Risk Analysis, Vol. 26, No. 2, 2006 DOI: 10.1111/j.1539-6924.2006.00744.x

Loss of Agro-Biodiversity, Uncertainty, and Perceived Control: A Comparative Risk Perception Study in Austria and China

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The biogeographical centers of origin of important food crops—called Vavilov centers—are considered to be crucial sources of genetic diversity for present and future crop-breeding programs and thus for human food safety worldwide. Global environmental change and more intensified modes of crop production may cause genetic erosion (loss of traditional crop varieties and loss of crop wild relatives), especially in Vavilov centers. The present study focused on how the risk of genetic erosion (or loss of agro-biodiversity) is perceived in comparison to 16 other risk topics by experts and lay people in Austria and China. The most striking result was that genetic erosion was perceived to be an exceptionally unknown and uncertain risk topic, given that only genetically modified organisms (GMOs) were perceived as being even more uncertain. As a consequence of the high uncertainty, the idea of applying the precautionary principle to further prevent genetic erosion is discussed. An unprecedented finding—one that differs from Austrian participants—is that the Chinese have a higher perceived control over all risk topics. The increased perception of controllability in China is discussed in light of the theory of reflexive modernization. This theory strives to explain the increased critical attitude in Western countries such as Austria toward scientific innovations and toward the idea that everything can be calculated and mastered at will. By revealing different notions of risk perception, this research also provides additional scientific input to risk communication efforts for public education.

KEY WORDS: Austria; China; genetic erosion; GMOs; risk perception

1. INTRODUCTION

Peace and the welfare of human society depend fundamentally on a sufficient, balanced, and secure supply of food. Of the 7,000 plant species used worldwide in food and agriculture, only 30 crops actually "feed the world." These are the crops that provide 95% of global plant-derived energy intake (calories) and proteins. Wheat, rice, and maize alone provide more than half of the global dietary energy. A further six crops or commodities—sorghum, millet, potato, sweet potato, soybean, and sugar (cane/beet)—bring the total to 75% of the global energy intake[3] (Ezcurra *et al.*, 2001; FAO, 1991; FAO, 1997). Taking into account the importance of relatively few crops for global food security, it is particularly important that the diversity within these major crops be conserved effectively, available for use and managed wisely. While only a few plant species supply most of the world's

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3 Note here that a substantial share of energy intake is provided by meat that is ultimately derived from forage and range land plants.

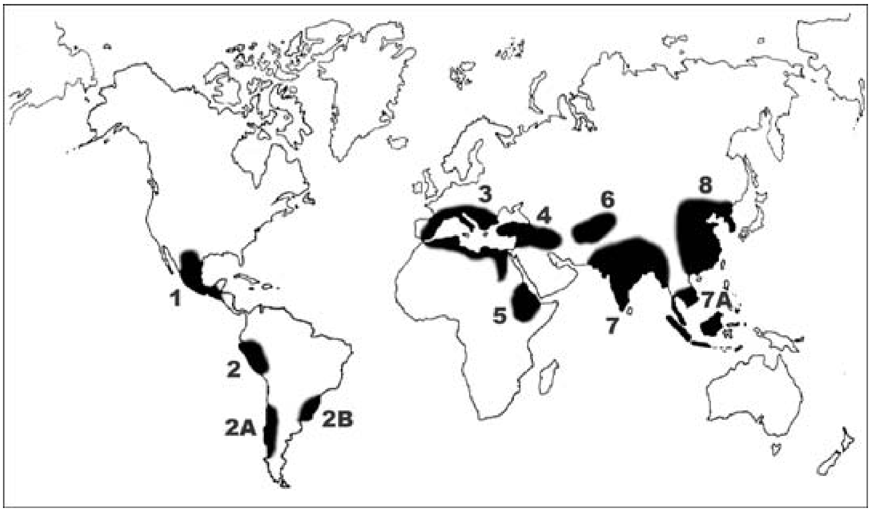


Fig. 1. Centers of origin and diversity for major cultivated plants (Vavilov centers): (1) Mexico-Guatemala, (2) Peru-Ecuador-Bolivia, (2A) Southern Chile, (2B) Southern Brazil, (3) Mediterranean, (4) Middle East, (5) Ethiopia, (6) Central Asia, (7) Indo-Burma, (7A) Siam-Malaya-Java, (8) China. (Source: Ladizinsky, 1998.)

energy and protein, the variety within these species is often immense.[4] Cultivated varieties can be broadly classified into "modern varieties" and "farmer's or traditional varieties." Modern varieties are the outcome of scientific breeding and are characterized by a high yield and a high degree of genetic uniformity. In contrast, traditional varieties (also known as landraces) are the product of breeding or selection carried out by farmers. They represent higher levels of genetic diversity and are therefore the focus of most conservation efforts (IPGRI, 2000a).

1.1. Centers of Origin and Diversity

Each crop has one or more centers of origin where that crop was domesticated. These are usually the primary centers of *in situ* diversity for that crop, and crop wild relatives (CWR) in these areas may contribute to new variability.[5] The Russian plant explorer N. I. Vavilov, in the early 20th century (for Vavilov's biography, see, e.g., Kolchinsky, 2001), was the first to discover that the centers of origin of domesticated crops were not uniformly distributed around the world. Instead, they share certain geographic characteristics and a history of ancient human settlement and agricultural practices (Vavilov, 1931; Harlan, 1951; Ladizinsky, 1998). Centers of origin are now also denominated as Vavilov centers (Fig. 1).

1.2. Interdependence

For most crops, the centers of origin and areas of high diversity are located in developing countries; however, food safety worldwide depends on the genetic variability in Vavilov centers. Today, the agriculture of virtually all countries is heavily dependent on a supply of resources from other parts of the world. For instance, North America is completely dependent upon species originating in other regions of the world for its major food and industrial crops. In other words, none of the major crops grown in the United States has its center of diversity within U.S. national borders. Sub-Saharan Africa is estimated to be 87% dependent on other parts of the world for the plant genetic resources it needs. For Europe, the dependency on other parts of the world is estimated to be 90% (Ezcurra *et al.*, 2001; FAO, 1997; Kloppenburg & Kleinman, 1987). Hence, the risk of genetic erosion is not only limited to developing countries but also affects industrialized countries. The "International Treaty on Plant Genetic Resources for Food and Agriculture," which had been ratified by 55 countries in 2004, acknowledges this issue (FAO, 2004).

1.3. Value of Plant Genetic Resources

When determining the value of plant genetic resources, consideration must be given not only to the

[4] For example, international germ plasm collections hold up to 80,000 varieties of rice and wheat, 35,000 for sorghum, 17,000 for maize, 5,000 for cassava, and 900 for banana (IPGRI, 2000b).

[5] The term "center" is commonly used to refer to the area of origin and/or of diversity of cultivated plants. In many cases, however, such areas are quite large and some scientists have suggested other terms (Harlan, 1971). Note that centers of diversity (secondary centers) do not always correspond with the area where the crop has been domesticated because many crops have been cultivated and diversified outside their centers of origin (Harlan, 1951; Zeven & de Wet, 1982).

conservation of particular genes or genotypes, but also to the conservation of diversity. Genes or genetic characteristics are valued for the benefit they provide. They include such agronomic traits as resistance to pests, diseases, and drought; adaptations to abiotic stresses such as salinity tolerance; plant stature and other factors affecting productivity; quality factors such as higher oil or protein content; as well as culinary and other factors of cultural importance.

