

# Personality Correlates of Risk Perception

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The aim of the present study was to systematically examine the variations of the effects of (1) transitional anxiety states and enduring anxiety dispositions, and (2) worldviews (hierarchical, egalitarian, individualist, and fatalist), as a function of the type of hazard considered. Ten risk factors were identified. Transitional anxiety contributed significantly to the prediction of four of these risk factors. The more anxious the respondents, the higher were their scores for the Common Individual Hazards, Pollutants, and Outdoor Activities factors, and the lower were their scores for the Public Transportation and Energy Production factor. Enduring anxiety contributed significantly to the prediction of the Psychotropic Drugs factor. The more anxious the respondents, the lower were their scores. The four worldview factors contributed significantly to the prediction of three of these risk factors. The more fatalistic the respondents, the lower were their scores for the Pollutants factor, and the higher were their scores for the Public Transportation and Energy Production factor; the more egalitarian the respondents, the higher were their scores for the Pollutants factor; the more hierarchical the respondents, the lower were their scores for the Public Transportation and Energy Production factor; and the more individualistic the respondents, the higher were their scores for the Pollutants and Deviance, Sex, and Addiction factors.

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**KEY WORDS:** Risk perception; personality; anxiety; worldviews

## 1. INTRODUCTION

People respond to hazards according to their perceptions of the risks they pose. What they perceive, why they perceive it that way, and how they will subsequently behave is a matter of great import to industries and governments trying to assess and implement new technologies" (Peters & Slovic, 1996, pp. 1427–1428).

Risk-perception studies have focused on the many factors that govern risk evaluation: factors linked to the hazard and factors linked to the perceiver.

### 1.1 Factors Linked to the Hazard

Among the factors linked to the hazard, the Dread factor has been repeatedly shown to be the most

determinant (Mullet, Duquesnoy, Raïff, Fahrasmane, & Namur, 1993; Slovic, 1987; Teigen, Brun, & Slovic, 1988). It refers to the perceived catastrophic potential of the hazard and also to the perceived lack of control over the situation. DNA technology and nuclear weapons are typical examples of such dread hazards. In fact, overall risk evaluations are much more linked to the dreadfulness of the hazards than to their actual lethality level (Slovic, Fischhoff, & Lichtenstein, 1985).

Two other factors linked to the hazard itself have also been shown to influence risk perception, although to a lesser extent: the unknown character of the hazard and the number of people possibly affected (Mullet *et al.*, 1993). Food preservatives and pesticides are typical examples of hazards for which the effects are not well known. Motor vehicles and home appliances are examples of hazards having the potential of affecting many people.

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## 1.2. Factors Linked to the Perceiver

Aside from the country of origin (for a review, see Neto & Mullet, 2001), four factors linked to the perceiver have been studied: age, gender, scientific education, and training in risk expertise. Hermand, Mullet, and Rompteaux (1999) have compared mean risk magnitude judgments expressed by participants aged 8 to 75. Between elderly people and adults, very few notable differences were detected. The most important results were that a considerable proportion of children were able to estimate the risk associated with most hazards and that the linear association between children ratings and adult ratings was high. Overall mean estimations were also close, although slightly higher in children (34 out of 100) than in adults (30 out of 100).

Karpowicz-Lazreg and Mullet (1993) showed that between women's and men's ratings, or between artists' and scientists' ratings, the linear association was also high (higher than .90). The only marked differences between men and women concerned the risks associated with domestic activities and public transportation (see also Barke, Jenkins-Smith, & Slovic, 1997; Slovic, 1997), and the only differences between artists and scientists concerned health risks. Finally, Savadori, Rumiati, and Bonini (1998) showed that between experts (insurers) and nonexperts (university students), linear associations were high and both groups of respondents based their risk evaluations mainly on the dread factor (for evidence regarding differences between experts themselves, see also Jenkins-Smith & Basset, 1994; Wiegman, Gutteling, & Cadet, 1995).

## 1.3. Personality Factors and Risk Perception

The effect of personality factors on risk perception has also been studied. Three kinds of personality factors have been considered: anxiety factors (Spielberger, 1966), affective reaction/personal valuation factors (Mullet *et al.*, 1993; Slovic, Flynn, & Layman, 1991), and worldviews (Dake, 1991).

Results have been inconsistent with regard to the relation between enduring anxiety level and risk evaluation. A positive link has been found by Simpson-Housley, de Man, & Yachnin (1986, anticipation of flood damage), Larrain and Simpson-Housley (1990, anticipation of earthquake damage), and Mehta and Simpson-Housley (1994, potential nuclear power disaster). An absence of relation was found by De Man, Simpson-Housley, and Curtis (1984, expectation of future nuclear waste disaster). A negative link was observed by De Man, Simpson-Housley, Curtis, and

Smith (1984, expectation of flooding). In any case, the link between anxiety level and risk evaluation was weak compared with the other effects. In Mehta and Simpson-Housley (1994), for example, Beta weight for anxiety level was .03, compared with .35 for gender.

