

Values in Risk Perception

- A study of the relationship between values and risk perception in three countries

Jelena Ivanisevic
Henrik Nordenstedt

**Department of Fire Safety Engineering and Systems Safety
Lund University, Sweden**

**Avdelningen för Brandteknik och Riskhantering
Lunds Tekniska högskola
Lunds universitet**

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Abstract

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

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Brandteknik och Riskhantering
Lunds Tekniska Högskola
Lunds universitet
Box 118
221 00 Lund

brand@brand.lth.se
<http://www.brand.lth.se>
Telefon: 046 - 222 73 60
Telefax: 046 - 222 46 12

Department of Fire Safety Engineering
and Systems Safety
Lund University
P.O. Box 118
SE-221 00 Lund
Sweden

brand@brand.lth.se
<http://www.brand.lth.se/english>

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Summary

The risk research of today focus largely on different demographic grounds to describe the risk perception of individuals. Previous risk perception research has found significant connections with demographic variables such as gender, age and culture. Curiously enough, the same demographic variables have been showing significant relationship with motivational values, i.e. what matters to people the most. A reasonable conclusion is that the two fields are related in some way. Since motivational values have been given credit as a governing factor for people's attitudes and decisions, values may constitute the underlying factor combining the respective demographic groups. We find the demographic findings useful indeed, however we want to investigate if there is an underlying factor in risk perception. A tri-national study using structured interviews was launched to investigate the relationship between values and risk perception dimensions in South Africa, Sweden and USA.

Our methodology combines two well-established and scrutinized tools from the literature into one tool, adjusting them for use in the three countries of choice. Schwartz Portrait Value Questionnaire and an adapted version of the psychometric paradigm are chosen to measure the tendencies with consideration to the different contexts. The survey method utilized is questionnaires which were translated into four languages being English, Swedish, Setswana and isiXhosa.

Several statistical analyses is performed by first modeling demographic dependent variables for each of the ten chosen hazards, followed by the same analyses with motivational value types as dependent variables for each of the ten hazards. The final and main analyses are the combined analyses where the value variables are adjusted for the demographic variables to see if they contribute to the regression model. However, all three types of analyses are important in order to compare the results to previous research and for theorizing about the importance of values as a predictor.

The results support the hypothesis that there is some connection between motivational values and risk perception dimensions. The most significant fact for values contribution to risk perception is that higher motivational types seem significant for a majority of the hazards, even when adjusted for the demographic variables. However, the statistical methods does not allow for quantification of the relationship at this time. If further research can extend these findings to show more detailed results, it would be possible to map individuals risk perception combining individuals from different demographical groups, ethnicities and ages. In order to find out characteristics with better precision, a combination of quantitative and qualitative studies need to take place. For better precision we suggest a joint venture with researchers from both fields and with methods that include deep qualitative interviews.

Sammanfattning (Summary in Swedish)

Dagens riskforskning fokuserar till största del på olika demografiska egenskaper för att beskriva individers riskperception. Tidigare riskperceptionsforskning har funnit signifikanta samband mellan demografiska variabler som kön, ålder och kultur. Underligt nog har samma demografiska variabler visat sig ha signifikanta samband med människors värderingar, det vill säga vad som betyder mest för människor. En trolig slutsats är att dessa två fält är relaterad på något sätt. Eftersom värderingar har uppgetts att vara den styrande faktorn för människors attityder och beslutsfattande kan värderingar vara den underliggande faktor som förenar de demografiska grupperna. Vi anser att de demografiska fynden är mycket användbara, men vill vidare undersöka om det finns en underliggande faktor som styr människors riskperception. Vi har därför utfört en enkätstudie i tre länder för att undersöka sambandet mellan människors uttryckta värderingar och riskperception i Sydafrika, Sverige och USA.

I vår metod har vi kombinerat två väletablerade och granskade verktyg och anpassat dessa till att användas i en enkät för de tre länderna. Schwartz Portrait Value Questionnaire och en anpassad version av den psykometriska paradigmen valdes ut för att mäta eventuella tendenser med hänsyn till de olika miljöerna fältstudien utfördes i. Enkäten översattes till fyra språk; engelska, svenska, setswana och isiXhosa.

Ett stort antal statistiska analyser utfördes genom att först modellera de demografiska variablerna för var och en av de tio utvalda riskerna, vidare utfördes likadana analyser med de uttryckta värderingarna som beroende variabler för de tio riskerna. De slutgiltiga och huvudsakliga analyserna var kombinerade analyser där värderingsvariablerna var reglerade för de demografiska variablerna för att se om de bidrog till regressionsmodellen. Dock är alla tre typer av analyser viktiga för att kunna jämföra resultaten mot tidigare forskning och för att kunna teorisera om vikten av värderingar som förutsägare.

Resultaten från studien stödjer hypotesen att det finns samband mellan värderingar och riskperception. Det mest signifikanta tecknet på att människors värderingar bidrar till deras riskperception är att vissa värderingstyper var signifikanta för en majoritet av riskerna, även när dem reglerats för dem demografiska variablerna. Dock tillåter de statistiska metoder som använts inte att detta samband kvantifieras, utan det krävs vidare forskning för att upptäcka detaljerna inom forskningsfältet. Om vidare forskning kan utökas och finna mer detaljerade resultat skulle det vara möjligt att kartlägga individers riskperception genom att kombinera individer från olika demografiska grupper. För att kunna kartlägga detta samband med bättre precision krävs en kombination av kvalitativa och kvantitativa studier. Vi föreslår ett förenat tilltag med forskare från båda forskningsfälten och metoder som inkluderar ingående intervjuer föreslås som en möjlig ansats.

Table of Contents

1	INTRODUCTION	1
1.1	RESEARCH QUESTION	1
1.2	DELIMITATIONS	2
1.3	DISPOSITION	2
2	THEORETICAL FRAMEWORK	3
2.1	VALUES RESEARCH	3
2.2	RISK PERCEPTION	7
2.2.1	EMPIRICAL STUDIES	7
2.2.2	AXIOMATIC MEASUREMENT PARADIGM	8
2.2.3	SOCIO-CULTURAL PARADIGM	9
2.2.4	PSYCHOMETRIC PARADIGM	10
2.3	THEORETICAL FRAMEWORK SUMMARY	11
3	METHODOLOGY	13
3.1	SURVEY METHOD	13
3.2	CONSTRUCTING QUESTIONNAIRE	14
3.2.1	SCHWARTZ VALUE THEORY	14
3.2.2	PSYCHOMETRIC PARADIGM	15
3.2.3	DEMOGRAPHIC QUESTIONS	17
3.3	QUALITY CONTROL	17
3.3.1	QUESTIONNAIRE PRE-TEST	17
3.3.2	UPDATE	18
3.3.3	MEETING THE METHOD CRITERIA	18
3.4	IMPLEMENTING METHOD	19
3.4.1	SOUTH AFRICA	19
3.4.2	SWEDEN	21
3.4.3	USA	21
3.4.4	GENERAL COMMENTS FROM THE FIELD STUDY	22
3.5	STATISTICAL ANALYSES	23
3.6	METHODOLOGY SUMMARY	26
4	RESULTS AND ANALYSES	29
4.1	HIGH DREAD	30
4.2	LOW DREAD	32
4.3	NOT INFORMED	34
4.4	WELL INFORMED	36
4.5	RESULTS SUMMARY	37
5	DISCUSSION	39
6	CONCLUSION	45
7	REFERENCES	47
	APPENDIX A – QUESTIONNAIRES	51
	APPENDIX B – AMENDMENT	53
	APPENDIX C – SPSS OUTPUT FILES	54

1 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. The conflict between the experts' and public risk perception is at the basis of the social dilemmas of risk management (Sjöberg et al 2004). Public risk perception, and indeed that of the decision makers, govern the focus of society and thus have 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 (Savage 1993; Rohrmann 2000; Gustafson 1998). While we find these results useful, they may be insufficient to explain the complex structure of social groups, which in turn might lead to ineffective decision-making. We have considered the possibility that there may be something more fundamental underlying these differences. Values are considered one of the most fundamental factors governing human behavior. Their importance for decision-making have been well documented and theorists consider them a driving force in decision-making (Keeney 1992). In relation to risk research, Renn and Rohrmann (2000) underlines the important precondition to understand peoples' values and positions when making societal decisions concerning risk regulation, or new technologies with potentially large consequences. Value research has in recent years shown connections between motivational values and different social groups such as gender, age and different cultural groups (Schwartz 2005). With similar findings in the two respective fields we ask ourselves if this could be pure coincidence? A reasonable assumption is that risk perception and motivational values are somehow related. The purpose of this thesis is thus to explore if 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. We have chosen an exploratory approach to investigate the impact of expressed motivational values in a broader sense on risk perception dimensions. In order to analyze the explanatory value of expressed motivational values on risk perception, a tri-national survey has been conducted to delve further into the focal groups of earlier studies. The three countries are South Africa, Sweden and the USA.

1.1 Research question

In order to deal with the research problem on which this thesis is based, our research questions is;

How do individuals' expressed motivational values compare to demographic groups in predicting risk perception?

1.2 Delimitations

In order to conduct a tri-national study combining the values and risk perception fields respectively, several delimitations are made;

- Tendencies are explored within our sample of 293 individuals from the three respective countries South Africa, Sweden and the USA. The purpose of the study is thus not to estimate any population parameters from the sample to a larger population since this would require a scientifically drawn, unbiased probability sample.
- We make use of methods well known to each respective field and well scrutinized in the academic literature. We comment on the advantages and disadvantages of the methods and refer to the literature for further discussion of which methods are superior in different settings.
- There are discussions in the social sciences about the 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 & others 1995). Abstract qualities cannot be measured with absolute accuracy, so for the purposes of this report we deal with *expressed* motivational values only.
- We are limiting the demographic categories of interest to include differences in culture, educational level, gender, age and whether respondents have children. We are aware there has been risk perception research including other categories of individuals, such as income and ethnic background (Savage 1993; Kahan et al 2007). The five categories are chosen because they are commonly mentioned in the academic literature and facilitate comparison with previous studies in the field of risk perception.

1.3 Disposition

The first chapter describes the background of the study, research questions and the delimitations made. A theoretical framework is introduced in the second chapter and serves to present each field respectively as well as commonly used methods. The third chapter describes the development of the respective methods and tools used in our survey. Motivations for choices and modifications are presented. Observations when implementing our method to the three countries are described and statistical methods for analyzing the data are presented. Results from our analyses are presented in chapter four with interesting connections highlighted. Chapter five includes a discussion of the results and comparison with previous research. Conclusions are presented in chapter six addressing our research question.

2 Theoretical Framework

The purpose of this chapter is to provide the necessary background for the values and risk perception field. The theoretical framework presented below comprises the foundations for choosing the methods and developing our research tools.

2.1 Values Research

Values have been a central concept in the social sciences since its beginning, and agreement of the concept of basic values started to emerge among theorists and researchers in the 1950's (Schwartz 2005). Many researchers give values credit for governing much of the human behaviors and theorists from different fields have emphasized the importance of people's value priorities in understanding and predicting attitudinal and behavioural decisions (Keeney 1992; Rokeach 1973; Rohan 2000). The study of values is not confined to a single discipline and has played an important role in a number of related disciplines, e.g. psychology, philosophy, behavioral science and anthropology (Schwartz 2005; Williams 1979). For example, the behavioral and social science developed methods to measure and manipulate "attitudes" and opinions, which was considered very useful for the advertising industry, government and political leaders and business management (Williams 1979). Values have also shown significant relationships with a wide range of areas such as political orientation, religion, public inter-racial behavior and choice of friends (Homer & Kahle 1988).

In the past, there has been an absence of an agreed-upon conception of basic values, of the content and structure of relations among these values, and of reliable empirical methods to measure them (Schwartz 2005). There have been major philosophical discussions about what values consist of and the meaning thereof. One of the main dilemmas with value research has been the defining of "values", something that have caused confusion within the field (Rohan 2000). Despite the many definitions of values, theorists and researchers agree on the value characteristics that follows (Schwartz 2005):

- Values are beliefs. But they are beliefs tied inextricably to emotion, not objective, cold ideas.
- Values are a motivational construct. They refer to the desirable goals people strive to attain.
- Values transcend specific actions and situations. They are abstract goals. The abstract nature of values distinguishes them from concepts like norms and attitudes, which usually refer to specific actions, objects, or situations.
- Values guide the selection or evaluation of actions, policies, people and events. That is, values serve as standards or criteria.
- Values are ordered by importance relative to one another. Peoples' values form an ordered system of value priorities that characterize them as individuals. This hierarchical feature of values also distinguishes them from norms and attitudes.

Because of the widespread use of values, many different conceptions of this construct have emerged. One of the most well known is the Rokeach's Value Survey, a widely used instrument to measure personal and social value priorities in a practical way (Rokeach 1973). The tool was developed by one of the major drives behind values research, and inspired much of the values research tools being used today. Rokeach's Value Survey consisted of a list with two types of value words; goals and modes of conduct. The values were briefly explained and people were asked to arrange the value words "in order of importance to YOU, as guiding principles in YOUR life". The instrument is considered very versatile and researchers have had success in finding specific values that differentiate various political, religious, economic and cultural groups. However, Rokeach's Value Survey has received critique regarding its lack of representative coverage of some of the major value constructs. The major exceptions

are the disregard of values relating to well-being and basic human right, e.g. dignity and freedom, considering that they are among the most fundamental beliefs of today's society (Braithwaite, & Law 1985). Furthermore, Rokeach never presented any theory about underlying value system structure rendering the instrument to be described in the literature as "essentially a list of unconnected value words". Without the underlying value system structure, the consequences of high priorities on one value type for priorities on other value types cannot be understood (Rohan 2000).

Based on Rokeach's work, a contemporary theory referred to as the Schwartz Value Theory was developed by Schwartz and Bilsky (1987; 1990). The theory defines motivational values by defining eleven motivational types believed to encompass all the core values recognized in cultures around the world. The eleven motivational types in the original theory were: spirituality, power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity and security. Later spirituality was excluded because of little empirical support although the authors believed it to play part in some of the other value types (Schwartz 1992). With the underlying theory that Rokeach lacked in his earlier work, Schwartz developed two tools to accommodate and empirically test his method; first Schwartz Value Survey (SVS) and later, another tool known as the Portrait Value Questionnaire (PVQ) (Schwartz et al 2001).