1.4. Genetic Vulnerability and Genetic Erosion

Genetic vulnerability is the condition that results when a widely planted crop is uniformly susceptible to a pest, pathogen, or environmental hazard, thereby creating a potential for widespread crop loss. One of the main causes of genetic vulnerability is the widespread replacement of genetically diverse traditional crop varieties (TCV) by homogeneous modern varieties. In the United States, virtually all modern soybean varieties can be traced back to a dozen strains from a small area in northeastern China, and most hard red winter wheat varieties in the United States originated from just two lines imported from Poland and Russia. One case where the risk of genetic vulnerability was brought sharply into focus was in 1970 with the outbreak of southern corn leaf blight. This disease drastically reduced corn yields in the United States and was attributed to the extensive use of a single genetic male sterility factor that was—unfortunately—linked to disease susceptibility (Harlan, 1987; Tanksley & McCouch, 1997).

Genetic erosion, on the other hand, is the loss of genetic diversity, including the loss of individual genes, and the loss of particular combinants of genes such as those manifested in locally adapted landraces. The term genetic erosion is sometimes used in a narrow sense such as for the loss of alleles or genes, as well as more broadly, referring to the loss of varieties or even species. Many researchers believe that the main problem related to agro-ecosystem management is the general tendency toward genetic and ecological uniformity imposed by the development of modern agriculture (Ezcurra *et al.*, 2001).

Gao (2003), for example, discusses the loss of cultivated rice varieties in China and reports that genetic erosion has been threatening the integrity of the Chinese rice gene pool. In particular, the advent of hybrid rice has further promoted genetic erosion, and many TCV have been replaced by widely grown hybrid rice. However, another case study on genetic erosion in Thailand concluded that although "modern varieties became important, they had no negative impact on the overall distribution and diversity of traditional varieties" (Dennis, 1987; Brush, 1991). This view agrees with Brush's theory (Brush, 1991) that farmers maintain a significant degree of crop diversity even as they adopt modern varieties in Vavilov centers. Similar farmer behavior has been reported from South Africa and Zimbabwe (Wenzel, 2003; Tongoona, 2003). Gao also reports that, due to the increase in the Chinese population and particularly the rapid growth of a market economy since the 1980s, most of the localities of wild rice (CWR) have been turned into cultivated rice fields, fish ponds, residences, factories, and highways. With the drastic change in habitats, the existence of wild rice has been seriously threatened, with most of the populations having disappeared or being endangered (Gao *et al.*, 1996; Gao, 2003). For Taiwan, loss of CWR had already been reported in the late 1970s (Kiang *et al.*, 1979).

1.5. Regional Focus

Two countries were selected for this study: Austria and China. Comparisons in the risk perception of genetic erosion were made for stakeholders within each country and for stakeholders between the two countries. The special interest in comparing these two countries is justified by their different ecogeographic and socioeconomic characteristics. China—a Vavilov center—is an important cradle of agriculture as well as a center of origin and diversity for globally important crops such as rice (*Oryza sativa*) and soybean (*Glycine max*). China still maintains a high diversity in traditional crops and CWR, and is confronted with the risk of genetic erosion (Gao, 2003). Austria, on the other hand, is not situated in a Vavilov center and has a comparably low agricultural diversity (see Pascher & Gollmann, 1999). Also, Austria, as a highly developed country, is less affected than China by ongoing socioeconomic and environmental changes (e.g., population growth and land-use change) (USDA, 2004). Accordingly, Austrians, inhabiting a country with less diversity and fewer diversity-reducing processes, were expected to be less affected by losses of agricultural diversity. Another difference is the rather sceptical public opinion in Austria on green biotechnology (genetically modified crops). Only a small number of national R&D programs focus on GMOs, while organic farming—which excludes genetically modified (GM) technology—is increasingly popular in Austria.

China, on the other hand, has a strong, independent national R&D program on green biotechnology, but little is known about public opinion on this technology (Gao, 2003; Harlan, 1998; INRA, 2000; James, 2001). The different cultural backgrounds of the two countries could potentially add a notable bias to the study. Earlier studies, however, show the opposite: cultural biases, based on cultural theory, were minor rather than major factors in explaining risk perception (Sjöberg, 1997, 1998).

1.6. Risk Perception Studies in Developed and Developing Countries

Most investigations on risk perception were carried out in industrial countries and areas such as the United States, Europe, Japan, and Hong Kong (for Hong Kong, see Keown, 1989). Only recently have attempts been made to apply the risk perception methodology, e.g., the psychometric paradigm, also in developing and emerging countries, e.g., Chile (Bronfman & Cifuentes, 2003) and China (Zhang, 1994; Lai & Tao, 2003; Neto & Mullet, 2001). Keown (1989) and Lai and Tao (2003) revealed a two-factor pattern similar to previous studies, whereas Zhang could not obtain similar risk space factors from his mainland Chinese sample. Direct comparisons on risk perception between developed and developing countries remain scarce. While studies on the psychometric paradigm in developing countries are rare, other methodologies to investigate public opinion on specific topics such as GM technology in agriculture have been carried out, for example, by Aerni in Mexico, the Philippines, and South Africa (see Aerni, 1999, 2001, 2002; Aerni *et al.*, 1999) and Lopez-Vazquez and Marvan (2003) in Mexico. Recent discussions and international disputes, e.g., on the refusal to import U.S. GM maize to combat malnutrition in Zambia and Zimbabwe, have also demonstrated the need to study risk perception in developing countries (Magrath *et al.*, 2002).

1.7. Aim of the Study

The aim of the study was to investigate the risk perception of 18 different topics comparing Austria and China. A special focus was put on two new risk topics (loss of TCV and loss of CWR in Vavilov centers) that were presented within an established risk perception framework (the psychometric paradigm). In addition, two different stakeholder groups were differentiated in each country, namely, experts and so-called lay people. Experts are defined here as specialists who work in the field of global environmental change, plant biotechnology, plant diversity, plant breeding, conservation, and other related fields. The aim of this study is also to facilitate the dialogue between experts, the general public, and decisionmakers, and should contribute to develop a clear risk communication strategy between different stakeholders on the sensitive topic of agro-biodiversity loss in centers of origin and diversity.

2. METHODS

2.1. Risk Perception Questionnaire

The method used in this risk perception study, the psychometric paradigm, is derived from Slovic *et al.* (1980). The psychometric paradigm was the first attempt to group different risk topics according to their perceived qualitative characteristics (in contrast to purely quantitative characteristics such as annual mortalities, life years lost, or financial damage). Interestingly, the qualitative characteristics can be combined into two to three groups that are perceived similarly. For example, if a risk is perceived as being new, then it is mostly also perceived as unknown to science, or if a risk is perceived as being catastrophic, then it is frequently also perceived as uncontrollable, and so forth. This explains why a variety of characteristics can be combined into two or three factors. The two most important factors are denominated "dread" or "catastrophic" and "unknown" or "unfamiliar" risk (Slovic *et al.*, 1980; Slovic, 1987). Some changes, however, have been made regarding the selection of risk topics and items. Two previously not investigated risk topics—representing two aspects of genetic erosion—were compared to 16 previously investigated risk topics (Table I).