With regard to personal valuation factors, Slovic, Flynn, and Layman (1991) showed that people were systematically less suspicious toward hazards from which they could generate mostly positive images as compared with hazards for which they could generate mostly negative images. Peters and Slovic (1996) found the same pattern of results regarding nuclear support. Mullet *et al.* (1993) showed that regardless of the dreadful nature of the hazard itself, hazards that were negatively estimated (e.g., alcoholic beverages or handguns) were judged as risky than to hazards that were positively estimated (e.g., vaccinations or railroad).

Finally, Krewski, Slovic, Bartlett, Flynn, and Mertz (1995) showed that "worldviews" were also correlated with the evaluation of risk. People who endorsed fatalistic or egalitarian views tended to perceive health hazards (e.g., bacteria in food, food irradiation, or genetically engineered bacteria in agriculture) as more risky than people who did not endorse such views. Peters and Slovic (1996) replicated these results and showed that the effect of worldviews was partly independent of the affective reaction effect. In these studies, the effect of worldviews on risk evaluation, although significant, was moderate in size. In Peters and Slovic (1996) for example, the higher association shown between egalitarian worldviews and nuclear power plants was .27. Finally, Palmer (1996) showed that worldviews strongly influenced the way in which people perceive risk, at least in the financial domain. Among hierarchists, the overall risk rating was mainly a function of the expected loss and benefit. By contrast, among egalitarians, the overall risk rating was mainly a function of the loss probability.

## 1.4. The Present Study

The aim of the present study was twofold. First, we wanted to systematically examine the variations of the effects of anxiety factors as a function of the type of hazard considered. In previous studies, the effects of enduring anxiety were studied on a relatively limited subset of catastrophic hazards (earthquake, flood). Negative correlations as well as positive ones were evidenced. In the present study, the effects of enduring anxiety dispositions as well as transitional anxiety states on a large set of hazards were studied, including not only catastrophic hazards but also more common ones pertaining to such diverse areas as outdoor activities, medical care, indus-

trial pollution, and attendance in meetings. In order to study more precisely the Anxiety  $\times$  Type of Hazard interaction, the structure of these hazards, as perceived by participants, was first determined.

Despite early results showing limited effects, the study of the role of anxiety factors on risk perception remains an important topic. People's risk evaluations are often dismissed by experts or by authorities on the basis that these evaluations are biased (Fischhoff, Slovic, & Lichtenstein, 1981; Freudenberg, 1996; Slovic, 1990)—notably by people's anxiety level, or are merely the reflection of this anxiety level. The aim of this study was to help determine the kinds of hazards in which perception would be particularly affected by anxiety, as well as determining this effect's direction. It is conceivable that high trait anxiety could lead to an exaggeration of the risks linked to Outdoor Activities on the one hand, and to a minimization of the risks linked to the anxiety drugs the participant is usually taking, on the other hand.

Second, we wanted to systematically examine the variations of the effects of the worldview factors as a function of the type of hazard considered. Four worldviews were considered: hierarchic, egalitarian, individualist, and fatalist. Following Peters and Slovic (1996), we hypothesized that (1) people endorsing hierarchic views would perceive hazards that are normally regulated at the state level (e.g., industrial activity, public transportation, and energy production) as less risky than people endorsing opposing views, (2) people endorsing egalitarian views would perceive hazards that are linked to capitalist-like economic growth (e.g., military-industrial development or nuclear energy production) as more risky than people endorsing opposing views, (3) people endorsing individualistic views would perceive hazards that are normally linked to individual comfort and personal opportunities as less risky than people endorsing opposing views, and (4) people endorsing fatalistic views would perceive hazards that normally could not be controlled as less risky than people endorsing opposing views.

The effects of these two kinds of factors were studied in association with the other more classical factors whose relations with risk perception have already been established: age, gender, education, and expertise.

## 2. METHOD

### 2.1. Participants

The sample was composed of 363 participants recruited on a voluntary basis. These participants

formed two subgroups. The first subgroup was composed of 122 men and 139 women aged 16 to 78 ( $M = 35.5$ ): 104 participants were 16 to 25 year olds, 78 participants were 26 to 45 year olds, and 79 participants were older than 46. They were mostly well-educated people; 184 had completed secondary school. The second subgroup was composed of 102 students enrolled in a 2-year risk management program: 72 men and 30 women aged 20 to 25 years.

