Values in risk perception - Studying the relationship between values and risk perception in three countries

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ABSTRACT

Risk perception research has largely focused on finding how different demographic variables predict risk perception dimensions. This article suggests including motivational values among the areas of focus, being a dimension shared across different demographical contexts. The methodology includes established and scrutinised tools from the values and risk perception fields respectively, combining them in a questionnaire. Data were gathered from South Africa, Sweden and the USA. The results support the hypothesis that there is a connection between motivational values and risk perception dimensions. Uses for disaster management are discussed. More advanced statistical methods and qualitative methods are suggested to delve deeper into this area.

KEYWORDS

Motivational values, risk perception, PVQ, psychometric paradigm

Introduction

Risk perception research has in recent decades gained more and more attention in the academic literature as an integral part of risk management (Renn, 1998). There is an ongoing debate about whether society should allocate the budget for risk reduction according to the priorities recommended by the risk assessments of technical experts or by the risk perceptions of the lay public. Public risk perception, and indeed that of the decision makers, governs the focus of society and thus has a significant effect on how resources are spent throughout society today (Pidgeon, 1998). Having greater knowledge in the field of risk perception can thus improve the quality and impact of decisions throughout society, rendering it a very important field for society as a whole.

Risk research has found significant differences in perception between groups of individuals divided by, for example, gender, age groups and different cultural settings (Gustafson, 1998; Rohrmann, 2000; Savage, 1993). While these results are useful, they may be insufficient to explain the complex structure of social groups, which in turn might lead to ineffective

decision-making. The possibility has been considered that there may be something more fundamental underlying these differences. Values are considered one of the most fundamental factors governing human behaviour. Their importance in decision-making has been well documented and theorists consider them a driving force in decision-making (Keeney, 1992). Values research has in recent years provided similar findings for the very same groups (see for example Schwartz, 2005). Can this be pure coincidence? One hypothesis is that risk perception and motivational values are somehow related. The purpose of this article was thus to explore whether there is any relationship between risk perception and expressed motivational values.

There has been little research in this particular part of the risk perception field, especially from a cross-cultural perspective. The purpose of this article is to suggest an alternative method for measuring risk perception, useful for practical application within disaster management settings. By mapping individuals according to the values they share, comparisons can be made across populations as well as across cultures, in order to achieve a better understanding of how individuals experience a threat. Consequently, this can lead to improved disaster management and facilitate the effective allocation of resources.

In order to relate motivational values to popular methods of measuring risk perception today the research question to which an answer was sought was:

> *How do individuals' expressed motivational values relate to demographic groups in predicting risk perception?*

Delimitations

Tendencies were explored within the data sample from the respective settings. The purpose of the study was thus not to extrapolate any population parameters from the sample to a larger population. Methods well known in each respective field and well scrutinised in the academic literature were used. The literature provides further discussion on which methods are superior in different settings. There have specifically been discussions in the social sciences about precision when measuring abstract qualities such as values and attitudes. It is argued that values are a constructive, context-dependent process, hence known to be hard to measure (Slovic, 1995). Accordingly, for the purposes of this article the focus will be on *expressed* motivational values only.

Survey design and implementation

An exploratory approach has been chosen to investigate the impact of expressed motivational values in a broader sense on risk perception dimensions. In order to analyse the possible relationship of expressed motivational values to risk perception, a tri-national survey has been conducted to delve further into the focal groups of earlier studies. The three settings were the second largest city in the USA (Los Angeles), two informal settlements in South Africa (Greenfield, Sonderwater and kwaNonqaba) and a medium town in Sweden (Sundsvall).

With the intention of constructing a representative yet manageable survey, two methods were combined into a functional questionnaire. The aim of the questionnaire was to be widely

understood, simple in structure and relevant to the respondents in the different settings. The methods were Schwartz' Portrait Value Questionnaire (PVQ) (Schwartz *et al.*, 2001) and an adapted version of the psychometric paradigm (Fischhoff *et al.*, 1978; Slovic *et al.*, 1980; Savage, 1993). In addition to the two methods, demographic questions were added to map the data sample.