The two new topics were:

- Loss of traditional crop varities (TCV) and
- Loss of crop wild relatives (CWR) in centers of origin

The other 16 previously investigated topics were included to ensure comparability with previous studies, using them as "anchor points" to help interpret the new topics. As an exception, the risk topic "terrorism" was split into two subcategories to specifically rate terrorism on agriculture, as agricultural systems with low agro-biodiversity are increasingly vulnerable to "low-tech high-impact" bioterrorism (Wheelis *et al.*, 2002).

Table I. Overview of the 18 Risk Topics Used in the Questionnaire, with Short Descriptions in Parentheses

Risk Topics
1. Nuclear energy (nuclear power plants, accidents, and final deposition of nuclear waste)
2. Traditional crop varieties loss (loss of diversity in agriculture, leading to monocultures, and also loss of variety-specific genes termed genetic erosion)
3. Volcanoes
4. Genetically modified crops (e.g., insect-resistant genetically modified maize)
5. HIV/AIDS (effects of infection with HIV)
6. Terrorism against human beings and their infrastructure (e.g., bombs, nerve gas, anthrax letters, and many more)
7. Tourism and touristic activities, including mass tourism (effects on the social, ecological, and economic conditions in touristic regions)
8. Pesticides/herbicides/insecticides (use of chemicals in agriculture to fight pests, harmful insects, and fungi)
9. Animal/plant species loss in general (loss of biodiversity)
10. Smoking (health effects for smokers)
11. Effects of population growth and population pressure, including urbanization (destruction of habitat and farmland)
12. Crop wild relatives loss in "centers of origin" (regions where the crop was initially domesticated from its wild relative)
13. Civil strife/war (consequences of war)
14. Poverty and malnutrition in developing countries
15. Water, air, and soil pollution (e.g., by nitrate, ammonium, and sulfate (acid rain))
16. Global climate change (e.g., global temperature increase and sea level rise)
17. Road traffic accidents (injuries and casualties)
18. Terrorism against livestock and crops on farms and against storing facilities (e.g., deliberate infection of livestock with foot and mouth disease, contamination of crops with exotic pests such as fungi or virus)

The 11 items (questions) used in this study were selected from similar previous studies (Lazo *et al*., 2000; McDaniels *et al*., 1997; Slovic *et al*., 1980). The final selection was based on the item's capacity to generate the three main risk factors "dread," "unknown," and "relevance." In the questionnaire, each risk topic had to be judged by the 11 items using a 7-point Likert scale (see Table II for a description of the 11 items). Each item could also be answered with "don't know" to avoid random answers or confusion in case the respondents did not know. In case of a "don't know," the answer was treated as missing and replaced with the average judgment value for that question. The last part of the questionnaire was designed to collect information on the respondents' age, sex, education, family status, type of residence, work experience in years, and field of work (which was used to confirm the lay or expert categorization).

2.2. Response Rate

The questionnaire was published on the Internet between October 2003 and January 2004. Respondents could either complete the questionnaire online (>95% of Austrian lay people and experts and Chinese experts) or fill out a paper version, returning it to the authors after completion (Chinese lay people received printouts). For a review on the comparability of online and paper versions of questionnaires, see Birnbaum (2004). Intense discussion between authors on the meaning of the items and risk topics was an important aspect during translation of the questionnaire. In addition, colleagues (native speakers) also checked and commented on the translation before publication. To inform potential respondents, a formal e-mail about the project, the questionnaire, and the webpage was sent to participants of scientific conferences,[6] members of expert mailing lists,[7] other general mailing lists (Austrian lay people), and university students. Three reminder e-mails were sent after 1, 3, and 6 weeks. No reward for participating in the survey was provided, but a summary of the results was offered upon request. The online hits were counted using the "Goweb" webcounter (with reload inhibition, available at www.goweb.de). Based on the amount of hits at the first introductory page, 39.9% of the visitors completed the questionnaire; however, this online response rate does not take into account the number of people receiving an e-mail and not visiting the webpage, so the real response rate would be lower. The response rate for Chinese lay people who received the paper version was actually higher

[6] For example, conferences on global change, biosafety, and risk analysis.

[7] Several mailing lists were used, including topics such as global climate change, biotechnology, environmental education, human dimensions of global change, crop variety preservation, gene technology, biosafety, botany, tropical ecology, and risk analysis.

Table II. Items Used in the Questionnaire (See the Description for the Extreme Minimum (1) and Maximum (7) Values of the Likert Scale)

Items	Likert Scale 1	Likert Scale 7
Affects me: Please rate how much this risk affects you	Does not affect me	Affects me
Affects future generations: Please rate how much this risk affects future generations	Does not affect them	Affects them
Catastrophic potential: Please rate the catastrophic potential for this risk, if it might cause a catastrophic impact or not	Catastrophic	Not catastrophic
Equity: Please rate the equity of this risk, in terms of whether those who receive the benefits are the same people who carry the risks	Not equitable	Equitable
Controllability: Please rate how controllable this risk is	Uncontrollable	Controllable
Voluntariness: Please rate the extent to which this risk is chosen voluntarily by the people affected	Involuntary	Voluntary
Observability: Please rate the observability of the impacts of this risk	Not observable	Observable
Known to experts: Please rate to what degree this risk is known by the experts	Known	Unknown
Known to people exposed: Please rate to what degree this risk is known by the people exposed	Known	Unknown
Immediacy: Please rate the immediacy of this risk, in terms of how soon possible harmful effects may occur	Delayed	Immediate
Antiquity: Please rate if this risk is rather new or old	Old	New

(69.4%) than the online response rate, as the questionnaire was administered during and after classes by Chinese university teachers.

During the 3-month period, 593 Austrian and 485 Chinese respondents completed the questionnaire. Chinese respondents were experts ($n = 103$) and lay people ($n = 382$) at Chinese research institutions and universities, mainly from Beijing, Hangzhou, and Qufu. Austrian respondents were experts ($n = 145$) and lay people ($n = 448$) at Austrian research institutions and universities, mainly from Vienna and Graz. The main bias of respondents (lay people) with regards to demographics was age and the level of education. This is a common problem in survey work (see, e.g., Sjöberg, 2003) and has to be taken into account, as the sample does not accurately represent the "general public" in all demographic aspects.

To improve the response rate, the workload for the respondents was reduced by splitting the 18 topics of the first part into three versions (Version a, b, and c). Three of the 18 topics (loss of crop varieties, loss of CWR in centers of origin, GMOs) appeared in all three versions. The remaining 15 topics were split into three groups, adding five topics to each version, resulting in eight topics per version (3 + 5) (Pedroso de Lima, 1993). Possible anchoring effects were considered when the 15 risk topics were distributed to the three versions, assigning them in a way that similar topics appeared in different versions (e.g., "terrorism against humans" in Version a; "civil strife/war" in Version b; and "terrorism in agriculture" in Version c). No statistically significant differences were found in the composition of the individuals of the different versions regarding age ($F = 0.26$, $p = 0.76$), sex ($X^2 = 2.3$, $p = 0.316$), education ($X^2 = 1.021$, $p = 0.600$), family status ($X^2 = 1.472$, $p = 0.479$), type of residence ($X^2 = 0.704$, $p = 0.703$), or work experience in years ($X^2 = 0.065$, $p = 0.968$). As there were no differences, it was possible to treat the data as if they came from a single sample. The female ratios of Austrian (64%) and Chinese (66%) lay people, and Austrian (35%) and Chinese (36%) experts were similar ($X^2 = 0.22$, $p = 0.883$ for experts and $X^2 = 0.33$, $p = 0.56$ for lay people); however, the average age was slightly higher in Austrian lay people (28.3 years, $SD = 9.6$) and experts (38.6 years, $SD = 10.3$) than in Chinese lay people (21.9 years, $SD = 2.3$) and experts (33.7 years, $SD = 6.3$).