### 2.2. Materials

Three questionnaires were used. The first was composed of 10 items issued from Spielberger, Gorsuch, and Lushene's (1970) State-Trait Anxiety Inventory. Five items measured enduring anxiety dispositions, and five items measured transitional anxiety state. The second questionnaire was composed of 12 worldview items taken from Krewski *et al.* (1995) and Peters and Slovic (1996), and included two supplementary worldview items. These two supplementary items were devised to distinguish better the hierarchic factor from the fatalist factor (as compared with Peters & Slovic, 1996), and referred to the government's ability to resolve environmental problems.

The third questionnaire was composed of 86 items taken from Slovic *et al.*'s (1985) risk questionnaire and included 55 additional items devised for the present study (see Table I).

### 2.3. Procedure

Each participant responded individually to the questionnaires. For the anxiety and worldviews questionnaires, responses were given on a 12-point scale, from "completely disagree" to "completely agree." For the risk perception questionnaire, participants were informed that the term "risk" referred to the risk of being seriously ill, wounded, or dying. They were invited to ask questions about unfamiliar terms and then to fill out the questionnaire. When an item did not evoke anything concrete, participants were allowed to not respond. Responses were given on an 11-point scale, from "no risk" to "extremely severe risk." No time limit was imposed.

Responses on the risk perception questionnaire were recorded in two successive steps. First, participants were invited to circle, with a black pencil, the number between 0 to 10 that best corresponded to their view. Then, the participants were allowed to change their responses using a red pencil. In particular, they were requested to clearly differentiate between risks

Table I. Mean Responses on the Items Pertaining to the Risk Perception Questionnaire