The original study to test the validity of the hypothesized value types from the Schwartz Value Theory included samples drawn from 20 countries, from cultures of every inhabited continent, representing 13 different languages and included adherents of eight major religions as well as atheists (Schwartz 1992). Since the original study Schwartz have extended the evidence for this theoretical structure to include samples from 67 nations and the SVS instrument has been translated into 47 languages and has been used in a wide variety of social studies (Schwartz & Rubel 2005). Recent studies using the PVQ extend Schwartz Value Theory even more as the result converge with the one obtained when using the SVS (Schmidt et al 2007).

The SVS aspires to make the abstract quality of values measurable in a practical way, in order to be able to map individuals' values or those of cultural or cross-cultural groups. The tool comprises two lists of totally 56 items, each linked to one of ten motivational types. The first list contains items that describe potentially desirable end-states in noun form, the second list describes way of acting in adjective form, similar to that of Rokeach (Schwartz 1992; Schwartz 2005). However, the SVS have received some critique against the 56-item instrument being impractical for survey researchers, since it takes up a large amount of space and time available of administrating a research instrument (Stern et al 1998). The individuals are asked to rate the importance of each of the 56 items "as a guiding principle in MY life" on a nine-point scale ranging from -1 through 7 referring to 'opposed to my values' and 'of supreme importance'. The scores can later be calculated to rank the relative importance of motivational values and the higher motivational drivers, as discussed later in this chapter (Schwartz 2005). The items in the SVS are presented in an order so that values that represent the same value types are separated with at least two items to avoid anchoring effects. Also, items in the same quintile of importance are separated from each other by at least three other items (Schwartz 1992).

The PVQ is an alternative method to the SVS and was developed mainly for two reasons. Firstly, samples where the SVS had been used had proved inadequate to measure the basic values of children from age 11, the elderly, and of persons less educated. Secondly, an alternative method was required to assess if the values theory was valid independent of the SVS method (Schwartz 2005). The PVQ method shares the same underlying theory as the SVS with the questionnaire items relating to the same ten motivational types. However, there are a few key differences. The PVQ makes statements about fictive people whom the individual chooses to agree or disagree with using a six-point scale ranging from 'not like me

at all' to 'very much like me'. Hence, it captures the person's values without explicitly identifying values as the topic of investigation (Schwartz 2005). See example provided in Figure 1.

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.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1: Example of PVQ item.

The PVQ is shorter, with 40 items in lieu of 56, but in return show more than one statement within items relating to the motivational type. There are also shorter versions of the PVQ available containing 20, 21 and 29 items. The different versions of the PVQ have been used with various populations and methods such as face-to-face interviews, telephone interviews, internet surveys and written questionnaires (Schwartz 2003). Both the SVS and PVQ have been validated in all three countries of choice for the field study, however the full PVQ of 40 items was never conducted in South Africa. A shorter version of the PVQ was used to validate the approach in South Africa with a representative sample of $n= 3,210$ individuals. The results supported the construct validity of the values theory (Schwartz et al 2001). Similar results have been acquired in Sweden and USA.

Considering the target groups of respondents that were the objective when creating the PVQ, the PVQ is reported being more easily understood. It is also regarded as superior to the traditional SVS when interviewing rural populations or individuals with little schooling because of the simple structure (Schwartz 2003; Schwartz 2005). Based on previous experience from researchers, respondents to the PVQ report no difficulty in making judgments, rarely ask questions, or comment on the significance of the research, and the PVQ is treated as a simple task (Schwartz 2003).

The survey items are computed to their respective value types and can then be aggregated to data for analysis. The results from the SVS are visualized by a circular *motivational continuum* consisting of the ten value types; see Figure 2 (Schwartz 2005). Figure 2 show the theoretical model of the relations among the value types, i.e. a fictive individual or group with all values equally important. The focal point of the diagram adjusts depending on the weights of respective values. There are conflicts and congruities among all ten basic values yielding an integrated structure of values. The model is structured so that values adjacent to each other are similar in means of motivation and values on opposite sides oppose each other. Schwartz summarizes the structure with two orthogonal dimensions, so-called higher order value types; Self-enhancement vs. Self-transcendence and Openness to change vs. Conservation. An exception to this structure is hedonism that can belong to either openness to change or self-enhancement depending on the respective weights of the model (Schwartz et al 2001).

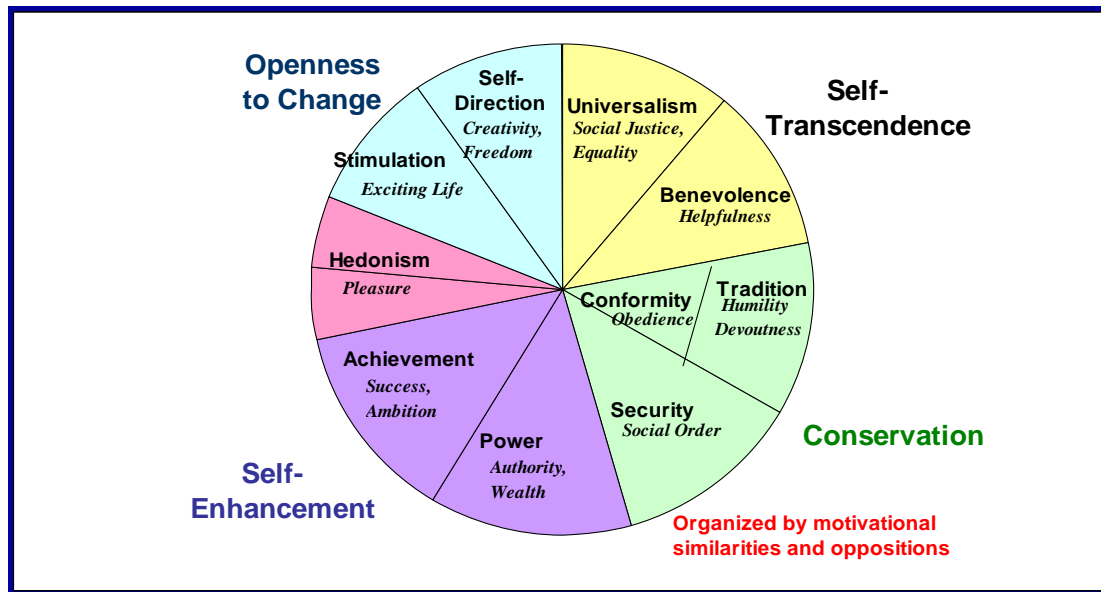


Figure 2: Theoretical model of relations among ten motivational types of values adapted from Schwartz (2005) with permission.

The most important development from the Rokeach Value Survey in the Schwartz Value Theory was the identification of the underlying value system structure. This allowed Schwartz to specify the relations among the value types in the value system where people's priorities on adjacent value types will be similar, whereas maximum differences in priorities will occur when they are opposite each other (Schwartz 1992; Rohan 2000).

There is a well-known difficulty when measuring values and preferences as they are commonly constructed in the process of elicitation, i.e. constructed in context (Slovic et al 1995). Another difficulty when trying to measure abstract qualities is whether the individual's answers truly mirror their values or their perception of what is a good person by societal standards, i.e. social desirability. These problems when measuring values and preferences has also been noted by other researchers (e.g. Fischhoff 1993; Hassel et al 2009; Sjöberg 1982; Slovic et al 1995)

Since eliciting people's values is important for any different fields of research such as survey research, attitude research, economics and behavior decision theory, these areas differ in their assumptions about the nature of values that are available for elicitation. The variation in assumptions leads to difference in interpretation, following the risk of reading too much or too little into people's responses (Fischhoff 1993).

There have been many procedures for eliciting people's preferences, although it is not clear which is the most appropriate procedure to use in a specific context because of the numerous biases that influence peoples' judgments. A commonly made recommendation is to use more than one procedure to elicit preferences since this can cast light on the validity as well as the uncertainty of the obtained preferences (Hassel et al 2009). For example, in the study by Sjöberg (1982) it was attempted to mitigate social desirability by first asking respondents to rate, on a category scale, to what extent they agreed with the attitude statement, and in addition answer a question with a behavior item relating to the attitude statement. In the Schwartz Value Theory biases like social desirability have been mitigated by having several items relating to the same motivational value type to detect inconsistency. Although attempts have been made to control issues like this, it is important to stress that when measuring such abstract qualities as motivational values or attitudes, it is the *expressed* motivational values that are actually being measured.

2.2 Risk perception

Many researchers have made contributions in an attempt to define risk. The definitions vary largely depending on the context, which is not always communicated among lay people. Renn (1998) discuss the problem that there is no commonly accepted definition of the term risk in either science or public understanding. However, all risk concepts have one element in common; the distinction between reality and possibility. Based on this distinction Renn defines the term risk as;

“The possibility that human actions or events lead to consequences that have an impact on what humans value.”

However, risk perception is not only a function of probability of harm but many other factors such as peoples’ beliefs, attitudes, judgments and feelings as well as the wider cultural and social dispositions towards threats to the things that we value (Sjöberg 2000b; Pidgeon 1998)

The risk perception as a field of research emerged on a policy level during the 1960’s with the heated discussions facing the advancement of technology, most notably the nuclear industry. In order to handle the difficult situation of nuclear power, Sowby (1965) suggested weighing risks versus benefit. This later gave way to the pioneering work by Starr (1969) who investigated certain risks more in-depth, which laid the foundation for later research in the field of risk perception. The current understanding of risk perception has emerged from contributions from many different scientific disciplines such as geography, sociology, economy, political science, anthropology and psychology (Slovic 1987).

2.2.1 Empirical studies

During the past decades researchers have been investigating the opinions that people express when they are asked to evaluate hazardous activities, substances and technologies in order to put forward a model suggested for risk perception, not unlike Starr’s (1969) original work. The empirical risk perception approaches conducted over the years differ in both substantial and methodological aspects. However, most studies deal with a multiple and heterogeneous set of hazards, where some focus on a particular sort of hazards, e.g. technologies or activities and other focus on a specific risk e.g. nuclear energy. The selected hazards are judged by respondents according to a set of predefined characteristics (Renn & Rohrman 2000).

In most of the studies conducted so far the risk aspects have been investigated in quantitative terms. However qualitative research has been employed as well, for example see Earle (1984). The majority of these studies are either conducted by interviews or by using questionnaires. The sampling of respondents is often based on convenience sampling rather than representing specified target populations, but demographic variables such as age, gender or occupation are often considered in order to analyze their influence on risk perception (Renn & Rohrman 2000).

When asking lay people to evaluate different risks, their responses are often biased based on earlier observations about the risk in question. Research has identified a number of intuitive judgments rules, known as heuristics, used to simplify mental tasks, e.g. availability and anchoring effect (Tversky & Kahneman 1974). Out of the heuristics it has been argued that availability is especially relevant for understanding risk perception (Slovic 1979; Sjöberg 2000a). Availability is when events that come to people’s minds immediately are rated more probable than events less mentally available (Renn & Rohrman 2000), i.e. if availability heuristics is applied the subjective probability of events will be affected (Kahneman & Tversky 1973). However, in reality availability is often affected by other factors than the frequency of occurrence, e.g. the size of a disaster. This might lead to distortion of the frequency judgment, hence also the risk judgment (Slovic 1979).

It has been argued that although these heuristic biases constitute clear violations in logical rules, they might have been overrated in the literature and have in the long run been less important for the study of risk perception than initially believed (Sjöberg 1996). The work by Tversky and Kahneman (1974) is based on subjective probability, however researchers argue that risk perception is not only a question of probability, even if probability is important in accounting for risk, but also attitudes and beliefs. Another source of error is that the heuristics work had its basis in calculus problems and risk is seldom connected with well specified calculus problems. The laboratory situations used in the studies have been accused of not being applicable to “real world” situations (Sjöberg 2000b). However, it is still important to be aware of these biases as they are found in public perception and may be one of the basis for the observed response in a risk perception study (Renn & Rohrman 2000).

Findings from various risk perception studies have also shown that demographic characteristics such as gender, age, education, ethnicity and income influence on risk perception (Flynn et al 1994; Savage 1993). Previous research has also shown that risk perception for different hazards vary from one country to another. Some of the reasons behind it could be the difference in what media choose to report, what cultural norms are viewed as important and what technical and legal opportunities exist for control and regulation of risk (Keown 1989). It is accepted among risk analysts that women and men differ in their risk perception. Different psychometric studies have shown a rather consistent pattern where men express less concern for most of or all of the risks studied (Flynn et al 1994; Gustafson 1998; Savage 1993). However, it is argued that these results come from the risks being investigated often reflect predominantly male experiences, hence men are more familiar with the risks and perceive them as less frightening than women do (Gustafson 1998). The difference in risk perception between men and women are also supported by other studies that have shown that white men tend to differ from everyone else in their risk perception. They perceive risk as much smaller and more acceptable than other people, which is also known as the “white-male effect” (Flynn et al 1994). The results from a study by Savage (1993) showed that women, people with lower levels of schooling and income, and blacks had more dread for the hazards included in the study. Also, younger people had higher dread than older people in general. Savage also tried to elicit how well-informed people were about the risks, but this had little consistency in the signs and significance of the demographic variables (Savage 1993).

Three general approaches to study risk perception are: the axiomatic measurement paradigm, the socio-cultural paradigm and the psychometric paradigm (Slovic & Weber 2002).

2.2.2 Axiomatic measurement paradigm

The axiomatic measurement paradigm is a psychological theory of perceived risk developed by Pollatsek and Tversky (1970) that focuses on the way in which people subjectively transform objective risk information. The theory assumes the risk of an option to be expressible as a linear combination of its means and variance (Pollatsek & Tversky 1970). Descriptive work has shown that people weigh positive and negative outcomes different and these weights give different reference points, which are not captured by variance measurements (Bontempo et al 1997).