Analysis of the data was carried out using Microsoft Excel and SPSS 11.5 software. For a test of equality of average values for different items and subgroups, the Z statistic was used (Lazo *et al.*, 2000). Factor analysis was carried out with average judgment values. Only those factors were selected that had an eigenvalue >1. The extraction method for the factors was main component analysis; the rotation method was Varimax with Kaiser-Normalization. (The number of iterations needed to converge rotation is given at the respective table.)

3. RESULTS

The most striking difference in the risk perception of Austrian and Chinese lay people and Austrian and Chinese experts was that Chinese believed much more in the controllability of nature, society, and technology.

3.1. Comparison of Chinese and Austrian Lay People

Significant differences in the judgments of the risk topics were found for all items. The most differently judged item of lay people from both countries was the controllability of risks. Chinese lay people perceived the risks to be far more controllable. The perception of controllability was the most distinguishing item of all compared subgroups investigated in the whole study. Another major difference was in the evaluation of expert's knowledge, where Chinese lay people believed experts were better informed. Chinese also believed that people exposed were better informed, even though the difference in the judgment was not as strong as regarding expert's knowledge. Chinese lay people also felt that the risks are less voluntarily chosen by people affected, that a longer delay period takes place before the effects of the risk become observable, and that the risks have a higher catastrophic potential. Chinese lay people felt personally more affected by the risks but judged future generations to be less affected than Austrians. Also, Austrian lay people assessed the risks to be less equitable, easier to observe, and newer than their Chinese colleagues (Table III).

3.2. Comparison of Chinese and Austrian Experts

The judgments of the risk topics differed significantly in 9 out of 11 items. In general, the comparison between Chinese and Austrian experts revealed less striking differences than the lay people comparison. The most differently judged item was on the expert's knowledge: Chinese compatriots regarded it as being higher. Similarly, Chinese also judged the exposed people's knowledge to be higher than Austrians. Chinese experts also rated the observability lower and the delay period higher than Austrian experts. Other differences were that experts from China judged the risks to be more controllable and more equitable but with a higher catastrophic potential. On the other hand, Austrian experts rated the risks to be more

Table III. Average Judgment Values and Standard Deviations for Austrian and Chinese Lay People

Item	Range (1 to 7)	Austrian Students Average ($n = 289$)	Austrian Students *SD*	Chinese Students Average ($n = 382$)	Chinese Students *SD*	*Z*
Controllability	Uncontrollable ↔ Controllable	3.67	1.94	4.51	1.95	−16.59***
Known to experts	Known ↔ Unknown	2.87	1.49	2.60	1.66	−10.15***
Voluntariness	Involuntary ↔ Voluntary	2.74	1.86	2.41	1.81	−9.34***
Immediacy	Delayed ↔ Immediate	3.70	1.97	3.33	2.09	−8.63***
Affects me	Does not affect me ↔ Affects me	4.47	1.96	4.87	1.88	−8.02***
Affects future generations	Does not affect them ↔ Affects them	6.08	1.31	5.82	1.58	−5.42***
Observability	Not observable ↔ Observable	4.83	1.91	4.62	2.24	−3.90***
Catastrophic potential	Catastrophic ↔ Not catastrophic	2.77	1.68	2.66	1.69	−3.47***
Equity	Not equitable ↔ Equitable	2.60	1.82	2.78	1.86	−3.35***
Known to people exposed	Known ↔ Unknown	4.6	1.71	4.39	1.99	−3.24**
Antiquity	Old ↔ New	3.95	2.05	3.79	2.16	−2.96**

***and **indicate significant difference at 0.1% and 1%, respectively.
Note: The final column presents the Z statistic for a test of equality of means.

Table IV. Average Judgment Values and Standard Deviations for Austrian and Chinese Experts

Item	Range (1 to 7)	Austrian Experts		Chinese Experts		
		Average ($n = 145$)	*SD*	Average ($n = 103$)	*SD*	*Z*
Known to experts	Known ↔ Unknown	3.13	1.59	2.70	1.83	−8.64***
Observability	Not observable ↔ Observable	4.97	1.94	4.21	2.16	−8.36***
Controllability	Uncontrollable ↔ Controllable	3.73	2.02	4.30	2.12	−6.76***
Voluntariness	Involuntary ↔ Voluntary	2.71	1.83	2.40	1.84	−5.77***
Catastrophic potential	Catastrophic ↔ Not catastrophic	3.21	1.83	2.84	1.84	−5.47***
Immediacy	Delayed ↔ Immediate	3.55	1.98	3.32	2.15	−3.74***
Known to people exposed	Known ↔ Unknown	4.63	1.78	4.28	2.12	−3.43***
Affects future generations	Does not affect them ↔ Affects them	5.85	1.55	5.51	1.84	−3.34***
Equity	Not equitable ↔ Equitable	2.56	1.82	2.84	1.96	−3.20**
Affects me	Does not affect me ↔ Affects me	4.49	2.00	4.56	2.05	−0.99
Antiquity	Old ↔ New	3.59	2.10	3.67	2.23	−0.65

***and **indicate significant difference at 0.1% and 1%, respectively.
Note: The final column presents the *Z* statistic for a test of equality of means.

voluntarily chosen and that they would affect future generations to a higher extent (Table IV).

3.3. Factor Analysis: Austrian Sample

Based on the average judgment values of Austrian experts and lay people, a factor analysis was done, explaining 79.91% of the total variance (Table V). The three main factors were composed by the 11 items in a way that allowed a relatively clear characterization of the three factors. The first factor represents the items: catastrophic potential, equity, controllability, voluntariness, expert knowledge, and exposed person knowledge. Based on the items that characterize it, it can be named "catastrophic risk factor." The second factor is represented by the items: observability, expert knowledge and exposed person knowledge, immediacy, and antiquity; it can therefore be named "uncertainty risk factor." The third factor includes the items that affect me and affect future generations, and can therefore be named "relevance risk factor" (Table VI). Factor values were calculated for all 18 risk topics. In general, lay people judged most risk topics as more certain and more catastrophic than experts did; also, lay people felt more affected by most risks. The two risk topics "loss of crop varieties" (varieties) and "loss of CWR" (wild relatives) were rated below average by both experts

Table V. Explained Variance of Main Component Analysis for Chinese and Austrian Experts and Lay People Before and After Rotation (Only Those Factors Were Selected with an Eigenvalue >1)

Component	All Chinese (Experts and Lay People)						All Austrian (Experts and Lay People)					
	Initial Eigenvalue			Rotated Sum of Squares			Initial Eigenvalue			Rotated Sum of Squares		
	Total	% of Variance	Cumulated %	Total	% of Variance	Cumulated %	Total	% of Variance	Cumulated %	Total	% of Variance	Cumulated %
1	3.29	29.87	29.87	3.25	29.59	29.59	4.45	40.47	40.47	3.75	34.08	34.08
2	2.74	24.94	54.80	2.74	24.90	54.49	2.91	26.45	66.93	3.19	29.06	63.15
3	2.48	22.50	77.31	2.51	22.81	77.31	1.42	12.98	79.91	1.84	16.76	79.91
4	0.85	7.72	85.02				0.77	7.00	86.92			
5	0.64	5.85	90.88				0.48	4.36	91.28			
6	0.42	3.84	94.71				0.37	3.43	94.72			
7	0.20	1.83	96.55				0.26	2.44	97.17			
8	0.19	1.70	98.25				0.16	1.48	98.65			
9	0.11	0.98	99.23				0.08	0.75	99.40			
10	0.05	0.48	99.71				0.04	0.37	99.78			
11	0.03	0.29	100				0.02	0.21	100			

Note: Extraction method, main component analyses. Rotation method, Varimax with Kaiser-Normalization.