The PVQ is described as easy to understand and previous research has shown that respondents treat the PVQ as a simple task which is thus suitable for the respective countries. The method makes statements about a fictive person and asks the individual to rate to what degree they share the views of this person (Schwartz *et al.*, 2001).The method remained largely unaltered except for minor changes for improved comprehension, e.g. response scale reading with an increasing resemblance to the own person from left to right. An example of an item can be found below.

HOW MUCH LIKE YOU IS THIS PERSON?	**Very much like me**	**like me**	**some-what like me**	**a little like me**	**not like me**	**not like me at all**
1. Thinking up new ideas and being creative is important to her. She likes to do things in her own original way.	☐	☐	☐	☐	☐	☐

The psychometric paradigm (Fischhoff *et al.*, 1978; Slovic *et al.*, 1980) has individuals rate a number of hazards to explain different risk perception dimensions. Previous research has shown that between 70% and 90% of the variance can be explained by two of these risk perception dimensions labelled *dread* and *unknown* (Renn, 1998; Rohrmann, 2000; Mullet *et al.*, 1993). An adapted version of the psychometric paradigm was used to measure risk perception dimensions, inspired by risk perception research by Savage (1993). Savage used a total of 12 questions to map risk perception dimensions. For the purposes of this study, it was envisioned that the risk perception questionnaire would comprise 20 questions in total, which was considered short enough for asking an individual in a casual situation. Additional hazards were considered more useful in giving more measuring points, while additional dimensions would only marginally increase the quality of the study.Thus, a configuration of two dimensions and ten hazards was chosen.

The choice of hazards was inspired from previous risk perception research and the hazards were chosen with regard to the relevance to all three countries respectively (Fischhoff *et al.*, 1978; Sjöberg, 2003; Slovic *et al.*, 2000), and also included newer hazards such as climate change and terrorism. The hazards were AIDS, drinking alcohol, climate change, terrorism, fire in the home, motor vehicles, commercial airplanes, cancer and nuclear power plants together with the risk dimensions *dread* and *unknown*.

Added demographic variables included: culture (nationality), gender, age group, education level and whether the respondents had children or not.

Earlier research has articulated that the word "*dread*" is no longer in common use among lay people, especially in relation to risk (Savage, 1993). High degree of fear was considered an adequate synonym for dread and deemed likely to be understood in the three different settings. Moreover, fear was believed to be an emotion which many individuals would be able to relate to, which in turn would make it easier both to understand and associate with the question. Comparison of the results with previous risk perception research supports the statements above.

The languages chosen for the survey were English and Swedish and further confirmed with the African Centre for Disaster Studies as suitable for use in South Africa (Van Niekerk, 2009).

Application of method in context

The data sampling was conducted by structured interviews using the questionnaires formulated for the study. A combination of purposive and convenience sampling was used to choose individuals as the purpose was not to aggregate the data to larger populations such as nations, but rather look at data at the individual level. An interpreter was used in South Africa to better convey detailed information when necessary. The response frequency was high, a physical questionnaire maintained the same information to all respondents, clarification could be provided if needed and the study was able to include less educated and elderly individuals.

Applying the method in context, there were some alterations to the method. It was quickly discovered that English was not a suitable language when asking detailed questions about values in South Africa. The questionnaire was translated into the local South African languages of Setswana and isiXhosa by the language department of North-West University, Potchefstroom, and Eden Municipality respectively. The questionnaire was then independently back translated for quality purposes without remarks. The translation had the added benefit of providing the interpreter with a specific script to follow, eliminating many biases of using interpretation.

The survey resulted in a total of n=293 individuals from three countries. A summary of descriptives can be found below in Table 1.