Item	Risk perception factor										
	Mean	I	II	III	IV	V	VI	VII	VIII	IX	X
Mineral water (bottles)	1.16	<b>0.65</b>	-0.11	0.05	0.06	-0.06	0.10	-0.04	-0.02	0.05	0.09
Cleasers	2.50	<b>0.63</b>	0.15	0.07	0.05	0.01	0.14	-0.08	-0.02	0.01	-0.05
Computer screens	3.68	<b>0.60</b>	0.18	0.06	0.03	0.10	0.08	0.21	0.08	0.02	0.02
Hair dyeing	2.21	<b>0.59</b>	0.13	0.02	<b>0.38</b>	-0.05	0.17	0.05	-0.05	-0.04	0.02
Piercing	3.26	<b>0.58</b>	0.15	-0.09	<b>0.30</b>	0.12	0.07	0.09	0.07	0.04	0.03
Pesticides	6.47	0.11	<b>0.72</b>	0.02	0.14	0.16	0.04	0.06	0.09	-0.02	0.21
Industrial pollution	6.64	0.08	<b>0.70</b>	0.12	0.07	0.11	0.11	0.14	-0.04	0.05	-0.06
Deforestation	7.30	0.07	<b>0.66</b>	0.08	-0.06	-0.02	-0.01	0.12	-0.03	0.05	0.02
Nitrates	6.19	0.08	<b>0.65</b>	0.07	0.18	0.21	0.00	0.05	-0.04	0.02	0.17
Loads	6.18	-0.07	<b>0.65</b>	-0.15	0.30	0.23	0.07	-0.09	0.04	0.05	0.08
Hydroelectric power plants	3.92	0.13	0.13	<b>0.72</b>	0.06	0.09	0.04	-0.04	0.05	-0.05	0.08
General aviation	4.62	0.08	0.02	<b>0.66</b>	0.12	0.07	0.18	0.07	0.28	0.15	0.00
Railroads	3.74	0.12	-0.01	<b>0.64</b>	0.21	0.02	0.04	0.23	0.26	-0.01	-0.02
Thermal power plants	4.27	0.14	0.20	<b>0.63</b>	0.03	-0.02	0.06	0.02	0.01	-0.03	0.12
Supersonic aircraft	4.99	0.14	0.00	<b>0.63</b>	0.13	-0.01	0.22	-0.08	0.13	0.19	0.04
Tractors	3.91	0.26	0.08	0.24	<b>0.62</b>	-0.05	0.05	-0.04	-0.03	0.10	0.09
Swimming pools	3.44	0.26	0.20	0.14	<b>0.62</b>	0.06	0.02	0.00	0.13	0.09	-0.03
Skateboards	2.97	0.28	0.17	-0.01	<b>0.61</b>	0.12	0.18	0.21	-0.02	-0.07	0.12
Power mowers	3.81	0.25	0.12	0.17	<b>0.59</b>	0.10	0.15	0.01	0.01	0.08	0.05
Surfing	3.49	0.23	0.14	0.15	<b>0.59</b>	0.09	0.14	0.16	0.13	-0.08	0.10
Homosexual relationships (with many partners)	<b>7.16</b>	0.18	0.14	0.01	0.09	<b>0.76</b>	0.12	0.00	0.03	0.03	-0.03
Heterosexual relationships (with many partners)	6.89	0.27	0.11	0.04	0.15	<b>0.63</b>	0.03	-0.02	0.02	0.02	0.00
Marijuana	6.55	0.03	0.00	0.02	0.00	<b>0.60</b>	0.13	0.13	0.08	0.07	0.20
Terrorism	<b>8.10</b>	-0.22	0.28	0.15	-0.03	<b>0.60</b>	0.06	0.16	-0.06	0.15	0.06
Tobacco smoking	<b>7.14</b>	0.03	0.29	-0.03	0.06	<b>0.53</b>	0.08	0.22	0.12	0.02	0.12
Home power tools	3.65	0.12	0.06	<b>0.38</b>	0.17	0.09	<b>0.51</b>	0.12	0.04	0.13	0.06
Home appliances	2.31	0.12	0.04	0.10	0.17	0.06	<b>0.51</b>	0.02	-0.01	-0.01	0.03
Air conditioning	2.48	<b>0.32</b>	0.27	0.03	0.17	0.09	<b>0.41</b>	-0.05	0.02	-0.03	0.17
Aspirin	2.45	0.29	0.18	0.20	0.20	-0.04	<b>0.36</b>	-0.10	0.08	-0.07	0.18
Plastic food containers	2.15	0.28	0.15	0.12	0.04	0.06	<b>0.35</b>	0.04	0.10	-0.13	0.13
Schooling (violence)	5.48	0.14	0.23	0.09	-0.02	0.16	0.01	<b>0.64</b>	-0.03	0.02	-0.01
Megalopolis (violence)	<b>7.07</b>	0.09	0.33	0.12	0.05	<b>0.33</b>	-0.05	<b>0.55</b>	0.06	0.12	0.06
Stadium (violence)	5.59	0.23	0.24	0.10	0.17	0.22	-0.03	<b>0.54</b>	-0.02	-0.05	0.13
Excessive food consumption	5.06	0.17	0.25	-0.10	0.20	0.00	0.15	<b>0.42</b>	0.02	0.13	0.23
Alcoholic beverages	5.58	0.13	0.25	0.18	0.11	0.24	0.29	<b>0.32</b>	0.19	0.06	0.06
Surgery	4.44	0.18	0.09	<b>0.34</b>	0.11	0.09	0.00	0.06	<b>0.73</b>	0.01	-0.07
Open-heart surgery	6.00	0.11	0.11	<b>0.36</b>	0.08	0.17	-0.04	-0.01	<b>0.65</b>	0.09	-0.04
Anesthetics	5.05	0.13	0.20	0.29	0.07	0.04	0.22	-0.08	<b>0.52</b>	0.09	0.13
Clinics (medical care)	3.38	<b>0.34</b>	0.21	0.24	0.09	0.04	0.00	0.15	<b>0.51</b>	-0.07	0.02
Childbirth	2.92	-0.02	-0.09	0.19	0.15	0.04	0.21	-0.01	<b>0.50</b>	0.07	0.15
Chemical weapons	<b>9.34</b>	-0.02	0.19	-0.01	0.04	0.10	-0.07	-0.02	0.01	<b>0.79</b>	0.06
Bacteriologic weapons	<b>9.26</b>	0.10	0.26	-0.01	0.03	0.03	-0.06	-0.12	-0.04	<b>0.72</b>	0.04
Handguns	<b>8.44</b>	-0.07	0.21	<b>0.30</b>	0.03	0.10	-0.01	0.16	-0.03	<b>0.53</b>	0.09
Nuclear weapons	<b>9.26</b>	-0.04	0.22	0.01	-0.10	0.23	-0.03	0.12	0.15	<b>0.44</b>	-0.18
Asbestos	<b>8.24</b>	0.06	0.29	0.14	0.11	0.19	0.05	0.05	0.00	<b>0.43</b>	0.21
Antidepressants	6.21	0.10	0.21	0.13	0.00	0.07	0.20	0.09	0.13	0.17	<b>0.68</b>
Sleeping pills	5.46	0.24	<b>0.32</b>	0.09	0.15	0.24	0.12	0.14	0.09	-0.01	<b>0.59</b>
Valium	5.38	0.21	<b>0.31</b>	0.06	0.13	0.17	0.14	0.03	-0.04	-0.05	<b>0.58</b>
Tranquilizers	5.28	0.30	<b>0.32</b>	0.06	0.15	0.27	0.06	0.06	0.00	-0.04	<b>0.53</b>
Amphetamines	<b>7.20</b>	0.10	0.27	0.15	-0.05	0.12	0.16	0.11	0.02	<b>0.36</b>	<b>0.48</b>
Explained variance		10.2	13.1	9.1	7.2	5.9	3.8	3.4	5.1	3.7	3.5
Percentage of variance		0.07	0.09	0.06	0.05	0.04	0.03	0.02	0.04	0.03	0.02
Weighted mean		2.36	6.55	4.20	3.73	7.17	2.98	6.05	4.36	9.01	5.58
A: Voluntary risks		<b>0.85</b>	0.42	<b>0.70</b>	<b>0.78</b>	0.17	<b>0.77</b>	0.33	<b>0.74</b>	0.05	0.45
B: Involuntary risks		0.19	<b>0.73</b>	0.33	0.28	<b>0.79</b>	0.21	<b>0.63</b>	0.16	<b>0.66</b>	0.58