Based on observed empirical regularities in risk judgments, different axiomatic measures of perceived risk has been suggested, one of them is the Conjoint Expected Risk (CER) model suggested by Luce (1986). The CER model was developed to explain the risk judgements of well-defined financial gambles, however the CER model was recently extended in an attempt to accommodate both objective and subjective types of activities. Results of the studies conducted with the simplified CER show that it could broaden the application of the CER approach. The simplified CER could for example be useful for understanding risk perception in health or technology domains, but also provide a general approach to model risk perception in a variety of domains (Carlstrom et al 2000).

The CER model has been described as the “most viable model to describe single-dimensional risk appraisal” (Bontempo et al 1997). However, in correspondence with Bontempo regarding usage of the model in the field study it is concluded that “informally educated rural dwellers will be unlikely to use this kind of expected value calculations (probability times magnitude) to make it relevant” (Bontempo, personal communication, 2009).

2.2.3 Socio-cultural paradigm

Studies within the socio-cultural paradigm examine the effect of group- and culture-level variables on risk perception. The Cultural Theory developed by Douglas and Wildawsky (1982) argues that perceived risk is chosen in order to sustain and strengthen the social relations in a group and aims to explain how people perceive and act upon the world around them. The basis of cultural theory is Douglas’ grid-group typology, where variation in social participation can be accounted for by the dynamics between the two dimensions group and grid. *Group* refers to whether an individual is member of bonded social units and how absorbing the group’s activities are on the individual. *Grid* refers to what degree a social context is regulated and restrictive in regard to the individual’s behavior (Oltedal et al 2004). When the dimensions are placed in a two-axis system, the result is as shown in Figure 3.

		Grid	
		High	
Group	Low	Fatalistic	Hierarchic
	Low	Individualistic	Egalitarian
			Hig

Figure 3: Douglas’ grid-group model.

Depending on which group an individual belongs to, he/she will focus on different kinds of risks, i.e. the cultural theory claims to explain what kind of people will perceive which potential hazards to be how dangerous (Wildavsky & Dake 1990). Individualists fear risks that obstruct their individual freedom, e.g. war. Egalitarians fear developments that may increase the inequalities among people, e.g. pollution or new technologies that might affect the nature. Hierarchists emphasize on the “natural order” of society and perseverance of this order, hence they fear things such as social commotion, demonstration and crimes. The fatalist is indifferent and in general do not worry about things they cannot do anything about (Oltedal et al 2004).

To investigate the relationship between risk perception and the cultural adherence Wildawsky (1990) translated the four types into measureable dimensions and reported correlations between these dimensions and perceived risk. The result of the study showed that cultural adherence was the best predictor for risk perception, over other predictors tested such as personality, economy, level of knowledge and political attitudes (Oltedal et al 2004).

The theory has been regarded as a serious alternative to the psychometric approach, however the results have not been able to replicate. Later research has also shown that cultural theory dimensions account for only a very small fraction of the variance in perceived risk across respondents (Sjöberg 2003). Comparison between the psychometric paradigm and cultural theory shows that the psychometric model is superior when it comes to explanatory power (Sjöberg 1996).

2.2.4 Psychometric paradigm

The psychometric paradigm is the most common approach to conduct cross-cultural risk perception research (Renn & Rohrman 2000). The model is derived from the early work of Fischhoff et al. (1978) who, influenced by personality theory, asked people to characterize various hazards and technologies by rating them on qualities such as voluntariness, controllability, catastrophic potential and dread that had previously been theorized by other researchers (e.g. Starr 1969) to influence risk perception. In the study, 30 different hazards were evaluated with regard to its position on 9 dimensions of risk (Slovic 2000). One of the major results from the study was that the 9 characteristics that had been theorized to influence judgments of perceived and acceptable risk were highly intercorrelated and could by factor analysis be reduced to two dimensions of risk. The first dimension discriminates between high- and low-technology activities, with the high end characterized by new, involuntary, poorly known activities, often with delayed consequences. This dimension is labeled *unknown* risk. The second dimension primarily reflects the certainty of death given that an accident occurs. This dimension is labeled *dread* risk (Fischhoff et al 1978). This two-factor structure is a relatively simple structure, however it is argued that it accounts for between 70% to nearly 90% of the variance in risk perceptions (Renn & Rohrman 2000; Mullet et al 1993). It is also reported as easy to use in a wide range of settings.

The work by Fischhoff et al (1978) was later extended by Slovic et al (1980) to include a broader set of activities, technologies and substances, 90 in lieu of 30, and 18 risk characteristics in lieu of 9. Among the results of this study was that three factors; *dread*, *unknown* and *exposure* seemed able to account for most of the interrelations among the 18 risk characteristics. Since this result differ from the previous study it indicates that the particular set of hazards and risk characteristics chosen can have an important effect on the nature of the observed “dimension of risk” (Slovic et al 1980).

The psychometric paradigm produces quantitative representations or “cognitive maps” of risk attitudes and perceptions, derived from factor analysis. These maps are considered to be icons in risk perception research and present a visualization of lay people’s risk perception (Slovic et al 1982). Figure 4 below shows the “map” with factors 1 and 2 of the three-dimensional structure derived from interrelationships among 18 risk characteristics. Factor 3 is not shown in the map but reflects the number of people exposed. Each factor is made up of a combination of characteristics, as indicated by the lower diagram.

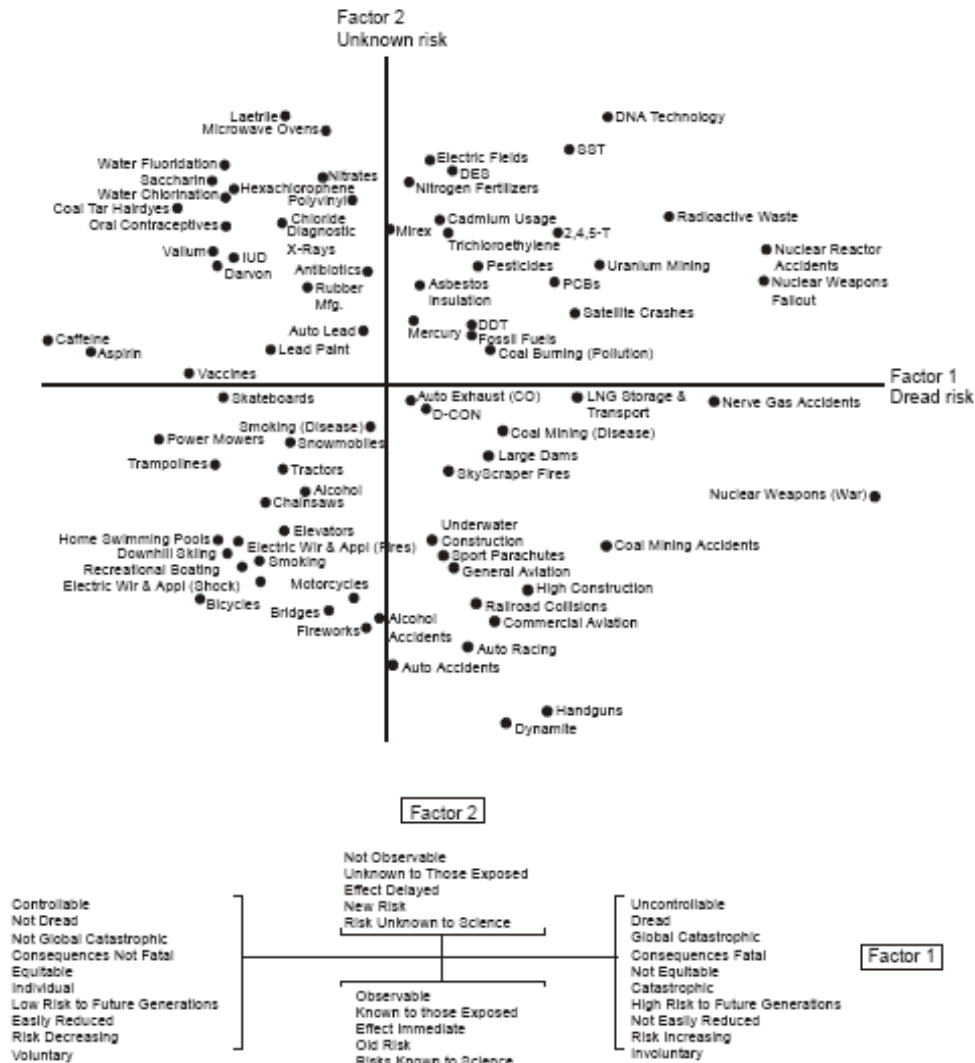


Figure 4: Factors 1 and 2 of the three-dimensional structure from Slovic (1982) with permission.

The psychometric paradigm has received various critique, among them for the important aspect of interference with nature (unnatural risk) was missing from the scales used in the earlier studies (Sjöberg 2000a). Also, it is argued that the large share of the variance of perceived risk that can be explained by two dimensions is because Fischhoff et al (1978) analyzed mean ratings, not raw data. The problems associated with using this type of analysis has been addressed by different critics where mean data are less subject to error than raw data, hence various models are more likely to fit (Sjöberg 1996; Sjöberg 2000a). By using aggregated data it is also impossible to know how well the “cognitive maps” explains risk perception at the level of the individual (Siegrist et al 2005). However, despite of its deficiencies even its heaviest opposition state that it is still considered the most promising model of risk perception (Sjöberg & Drottz-Sjöberg 2009).

Many researchers have also used slightly altered methods based on the psychometric paradigm to describe risk perception (Sjöberg & Drottz-Sjöberg 2009; Savage 1993; Keown 1989).

2.3 Theoretical Framework Summary

Two methods stand out as being superior for our purposes as per the descriptions given within this chapter. Schwartz Value Theory is suitable to measure the abstract quality of motivational values, as it is a well-known and commonly used method throughout its research

field. The theory has been validated in over 67 countries, including the subject countries for this study, while using similar settings as the one used in this report. The psychometric paradigm stands out as being the most suitable for a number of reasons. The psychometric paradigm has been widely used and has withstood scrutinizing from the academic literature for more than two decades. It is also easily implemented and understood by people in different cultural contexts.

Both of the methods have been explicitly described as suitable when using questionnaires. Thus, the combination of the two methods will give a good foundation when constructing the survey.

3 Methodology

To answer the research question on which this thesis is based, the two methods for measuring risk perception and expressed motivational values was combined into a tool. Criteria were set up in order to create a tool that will facilitate in conducting a cross-cultural field study in three widely different settings. The criteria were:

1. *The tool needs to be user-friendly and easy to understand by both educated and uneducated individuals.*
2. *The tool needs to contain questions relevant for all three cultures.*
3. *The tool needs to be quick to implement and not too time consuming for respondents to complete.*
4. *The tool should take special consideration in mitigating effects of heuristics and biases.*
5. *The results from the field study needs to be able to be compared with similar studies within the area of risk perception.*

The study took place in South Africa, Sweden and the USA. Although including three different countries, the purpose of the study was to interview respondents on an individual level, hence not to estimate population parameters from the sample to the respective countries. Instead, the objective of conducting a field study in three countries was to gather data, which can be compared to previous studies in risk perception, where cultural differences is a recurring category. Hence, it was essential that the sampling of data took place in environments where we could measure the five demographic categories of risk perceptions, as per our delimitations; cultural difference, age, gender, educational level and whether the respondents had children. We chose countries on three separate continents, with diverse locations for the respective countries; the second largest city in USA (Los Angeles), a middle size city in Sweden (Sundsvall) and townships in South Africa. Another objective for conducting the field study in three such widely different countries and settings was to get a wide range of individuals from various conditions of living. Also, with South Africa having the second language of English, the survey process was envisioned to be somewhat facilitated compared to other developing countries.

3.1 Survey method

There are several ways to conduct a multi-national survey such as this one. One way to go about it is to go to the subject countries and stay there for a few years and make conclusions based on the experience, another way might be to interview people with deep knowledge about the subject populations and values, so called expert informants (Bernard 2006). However, expert informants are mainly used when the data of interest is cultural data, which require experts, not individual attribute data. For our survey, individual attribute data is the data of interest and this normally require a probability sampling method.

A different approach to sampling was chosen for the field study; a combination of non-probability samplings methods i.e. purposive, convenience and quota sampling. Convenience sampling is also known as opportunity sampling and basically means that a sample (an individual) is taken from whatever part of the population that is readily available and convenient. Purposive sampling indicates that there is a purpose in mind hence the sample targets a particular group of people. When using quota sampling the population is segmented into sub-groups and decide on the proportions of these sub-groups in the final sample (Bernard 2006). In our survey, this meant approximately 100 individuals from each country, with a roughly equal distribution over gender and the four age groups. In this type of sampling the selection of the sample is prone to certain biases, since the interviewer might be tempted to interview those who look most helpful, or someone he/she can identify themselves

with socially, hence sub-consciously chose individuals with a certain quality. This is an important bias to be aware of; it might contribute to the sample being skewed since everyone does not get a chance of selection (Bernard 2006; Dahmström 2000). Another difficulty with quota sampling is that there is a possibility of missing values not accounted for, i.e. people who decline to participate in the survey (Dahmström 2000).

By using these, non-probability, sampling methods there cannot be any scientifically generalizations made about the total population. If the purpose of the study was to estimate the population parameters, then a scientifically drawn, unbiased sample would be a must. Although, since the purpose of the study was not to estimate any population parameters from the sample to a larger population, we did not have the means to get an unbiased probability sample and we were aware of the biases, non-probability sampling was considered to be sufficient (Bernard 2006).

To facilitate the data sampling for the study we chose to conduct structured interviews using questionnaires, following the approach taken by each of the methods but also because of the many advantages for our study. When separately using face-to-face interviews or self-administered questionnaires to conduct a survey, there are a number of disadvantages to be considered. When using face-to-face interviews there is a risk for interviewer effects, prestige biases and it also takes long time to conduct the interviews. The most commonly discussed disadvantages when using questionnaires includes the risk of low response rate, risk for many missing values, no one to consult if clarification is needed, there is no control over who respond and it is not appropriate for illiterate populations (Bernard 2006; Dahmström 2000).