Table 1. Descriptives of empirical sample

	South Africa	Sweden	United States
Male	40 (46%)	57 (50,4%)	46 (49,5%)
Female	47 (54%)	56 (49,6%)	47 (50,5%)
Age 18 - 30	19 (21,8%)	32 (28,3%)	29 (31,2%)
Age 31 - 45	21 (24,1%)	27 (23,9%)	30 (32,3%)
Age 46 - 60	24 (27,5%)	29 (25,7%)	23 (24,7%)
Age > 60	23 (26,4 %)	25 (22,1%)	11 (11,8%)
Education GRADE	52 (59,8%)	11 (9,7%)	0 (0%)
Education HIGH	21 (24,1%)	45 (39,8%)	5 (5,4%)
Education UNI	14 (16,1%)	57 (50,4%)	77 (82,8%)
Education Missing	0 (0%)	0 (0%)	11 (11,8%)
Children	74 (85,1%)	57 (50,4%)	41 (44,1%)
No Children	13 (14,9%)	56 (49,6%)	52 (55,9%)
Total	**87**	**113**	**93**

Analytical technique and results

The risk perception data were categorised in order to perform meaningful analyses. The main interest was to investigate which of the independent variables predicted high and low risk perception dimensions, not so much which predicted "average" risk perception. Similar approaches have been taken in other risk perception studies, i.e. by Flynn *et al.* (1994). With the data also showing bipolar distributions over high and low scores, it was considered a reasonable choice of categories. The data for *unknown* were transformed from the questionnaires by subtracting from 8 in order to have the "worst" outcomes corresponding to the highest scores, similarly to what was done by Savage (1993).

To be able to say anything meaningful about the relationship between values and risk perception, individuals who share similar value characteristics were categorised into four higher order value types provided by Schwartz (1992). The four higher motivational types were labelled: openness to change, self-transcendence, conservatism and self-enhancement, arranged by motivational similarities and constructed by averaging the values that constitute them. The categorisation also simplifies theorising about value driven risk perception, and is thus useful for practical purposes.

A binary logistic regression model was used to process the data. While the model can handle both categorical and continuous data, it is important to remember that the interpretation of results varies slightly. Odds ratios are used with the reference variable signified by the number "1" in the tables. For further clarification of interpreting the results, see the example following Table 2.

Table 2. High Dread

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Cultures										
USA	1	0		1	1	1	1	1	1	1
South Africa	4,606	1		4,43	4,863	[2,246]	[2,848]	[1,957]	[0,82]	26,42
Sweden	[0,976]	0,01		[1,218]	[2,045]	[0,465]	0,246	0,262	0,24	[1,086]
Gender										
Male				1	1	1			1	
Female				1,941	2,834	2,415			2,372	
Age										
18-30								1		
31-45								3,341		
46-60								7,207		
>60								4,298		
Education										
Grade	1								1	
High	0,283								0,39	
Uni	0,335								0,276	
Children										
No children								1		
Children								0,381		
Values										
Self-enhancem					*2,271**		*1,586**			
Openness					*0,58**					
Conservation		*0,403**				*1,622**			*1,667**	
Self-transcend			*2,288**					*1,974**		

Analyses were conducted for demographic variables alone (as per risk perception research tradition), values alone and lastly in a combined analysis including all variables. The results are presented in tables under each of the respective cases: high dread, low dread, not informed and well informed. Because of the large number of analyses performed, only the combined analyses including all variables and statistically significant results are presented in figures in the following sections.

Dread factor

The results are presented in the form of odds ratios. The ratio implies significance relative to a reference, in the tables signified by "1". Values as a continuous variable refer to the data step before on the response scale, e.g. the increase between steps 3-4 or 5-6.Significance appears in the tables if there is at least one statistically significant difference between the reference group and one other group within the categorical variables. Groups where insignificant odds ratios occurred are marked with square brackets.Note that for alcohol, the reference group was changed to South Africa, in lieu of USA, since no individuals from the US sample responded with the equivalence for high dread on the response scale.

In Table 2 above, an odds ratio larger than 1 implies increased likelihood within the sample to score high dread. For example, South Africans were 4,606 more likely to score high dread for the hazard of AIDS in the data sample compared with the reference category USA. Considering gender, females from the sample had an approximately twice as high odds ratio for feeling high dread for the significant hazards compared with men. Further, Table 2 showed that culture was significant for a majority of the hazards, nine out of ten. Gender and values showed significance for four and seven hazards respectively.