Note: Results shown are from the exploratory factor analysis conducted on the items pertaining to the risk perception questionnaire. For each factor, the five items with the highest loadings have been selected. See text for a description of each factor. Loadings higher than .30 are in boldface.

as much as possible. The main goal of this two-step procedure was to ensure that participants used the entire range of the response scales.

### 3. RESULTS

#### 3.1. Risk Perception Inventory: Mean Responses and Structure

Mean responses to the questionnaire's risk perception items ranged from 1.16 to 9.34. Items with the lowest means (<2.50) were mineral water (bottles), wind energy, Christmas tree lights, acupuncture, jogging, homeopathic drugs, plastic food containers, hair dyeing, home tools, lifts, cosmetics, aspirin, and air conditioning. Items with the highest means (>7.50) were chemical weapons, bacteriological weapons, nuclear weapons, antipersonnel mines, nuclear waste, heroin, handguns, crime, asbestos, nuclear waste dumping, terrorism, ecstasy, warfare, and cleaning of tankers at sea.

An exploratory factor analysis was conducted on the raw data. Correlation coefficients were computed between items and across participants, and the resulting correlation coefficients were then factor analyzed. A 10-factor solution was retained based on the scree test, and a VARIMAX rotation was performed. Table I shows, for each factor, the five items with the highest loadings.

The first factor was called Common Individual Hazards. It was moderately loaded by numerous common activities, substances, or technologies: mineral water (bottles), cleansers, computer screens, hair dyeing, piercing, wind energy, jogging, cosmetics, and vaccinations. A weighted mean was computed for this factor by weighting the mean response obtained for each item by the corresponding loading. The overall perceived severity was the lowest of all factors: 2.36 out of 10.

The second factor was called Pollutants. It was loaded with items describing the production and large-scale use, diffusion, and conservation of various substances: pesticides, industrial pollution, deforestation, nitrates, loads, herbicides, chemical fertilizers, nuclear waste, full gas canister, cadmium (batteries), DDT, chlorofluorocarbon, mercury, nuclear waste dumping, cleaning of tankers at sea, batteries, and giant tankers. The overall perceived severity for this factor was high: 6.55.

The third factor was called Public Transportation and Energy Production. It was loaded with items describing various modes of public transportation and energy production: hydroelectric power plants, gen-

eral aviation, railroads, thermal power plants, supersonic aircraft, charters, nuclear power plants, solar power plants, and dams. Despite the inclusion of the nuclear power plants item, this factor's overall perceived severity was low: 4.20.

The fourth factor was called Outdoor Activities. It was loaded with a series of a priori heterogeneous items. The factor was named after the common point shared among these items—they all involved outdoor activities: tractors, swimming pools, skateboards, power mowers, surfing, diving, and downhill skiing. The overall perceived severity was one of the lowest: 3.73.

The fifth factor was called Deviance, Sex, and Addiction. It was loaded with a series of risky activities: homosexual relationships (with many partners), heterosexual relationships (with many partners), marijuana, terrorism, tobacco smoking, and heroin. The overall perceived severity was one of the highest: 7.17.

The sixth factor was reminiscent of the first factor; it was called Domestic Hazards. It was loaded with items connected with home comfort: home power tools, home appliances, air conditioning, aspirin, and plastic food containers. The overall perceived severity was one of the lowest: 2.98.

The seventh factor was reminiscent of the fifth factor; it was called Urban Violence. It was loaded with three items with the same subtitle—schooling (violence), megalopolis (violence), and stadium (violence). The overall perceived severity was medium: 6.05.