However, by conducting interviews using questionnaires it was considered that we mitigated the majority of disadvantages the two methods include and instead there was a number of advantages to the study;

- The response frequency was high, i.e. it was possible to set a target number of questionnaires, and achieve it.
- The respondents read the questionnaires individually, where feasible and a physical questionnaire allowed for control to maintain the same information to all respondents.
- We had control over where to go and whom to ask.
- By being onsite simultaneously as the survey was conducted we were able to answer questions or provide clarification if necessary in person.
- The questionnaire was read out loud, where needed, hence the study was able to include less educated or elderly individuals.
- The survey could be conducted within a relatively short timeframe.

3.2 Constructing questionnaire

The Schwartz Value Theory and the psychometric paradigm, combined with demographic questions constituted the questionnaire that was used for the field study in each of the three countries. The order of the respective parts in the questionnaire was chosen so that the Schwartz Value Theory came first due to its extent and the psychometric paradigm second. The demographic questions came last, which is the most common and recommended approach when constructing a questionnaire (Troost & Hultåker 2001; Schwartz 1992).

3.2.1 Schwartz Value Theory

As previously discussed there are two instruments based on the Schwartz Value Theory currently in use, the SVS and the PVQ. The PVQ was concluded as the most appropriate instrument to be used for the field study. Given that the PVQ is perceived as easier to understand than the SVS and previous research has shown that respondents treat the PVQ as a simple task, it is more user-friendly and suitable for the respective countries. The PVQ has shown to be superior to the SVS when it comes to interviewing rural populations with little or no schooling.

Previous research has used the PVQ with various methods, among them face-to-face interviews and written questionnaires, which are the methods that were used in the field study. Research has also shown that respondents rarely ask question when completing the PVQ. Applying an uncomplicated and user-friendly tool will benefit the field studies as it might lead to fewer questions being asked and all additional explanation wants to be kept at a minimum as it might lead to biases.

Further advantages for the PVQ is that it is shorter than the SVS, with 40 items in lieu of 56 items, hence will take less time to complete. The SVS has, because of its size, received critique for being an impractical instrument for survey researchers.

The PVQ has been validated in all three countries and in order to conserve the validity of the instrument, the PVQ was not been altered to larger extent, however minor updates were applied after pre-testing the questionnaire, see Section 3.3.2.

3.2.2 Psychometric paradigm

The psychometric paradigm was chosen as the most appropriate method to be used in the survey. However, the method had to be slightly adapted in order to create a tool that would be of most benefit to the survey.

The original study by Fischhoff et al (1978) with the psychometric paradigm asked respondents to evaluate 30 different hazards and technologies with regard to its position on 9 dimensions of risk. For the purposes of this survey, 9 dimensions and 30 hazards produces a matrix of 270 questions which was, due to budget and time limitations, in excess what we had envisioned for our study. Another important reason for a smaller subset was that all the previous hazards used would not be familiar to individuals in all of the three countries and using fewer hazards would simplify the task extensively as well as make comparisons among hazards more meaningful. One objective was thus to shrink it down into a manageable size, suitable for asking an individual in a casual situation. To limit the number of questions, we had to limit the number of hazards and/or dimensions to be able to cope with interviewing approximately 300 individuals.

In previous studies using the psychometric paradigm, researchers have adapted the method to use a smaller subset of questions e.g. (Savage 1993) and (Keown 1989). Savage (1993) applied the psychometric paradigm in his study, however reduced it to only 12 questions in total. Based on the research by Slovic et al (1980) Savage used the dimensions *dread*, *unknown*, and *personal exposure* together with four hazards to measure risk perception in his sample of individuals. The four hazards where chosen based on previous studies from Slovic et al that showed that these hazards where cognitively viewed as having very different characteristics; commercial airplane accident, stomach cancer, fire in the home and automobile accident (Savage 1993).

Based on the approach taken by Savage to reduce the number of questions, we could achieve a more concentrated hazard/dimension matrix including only hazards that would be suitable for our subject countries. A reduced number of focused questions would also shorten the time for respondents to fill out the questionnaire hence increase the chances of getting participants to volunteer for the study. To limit the time it would take to complete the total questionnaire to around ten minutes, we needed to reduce the number of questions concerning risk perception to approximately 20. Hence the alteration of the method, i.e. reduce the number of questions, could be done by using a matrix of either;

3 dimension x 6 hazards; or
2 dimensions x 10 hazards

A decision was made to use an increased number of hazards rather than of additional dimensions as the additional dimensions would marginally increase the validity while the additional hazards would broaden the study and give more measuring points. Slovic agreed that this was a good use of his previous research, conserving most of the validity while seriously reducing the numbers of both hazards and dimensions (Slovic, personal communication, 2009).

The hazards initially considered for the study were based on the previous risk perception studies by Fischhoff et al (1978), Slovic et al (2000) and Sjöberg (2003). When choosing hazards for a cross-cultural field study, it was important to consider the differences in culture between the three countries in order to choose relevant hazards for all countries included. Since the field study in South Africa was to take place in townships where the population might be less educated it was not meaningful to include “new” technologies and substances that are scientifically complicated and would be difficult to explain. For example DDT, asbestos, DNA research, solar electric power or food irradiation, which were included in the extended study of the psychometric paradigm by Slovic et al (2000). Also, considering the age of the respondents would range from 18 years to over 60 years, certain types of activities were excluded, e.g. mountain climbing, skateboarding, scuba diving, downhill skiing and surfing (Slovic et al 2000).

The final hazards were chosen with the intention to include a variety of different hazards as well as having all the individuals being able to relate to them, associate with them and give accurate answers. Furthermore, we wanted to broaden the range of hazard types in order to include modern hazards such as climate change. Climate change and terrorism was also suggested by Slovic to be included as they are considered to be important hazards of interest (Slovic, personal communication, 2009). The hazards that were included in the final study was AIDS, drinking alcohol, climate change, stress, terrorism, fire in the home, motor vehicles, commercial airplanes, cancer and nuclear power plants together with the risk dimensions dread and unknown. The hazards included were considered to be representative and up-to-date for all three countries.

When measuring risk perception the questions being asked guard the validity and precision of the results. In the study conducted by Savage (1993) the pre-testing showed that the respondents had difficulties understanding what the term “dread” meant as the word is no longer in common use among lay people, especially in relation to risk. As a result Savage chose to approximate the feeling of dread by a nervous emotional response and dread was redefined as to whether respondents could think about a risk in a calm way or if they became nervous when thinking about it. We found it hard to translate “degree of nervousness” to approximate dread. We decided to use a different approach approximating the dread factor with fear and amplifying the meaning by stating the scale from “no fear” to “very high degree of fear”. This was mainly because we consider “fear” to be a more adequate synonym to the term “dread” than nervousness is, and “fear” is a simple and commonly used term hence it is likely to be understood by all individuals in the included countries. Also, fear is an emotion most individuals can relate to which makes it easier both to understand and associate with the question. This approach was discussed and agreed upon with the author of the original study (Slovic, personal communication, 2009).

Furthermore, when phrasing a question there is a significant difference to distinguish between the word hazard and accident. The word *accident* can be considered as having an inherent bias of actually being exposed to a hazard or a “hazard come true”. Hence all hazards were phrased as neutral as possible in the questionnaire, e.g. asking about *motor vehicles* in lieu of *motor vehicle accident*.

3.2.3 Demographic questions

Demographic questions were added to record age, gender, the number of years spent in school and whether the respondents had any children. The purpose of the questions was to see if demographic factors influence on risk perception, compare it to previous research results and to obtain the descriptive statistics for our sample. Initially there were five categories, with the fifth being “occupation”. The response alternatives for occupation were originally; student, unemployed, employed and retired. However, after the pre-testing of the questionnaire, more possible response alternatives for the category were suggested. The occupation category was decided to be excluded from the demographic questions since the possible response alternatives were not considered suitable for all three countries and consistency in the questionnaires for all three countries was important for the survey.

The demographic variables were measured by using traditional nominal scales (e.g. gender) with different categories (e.g. male or female), see Figure 5. The age of the respondents was measured by using predefined age groups, in lieu of asking for each respondent’s specific age. Using predefined age groups facilitated in targeting respondents, in order to achieve an approximately equal distribution over age in the sample. The level of education was recorded by measuring the number of years spent in school, as opposed to highest level of education. The reasoning behind that are the differences in the educational systems in the three countries respectively. Although the systems are similar in nature, the terminologies between the three are distinctly different which may make it difficult for comparison between the countries.

Gender		Age		Education		Do you have any children?	
Male	<input type="checkbox"/>	18-30	<input type="checkbox"/>	Number of	_____	Yes	<input type="checkbox"/>
Female	<input type="checkbox"/>	31-45	<input type="checkbox"/>	years in school		No	<input type="checkbox"/>
		46-60	<input type="checkbox"/>				
		60+	<input type="checkbox"/>				

Figure 5: Demographic variables included in the final questionnaire.

3.3 Quality control

To establish that the questionnaire met the survey criteria to conduct a quality survey in the three countries, it was first pre-tested and updated accordingly. See Appendix A for the complete questionnaires.

3.3.1 Questionnaire pre-test

Before conducting the survey in the three respective countries, a test version of the questionnaire was distributed to 15 test persons. The group of test persons included both persons with English and Swedish as their mother tongue. The questionnaire was not however sent directly to test persons in USA and South Africa. The pre-testing showed that it took approximately 10 minutes to complete the questionnaire, which was considered as an appropriate time frame for completion of the questionnaire.

Most of the remarks were in regards to the PVQ and the remarks that were sent back are listed below. The remarks apply to both the English and Swedish version unless otherwise is stated:

- The items felt biased – people get a feel for what is the right and wrong thing to answer in the PVQ in order to be a “good” person. This might lead to the responses given reflects what a person wants to be like rather than what they actually are like.

- Some of the items have two statements in one – sometimes these statements conflict, i.e. one can agree with the first statement but not the second.
- There were some remarks regarding a few of the items using odd or outdated words. The most apparent was item 14, which was phrased as “he/she thinks the state must be on watch against threats from within and *without*”, where the word *without* was considered to be used incorrectly.
- Another common opinion expressed among the test persons was regarding the response scale. The answers were phrased in a way that was much too similar to each other, and sometimes even had the same meaning. For example, the answers “A little like me” and “Somewhat like me” can be viewed upon as having the same meaning, thus rendering the scale non-linear.
- The response scale read with an decreasing resemblance to the own person from left to right, i.e. it started with “Very much like me” furthest to the left (6) and “Not like me at all” to the right (1). It was noted that it feels more natural to read an ascending scale from left to right.
- The following additional response alternatives to the occupation category in the demographic section were suggested; housewife/husband, part-time worker, sick leave and long-term sick leave.
- The PVQ had an even number of alternatives in the response scale, hence there is no middle alternative for the respondents to express neutrality.

3.3.2 Update

In general, a minimum of changes was applied to the original PVQ, both the Swedish and the English version. Since the method is already validated in 67 countries and for 47 different languages it is of great importance that it is maintained as per its original document. All the updates applied to the PVQ were done after discussions and agreement with the author of the original study (Schwartz, Personal communication, 2009). The final questionnaire included the following updates;

- The original PVQ was in Hebrew, a language that is written from right to left. However, in English and Swedish it feels more natural to have an ascending scale reading from left to right. Hence, the scale of the answers were changed to read with an increasing resemblance to the own person from left to right, i.e. starting with “Not like me at all” to the left (1) and “Very much like me” (6) furthest to the right.
- Item 14 of the PVQ was reworded to “threats from within and *outside*” as “within” was not considered to express the actual meaning of the question. This only applied to the English version of the PVQ.
- “Occupation” was excluded because of all the possible alternatives that would have to be included on a sufficiently good response scale for three countries.

3.3.3 Meeting the method criteria

By combining the two chosen methods, a tool to conduct the field study in three countries was created. The tool will facilitate the field study with regards to the following method criteria;

1. *The questionnaire needs to be user-friendly and easy to understand by both educated and uneducated individuals*
The PVQ was considered as the user-friendliest method to measure expressed motivational values, in comparison to the SVS. An adapted version of the psychometric paradigm was used which facilitated the study.
2. *The questionnaire needs to contain questions relevant for all three cultures.*
The PVQ has proven to be superior when interviewing rural populations with little or no schooling. The adapted version of the psychometric paradigm has been focused on only including hazards considered relevant for the respondents in all three countries.

3. *The tool needs to be quick to implement and not too time consuming for respondents to complete.*

The PVQ is shorter and perceived as easier to understand than the SVS, hence should be quicker to complete. The adapted version of the psychometric paradigm will include a smaller subset of questions, i.e. 10 hazards on 2 dimensions of risk. After pre-testing the questionnaire, the time it took to complete it was approximately 10 minutes, which is considered to an appropriate time frame for the survey.

4. *The tool should take special consideration in mitigating effects of heuristics and biases.*

Modifications to mitigate the identified heuristics and biases were made.

5. *The results from the field study needs to be able to be compared with similar studies within the area of risk perception.*

Both the PVQ and the psychometric paradigm have been used in various studies, hence are established and validated methods for their respective fields. The psychometric paradigm has been used for a various studies in risk perception where it has been applied as an adapted method with a smaller subset of questions, hence there is a number of similar studies to be used for comparison of results.

3.4 Implementing method

Because of the different cultural and sociological settings in the three subject countries, the survey work had to be slightly adjusted to each country. Descriptions of each individual survey are found below.

3.4.1 South Africa

The South African survey was conducted on two sites in different parts of the country, inland in the little university town Potchefstroom, and in the coastal town Mossel Bay. South Africa has eleven official languages spoken throughout the nation with English being the obligatory second spoken language that is spoken widely throughout the country. The official unemployment rate is very high with a large part of the population living in informal settlements, so-called townships. A township contains a wide variety of people with different backgrounds and schooling, making it difficult to custom-fit our survey in a meaningful way. The standard of living is typically very modest with some parts of the country being without a constant supply of drinking water and the people using rusty shacks of leaf metal as protection from the weather. The survey was conducted in collaboration with the African Centre for Disaster Studies at the North-West University, who also helped with choosing the sites in question as well as helped with interpretation. The centre has great knowledge and experience with these types of studies as well as connections with the local municipality. Initial discussions with the Centre resulted in the English language being chosen as suitable for our study as the questionnaire in itself does not have a complicated structure. A site visit was conducted, and out of the seven townships surrounding Potchefstroom, Sonderwater and Greenfield were chosen representing the poorest ones. The site in Mossel Bay was chosen to the kwaNONqaba township in collaboration with the local Eden municipality. The number of questionnaires for each of the townships was divided as below:

Sonderwater – 25

Greenfield – 25

kwaNONqaba - 50

The centre and the Eden municipality provided local interpreters in order to help with the interviews and to record any unclear items. An interpreter provided many benefits for the study aside from being able to communicate to the locals using their local tongue. Because of the current political situation in South Africa it also worked as a social lubricant as a white male walking around in the townships is highly unusual and might lead to political suspicion.