Table 3. Low Dread

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Cultures										
USA	1	1	1			1	1		1	1
South Africa	0,216	0,125	[1,031]			[0,648]	[1,664]		[1,776]	0,067
Sweden	[1,263]	[0,658]	0,386			2,38	4,051		6,031	[0,684]
Gender										
Male				1	1	1	1			
Female				0,325	0,403	0,392	0,545			
Age										
18-30							1	1		
31-45							0,322	0,37		
46-60							0,335	0,258		
>60							0,31	[0,475]		
Education										
Grade										
High										
Uni										
Children										
No children										
Children										
Values										
Self-enhancem					*0,559**		*0,64**			
Openness		*1,743**								
Conservation								*0,557**		
Self-transcend			*0,559**							

Table 4. Not informed, Unknown factor

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Cultures										
USA	0		1							
South Africa	[1]		[1,708]							
Sweden	[0,216]		[0,197]							
Gender										
Male										1
Female										3,057
Age										
18-30			1			1				1
31-45			0,1			[0,192]				[0,452]
46-60			0,094			[2,402]				0,223
>60			0,074			[0,506]				0,09
Education										
Grade			1							1
High			0,183							[0,328]
Uni			0,076							0,229
Children										
No children						1				
Children						0,229				
Values										
Self-enhancem	*0,394**				*0,503**			*0,62**		
Openness					*1,876**		*2,649**			
Conservation		*3,02**			*2,548**					
Self-transcend				*0,406**			*0,386**			

Table 5. Well informed

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Cultures										
USA	1							1	1	1
South Africa	[0,614]							3,365	5,492	22,807
Sweden	0,292							[1,248]	1,615	3,788
Gender										
Male										1
Female										0,523
Age										
18-30	1				1			1	1	1
31-45	5,01				[1,999]			[2,075]	[1,556]	[1,613]
46-60	[1,619]				[2,113]			[2,443]	[1,736]	3,107
>60	4,112				5,259			5,548	7,236	9,957
Education										
Grade	1	1								
High	[2,449]	[0,868]								
Uni	4,134	[2,452]								
Children										
No children	1			1						
Children	2,621			2,337						
Values										
Self-enhancem					*1,942**			*1,855**	*1,732**	
Openness										
Conservation	*0,361**			*0,633**				*1,858**	*0,533**	
Self-transcend	*2,704**								*1,664**	

The odds ratios for the higher order value types were compared with the increase of one point on the response scale for that value type. The increase is thus exponential, e.g. increase of two points corresponds to (Odds Ratio) ^{2}. For transparency, these results are marked with an asterisk (*) in italics. The higher order value types showed significance for seven out of the

ten hazards. Considering the exponential increase, the higher order value types seem to have a larger impact over, for example from the Low (1-2) to High (5-6) end on the response scale. For example a three step change in self-enhancement for terrorism renders a $2{,}271^3 = 11{,}713$ times more likely to score high dread for terrorism, exceeding the odds ratios for culture as well as gender.

Discussion

The results obtained from the analyses with demographic variables reflect those of precious risk perception research. Cultural differences appear as the most robust predictor for the dimension of *dread*, with the remaining demographic variables appearing less frequently. Females seemed to predict higher scores on dread for a majority of hazards, compared with men. Conversely females also seem more averse to score low dread implicating a significant relationship across the variable. The results confirm earlier research in showing that females tend to express more concern about the risks of different hazards (Flynn *et al.*, 1994; Savage, 1993). The other demographic categories show significance to a lesser extent and in the case of *dread*, it is not present enough to suggest strong relationships. Education and Age exceed the other demographic variables when predicting the two cases of *unknown.*

There seems to be some relationship between values and risk perception dimensions. One or more of the four higher order value types were represented in most of the hazards and in some of the cases were present more often than various demographic variables. For the dimension of *unknown*, motivational values seemed to predict risk perception where demographic variables could not. Both low and high cases of the risk perception dimensions show coupled results, implying a continuous relationship across the response scale. It is important to note that having all higher motivational types significant would actually say very little about a relationship between motivational values and risk perception dimensions as it would imply that all types of values are important everywhere. The result that one or more of the higher motivational groups show significance is what is important to this study.