The eighth factor was called Medical Care. It was loaded with items describing medical interventions: surgery, open-heart surgery, anesthetics, clinics (medical care), childbirth, and pregnancy. The overall perceived severity was not very high: 4.36.

The ninth factor was very specific; it was called Weapons. It was loaded with the following items: chemical weapons, bacteriological weapons, handguns, and nuclear weapons. Its overall perceived severity was the highest of all: 9.01 out of 10.

Finally, the tenth factor was reminiscent of the eighth factor; it was called Psychotropic Drugs. It was loaded with the following items: antidepressants, sleeping pills, valium, and tranquilizers. The overall perceived severity was medium: 5.58.

An oblique factor analysis was then performed. It showed that the 10 factors were more or less interrelated. Correlation coefficients between factors ranged from 0.11 to 0.76. Two higher order factors were extracted. Their correlation with the primary factors are also shown in Table I. The first secondary factor was called Voluntary Exposition. It was strongly related to Common Individual Hazards, Public Transportation

and Energy Production, Outdoor Activities, Domestic Hazards, and Medical Care. The second secondary factor was called Involuntary Exposition. It was strongly related to Pollutants; Deviance, Sex, and Addiction; Urban Violence; and Weapons. Psychotropic Drugs was, logically, linked to both secondary factors.

**3.2. Relationships among Personal Characteristics, Anxiety, Worldviews, and Risk Perception Factors**

Correlation coefficients between personal characteristics, anxiety, worldview factors, and primary risk perception factors are shown in Table II. Ten multiple regression analyses were conducted with each risk perception factor as the dependant variable. Predictors were age, gender, education level, expertise, and the two anxiety and four worldview factors.

Age contributed significantly to the prediction of every risk factor except Weapons. The older the respondents, the higher were their scores for the Com-

mon Individual Hazards; Pollutants; Outdoor Activities; Deviance, Sex, and Addiction; Domestic Hazards; and Psychotropic Drugs factors. By contrast, the older the respondents, the lower were their scores for the Public Transportation and Energy Production, Urban Violence, and Medical Care factors.

Gender contributed significantly to the prediction of six risk factors. Females showed higher scores than males for the Common Individual Hazards; Pollutants; Public Transportation and Energy Production; Deviance, Sex, and Addiction; and Urban Violence factors. Males showed higher scores than females for the Outdoor Activities factor.

Expertise contributed significantly to the prediction of two risk factors. Management students showed higher scores than other participants for the Medical Care factor and lower scores for the Weapons factor.

Transitional anxiety contributed significantly to the prediction of the first four risk factors. The more anxious the respondents at the time of responding, the higher were their scores for the Common Individual

**Table II.** Correlation Coefficients among Personal Characteristics, Anxiety, Worldviews, and Risk Perception Factors: Results of the Multiple Regression Analyses

Predictors	Risk perception factor									
	I	II	III	IV	V	VI	VII	VIII	IX	X
Correlation coefficients										
Age	0.19	0.09	-0.21	0.24	0.28	0.20	-0.17	-0.28	0.07	0.01
Gender	0.15	-0.08	0.17	-0.04	0.21	0.01	0.13	-0.07	0.00	0.18
Education level	-0.15	0.00	0.01	-0.20	-0.21	-0.10	0.05	0.13	0.04	-0.03
Expertise	-0.14	-0.11	0.04	-0.01	-0.23	-0.11	0.09	0.32	-0.15	-0.05
Transitional anxiety	0.12	-0.08	-0.02	0.13	0.05	-0.04	-0.01	0.03	-0.04	0.01
Enduring anxiety	0.00	-0.01	0.10	-0.04	-0.06	-0.06	0.04	0.12	-0.06	-0.11
Fatalist	0.08	-0.13	0.11	0.10	0.08	0.02	-0.01	-0.03	-0.09	0.03
Egalitarian	-0.01	0.19	0.04	0.10	0.12	0.03	-0.02	-0.07	0.11	0.06
Hierarchic	-0.03	-0.05	-0.15	0.06	0.07	0.09	-0.08	-0.06	0.11	0.04
Individualist	-0.02	0.15	-0.02	-0.13	0.12	-0.09	0.06	0.00	0.08	0.00
Beta weights										
Age	0.15**	0.15**	-0.21***	0.24***	0.26***	0.20***	-0.18***	-0.16***		0.19***
Gender	0.11*	0.11*	0.20***	-0.13**	0.19***		0.14**			
Expertise								0.26***	-0.15**	
Transitional anxiety	0.11*	0.11*	-0.10*	0.12*						
Enduring anxiety										-0.13*
Fatalist		-0.13*	0.14**							
Egalitarian		0.19***								
Hierarchic			-0.15**							
Individualist		0.15***			0.12*					
R	0.26	0.28	0.35	0.30	0.35	0.20	0.22	0.35	0.15	0.22
F	6.23	9.95	8.31	12.18	17.03	15.30	9.17	25.87	8.50	9.22
p	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.01	0.001

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

Hazards, Pollutants, and Outdoor Activities factors, and the lower were their scores for the Public Transportation and Energy Production factors. Enduring anxiety contributed significantly to the prediction of only one risk factor. The more anxious the respondents, the lower were their scores for the Psychotropic Drugs factor.