A local translator helped to mitigate this initial bias. Any type of “official” help was quickly discarded as that might have biased the answers further. Moreover, someone unfamiliar with the township would not be able to guarantee the safety in the township. The downside of having an interpreter includes not being able to control the flow of information affecting the study. This issue was mitigated by clear specific instructions with controls as the interviews went along. Any uncertainties were made clear on site.

The method for finding people within the townships was simply by walking door to door, asking people if they wanted to participate in the survey. No compensation was given, as the budget did not allow for this. Rarely did someone object to filling in surveys. Most of the individuals were unemployed and in their home when filling out the surveys. The survey was to be read and completed individually where feasible and read aloud in the cases where the individual could not read on their own, i.e. the elderly or people with little schooling. The individuals were as far as possible to complete the surveys without assistance, assuring minimal differences in information flux between respondents.

The English literacy in Sonderwater and Greenfield proved very limited and while it was fully possible to communicate context, the survey had to be read in the respective local tongues in order to convey the correct information required to properly use the questionnaires. Especially elderly individuals had generally poor knowledge largely explained by education not being available to black people during the apartheid era. Early interviews showed rather extreme results in both PVQ and risk perception questionnaires. As an example 39 of the first 40 questions mapping the individual’s values were answered with “very much like me”, a very unlikely result one since some of the posed questions are in conflict with each other (Schwartz et al 2001). For example it would be hard to find an individual who would be completely pro-change while simultaneously being completely pro-tradition. These interviews were discarded as unlikely results. The dominant language in Sonderwater and Greenfield townships was Setswana, which has some inherent problems with scaling. The more common way to answer a scaled question is to answer yes or no with a description why. This could possibly explain the poor quality of the first few surveys. The conclusion drawn was that verbal translation was not enough in this instance and a decision was made to translate the survey to Setswana. The language department of North West University provided the translation to fit the recipients (i.e. community people). The intent behind the translation was to explain the questions in simple terms that easily could be understood by the local people. Special care was taken to satisfy the cultural preferences in the language. The language department had previous experience with these types of translations with many social and cultural research projects being located in the vicinity of Potchefstroom. To keep the level of information similar to the surveys in other countries, emphasis was to put much of the needed information IN the survey to minimize biases caused by interpretation and additional explanation.

Another few paragraphs of information about the purpose of the study as well as an example of how to complete the questionnaire were added illustrating specifically the use of the scale. On suggestion by the language department a scale from 1-6 was also included as it would increase the understanding of how to use the scaling, especially if the alternatives are not perceived as linear. The intention with the added information was that the same information should be used among all respondents, including Sweden and the USA, which was the case albeit verbally. The amendment can be found in Appendix B.

The translation was then translated back to English for quality purposes using the same procedure as was used when translating the original SVS and PVQ surveys (Schwartz 1992). This method, i.e. back translation, is the standard method for adapting social measurement scales (Bernard 2006). No remarks were found. The translation had the added benefit of helping the interpreter conveying the same information to the recipient every time.

However, even with the translated surveys, some individuals' especially elderly did not read Setswana very well and had to have it verbally read to them. In doing so the method deviated somewhat in these instances. To keep the deviation to a minimum, the interpreter was instructed to explain the contained examples with options and then read the survey questions aloud word by word. Only when people did not understand a word or question was the translator allowed to as briefly and neutral as possible explain the meaning of the word, omitting examples if possible to avoid biases. The individuals' were then instructed to mark their own answer with an 'x', and when in doubt have the options read to them again. After a few questions the individuals seemed to acclimatize to the process.

KwaNONqaba is the largest township in the vicinity of Mossel Bay. English is widely spread but the leanings from the previous site supported translating the survey the local mother tongue of the majority of individuals, being isiXhosa. The back translation was undertaken by the staff of the local municipality. There were a few remarks corrected directly on site. The interpreter was a resident of the township working with the local fire brigade and knew most of the residents and their respective age. The interpreter was fluent in both English and the local tongue, isiXhosa and got identical instructions as in the first site with emphasis to explain the scale. The interpreter was also used in choosing individuals. Different individuals from different parts of the townships were picked according to their respective age groups. There is a possible bias as to the interpreters choices of individuals but the choices seemed to be well spread and not limited to people he knew intimately. In opposite, because of the individuals knew him, they seemed to make a more serious effort since he vouched for the study. With using the interpreter and his knowledge about the township it was possible to go between houses, leave surveys with the individuals and collect them later in the day. Since the respondents seemed to have no trouble understanding the survey, very few questions or comments were made to the interpreter and data was successfully collected.

3.4.2 Sweden

A research assistant was used to gather data from Sweden. A letter with detailed instructions was sent to the research assistant as well as verbal instructions before the survey started. The research assistant was specifically asked to be attentive to any questions and factors that might affect the study. The assistant was interviewed after collecting all the data and reported few questions and none of which could not be answered upfront. The research assistant discarded questionnaires missing information, missed items etc. where the information would not be enough to analyze. People included in the study were mainly individuals met in extended social contexts, relatives, and friends as well as individuals randomly approached.

Talking to the research assistant after completing the Swedish part of the survey, there had been few questions and the research assistant were able to answer them without complications. It seemed like respondents did not understand from which perspective to fill in the questionnaire, which was facilitated after a brief instruction but recorded for future feedback.

3.4.3 USA

The survey was conducted in English. With consideration to the target groups of age and gender, the respondents were all randomly approached and asked to participate in the survey. However the majority of the respondents were students and teachers from Santa Monica College, Los Angeles. This was mainly due to students and teachers being an appreciative target group for surveys of this kind. Santa Monica College has about 30,000 students and a large campus area with a lot of students and teachers in circulation, which made it easy to approach potential respondents. There were also other students conducting different surveys on the campus, hence the students seemed rather used to filling out questionnaires and participating in surveys of different kinds.

When the respondents agreed to participate in the study the purpose of the study and brief instructions of how to fill out the questionnaire was given. As previously mentioned, to keep the level of information similar to the surveys in the other countries chosen, as well as to avoid biases, additional explanation was kept to a minimum. All respondents were literate; hence all the questionnaires were read and completed individually. However, it cannot be guaranteed that English was the respondent's native language considering USA is a relatively immigrant-dense country and also there are many exchange students at the college.

Furthermore, it was at times noticeable that the respondents did not put much effort into or thought behind what answers they were giving in the questionnaire. The fact that all respondents participated in the survey out of free will and without compensation in return for their participation could have affected their willingness to answer properly. The questionnaire took about 10 minutes to finish and in order to finish quicker it is considered likely that some respondents did not reflect over what they read, but instead might have ticked any box convenient to avoid spending too much time filling out the questionnaire. A few questionnaires also fell away due to not being adequately completed and having a number of unanswered items.

3.4.4 General comments from the field study

During the field study in South Africa, USA and Sweden the method had to be slightly adapted to each country, specifically in South Africa, due to the language problems. When conducting the survey, a few comments and possible biases were brought up for further discussion. There seemed to be a cultural difference when answering the questionnaires. It was noted that the Xhosa population seemed to use a broader spectra of answers compared to the Setswanan population, who mostly used extremes to describe their motivational values. This may be explained again by the scaling not being habitual to the Setswanan population. It can also be explained by the difference in cultures and language, where individuals may be biased to answer to different degrees of extremes. For example in the Setswana language extremes are usually used to describe items, followed by an explanation as to why. In Sweden however it seemed like few people use extremes to portray their opinions. Overall, there were no respondents questioning the method in the South African sample, however a lot of people were interested in the purpose of the study and some respondents only participated after been given an explanation of the purpose as well as a promise of anonymity.

The most frequent comment regarding the questionnaire from the respondents from USA and Sweden was that some of the items in the first part of the questionnaire, i.e. the PVQ, were giving two statements in the same item. Respondents queried that a lot of these did not mean the same thing, and while agreeing with the first statement they did not agree with the second and vice versa. The result of this was that they simply chose an answer "somewhere in the middle". However, "middle" on a six-point response scale is subject to individual response scaling, i.e. where the respondents anchor their answers on the 1-6 scale will affect what is considered to be "middle". This critique came up already when pre-testing the questionnaire (see Section 3.3.1) and was raised with the original author of the method. Schwartz commented that he was aware of this limitation, although it was not regarded as a major issue for the method (Schwartz, personal communication, 2009).

The question regarding number of years in school also caused some confusion for the Swedish and the US sample. This question has sometimes been answered correctly with the total number of years spent in school and sometimes only counting the years spent in a higher seat of learning after graduating high school. The latter was, to as large extent as possible, corrected before the respondent returned the questionnaire. Considering the majority of the respondents in the US part of the field study was students and teachers approached on campus, the demographics question regarding education might be skewed. Since the majority of the people approached on campus have higher schooling, i.e. college or university, this might result in few of the respondents in the age group 18-35 having less than 12 years of

schooling, as grade 12 is the final grade of high school. However, high school can be resembled to the Swedish educational level of “gymnasieskola” which is a 3 year, non-compulsory, secondary level preceded by 9 years of compulsory education. Given that majority of the Swedish population in the age group 18-35 follows through the “gymnasieskola” hence has also completed 12 years of schooling, there might be similar results in educational level between the Swedish and the US sample.

It is also worth noting that during the time of the data sample collection, on 1st of June 2009, the Air France flight 447 from Rio de Janeiro to Paris disappeared from the radar and was later found crashed in the Atlantic Sea. This was an accident that got much attention on the news in both the United States and Sweden, hence it is possible that the result of the risk perception of commercial airplanes is biased due to the availability of this recent accident, see Section 2.2.1 for further discussion on availability heuristics.

3.5 Statistical analyses

The field study resulted in a total of 293 complete questionnaires, which were used for further analysis. We needed to define which qualities we wanted to assess and identify objectives for the analysis in order to decide on the most suitable statistical method.

	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

Figure 6: Descriptives of empirical sample.

There were three main objectives with our analyses. We wanted to analyze the individual data using the classic risk perception approach with only demographic variables as predictors. Drawing on the conclusions of previous research coupled with demographic groups, we should be able to draw similar conclusions within our sample. The main purpose was to investigate if there are any tendencies for statistical significant connections in the sample, using expressed motivational values as predictors for risk perception dimensions. With that foundation the main analyses can then be performed, including both demographic variables and expressed motivational values as predictors in the *same* model. This will possibly exclude weaker contributions from the model and show tendencies of connection within the sample.

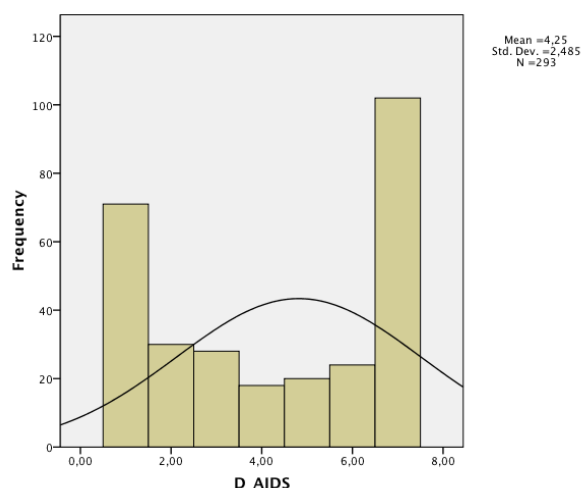


Figure 7: Data distribution of dread for AIDS.

Previous risk perception research has used a variety of regression models to describe the effect of different dependent (i.e. risk perception dimensions) variables with independent (e.g. demographic) variables. The type of possible analyses that can be used depends to a large extent on the distribution of the independent variables thus have to be assessed. By creating histograms of the risk perception data the general distribution of data can be viewed graphically with a normal distribution curve included. From histograms (see Appendix C for all histograms), conclusions can be drawn that the data clearly cannot be considered as normally distributed, see example in Figure 7. The distinction indicates that comparing means with independent t-tests or by using the ANOVA approach is not feasible as these tests require normal distribution. Linear regression models are no longer meaningful as they prerequisite normally distributed data. Hence, the risk perception data must be categorized in order to perform significant analyses. One can discuss the impact of analyzing different categories of the risk perception spectra. We are interested in investigating which of our independent variables predict high and low risk perception dimensions, hence discard the category of “average” risk perception. A similar approach has been used in a previous risk perception study by Flynn et al. (1994). Grouping the risk perception data as high and low categories significantly facilitates further analysis. Because of the seemingly bipolar distribution it is also considered a logical choice of categories. The scores for the ten hazards on the two risk dimensions will thus be categorized as;

Scores 1-2= low dread/well informed; and
 Scores 6-7 = high dread/not informed

With number 4 of the scale being the mid value indicating neutral perceptions, it seems no use including 3 and 5 into low and high respectively as it would imply going from neutral to high in one step. It should be noted that the data for *unknown* have been transformed from the questionnaires by subtracting from 8. In the questionnaires it was advised to have the response scale reading with an increasing scale from “don’t know anything” (1) to “well informed” (7). However, in order to have both of the “worst” outcomes, i.e. feeling high dread and not informed to correspond to the highest scores the transformation was performed. This approach is also used by Savage (1993).

The high/low groups will be modeled versus a complimentary group, e.g. high dread (scores 6-7) will be modeled against the complimentary group with scores 1-5. During the rest of this chapter we will simply refer to the cases as High dread, Low dread, Well informed, and Not informed respectively.