Table VI. Rotated Factor Matrix for Chinese and Austrian Experts and Lay People, Only Loadings Higher Than 0.4 are Shown

	Chinese Experts and Lay People			Austrian Experts and Lay People		
		Factors[a]			Factors[b]	
Item	Catastrophic	Uncertainty	Relevance	Catastrophic	Uncertainty	Relevance
Affects me			0.77			0.74
Affects future generations			0.88			0.84
Catastrophic potential	0.93			0.79		
Equity	0.90			0.80		
Controllability	0.47		0.69	0.81		
Voluntariness	0.90			0.94		
Observability		−0.92			−0.88	
Known to experts		0.61		−0.64	0.57	
Known to people exposed	−0.43	0.69		−0.56	0.78	
Immediacy		−0.48	−0.59		−0.74	
Antiquity		0.88			0.77	

[a]Rotation converged in 4 iterations.
[b]Rotation converged in 7 iterations.
Note: Extraction method, main component analyses. Rotation method, Varimax with Kaiser-Normalization.

and lay people on the catastrophic risk factor (see Fig. 2). Wild relatives rated very high for both groups on the uncertainty factor. Varieties rated rather high for lay people and about average for experts on the uncertainty risk factor (see Table VII). On the third risk factor, varieties came slightly above average and wild relatives below average for both Austrian groups.

3.4. Factor Analysis: Chinese Sample

Based on the average judgment values of Chinese experts and lay people, a factor analysis yielded again three main factors explaining 77.31% of the total variance (Table V). The first (catastrophic) and the second (uncertainty) factors were made up by five items (exceeding a factor loading of 0.4) and the third (relevance) factor was made up by four items (Table VI). Lay people judged most risks as more catastrophic, and experts judged most risks as more uncertain compared to lay people. With no exception, lay people felt more affected by all risks. The location of the risk topics "loss of crop variety diversity" (varieties) and "loss of CWR diversity" (wild relatives) on the three factors is in general comparable between experts and lay people (Fig. 3). Differences in the ranking between lay people and experts on the catastrophic factor were found for "varieties," with position 11 for lay people and 12 for experts. Also, on the uncertainty factor, "varieties" were judged differently. While lay people judged it the most uncertain risk topic, experts rated it second after GMOs (see Table VII). On the relevance factor, lay people rated both topics slightly lower than experts. Loss of varieties came 8th for lay people (7th for experts), loss of CWR 16th for lay people (15th for experts).

3.5. "Don't Know" Responses

The comparison of the number of "don't know" responses for all risk topics and all 11 items showed some differences between the subgroups, especially between Chinese (1.1%) and Austrian lay people (10.6%). On the other hand, the two expert groups were more or less comparable (Chinese: 7.8%; Austrian: 6.8%). For the topic "loss of TCV," it was shown that Chinese experts and Austrian lay people had higher than average do not know rates. For "loss of CWR," all subgroups had elevated do not know rates (see Table VIII).

4. DISCUSSION

The results of this study are generally comparable to previous risk perception studies. Both the composition of the three main risk factors and the location of characteristic risk topics within the risk factor space matched the findings of important earlier studies. Previously used risk topics such as "DNA technology" (previous studies) and "GMOs" (this study), "Nuclear Reactor Accidents" and "Nuclear Energy," "Auto Accidents" and "Traffic Accidents," "Warfare" and "War/Civil Strife," "Pesticides" (both studies), and "Smoking" (both studies) appeared in similar relative positions within the factor space and support the results of this study (compare with Slovic, 1987; Slovic *et al.*, 1980, 1987). Apart from

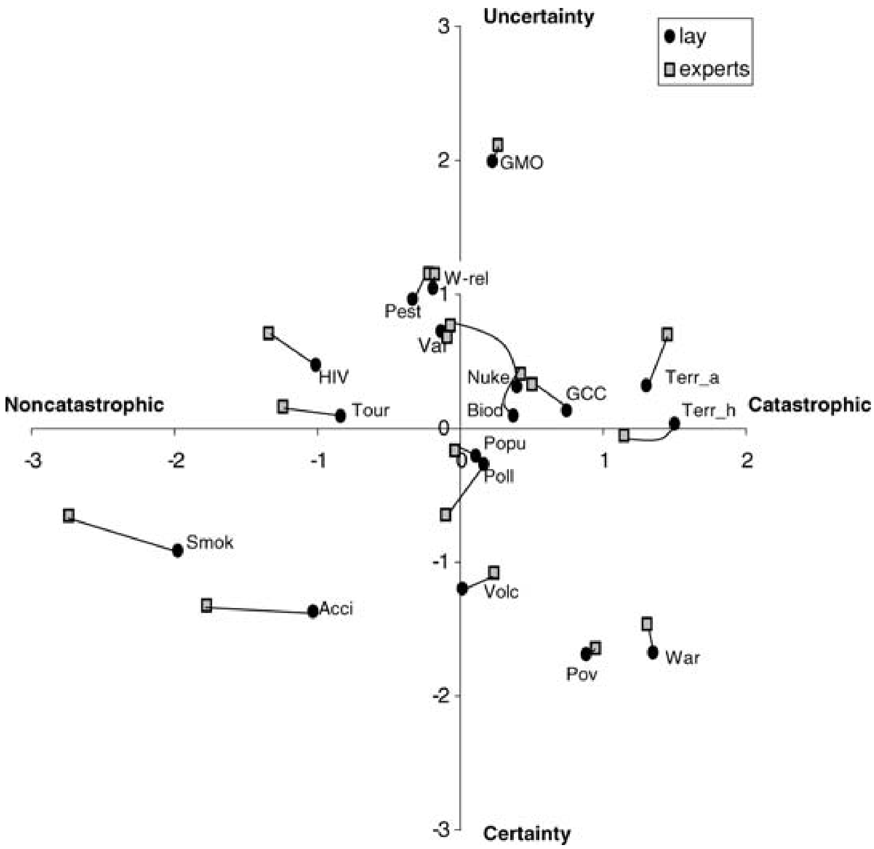


Fig. 2. Differences in the perception of risks between Austrian lay people and experts (factors catastrophic and uncertainty). Lay people judged most risk topics as more certain and more catastrophic than experts did (see, e.g., "smoking" and "traffic accidents"). However, "loss of crop wild relatives," "traditional crop varieties," and "GMOs" were judged rather similar by both subgroups.