Fatalist contributed significantly to the prediction of two risk factors. The more fatalistic the respondents, the lower were their scores for the Pollutants factor, and the higher were their scores for the Public Transportation and Energy Production factor. Egalitarian contributed significantly to the prediction of only one risk factor. The more egalitarian the respondents, the higher were their scores for the Pollutants factor. Hierarchic contributed significantly to the prediction of another factor. The more hierarchic the respondents, the lower were their scores for the Public Transportation and Energy Production factor. Finally, Individualist contributed significantly to the prediction of two risk factors. The more individualistic the respondents, the higher were their scores for the Pollutants and Deviance, Sex, and Addiction factors.

Finally, correlation coefficients between personal characteristics, anxiety, and worldview factors and secondary risk perception factors were computed. These correlation coefficients were nonsignificant and are therefore not discussed.

## 4. DISCUSSION

The two objectives of the present study were to systematically examine the variations of the effects of the anxiety factors and of the worldview factors, as a function of the types of hazards considered. To do that, it was necessary to determine the structure of these hazards as perceived by the participants.

### 4.1. Risk Perception Structure

A 10-factor risk-perception structure was evidenced. Some factors were reminiscent of factors already shown. The Pollutants and Weapons factors could be considered as close to the “dread” pole of the Dread factor, which was identified in earlier studies. As for the Common Individual Hazards factor, it possibly represents the “common” pole of the Dread factor. Nevertheless, the obtained structure appeared notably different from the three-factor structure identified in Slovic *et al.* (1985) or from the four-factor structure identified in Mullet *et al.* (1993). In the present study, risk perception appeared clearly organized as a function of the kind of hazard: pollutants,

medical care, home risks, and public transportation and energy production.

The reason for these differences has to be found in the analyzed database. In Slovic *et al.* (1985) and Mullet *et al.* (1993), participants were asked to rate a number of hazards as a function of their aspects: catastrophic, new, voluntary, or known to science. Data were aggregated across participants and the database analyzed was an Aspect  $\times$  Hazard matrix. The identified three- or four-factor structure reflected the way in which the various aspects structured themselves as a function of the hazards considered and from the viewpoint of the average participant. In the present study, as indicated in the Results section, a Hazard  $\times$  Participants data matrix was analyzed. The identified 10-factor structure reflects the way in which the various hazards structure themselves from the viewpoint of the individual participants. The two types of structures do not need to be identical; they correspond to complementary viewpoints with regard to risk perception. In the present study, a Hazard  $\times$  Participants data matrix was used because individual scores were needed.

### 4.2. Anxiety Effects

For three factors, Common Individual Hazards, Pollutants, and Outdoor Activities, the effect of transitional anxiety state was positive, and it was significant over the effects of all other variables or factors considered in the analysis: age, gender, education level, expertise, and other personality factors, including enduring anxiety dispositions. This result was consistent with, but not equivalent to, those found in the early studies by Simpson-Housley and collaborators (de Man *et al.*, 1984; Simpson-Housley *et al.*, 1986). In Simpson-Housley's studies, only enduring anxiety dispositions were considered. The level of anxiety that participants felt at the time of the inquiry thus can have a slight, exaggerating effect on some, but not all, hazards.

For one factor, Public Transportation and Energy Production, the effect of transitional anxiety was negative, and it was significant over the effects of all other variables or factors considered. This result is theoretically important. It shows that the anxiety that participants feel at the moment of the inquiry does not necessarily have a magnifying effect on risk evaluation. In some cases, it can have a minimizing effect. The fact that people who feel temporarily anxious could perceive less risk in public transportation than people who are not anxious makes sense: considering that public transportation is often safer than personal transportation, it should induce less anxiety.

Finally, for one factor, Psychotropic Drugs, the effects of enduring anxiety dispositions was negative, and it was significant over the effects of all other variables or factors considered, including transitional anxiety dispositions. It is perfectly understandable that anxious people would perceive less risk in the pills that they possibly take on a regular basis.