The strength of the relationships seems to be of similar magnitude, if not stronger, than that of demographic variables. The odds ratios for the values categories provided in Tables 2 to 5 show that there may be a large difference in risk perception between individuals with widely different motivational drivers, which the authors find very interesting.These results do not negate or oppose the brilliant risk perception research conducted throughout the years. On the contrary, motivational values' influence on risk perception may be viewed as a complementary way of reaching the same objective. The authors believe that the decision regarding which tool should be used for any given situation should rely on one principle: usefulness.

Using motivational values in lieu of demographic parameters, populations can be mapped across demographic groups and hopefully more accurately. The implied benefit for disaster management is that of making better quality decisions by having a greater insight into how the target population experiences a threat. A more transparent understanding of how motivational values affect risk perception may have major benefits in the field with large demographic variety, and a stronger sense of community, as found in many of the disaster management

settings around the world. The strength of the motivational values in principle is that they are universal, transcending demographic boundaries. There is already much data from earlier studies mapping populations and in some cases, over many countries. With future research there might be a way to take an intelligent guess, and make better decisions based on these data. Even if not 100% accurate, it might provide a better guess than the normalised approach in handling the problem.

Possible biases

Cross-cultural psychology sometime uses an approach of normalising the individual scores. Thus there would be less weight for an individual rating high if he/she always uses high scores throughout the questionnaire. This is feasible in studies where the values are hierarchical and the absolute numbers are of less relevance. However, a careful approach has been taken to normalise the individual's scores since the study was investigating if individuals' *expressed* motivational values predict their risk perception, hence it was not appropriate to "correct" for their cultural response scaling or anchoring effects. The main reason for using the expressed data, i.e. raw data, was that it was considered almost impossible to know whether the respondent simply feels heightened dread or if they anchor their responses differently. For example in the sample populations, the South African individuals seem more likely to use extreme scores, while fewer of the US and Swedish individuals seem to use extremes. Further investigation of the effect of cultural biases was not feasible as 100 individuals per country proved too small to explain anything conclusive about risk perception dimensions, considering no variables fell out as significant. A larger sample would probably show the cross-cultural biases more clearly.

While it is believed that there is an effect of the cultural bias within the model, it is considered to be small. The binary logistic regression takes care of the biases in relation to the risk perception data to some extent, when using two categories to portray "high" or "low". If the assumption that individuals regardless of culture or other demographic group are unlikely to score 5 to describe extreme dread, the statistical method is actually quite robust in this respect.

One limitation in the study has been the complex mapping of dependencies between the respective motivational values and higher order value types. It is also likely that motivational values are inherited from the culture to some extent, or developed from living conditions or life experiences that come with age and education, creating dependencies between values and the demographic variables.The multidimensional nature and interdependency of the higher order value types have not been further analysed, neither has the full integrated structure between values and demographic variables been further explored. The possibility of intercollinearity in the values data has been noted, likewise that including all four higher order value types may not be ideal. It is believed that spending more time on producing quality clusters of values would provide data for more transparent conclusions. While the clusters used may not be ideal in structure, it is still important to incorporate clusters that allow for meaningful interpretation and application. Even showing perfect correlation between values and risk perception dimensions does not matter if the results cannot be applied.

This was a pilot study in the field using exploratory methods to investigate a complementary method of looking at risk perception. To explain the anticipatory connection between motivational values and risk perception finer statistical methods and larger samples are required. Future research may include using more advanced quantitative methods for statistical relationships and qualitative methods including thorough interviews where the rating questions are followed up with additional questions regarding the actual behaviour of the respondent.

Conclusions

This article suggests an alternative way to explore risk perception.The results support the statement that values may very well contribute in shaping our risk perceptions. Values seem to be related to a larger extent than age, gender and education in the gathered sample, which are some of the variables described at great length in the literature as predictors of risk perception. Although the exact relationship cannot be quantified in this study the relationships seem to be at least of the same order of magnitude as that of demographic variables.

Conclusively, values bring potential to extend the field of risk perception into uncharted territories. It may be possible to map individuals' risk perception, combining individuals from different demographical groups, ethnicities and ages, which would simplify decision making in some settings. Thus, there may be great rewards in including motivational values as an area of focus in risk perception research. Future research is required to more carefully explore this relationship and with that hopefully lay the foundation for more effective decision making.

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