Description of topics: GMOs: Genetically modified crops (e.g., insect-resistant, genetically modified maize); **Var:** Traditional crop varieties loss (loss of diversity in agriculture, leading to monocultures, also loss of variety-specific genes termed genetic erosion); **W-rel:** Crop wild relatives loss in "centers of origin" (regions where the crop was initially domesticated from its wild relative); **Nuke:** Nuclear energy (nuclear power plants, accidents, final deposition of nuclear waste); **HIV:** HIV/AIDS (effects of infection with HIV); **Volc**: Volcanoes; **Tour:** Tourism and touristic activities, including mass tourism (effects on the social, ecological, and ecological conditions in touristic regions); **Terr-h:** Terrorism against human beings and their infrastructure (e.g., bombs, nerve gas, anthrax letters, and many more); **Pest:** Pesticides/herbicides/insecticides (use of chemicals in agriculture to fight pests, harmful insects, and fungi); **Biod:** Animal/plant species loss general (loss of biodiversity); **Smok:** Smoking (health effects for smokers); **Popu:** Effects of population growth and population pressure, including urbanization (destruction of habitat and farmland); **War:** Civil strife/war (consequences of war); **Pov:** Poverty and malnutrition in developing countries; **Poll:** Water, air, and soil pollution, e.g., by nitrate, ammonium, sulfate (acid rain); **Terr-a:** Terrorism against livestock and crops on farms and storing facilities (e.g., deliberate infection of livestock with foot and mouth disease, contamination of crops with exotic pests such as fungi or virus); **GCC:** Global climate change, e.g., global temperature increase, sea level rise; **Acci:** Road traffic accidents (injuries and casualties).

these expected outcomes, other aspects were not predictable and are worth discussing in greater detail: (1) general differences in the judgment between Chinese and Austrian respondents, especially regarding perceived control; (2) high levels of uncertainty regarding loss of TCV and CWR, as perceived by all respondents.

4.1. Perceived Control Is Increased in Chinese Respondents

The most surprising difference in the general judgment bias of Austrians and Chinese (experts and lay people) is that Chinese perceived the 18 risk topics to be less observable, more catastrophic, and less voluntary than Austrians, although the Chinese still judged the risks to be more controllable! This is an unexpected finding because these items are normally highly correlated. Thus, a less observable, more catastrophic, and less voluntary risk is normally also judged to be less controllable; however, this was not the case in the Chinese sample. Two possible explanations might help explain this: different cultural interpretations of control, and the theory of reflexive modernization.

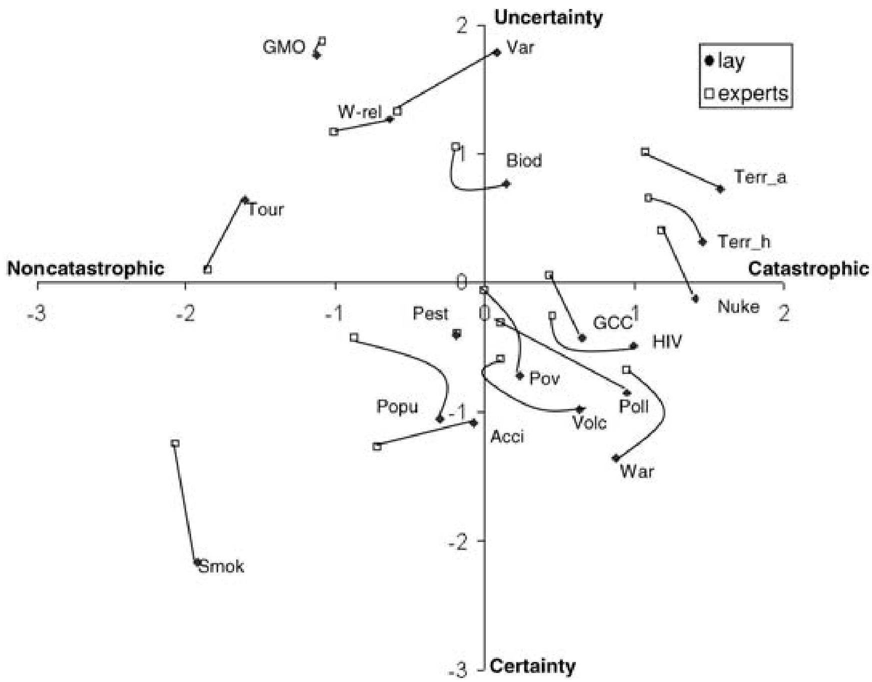
The item "controllability" did not specify whether individual, expert, or societal control was meant, so the general way in which the question was asked left

Table VII. Chinese and Austrian Lay Person and Expert Factor Values and Ordering of the 18 Risk Topics on the Uncertainty Factor (Factor 2)—Together with GMOs, Loss of Crop Varieties, and Loss of Crop Wild Relatives Were Judged as the Most Uncertain Topics

	Uncertainty (Factor 2)							
	Chinese				Austrian			
	Experts	Expert Ordering	Lay Person	Lay Person Ordering	Expert	Expert Ordering	Lay Person	Lay Person Ordering
GMO	1.87	1	1.77	2	2.12	1	1.99	1
Varieties	**1.33**	**2**	**1.78**	**1**	**0.68**	**7**	**0.73**	**4**
Wild relatives	**1.16**	**3**	**1.26**	**3**	**1.15**	**2**	**1.05**	**2**
Biodiversity	1.05	4	0.77	4	0.41	8	0.10	9
Terror-agro	1.01	5	0.73	5	0.70	6	0.32	6
Terror-humans	0.66	6	0.32	7	−0.05	11	0.03	11
Nuclear	0.40	7	−0.11	8	0.77	4	0.31	7
Tourism	0.09	8	0.64	6	0.16	10	0.09	10
Climate change	0.05	9	−0.43	10	0.33	9	0.13	8
Poverty	−0.05	10	−0.72	12	−1.64	18	−1.69	18
Contamination	−0.26	11	−0.85	13	−0.65	13	−0.27	13
HIV AIDS	−0.32	12	−0.49	11	0.71	5	0.47	5
Pesticides	−0.40	13	−0.40	9	1.15	3	0.96	3
Population	−0.43	14	−1.05	15	−0.17	12	−0.21	12
Volcanoes	−0.60	15	−0.99	14	−1.08	15	−1.20	15
War	−0.68	16	−1.36	17	−1.46	17	−1.68	17
Smoking	−1.25	17	−2.17	18	−0.65	14	−0.91	14
Traffic accidents	−1.28	18	−1.08	16	−1.32	16	−1.37	16

Description of topics: GMO: Genetically modified crops (e.g., insect-resistant genetically modified maize); **Varieties:** Traditional crop varieties loss (loss of diversity in agriculture, leading to monocultures, also loss of variety-specific genes termed genetic erosion); **Wild relatives:** Crop wild relatives loss in "centers of origin" (regions where the crop was initially domesticated from its wild relative); **Nuclear:** Nuclear energy (nuclear power plants, accidents, final deposition of nuclear waste); **HIV AIDS:** HIV/AIDS (effects of infection with HIV); **Volcanoes**: Volcanoes; **Tourism:** Tourism and touristic activities, including mass tourism (effects on the social and ecological conditions in touristic regions); **Terror-humans:** Terrorism against human beings and their infrastructure (e.g., bombs, nerve gas, anthrax letters, and many more); **Pesticides:** Pesticides/herbicides/insecticides (use of chemicals in agriculture to fight pests, harmful insects, and fungi); **Biodiversity:** Animal/plant species loss general (loss of biodiversity); **Smoking:** Smoking (health effects for smokers); **Population:** Effects of population growth and population pressure, including urbanization (destruction of habitat and farmland); **War:** Civil strife/war (consequences of war); **Poverty:** Poverty and malnutrition in developing countries; **Contamination:** Water, air, and soil pollution, e.g., by nitrate, ammonium, sulfate (acid rain); **Terror-agro:** Terrorism against livestock and crops on farms and storing facilities (e.g., deliberate infection of livestock with foot and mouth disease, contamination of crops with exotic pests such as fungi or virus); **Climate change:** Global climate change, e.g., global temperature increase, sea level rise; **Accidents:** Road traffic accidents (injuries and casualties).