### 4.3. Worldviews Effects

As hypothesized, it was with the factor closest to the idea of agricultural and industrial development—Pollutants—that most of the associations between worldviews and risk evaluation were shown. People endorsing egalitarian and individualistic views perceived more risk in chemical pollutants than people endorsing opposing views. This result is consistent with those found by Peters and Slovic (1996) and Krewski *et al.* (1995), with regard to the effect of egalitarian views. By contrast, people endorsing fatalistic views perceived less risk in chemical pollutants than people endorsing opposing views. This result is also consistent with Peters and Slovic's (1996) results.

As hypothesized, it is with the factor closest to the idea of government regulation—Public Transportation and Energy Production—that the association between risk perception and hierarchic views was found. People endorsing hierarchic views perceived less risk in public transportation and nuclear energy production than people endorsing opposing views. By contrast, people endorsing fatalistic views perceived more risk in public transportation and nuclear energy production than people endorsing opposing views. This result is consistent the results of Peters and Slovic (1996) with regard to public transportation.

Finally, the association found between Deviance, Sex, and Addiction and individualistic views was not expected. It is not clear why people endorsing individualistic views perceived more risk in these particular hazards. Possibly, individualists, as a result of their dispositions, may view themselves as potentially more exposed to these hazards.

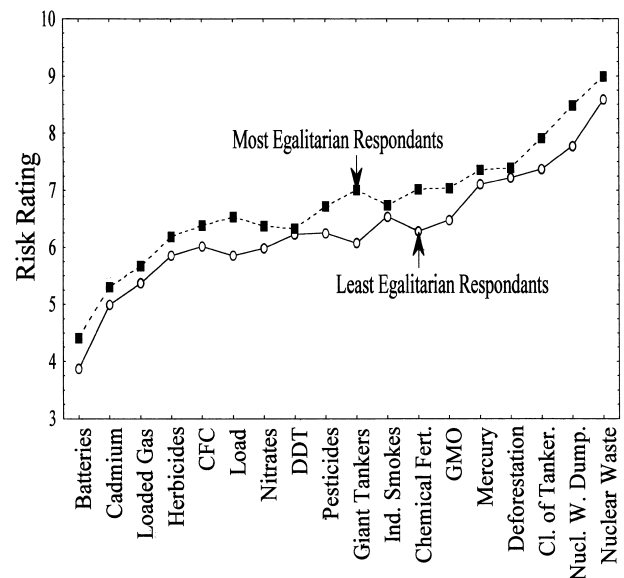
As for the other effects shown, these were consistent with previous findings. In particular, in the majority of cases women tended to judge hazards as slightly more risky than men.

### 4.4. Implications for Risk Assessment and Risk Analysis

The overall message conveyed by the data is that when asked to estimate the risk levels they perceived

in various hazards, participants largely followed the instructions given. Their responses were primarily influenced by the items they had to evaluate and only secondarily influenced by (1) their personal philosophy regarding the way the world should be, (2) transitional anxiety states in which they felt themselves to be in while responding, or (3) more enduring anxiety dispositions.

The evaluation that participants gave for various kinds of hazards practically covered the entire range of the response scale they were instructed to use. Weapons (9 out of 10) and Deviance, Sex, and Addiction were understandably given the higher ratings. Common Individual Hazards (2 out of 10) and Domestic Hazards were given the lowest ratings. Urban Violence, Psychotropic Drugs, and Medical Care were given medium ratings. Worldviews, transitional anxiety state, and even age and gender did not considerably alter the general pattern of results. As an illustration, Fig. 1 compares mean ratings for Pollutants given by people endorsing strong egalitarian views (participants whose score was at least 0.5 *SD* higher than the overall mean) and by people endorsing opposing views (participants whose score was at least 0.5 *SD* lower than the overall mean). As can be seen, the egalitarian effect is clearly visible and consistent across the 18 hazards selected. But the overall picture that emerges is that of stability in the pattern. Between the two groups of participants, the mean differ-



**Fig. 1.** Effect of egalitarian views on the perception of pollutants. CFC = chlorofluorocarbon; GMO = genetically modified organisms.



ence in evaluations was less than 0.5, as compared with the 5-point difference evidenced in the figure between the two extreme mean ratings.

As a result, it can be stated that people's assessments of the risk posed by weapons, urban violence, medical care, and pollutants are not fluctuating estimations that mainly reflect the emotional state in which people find themselves at the time of responding or more enduring anxiety dispositions. Although unquestionably influenced by many psychological factors, such as anxiety and worldviews, these estimations are fundamentally stable ones, and, thus, should be given the full importance they deserve in the definition of public policies with regard to risk management.

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