The variables can now be modeled in a binary logistic regression. The binary logistic regression model can handle both categorical and continuous data and does not come with many inherent shortcomings. Considering the distribution in the sample a linear regression model would describe the data poorly. The histograms show a majority of individuals choosing extreme values, i.e. values of 1-2 or 6-7, see Appendix B, making binary logistic regression more meaningful. The choice of statistical method for analysis has also been discussed and agreed upon with Lund University Statistical Department.

In a binary logistic regression the dependent variable (Y) has to be a binary variable, i.e. categorized into only two groups limited to the interval 0/1. The X-variable can have any value. However, the assumption if the X-variable is continuous data is that the odds ratio increases or decreases when the variable increases with one unit, given that the rest of the variables are constant. The binary logistic regression is a fairly common approach used for example in epidemiological studies where only two categories are of interest, e.g. having high blood pressure and not having high blood pressure.

Among the demographic variables only education is a continuous variable. Studying the data, many individuals in Sweden and USA gave their education in years corresponding to distinct levels of educations, e.g. high school or higher education. In South Africa, there were some differences with younger individuals giving years according to the categories above and older people lacking education. The educational variable is recoded into three categories; grade school, high school and university. There are some differences within the respective school systems, but they relate more to the naming of each level, than to difference in school years. The alternative is to get the increase in risk perception dimensions per school year, which is not deemed meaningful for interpretation. The variable was recoded as per below:

0-9 years = grade school
10-12 years = high school
> 12 years = university

Initially, each country was analyzed separately in a binary logistic regression. However, these analyses showed no significance among any of the variables. One of the main reasons for this is believed to be insufficient sample sizes for each country when analyzed separately. To keep the sample size of 293 individuals, reference groups were used for each of the demographic categories. USA was chosen as the reference groups for the three countries. This was due to the countries being sorted in alphabetical order in the data sheet, hence USA and South Africa were the two options available since they are first and last in the list. However, South Africa showed some extreme values, thus the interpretation of results was facilitated by using USA as the reference group. To facilitate the analysis and the presentation of the results, the same reference groups have been used for all analysis. The reference groups for the demographic categories are:

Cultures: USA
Gender: Male
Age: 18-30 years
Education: Grade school
Children: No children

The conflicts and congruities among the ten value types contribute to a multidimensional structure of values. To be able to say anything conclusive about the relationship between values and risk perception we need to categorize groups of individuals who share similar value characteristics. For this purpose the four higher order value types provided by Schwartz (Schwartz 1992) are suitable. This categorization will also simplify theorizing about value driven risk perception. The ten motivational values have thus been combined to four higher motivational types; openness to change, self-transcendence, conservatism and self-enhancement, arranged by motivational similarities, as discussed in Section 2.1. Each of the higher motivational types are computed by taking the mean from the values that constitute them according to Schwartz (personal communication, 2009). According to Schwartz Value Theory, hedonism belongs to either "openness" or "self-enhancement". A bivariate correlation analysis is undertaken to determine where hedonism best is placed. The results show that hedonism correlate with all four of the subject values, see Appendix C. However the correlation is stronger for both of the values corresponding to openness to change, i.e.

stimulation and self-direction. Based on this correlation analysis, hedonism is included in the higher category “openness to change” for all of the future analysis performed.

An alternate approach is to adjust the individuals score around his/her means to get the centered value scores. This approach adjusts for the bias of cultural response scaling. There is an ongoing discussion regarding adjusting for cultures in the cross-cultural psychology literature. By not adjusting for the centered value scores, we are making an assumption and deviating slightly from the original method of handling data as per the Schwartz Value Theory. We are investigating if individuals’ risk perception relate with their *expressed* motivational values, hence we have chosen not to correct for any cultural bias when scoring values. We are aware of the possible cultural bias when not using centered value. However, we have chosen to take an exploratory approach to see if there are any tendencies to statistical significant connections between risk perception and motivational values in a broader sense.

Neither the responses for the hazards on the risk dimensions has been corrected for individual response scaling. Such a correction can be made by having the psychometric variables to be the deviation from the respondent’s answer to one of the hazards. Although such an approach removes the scaling problem, other potentially important information is also removed. It is considered hard to know whether a respondent express heightened dread for the hazards because that is what they feel or because they anchor their responses differently on the 1-7 scale. The study by Savage (1993) used this approach as a second type of analysis. However it was concluded that all the demographic coefficients became statistically insignificant, which “implies that the effect of demographics is in the scaling of perceptions and not in the relative positioning of the hazards” (Savage 1993).

As previously discussed, there are three main objectives with the analyses. In accordance with these objectives, analyses are made by first modeling demographic dependent variables for each of the ten hazards in order to compare the results to previous research. Next, the four higher motivational values are modeled as dependent variables for each of the ten hazards, and in the last analysis both demographic variables and value variables are included. To model the different categories within our demographic variables and to be able to make comparisons within the categories, dummy variables were created. We expect to find statistical significance for the demographical variables as they have been represented repeatedly in the academic literature. Because of the values being described as a guiding principle for people’s behavior a reasonable expectation would be to find tendencies in connections between risk perception and the higher motivational types. Only the last analysis will inform us if the higher motivational variables fell away or excluded the demographic variables.

All of the analyses use a stepwise approach, i.e. backward elimination, with the common limit for significance at 5%. Backward elimination starts with a model that includes all variables and eliminates the least significant at each step. Since we want to keep the variables in the model for easier presentation, removal rate was set to 0,99. All the statistical analyses are made with the statistical software SPSS v17.0.2.

3.6 Methodology Summary

The field study took place in three countries; South Africa, Sweden and USA. The survey was conducted by structured interviews using questionnaires as it is considered to be of great advantage for the survey. The sampling methods were a combination of non-probability sampling methods, as the purpose of the study is not to make any scientifically generalizations about the entire population. The questionnaire consisted of three parts; demographic questions, PVQ and an adapted version of the psychometric paradigm. It was established that the pre-set method criteria was met in order to conduct a quality survey.

A total of 293 complete questionnaires were collected during the field study in the three countries. Smaller groups were initially considered interesting for analyses, but limiting the respective sample sizes to 100 individuals or less rendered no significance when performing analyses for each country separately. Hence only the complete sample of 293 respondents was included in the analyses. Statistical analyses of the data were made by using binary logistic regression with dummy variables in the software SPSS v17.0.2. The binary logistic regression was chosen as the risk perception data showed to have an approximately bipolar distribution of high and low scores over the two risk dimensions. For the purpose of the statistical analyses, the ten value types were categorized into four higher order value types as theorized by the Schwartz Value Theory.

4 Results and analyses

A total of 120 binary logistical regression analyses were performed in SPSS. Because of the large number of analyses only statistically significant results are presented in tables in the following sections. The results are presented in the form of odds ratios. The ratio implies significance relative to a reference. For categorical variables, i.e. demographic categories, the reference variable is signified with the number “1” in the tables. The categories are then compared with this reference variable. If an odds ratio is larger than 1 it implies increased likelihood that the independent variable are explained by the dependent, relative to its reference group. If an odds ratio is smaller than 1 it implies decreased likelihood that the independent variable are explained by the dependent, relative to its reference group.

Significance appears if there are significant differences between the reference group and at least one other group within the categorical variables. When a variable show significance between only some of the groups within the categorical variable, the remaining groups are marked with square brackets. By adjusting the reference group for each analysis, a better fit is possible. However, for the purposes of this report we will establish significance with the categories and describe the significant differences within the respective categories only. To facilitate presentation of the results, the same reference categories have been used for all analyses, see Section 3.5.

Significance for higher order value types are in italics and marked with an asterisk. It should be noted that the interpretation of odds ratios for the higher order value types differs from the demographic groups. The higher order value types are always compared with the step before – not a reference category. For the interpretation of the odds ratio for the higher value types, the odds ratios are compared to the increase of one point on the response scale for that value type. Moreover, the increase is exponential, e.g. increase of two points corresponds to (Odds Ratio)², see illustrated examples in Figure 8. Differences between low and high scores for the higher value types can thus become large. For further clarification see the example using climate change and higher order value types in Section 4.1. Furthermore, an inherent shortcoming with the statistical model is that if the significant differences between odds ratios are too small, these variables are excluded from the model. This affects the results for higher order value types as a small difference in odds ratio can mean a large difference between high and low scores. However, because of this limitation these variables will not show in the results.

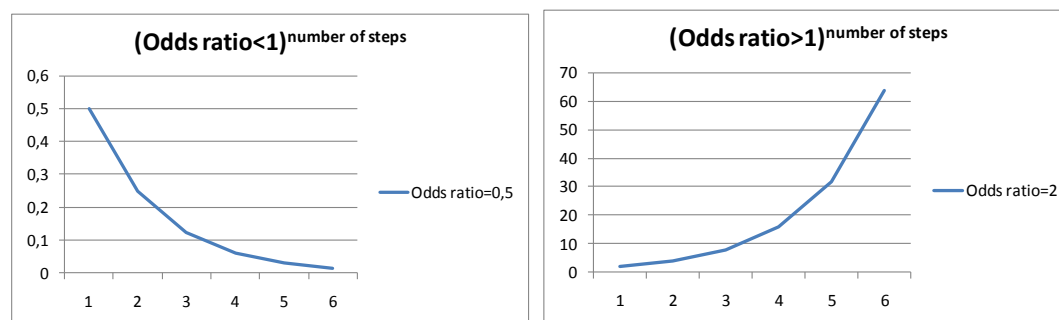


Figure 8: Exponentially decreasing and increasing odds ratios.

The results are presented chronologically under each of the respective cases, starting with the demographic variables only to predict risk perception dimensions. Secondly, an analysis with higher values groups alone as predictors is presented to map possible significant connections. The last analysis covers all predictors in one model to eliminate the ones with little explanatory values. The emphasis is on the combined analyses where the value variables are

adjusted for the demographic variables to see how they contribute to the regression model. However, performing and presenting the results from the other analyses serve the important purpose of reconnecting with previous research and theorizing about the importance of values as predictors. Comments will follow each analysis to point out interesting connections. The first case, high dread, will give a thorough explanation to how the results are interpreted.

4.1 High dread

For alcohol, the reference group is changed to South Africa, in lieu of USA, because no individuals from the US sample responded with the equivalence for high dread, i.e. 6 or 7, on the response scale.

	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	4,71	1		5,063	6,624	[3,147]	[3,738]	[3,341]	[1,14]	26,984
Sweden	[0,804]	0,027		[1,007]	[1,775]	[0,335]	0,214	0,214	0,28	[0,907]
Gender										
Male				1	1	1				1
Female				1,813	1,9	2,149	2,423			2,482
Age										
18-30									1	
31-45									2,418	
46-60									5,261	
>60									3,026	
Education										
Grade							1			1
High							1,407			0,386
Uni							0,263			0,255
Children										
No children										
Children										

Figure 9: High dread including demographic variables as predictors.

Overall, gender and culture are the two demographic variables with significance for most of the hazards in the study. All demographic variables have significant relationships for one or more hazards, except for the variable ‘children’ which does not predict high dread scores at all.

Culture shows significance in nine out of ten hazards as a predictor for high dread. South African individuals in the sample are more likely to score high dread than individuals from Sweden and USA in the sample. There is an exceptionally large difference in odds ratios between USA and South Africa for Nuclear power. It should be noted that there is an implied significance between Sweden and South Africa if they are on either side of the US being the reference variable. For example, although there is no statistically significant difference in odds ratios between Sweden and USA for Nuclear Power (1 and 0,9), the proximity of these ratios and the statistically significant difference between USA and South Africa implicitly means that there is a statistically significant difference between Sweden and South Africa. This would become apparent if the reference group is changed, however because of the large number of analyses this could not be done for each analysis specifically. Furthermore, Swedish individuals are less likely to score high dread for almost all the significant hazards than US individuals, with the exception of terrorism and stress. Both South African and Swedish individuals within the sample had higher likelihood for scoring high dread for terrorism compared to US individuals.

Gender differences are significant in five out of ten hazards. For all the significant hazards females have an approximately twice as high odds ratio for feeling high dread compared to men. Age groups are only significant for one hazard, Airplanes, where all the age groups have higher odds ratios for high dread compared to the reference group, i.e. 18-30 years. Education is significant for two hazards. For cancer, the higher educational levels have lower odds ratios

for feeling high dread compared to the reference group of Grade. However, Fire in home shows no continual results in the odds ratios between the different educational levels. The following table presents the results from the analyses with higher order value types as predictors.

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Values										
Self-enhancem	1,359*	2,034*			2,113*		1,644*			
Openness		0,521*			0,492*					
Conservation	2,095*	2,684*		1,878*		2,863*		1,935*	0,815*	0,573*
Self-transcend			2,209*					1,916*		

Figure 10: High dread including higher order value types as predictors.

All higher motivational values have significant relationship for two or more hazards and each hazard is represented by at least one motivational value. For Alcohol, values from the same orthogonal dimension are significant, i.e. openness and conservation, but with the odds ratios going in opposite direction. Conservation has an increasing odds ratio and Openness has a decreasing odds ratio, see Figure 11. Hence there seems to be no conflict between opposing higher value types as described in Section 2.1. This means that an individual with an increasing score for Conservation have a higher odds ratio for high dread while an individual who is considered the opposite, increasing score for openness has a lower odds ratio for high dread. Alcohol is the only hazard that seems to be affected by multicollinearity between the higher order value groups. The rest of the hazards are only represented by one of the higher order value types from the orthogonal dimensions.

Using climate change as an example, an individual who scores 5 on self-transcendence seem 10,8 times more likely than an individual who scores 2 on self-transcendence, to score high dread for climate change. The new odds ratio is calculated exponentially between 3 steps ($2,209^3 = 10,779$). Thus difference in self-transcendence appear to induce a large difference in how individuals score high dread for climate change when looking at higher value types only.

All variables are now included in one final regression model, rendering the ones with little contribution to the model to be excluded.

	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*		

Figure 11: High dread including all variables as predictors.

