments and industry as sources of information on environmental health issues.

Results of the present study also show that individuals have much more confidence in the information obtained from federal government agencies and public groups than in the information obtained from regional governments and industry. Although individuals perceived that regional governments and industry were doing a poor job at protecting them against environmental health risks, they believed that federal government agencies and public interest groups were quite adequate at protecting them against potential health risks. Those various levels of confidence could be explained by the particular mandate of each organization as sources of information on environmental health risks, and the ability of each one to fulfill their responsibility to the public. First, federal government agencies generally have the responsibility to provide information to citizens about ways to deal with environmental health threats, once they are present. They are usually perceived as being able to fulfill their responsibility by means of educational programs they offer to the public and by various public advertisements. These efforts have led citizens to be generally confident in federal government agencies as sources of information on environmental health risks. Second, public-interest groups generally have taken on the responsibility to provide information to citizens about the presence of possible environmental health risks. These groups are, in general, recognized as being activists in various environmental issues. The efforts of public-interest groups in environmental causes have led citizens to be generally confident in these sources of information on health risks. Third, regional governments and industry generally have the responsibility to provide information to citizens on ways to prevent environmental health risks or on actions they have taken to prevent potential health risks in the environment. It seems that these organizations are often perceived as not always fulfilling their responsibility, despite the expression of concern and commitment to the prevention of environmental health hazards.

Confidence in federal government agencies and public groups, and limited confidence in regional governments and industry, can also explain the associations between information about perceived environmental health risks and behaviors. Although the amount of information obtained from federal government agencies, regional governments and industry, and public groups predicted the level of confidence in each source of information, the relation between information obtained from regional governments and industry and confidence in these organizations was the weakest. Furthermore, confidence in these organizations did not predict individuals' levels of perceived environmental health risks and, consequently, did not contribute to environmental behaviors, whereas confidence in

federal government agencies and public groups did influence perceptions of health risks and environmental behaviors. Taken together, these results seem to suggest that individuals do not perceive regional governments and industry as being trustworthy when it comes to environmental issues. The information on health risks given by regional governments and industry appears to be perceived as unreliable and, consequently, does not seem to influence perceived environmental health risks. However, the information federal government agencies and public groups are communicating to the public about environmental health risks appears to be perceived as reliable and, in turn, seems to influence perceived environmental health risks and environmental behaviors.

Although interesting, these results are still exploratory in nature. In the present study, we did not use a prospective design and in order to validate the proposed model, further studies, including prospective studies, are needed. Also, because the model was tested with cross-sectional data and our results are correlational, some limitations apply. For example, it would be necessary to evaluate the extent to which our model can predict the frequency of environmental behaviors and verify the causal ordering proposed with a longitudinal design. Finally, the nature of our sample may restrict the generalizability of our results. It is possible that our findings might be specific to the geographic region from which we sampled. It would be important, in future studies, to try to replicate the model with an independent, broader sample. However, the fact that we recruited a large sample of participants from the general population rather than university students makes our results applicable to an adult population.

Despite their exploratory nature, the results of the present study have two important implications, especially for policymakers. First, our findings suggest that increasing individuals' levels of self-determined motivation or autonomy toward the environment could facilitate environmental action in two possible ways. On one hand, it could lead directly to more environmental behaviors. On the other hand, self-determined individuals are also more likely to seek out information that will make them specifically aware of environmental health risks and that will ultimately motivate them to take action. According to self-determination theory (Deci & Ryan, 1985), the key elements needed to foster individuals' self-determined motivation are feelings of competence, choice, and autonomy when performing environmental behaviors. Contexts in which individuals become more knowledgeable about the environmental conditions and where a good rationale for environmental behaviors is provided should lead individuals to develop a sense of competence and autonomy for environmental behaviors.

Second, our findings suggest that one of the best predictors of environmental behaviors is the information obtained from federal government agencies and public groups specifically related to environmental health risks. In contrast, the least effective predictors of environmental behaviors are related to the information on environmental health risks obtained from regional governments and industry. In

fact, individuals obtained the least information from regional governments and industry, were generally not very confident in these sources of information, and perceived the information as relatively unreliable. When we consider the role that all governments plan to assume regarding the environment at the turn of the millennium (Marchi, 1997), it is critical that all levels of government (and all industries) evaluate their abilities to effectively and accurately convey environmental information to the public.

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