some room for interpretation. As such it is possible that Western notions of individualism tended to dominate in the Austrian sample, whereas the associations for Chinese could tend more toward societal ways of control. Even though China is currently facing enormous socioeconomic changes, including increasing individualistic tendencies, the predominant approach to control rather refers to large centralized and collective responses. It cannot be ruled out that traces of the Great Leap Forward stating that "we definitely beat nature" still exist in the minds of Chinese citizens. Also, tendencies prevail that Chinese do not want to spend time and effort on thinking of those potential risks, but rather leave these problems to the government and scientists. This approach, however, is only reasonable as long as there is at least some trust in the government or in scientists. In Western societies, on the other side, trust in such authorities is actually at a low level (e.g., Cvetkovich & Löfstedt, 1999). Lack of trust in Western societies brings us to the second possible explanation, the theory of reflexive modernization. The theory of reflexive modernization starts with the notion of a (Western) contemporary change, where "first" (or industrial) modernity makes room for developments leading to "second" (or reflexive) modernity. Under the rule of first modernity, society was based on the belief that everything can, in principle, be mastered by calculation and is thus controllable. The term "reflexive" modernity refers to the erosions of such beliefs and the



Description of topics: GMOs: Genetically modified crops (e.g., insect-resistant genetically modified maize); **Var:** Traditional crop varieties loss (loss of diversity in agriculture, leading to monocultures, also loss of variety-specific genes termed genetic erosion); **W-rel:** Crop wild relatives loss in "centers of origin" (regions where the crop was initially domesticated from its wild relative); **Nuke:** Nuclear energy (nuclear power plants, accidents, final deposition of nuclear waste); **HIV:** HIV/AIDS (effects of infection with HIV); **Volc**: Volcanoes; **Tour:** Tourism and touristic activities, including mass tourism (effects on the social, ecological, and ecological conditions in touristic regions); **Terr-h:** Terrorism against human beings and their infrastructure (e.g., bombs, nerve gas, anthrax letters, and many more); **Pest:** Pesticides/herbicides/insecticides (use of chemicals in agriculture to fight pests, harmful insects, and fungi); **Biod:** Animal/plant species loss general (loss of biodiversity); **Smok:** Smoking (health effects for smokers); **Popu:** Effects of population growth and population pressure, including urbanization (destruction of habitat and farmland); **War:** Civil strife/war (consequences of war); **Pov:** Poverty and malnutrition in developing countries; **Poll:** Water, air, and soil pollution, e.g., by nitrate, ammonium, sulfate (acid rain); **Terr-a:** Terrorism against livestock and crops on farms and storing facilities (e.g., deliberate infection of livestock with foot and mouth disease, contamination of crops with exotic pests such as fungi or virus); **GCC:** Global climate change, e.g., global temperature increase, sea level rise; **Acci:** Road traffic accidents (injuries and casualties).

Fig. 3. Difference in lay people and experts' risk perception in Chinese. Factors catastrophic and uncertainty. "GMOs," "loss of traditional crop varieties," and "loss of crop wild relatives" were judged as the most uncertain risks, but rather less catastrophic. Students judged "loss of crop wild relatives" and "loss of traditional crop varieties" as more catastrophic and more uncertain than experts did.

accompanying intellectual concepts, lifestyles, and policy patterns due to a loss of traditions. This entails uncertainties and different views of nature. Accordingly, the notion that nature as well as society can be steered at will is increasingly vanishing in the Western world (see e.g., Giddens, 1992; Bauman, 1992; Beck, 1999). To date, the theory of reflexive modernization has predominantly been applied to Western societies. In an attempt to explain the unusual differences in the Austrian and Chinese judgments, the theory could be applied to the respective societies. The results of this study indicate that Austrians have evolved to the second or reflexive modernity, doubting the controllability of nature and society. The Chinese, instead, still represent the first or industrial modernity, with its typical beliefs in the controllability of nature and society. This interpretation does not mean that technological and scientific developments are not taking place in China. The opposite is true: the current growth rate in economic terms as well as scientific research and development lacks a comparable development in the Western world (see the example of GMOs; James, 2003). This rapid development, however, enforces the reflexive modernization theory

Table VIII. Percentage of "Don't Know" Responses of Chinese and Austrian Experts and Lay People for All Risk Topics and Items, and Specifically for the Topics "Loss of Traditional Crop Varieties (TCV)," and "Loss of Crop Wild Relatives (CWR)"

		% Do Not Know		
		All Risk Topics	Loss of TCV	Loss of CWR
Chinese	Experts ($n = 103$)	7.8	10.5	11.8
	Lay people ($n = 382$)	1.1	2.3	1.3
Austrian	Experts ($n = 145$)	6.8	5.7	12.7
	Lay people ($n = 448$)	10.6	9.3	22.6

because the accompanying societal developments have not had enough time to develop the critical or sceptical worldview observable in Western countries. Supposing a linear development from first to second modernity, the perception of risks in China could be a journey "to the past" from a Western point of view.

Perceived control over risks, including loss of agro-biodiversity, does not necessarily mean that measures against genetic erosion are not taken. It also does not mean that Chinese consider conservation of agro-biodiversity to be an easy task; however, undertakings on an international level will have to deal with this difference in perceived control to guarantee successful biodiversity conservation measures.

4.2. Uncertainty and Genetic Erosion

A major finding was that both Austrians and Chinese acknowledged the enormous uncertainties, especially entailing the deployment of GMOs, the loss of TCV, and the loss of CWR. This result becomes even more important considering the marked socioeconomic and agro-ecological differences between these two countries. The unambiguous judgment of Austrian and Chinese respondents (both lay and experts) on the uncertainties of genetic erosion reflects the global importance of agricultural diversity, whether inside or outside of Vavilov centers.

Two possible hypotheses might help explain the extraordinary uncertainty level of these two risk topics, as perceived by all respondents:

The first "informed" hypothesis states that respondents were well informed about the importance of TCVs and CWRs in today's plant breeding. They knew that both plant groups serve as a pool of genetic resources necessary to continuously improve contemporary crop varieties; that, for example, a crop variety (including hybrids) typically only endures for about 3–5 years before it must be replaced by a better-adapted variety, whereby continuously co-evolving pathogens such as pests and diseases are the primary factors for this obsolescence (see, e.g., Swanson, 1996; Yimin & Mervis, 2002). The respondents did somehow know that crop varieties and CWR are still used in plant breeding and that they represent a genetic insurance that might yield resistance genes or other important genetic traits for future farming. Based on this knowledge, the respondents could be aware that an unknown benefit would be lost (see Figge, 2004). To paraphrase Lao-Tse, who lived in China 2,500 years ago: "knowing one's ignorance is the better part of knowledge" (e.g., Lao-Tse, 2001).

The second "ignorant" hypothesis states that there is simply a lack of knowledge about the use and importance of TCV and CWR.