Values in Risk Perception

The demographic variables have removed many of the higher value types found in earlier analysis from the model. Seven hazards still show significant contribution by the higher order value types. The demographic variables appear to follow a similar pattern as with the previous model including only demographic variables. However, the higher order value types seem to have a larger impact with say a 3-step change (from 1-4, 3-6 etc), which can be considered from Low to High, used here only for reference. For example a three step change in self-enhancement renders $2,271^3 = 11,713$ times more likely to score high dread for terrorism, exceeding the odds ratio for culture (South Africa and USA) as well as gender.

For one hazard, Climate change, one of the higher value types, Self-transcendence, remains as the only significant predictor of high dread, excluding gender as significant.

Age groups remain significant for Airplanes with the same relation of odds ratios within the group as per the previous analysis for only demographic variables. Education shows significance for two hazards, AIDS and Cancer, both of which are biological illnesses. The results show that individuals in the higher educational levels, High and Uni, have lower odds ratios for high dread compared to the reference group of Grade.

4.2 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	1
South Africa	0,274	0,091	[1,283]			[0,433]	[1,506]	1,484	2,048	0,087
Sweden	[1,244]	[0,573]	0,407			2,27	3,729	2,837	3,081	0,681
Gender										
Male				1	1	1	1			
Female				0,342	0,453	0,395	0,58			
Age										
18-30	1					1		1		
31-45	1,983					0,287		0,443		
46-60	2,999					0,28		0,312		
>60	4,359					[0,343]		0,556		
Education										
Grade								1		
High								1,295		
Uni								2,867		
Children										
No children										
Children										

Figure 12: Low dread including demographic variables as predictors.

As per the analysis for high dread, 'culture' and 'gender' are the two demographic variables with significance for most hazards and 'children' had no prediction for any of the hazards for low dread.

Culture fell out as significant for eight of the hazards. Out of the eight significant hazards, seven were in common for previous analyses for high dread. South Africa has corresponding results for the analyses of high and low dread for AIDS, Alcohol, Fire in home and Nuclear Power. For these four hazards, South Africa has the highest odds ratio for high dread and the lowest odds ratios for low dread compared to the other countries. Hence, tendencies are that the individuals' in the South African sample tends to feel higher dread for these four hazards compared to the two other countries.

Gender is significant for four of the hazards. For all of those hazards females have almost half the odds ratio for low dread as compared to men, which means females tend to be less likely to score low dread for those hazards. When compared to previous analysis for high dread, there are three significant hazards in common for gender; Stress, Terrorism and Fire in home. For the three hazards the results corresponds, i.e. women have higher odds ratio for high

dread and lower odds ratio for low dread. Hence within this limited sample there are tendencies showing women feeling higher dread for these three hazards compared to men.

Age is significant for three hazards. For Fire in home and Airplanes, all the age groups has lower odds ratios for low dread compared to the reference group, i.e. 18-30 years. However for AIDS, the odds ratio increases with the age groups in the sample, i.e. with increasing age there is a higher probability of feeling low dread for AIDS. Education is only significant for Airplanes, which shows a higher odds ratio for the higher educational levels.

For the analyses only including higher order value types, the results are obtained as shown in Figure 13;

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Values										
Self-enhancem		0,698*			0,648*		0,747*			
Openness		1,864*			1,464*					
Conservation		0,56*				0,472*		0,614*		0,581*
Self-transcend			0,626*							

Figure 13: Low dread including higher order value types as predictors.

All higher motivational values have significant relationship for at least one hazard and seven hazards are represented by at least one motivational value. Same as per the high dread analysis, values from the same orthogonal dimensions, Openness and Conservation, are represented for Alcohol. However the odds ratios are going in opposite directions.

Furthermore, the results from the analyses correspondence with those for high dread, showing tendencies within this sample that individuals with high Openness have low odds ratios for high dread, but high odds ratio for low dread, hence tends to feel lower dread for Alcohol. Individuals with high Conservation have high odds ratio for high dread, but low odds ratio for low dread, hence tends to feel higher dread for Alcohol.

For the final analyses for low dread, all variables are now included in the regression model, rendering the ones with little contribution to the model to be excluded.

	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*							

Figure 14: Low dread including all variables as predictors.

The demographic variables have removed half of the higher value types found in earlier analysis from the model. Now, five hazards show significant contribution by the higher order value types. The demographic variables appear to follow a similar pattern as with the previous model including only demographic variables. Except for Openness, all the significant higher order values show an exponentially decreasing odds ratio for scoring low dread, i.e. an individual within the sample with a high score for self-enhancement, self-transcendence and conservation are less likely to score low dread for the significant hazards.

Culture is significant for seven hazards which is only one less than when only using demographic variables as predictors. Gender remains significant for four hazards, as per the previous analyses of the model. Considering that half of the significant higher order values fell away when combined with demographic variables, culture and gender can be regarded as strong predictors for low dread.

Age remains significant for two hazards after the combined analyses. Airplanes remain, although Fire in home was replaced with Motor vehicles. Motor vehicles showed the same tendencies as Airplanes, i.e. all the age groups has lower odds ratio for low dread compared to the reference group of 18-30 years. Education is excluded as a significant predictor.

4.3 Not informed

For AIDS, the reference group is changed to South Africa, in lieu of USA, because no individuals from the US sample responded with the equivalence for not informed, i.e. 1 or 2, on the response scale.

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Cultures										
USA	0		1							
South Africa	[1]		[1,777]							
Sweden	[0,67]		[0,204]							
Gender										
Male						1				1
Female						[2,789]				3,14
Age										
18-30			1			1				1
31-45			0,12			[0,198]				[0,505]
46-60			0,112			[2,462]				0,259
>60			0,095			[0,633]				0,113
Education										
Grade			1		1				1	1
High			0,174		0,286				[0,261]	[0,355]
Uni			0,068		0,228				0,159	0,244
Children										
No children						1				
Children						0,233				

Figure 15: Not informed including demographic variables as predictors.

Age and education are the most significant categories, with significance in three respectively four out of the ten hazards. All of the demographic variables are significant for one or more hazards. However, four hazards are not represented by significance from any of the demographic variables.

Culture is significant for two hazards. The results show that Sweden has the lowest likelihood of feeling “not informed” for both the significant hazards compared to the reference country. Regarding Climate change, South Africa have the highest odds ratio for feeling not informed compared to the two other countries.

Gender is significant for two hazards, nuclear power and fire in the home, in which both females have approximately three times higher odds ratio for feeling more uninformed than men. Age groups are significant for three hazards. For two of those, climate change and

nuclear power, all the age groups have lower odds ratios for feeling not informed compared to the reference group. Education is significant for four hazards, for which people with the higher levels of education (High and Uni) has lower odds ratios compared to the reference group. The odds ratios are continually decreasing for an increasing level of education. The tendencies within this sample are that individuals with a higher level of education have a lower likelihood of feeling not informed for those hazards. The variable ‘children’ is significant for one hazard, Fire in home, where individuals with children has an approximately four times lower odds ratio for feeling not informed.

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Values										
Self-enhancem	0,545*				0,569*					
Openness					1,646*		2,096*			
Conservation		3,484*	2,745*	1,892*	2,995*			2,014*	2,71*	
Self-transcend				0,348*			0,361*			

Figure 16: Not informed including higher order value types as predictors.

All the higher motivational values are significant for one or more hazards and eight hazards are represented by at least one higher order value type. Conservation is the most occurring higher value with significance for six of the ten hazards.

For terrorism there seems to be a conflict between opposing higher value types, i.e. openness and conservation. Both of the odds ratios are going in the same direction for these higher values which according to the theory they should not. This means that an individual within this sample with a high score for Openness has a high odds ratio for feeling not informed and an individual with a high score for Conservation (which is supposed to be the opposite of Openness) also has a high odds ratio for feeling not informed.

All variables are now included in the regression model for the final analyses, rendering the ones with little contribution to the model to be excluded.

	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*			

Figure 17: Not informed including all variables as predictors.

The demographic variables have removed three of the higher value types found in earlier analysis from the model. Six hazards still show significant contribution by the higher order value types. Furthermore, for five of the hazards; alcohol, stress, terrorism, motor vehicles and airplanes, higher order values are the only predictors of feeling not informed. The conflict

Values in Risk Perception

in odds ratios for opposing higher order value types for terrorism remains also after the combined analysis.

The demographic variables appear to follow a similar pattern as with the previous model including only demographic variables, where culture and age groups remains significant for the previous number and types of hazards while gender and education decreases with significance. For terrorism, education was previously a significant variable however it fell away when combined with higher order values.

After the combined analysis, Conservation only remains significant for two of the hazards in lieu of six. Self-enhancement increased as a predictor and is now significant for three of the hazards where previously it was two.

4.4 Well informed

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Cultures										
USA	1				1			1	1	1
South Africa	[0,331]				[1,345]			3,144	4,084	16,398
Sweden	0,285				0,451			[1,035]	[1,748]	2,717
Gender										
Male				1						1
Female				0,597						0,493
Age										
18-30	1								1	1
31-45	4,231							[1,201]		[1,342]
46-60	[1,477]							[1,253]		2,447
>60	3,097							4,674		6,35
Education										
Grade	1		1							
High	[2,364]	[0,776]								
Uni	4,358	[2,314]								
Children										
No children										
Children										

Figure 18: Well informed including demographic variables as predictors.

Culture is the variable that is significant for most hazards, five out of ten hazards. All demographic variables have significant relationships for two or more hazards, except for the variable “children” which does not predict “well informed” at all.

For almost all of the significant hazards South Africa has the highest odds ratios of the three countries. The exception is AIDS, where both South Africa and Sweden has almost three times lower likelihood of feeling well informed, compared to USA. Similar to the results for the high dread analysis, South Africa has an exceptionally high odds ratio for feeling well informed about Nuclear power compared to the other countries.

Gender is significant for two hazards, where females had approximately half the odds ratio for feeling well informed as compared to men. When compared to previous analysis for not informed, Nuclear power is in common for being significant for both the analyses. The results for Nuclear power also correspondence between the analyses, i.e. females have a higher odds ratio for feeling not informed and a lower odds ratio for feeling well informed. Hence within this limited sample there are tendencies showing women feeling less informed about Nuclear power.

Age is significant for three hazards. For all three hazards, all the age groups have higher odds ratios for feeling well informed, compared to the reference group. For cancer and nuclear power, the odds ratios increase continually with the increase in age groups. Education is significant for two hazards. For both hazards the highest level of education has the highest

odds ratios for feeling “well informed” compared to the reference group. However, for Alcohol the odds ratio does not increase continually for the level of education.

	AIDS	Alcohol	Climate change	Stress	Terrorism	Fire in home	Motor vehicles	Airplanes	Cancer	Nuclear power
Values										
Self-enhancem					1,87*			1,733*	1,706*	1,371*
Openness								0,629*	0,521*	
Conservation	0,445*									1,479*
Self-transcend	2,694*	1,736*	1,623*				1,9*	1,636*		

Figure 19: Well informed including higher order value types as predictors.

All higher motivational values have significant relationship for two or more hazards. Seven hazards are represented by at least one higher order value. Self-transcendence is the most occurring value with significance for five hazards. As for the analysis for not informed there seems to be a conflict between opposing higher value types. For airplanes and cancer the odds ratios for self-enhancement and self-transcendence are going in the same direction, which is a curious result considering they are on opposite ends of the orthogonal axis.

For the final analyses for well informed, all variables are now included in the regression model, rendering the ones with little contribution to the model to be excluded.

	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*	

Figure 20: Well informed including all variables as predictors.

The demographic variables have removed many of the higher value types found in earlier analysis from the model. Five hazards still show significant contribution by the higher order value types. The conflict in odds ratios for opposing higher order value types for airplanes and cancer remains also after the combined analysis.

For the demographic variables, culture, gender and age all decreases in significance with one hazard. However, the variable of children became significant for two hazards, previously none, after the combined analysis.

4.5 Results summary

There seem to be tendencies within this limited sample showing values are significant for the majority of the hazards chosen for this study. These tendencies will be discussed in the remainder of this report.

5 Discussion

The results within our limited sample indicate tendencies for significant connections between higher motivational values and risk perception dimensions, and by extension, values in general. In the sample, values also had a significant odds ratio different from the score of 1, implying that the findings have strong impact with change in the respective values. The hypothesis that there is a quantified relationship is supported by the results indicating that there is a continuous relationship extending over the low and high categories of the risk dimension. However, because of the data distributions and statistical methods used, we cannot quantify this relationship at this time.

The main subject for discussion is the analyses where the value variables are adjusted for the demographic variables and how they contribute to the regression model. Discussing the other analyses serve the important purpose of reconnecting with previous research and in theorizing about the importance of values as a predictor. The discussion follows the chronological order of the analyses performed, i.e. starting with risk perception dimensions and demographic variables.

In general, the results from the analyses with demographic variables seem to predict risk perception dimensions similar to what has been concluded by previous research. The variable 'culture' appears in our demographic analyses as the most robust predictor, with the remaining variables appearing less frequently. The significance in culture is largely represented by differences between the reference group USA and individuals in the South African category. The Swedish category does not show statistically significant differences for many of the analyses indicating similarities in answering patterns with USA. Through manipulation of the reference groups for each analysis individually, it would be possible to show similar differences between Sweden and South Africa. Because of the sheer number of analyses as well as the little additional information it would add, reference categories remained set. Females seemed to predict higher scores on dread, compared to 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 be more concern about the risks of different hazards (Flynn et al 1994; Savage 1993). Age, education and children have most frequently occurring significance in the cases of *well informed* and *not informed*. These findings differ from the research by Savage (1993) where the explanatory power for the unknown factor is low and no consistent general statements could be made with regards to the demographic variables. The sole exception is that the oldest age group showed tendencies for more likely feeling well informed about cancer compared to the reference group, which corresponds with Savage's results. The variable 'Children' seem to have little to do with describing risk perception dimensions within our sample.

There is conflicting information in the analyses for low dread with regards to cultures. Half of the hazards show South African individual being less likely to score low dread, while half show them being more likely. There are possible explanations for both cases. The results from the high dread scenario support a lower likelihood for South African individuals to score low dread. South African individuals however, seem to express more extreme scores making it difficult to draw conclusions from these results.