The higher number of "don't know" answers for all subgroups in case of CWR suggests that there is some lack of knowledge on CWR, thus favoring the second hypothesis. Still, the remaining judgments that were counted (ranging from 77.4% to 98.7% depending on the subgroup) rated CWR as a particularly uncertain risk topic, thus favoring the first hypothesis. Falsification of either (or both) hypothesis is up to future investigations that will clarify also aspects of adequate risk communication regarding genetic erosion.

4.3. Precautionary Principle and Loss of Genetic Resources

Following the European policy on GMOs, namely, the precautionary principle as a strategy to deal with high uncertainties, application of the precautionary principle to prevent genetic erosion is discussed here. Three main reasons are responsible for this interaction triangle:

1. In this study, Austrians (and Chinese) judged GMOs as the most uncertain risk topic.
2. In the European Union, the precautionary principle is applied to GMOs because of the involved uncertainties.
3. Austrians judged loss of CWR as the second most uncertain topic.

Based on these facts, the question is: Should and can the precautionary principle also be applied to the loss of CWR and TCV?

The precautionary principle has so far been applied to technologies in case a reasonable suspicion that great harm is to be expected and in case lack of knowledge about the probability and the extent of damage is involved. From the European point of view, deployment of GMOs fulfills these criteria. Beyond GMOs, the loss of CWR and the erosion of genetic resources also share these criteria.

Given the obsolescence of any given modern variety, the agricultural industry and plant breeders cannot indefinitely resort to the same stock of genetic material because there would be insufficient variety to provide resistance to the wide range of pathogens and future pathogens. Instead, plant breeders must continuously infuse new genetic traits to maintain a dynamic equilibrium and to be one step ahead of pathogen co-evolution. Thus, genetic erosion in CWR may be fatal when needed genetic traits are no longer available (irreversible loss) (FAO, 1997; Swanson, 1995, 1996; WCMC, 1996; Wheelis *et al.*, 2002; Wilson, 1986). The translation of the precautionary principle into practical solutions in case of CWR (or TCV) differs from the case of GMOs, as CWRs are not the outcome of a new technology but represents a resource, a genetic resource. Moreover, CWR loss is not due to any single, easily identifiable technology, innovation, or application, but is the consequence of broad global environmental and socioeconomic changes (FAO, 1997). Regulating a few technologies or processes will not minimize the impact of global change. In fact, it is impossible or at least extremely difficult to regulate the causes of CWR loss. Therefore, resource management would be a more promising approach than technology assessment. In recent years, certain resource management initiatives have begun with *in situ*, *ex situ*, and *in vitro* conservation of CWR (for an overview of CWR conservation activities, see Meilleur & Hodgkin, 2004; but see also Greene & Guarino, 1999; Maxted *et al.*, 1997; Swaminathan, 2002; Tan & Tan, 2002). In terms of using financial and economic methodologies to describe the usefulness of diversity, Figge (2004) went one step further by applying the financial asset management portfolio theory to biodiversity (bio-folio). He clearly explains the necessity of conserving a wide range of species or varieties with different return-risk ratios to manage uncertainties (future pathogens), minimize risks (e.g., crop loss), and maximize return (e.g., yield) (Figge, 2004; see also Markowitz, 1959; Sharpe, 1970). Other authors, however, point out that the current underlying theories of portfolio management systematically underestimate the involved uncertainties and risks, requesting a new approach to assess and manage uncertainties and risks (Mandelbrot & Hudson, 2004).

4.4. An Exception to Slovic's Rule

The general rule proposed by Slovic—that splitting up (or specifying) topics has little effect on the factor structure or its position within the risk factor space (Slovic *et al.*, 1987)—can only partly be applied in this case. On the one hand, it can be applied, e.g., in the case of the risk topic "terrorism" that was split into two more specific subcategories to specifically rate terrorism on agriculture and terrorism against humans. The results obtained here showed that the position of these two terrorism aspects within the risk factor space was close, so splitting up the topic "terrorism" had little effect on its position. On the other hand, presenting the topic "loss of biodiversity" together with some more specific topics, such as loss of diversity in TCV and CWR, revealed different judgments and different positions in the factor space of these three topics. A reason for this altered judgment might be the perceived direct relevance of TCV and CWR for mankind in opposition to the relevance of biodiversity in general. Thus, diversity of TCV and CWR was probably not so much associated with being a part of biodiversity (as agricultural terrorism is part of terrorism), but more with their importance for food security. As soon as splitting up (or specifying) topics changes major associations, it seems that Slovic's rule cannot be applied.

5. CONCLUSIONS

The most striking difference in the judgments of Austrians and Chinese was that the Chinese clearly believed much more in the controllability of nature, society, and technology. A likely explanation for this phenomenon is the different understanding of control (individual vs. societal) and the theory of reflexive modernization, which describes the evolution from an industrial to a reflexive modernity. Under the rule of first modernity, society was based on the belief that everything can, in principle, be mastered by calculation and is thus controllable. The term "reflexive" modernity refers to the erosion of such beliefs and the accompanying intellectual concepts. In the last decades, the notion that nature as well as society can be steered at will is vanishing in the Western world. To date, however, the theory of reflexive modernization has predominantly been applied to Western societies: in an attempt to explain the unusual differences in the Austrian and Chinese judgments, this theory is applied here to both societies. The results indicate that Austrians have evolved to the second or reflexive modernity, doubting the controllability of nature and society. The Chinese, instead, still represent the first or industrial modernity, with its typical beliefs in the controllability of nature, society, and technology.

A number of risk topics (such as HIV/AIDS, traffic accidents, smoking, or terrorism) were judged highly differently by Austrians and Chinese. Both the Austrians and the Chinese did, however, acknowledge the enormous uncertainties entailed in genetic erosion (TCV and CWR) and GMOs. This result gains importance considering the marked socioeconomic and agro-ecological differences between these two countries. The risk that this study faced in investigating such diverse countries paid off because such an unambiguous judgment—regarding these three risk topics—was given by both Austrians and Chinese. Following the European policy on GMOs, the recommendation is therefore to apply the precautionary principle to prevent the loss of genetic resources in TCV and CWR. Existing agricultural biodiversity should be preserved, thoroughly investigated, and used in a sustainable manner.

ACKNOWLEDGMENTS

The authors would like to thank Assoc. Prof. Jose Palma-Oliveira from the Department of Environmental Psychology, University of Lisboa and his assistants Dalila Atunes, Rui Filipe Gaspar de Carvalho, Sergio Moreira, Sibila Marques, and Andre Paraiba for feedback in designing the risk perception questionnaire. Additional thanks to Dr. Andre Gazso and Assoc. Prof. Wolfgang Kromp from the Institute of Risk Research, University of Vienna and Univ. Prof. Josef Gloessl from the Center of Applied Genetics, University of Agricultural Sciences Vienna, Austria for comments, feedback, and reviewing the article. We also thank Prof. Jiayao Liu from the Biological College of Normal University of Qufu, Dr. Jun Yang from the Medical School of Zhejiang University, Dr. Yongguo Cao from the Biological College of China Agricultural University, and Ms. Yuanlei Hu from the Biological College of Beijing University, China for their help. Then, of course, the authors are especially grateful to the colleagues who made additional comments on the questionnaire during the development phase and, finally, to the more than 1,000 persons who took the time to participate in this study. The co-author was supported by National Natural Science Foundation of China (NSFC) Grant 30270228.

This article was previously presented at the Annual Conference of the Society of Risk Analysis in Paris, November 15–17, 2004.

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