The values seems to have many relationships with the risk perception dimensions when using the variables as sole predictors, with all the higher order value types showing significance for a majority of the hazards across all four analyzed cases. There seem to be a few occurrences when the results appeared with two higher order values for the same orthogonal axis (see values theory in Section 2.1). However, where they occurred there appears to be corresponding relationships, i.e. one odds ratio above and one below 1. After adjusting the

model for the demographic variables, about half of the value variables are excluded from the model. It is noted that while some higher order value types are excluded this way, so are demographic variables. This indicates stronger contributions by the values for the respective hazards. When adjusting for demographic variables, values are still represented in a majority of hazards across all four cases. The values also seem to predict risk perception for some hazards where demographic variables cannot in our sample, most notably for the dimension *unknown*. For *unknown*, motivational values appear to predict both a larger number of hazards than the demographic variables and with greater power, because of the values' exponential nature in the statistical model (comparing low to high ratings).

There are occurrences where the higher order value types are the only remaining predicting variables. In the case of "not informed" five hazards are represented with higher order value types alone. We find the result interesting in particular since it implies that values seem to explain the variance in the risk dimension better than the demographic variables. Previous research by Savage (1993) did not find any general connections between demographic variables and the unknown dimension for the four hazards chosen in that study, which are all included in our study as well (replacing stomach cancer for simply cancer). There is thus potential for that motivational values may explain the risk perception dimension better. Similar results are found for the *dread* dimension, where the values seem to predict dread with similar or higher strength as the odds ratios between demographic groups.

It should be noted that the statistical model does not allow for us to capture the finer details of the values spectra. Odds ratios close to 1 cannot be found in the results as they within our limited sample do not produce a statistical difference. For example, an odds ratio of 1,2 might fall away as not being significantly different from 1. However the difference over three steps result in an odds ratio of $(1,2)^3 = 1,73$, which implies a greater change than between many of the demographic variables. For this reason, the statistical model may underestimate the significance of motivational values on risk perception dimensions. Because of this limitation we can only present the stronger relationships.

There are more specific observations regarding individual higher value types within our analyses. Self-enhancement is significant for terrorism for all four cases. Individuals with high Self-enhancement tend to feel high dread and less informed about terrorism. Self-enhancement also had corresponding results for high and low dread for motor vehicles. Higher self-enhancement seems associated with higher dread for these accidents. But, why would values like achievement and power (see Figure 2, p.6) be associated with high dread for terrorism? One reason might be that it is because people sharing these values feel an increased threat to their personal achievements, and lack of control of the outcome. Climate change is an interesting hazard because of the relative novelty to the public risk perception. In the analyses, self-transcendence proved significant for both high and low dread for climate change, where higher scores of self-transcendence seem to correlate with higher perceived dread for climate change. People oriented towards self-transcendence emphasize enhancement of others and transcendence of selfish interests, i.e. welfare and interest of others. Self-transcendence might be associated with high dread for climate change since the threats from climate change will affect the future risks on a global level, and in many cases developing countries are most exposed to such threats. The demographic variables showed no conclusive results for this new hazard. When compared to earlier research using expressed values, our results seem to indicate similar attitudes as Sjöberg (2008) who found little significance for the influence of motivational values on the hazard of nuclear power. Nevertheless, the higher order value types are represented for other hazards often enough to suspect an underlying connection between values and risk perception.

Analyzing the results and finding one or two of the higher order value types represented may not seem like proof that a connection between motivational values and risk perception exist. Having all higher motivational types significant would actually say very little about the

explanatory value of motivational values. It would imply that all four types of values would predict risk perception dimensions in the same way. The result that one or a more of the higher motivational groups show significance is what is important to our study.

Based on earlier discussions there are certain biases present when conducting field survey work that needs to be discussed. These biases are present in both risk perception and values data and are dealt with in different ways in the academic literature. Cross-cultural psychology sometime uses an approach of normalizing the individual scores. Thus there would be less weight for an individual rating high if he or 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 (see values theory in Section 2.1). We are careful to normalize the individual's scores since we are investigating if individuals' *expressed* motivational values predict their risk perception, hence we do not want to "correct" for their cultural response scaling or anchoring effects. The main reason for using the expressed data is because it is considered almost impossible to know whether the respondent simply feels heightened dread or if they anchor their responses differently as per previous discussion. While using centered scores may give different results they are not part of the purpose of this thesis.

Considering our sample populations, South African individuals seem more likely to use extreme scores in our sample, where as fewer of the US and Swedish individuals seem to use extremes. This is manifested with the high odds ratios compared to the US. Linking to the discussion presented above there are two possible explanations; that more South African individuals actually feel a high degree of dread or because there is a cultural bias when scoring the questionnaire. As previously discussed, one of the chosen African language group Setswana, do not habitually make use of scales. While the questionnaire was adjusted for this purpose and measures taken to mitigate the possible source of error as discussed in the methodology chapter, there is no closer measure on exactly how great the effect is. For some hazards there is reason to believe that South Africa would have a higher sense of dread because of the availability in that part of the world, e.g. AIDS. There is however other hazards, like the relatively new hazard climate change, where it is harder to theorize about why South African individuals would have a higher odds ratio. A cultural bias seem obvious when looking at the hazard of nuclear power, where individuals from the South Africans sample showed to be 26 times more likely to rate higher dread for nuclear power and 23 times more likely to rate well informed than US individuals. The result is odd (as well as out of proportion) considering that some individuals from South Africa seemed to have little knowledge about what nuclear power comprise of, which is discovered when conducting the interviews. We note that the example of nuclear power is extreme but it does come with an important point of showing that there are biases inherent in our method, albeit attempts has been made to mitigate them. Further investigation of the affect of cultural biases are 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. Although the cultural biases are the most obvious to identify, it should be noted that there might be biases linked to other variables such as gender, education or values present as well. A larger sample would probably show significance and the cross-cultural biases more clearly.

While we believe there is an effect of the cultural bias we believe it 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 quiet robust in this respect.

Furthermore, biases relating to the expressed motivational values may also be present. The respondents in our study are chosen at random and not given compensation for their time. While there have been much longer studies conducted in the risk perception field, there have

usually been some sort of compensation. A practical issue for creating our survey and yet obtaining quality data was to limit the size, and hence the time, of completing the questionnaire. In the US and Sweden, there seemed to be some individuals getting impatient and answering quicker, possibly not thinking every question through completely which may have affected the result. For our study, we may have benefited from using a shorter version, like the PVQ21, and in exchange might have had the possibility of collecting a larger data sample. As previously discussed, some respondents also found it confusing having two statements in one item making it hard to give an accurate response. Given that the response scale has no middle option to express neutrality respondents may have anchored their responses differently on the scale. An improved version of the PVQ is currently being worked on to cover some of the points mentioned, including the use of two statements in one item. One strong point with using the PVQ is the process of externalizing the user, so as to give more accurate answers. While we see the potential in this, we feel it might also increase the social desirability bias. It is probably easier to agree with a positive statement about a person, albeit fictive, than to disagree especially for use in face-to-face interviews because of added social pressure. A refined version of the PVQ is under construction by the originator, but is of yet not published. The refined version includes only having one statement for each item, extending the questionnaire to include 57 items. The number of value types increases bringing forth the sub values inherent in the values theory. The practical use of the 57 item PVQ for field studies can be discussed and the added number of questions would probably not have had a positive effect on our study, but the positive aspects of extending it might have greater weight in this respect.

There is also an inherent benchmarking of values in the questions. For example, there are items meant to elicit the value of tradition, but tradition is viewed in different contexts for different cultures. Thus, identical questions might turn out to mean different things in different cultures. The problem of conveying information in different cultures is not a new problem, but might be a significant one. When translating our questionnaire into the South African languages special care was taken to ensure that not only the words and meanings is conveyed but also translated from the standpoint of the respondents in lieu of the social scientist. Merely translating the words may not be enough. We got the insight for free when forced to translate for quality, however we believe it can affect a study. To avoid the issue of having to spend time and resources on back translation, the pre-test the questionnaire should be tested in the actual countries subject for the study.

One limitation in our study has been the complex mapping of dependencies between the respective motivational values and higher value types, but also between values and the demographic variables. It is 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. Thus, it is important to note that the South African individuals in the townships are not representative to South Africans in general. The living conditions in the townships are most likely affecting which values are developed on an individual as well as on a community level. The purpose of choosing townships as a scene for our survey is rather to add individuals from different settings and analyzing the values across demographic groups. We have not further analyzed the multidimensional nature and interdependency of the higher order value types. We are aware of the possibility of intercollinearity in our values data and we realize that including all four higher order value types may not be ideal. One approach taken in cross-cultural psychology is only to include some of the higher order value types, which would have been theorized to effect the risk perception in certain way. To include only for example Self-Enhancement and Openness to describe the hazard of AIDS would be a poor approach from an exploring perspective since we have not been able to theorize about each of the 120 analyses. Usually multidimensional scaling analyses are used for further mapping these interdependencies, but are in excess of our statistical knowledge and time frame for this thesis. The purpose of our approach is instead to explore all connections, covering the big

variances in risk perception dimensions. Hence, statistical models have been used to keep within the limitations of our statistical knowledge and obtain results suitable for our purposes.

This is a pilot study in the field using exploratory methods to investigate a hypothesis. There may very well be, and probably are, other clusters of values that can provide a researcher with better analyses and taking values deeper down the rabbit hole. There seem to be a grey zone between no significance for values and large significance with odds ratio extending beyond a factor two. A reasonable assumption is that values extend into this grey zone and can only be explained with finer statistical methods and larger samples. One of our theoretical limitations include the statistical knowledge to find clusters of individuals sharing motivational values and using the knowledge to more accurately map dependencies among the motivational values. Aware of the limitations of the study, we hope that the results have the potential to inspire zealous researchers from the risk perception and values fields to take the findings further. Future research may include using more advanced quantitative methods for statistical relationships and qualitative methods in order to get a better picture of what really affects risk perception and values.

6 Conclusion

Values seem like a sound platform for examining risk perception in a different and maybe more universal way than many of the previous approaches. Our study suggests that there may be something more fundamental than mere demographics that govern our risk perception. The results support the hypothesis 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 our sample, which are some of the variables described in great length in the literature as predictors of risk perception. Although we cannot quantify the exact relationship in this study the relationships seem to be of similar strength or stronger than the demographic variables.

Values bring potential to extend to 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. We believe there may be great rewards in shifting the focus of risk perception research to variables that can be measured across demographic groups.

To guide us in our research purpose we set out to answer the following question:

How do individuals' expressed motivational values compare to demographic groups in predicting risk perception?

- Values seem to predict risk perception dimensions more often than four out of the five demographic variables for the dimension *dread* and more than all demographic variables for the dimension *unknown*. Where significant, the values generally seem to explain more of the variance than the demographic variables in our limited sample. However, keeping in mind that the sample size is relatively small and that crude statistical methods are being used, more research is needed in order to further explore the relationships between expressed motivational values and risk perception.

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Personal communication references:

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Appendix A – Questionnaires

1. English Male

2. Swedish Female

3. Setswana

4. Xhosa

Please fill in the information below.

Gender		Age		Education		Do you have any children?	
Male	<input type="checkbox"/>	18-30	<input type="checkbox"/>	Number of		Yes	<input type="checkbox"/>
Female	<input type="checkbox"/>	31-45	<input type="checkbox"/>	years in school	_____	No	<input type="checkbox"/>
		46-60	<input type="checkbox"/>				
		60+	<input type="checkbox"/>				

Thank you for your cooperation!

Var vänlig och fyll i informationen nedan.

Kön		Ålder		Utbildning		Har du barn?	
Man	<input type="checkbox"/>	18-30	<input type="checkbox"/>	Antal år i skola	_____	Ja	<input type="checkbox"/>
Kvinna	<input type="checkbox"/>	31-45	<input type="checkbox"/>			Nej	<input type="checkbox"/>
		46-60	<input type="checkbox"/>				
		60+	<input type="checkbox"/>				

Tack för din medverkan!

Ka kopo, tlatsa tshedimosetso e e ka mo tlase:

Bong		Dilemo		Dithuto		A o na le bana?
Monna	<input type="checkbox"/>	18-30	<input type="checkbox"/>	Palo ya dilemo tse o tseneng sekolo	_____	Ee, ke na le <input type="checkbox"/>
Mosadi	<input type="checkbox"/>	31-45	<input type="checkbox"/>			bana
		46-60	<input type="checkbox"/>			Nyaa ga ke na <input type="checkbox"/>
		60+	<input type="checkbox"/>			bana

Re leboga tirisano mmogo ya gago!

Nceda ugcwalise ulwazi olungezantsi:

Isini		Iminyaka		Imfundo		Ingaba unabo abantwana	
Indoda	<input type="checkbox"/>	18-30	<input type="checkbox"/>	Faka inombolo yeminyaka yakho ufunda	_____	Ewe	<input type="checkbox"/>
Inkosikazi	<input type="checkbox"/>	31-45	<input type="checkbox"/>			Hayi	<input type="checkbox"/>
		46-60	<input type="checkbox"/>				
		60+	<input type="checkbox"/>				

Enkosi ngentsebenziswano yakho!

Appendix B – Amendment

I am a Swedish student doing this study as part of my master's in disaster risk management. The objective of this study is to find out if there is a connection about individuals' motivational values and how individuals' relate to risk. The study is important because learning how people truly feel about risks in society affects where the government spends the money.

The results of the study are anonymous and will be assembled in Sweden.

Below are a number of people described. Please describe how much you share the views of these people by putting an 'X' in the boxes to the right. The scale range from 'Not like me at all' to 'Very much like me'.

Fill in the box that describes you best. Observe that there is no right or wrong answer.

Example:

She/he likes to hurt people. She/he smacks someone if she/he is angry. [Scale 1-6 + explanations]

If you look exactly like this person you mark 6, but if you differ a lot from them you would mark 1. You can think where you fall in between 1-6 you can mark where you think. If you once smacked someone you can mark 3 because then you are only a bit like she/he."

Appendix C – SPSS Output files

Output files are available through a Lund University database, which can be accessed through; <http://www.lu.se/student/uppsats-exjobb-och-examensarbete/soek-uppsatser-och-examensarbeten>

