Demographic and Psychological Factors and Preparation for Earthquakes

by

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ABSTRACT

New Zealand, like many countries, is at risk from a number of natural disasters including flooding, volcanoes, and earthquakes. The risk of exposure to such disasters over the course of a lifetime is substantial (Norris, 1992). Despite this, many New Zealanders are unprepared for the consequences of a natural disaster; nearly a quarter of New Zealand homes have flaws which could see them seriously damaged or detached from their foundations in a major earthquake (Ansell & Taber, 1996). Recent research suggests that psychological variables contribute to people's lack of preparation for natural disasters. A limitation, however, of much of this research has been the lack of attention paid to the psychometric quality of the instruments used to measure key constructs. The present investigation aimed to examine the relationships between different dimensions of personality and earthquake preparation in a large sample of Wellington residents using psychometrically sound measures. Measures of locus of control, risk, and earthquake preparation were first evaluated in a series of studies using both university students and Wellington residents. These questionnaires were then administered, along with items pertaining to the construct of unrealistic optimism, to a total of 358 Wellington residents. The results showed that locus of control, risk precaution, home ownership, and length of residence were significant predictors of earthquake preparation. Moreover, people exhibited evidence of unrealistic optimism, as demonstrated by both a belief that they were better prepared for a major earthquake than an acquaintance, or other Wellingtonians, and by a belief that they were personally less likely than others to suffer injury in a major earthquake. The implications of these results for emergency managers are discussed and several recommendations are made.

CONTENTS

APPENDIX

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 – INTRODUCTION

In regard to natural disasters New Zealand is a hazardous place to live. It is a small island nation surrounded by ocean and it sits on the top of two tectonic plates. New Zealand has unpredictable weather patterns which can lead to floods and cyclones, and tectonic plate movement which can lead to volcanoes and earthquakes.

In New Zealand's recent history there have been a number of significant natural disasters. Volcanic activity on Mt Ruapehu led to the 'Tangiwai Disaster' in 1953, where the collapse of a natural dam resulted in a flood of hot water that swept down the mountainside and formed a lahar which killed 151 people aboard a train heading north. In the 1931 Napier earthquake, 256 people died and the cost of the damage ran into many millions of pounds (Cox & Hayward, 1999). The most recent major earthquake in New Zealand, the Edgecumbe Earthquake in 1987, was 6.3 in magnitude on the Richter scale but occurred at a shallow depth of 8 km from the surface. Damage included railway lines buckling, water and sewage pipes breaking, and the blockage of roads by landslides. With regard to weather, New Zealand is most at risk from heavy rain (Brenstrum, 1990). Cyclone Bola in 1988 brought severe flooding to the Gisborne district, with 419 mm of rainfall recorded in one location. Damage was estimated at $90 million, with three people drowned (Brenstrum, 1998).

In addition to the natural disasters that have taken place in the past, there are a number of potential disasters that could occur in the future. Auckland, New Zealand's largest city, sits on an active hot-spot which has created 49 volcanoes in the past 150 thousand years. Current estimates suggest that there is a three percent chance of an eruption occurring in Auckland in the next 100 years and that the resulting damage could put 300,000 people in danger and cost $10 billion dollars (Ansell & Taber, 1996).

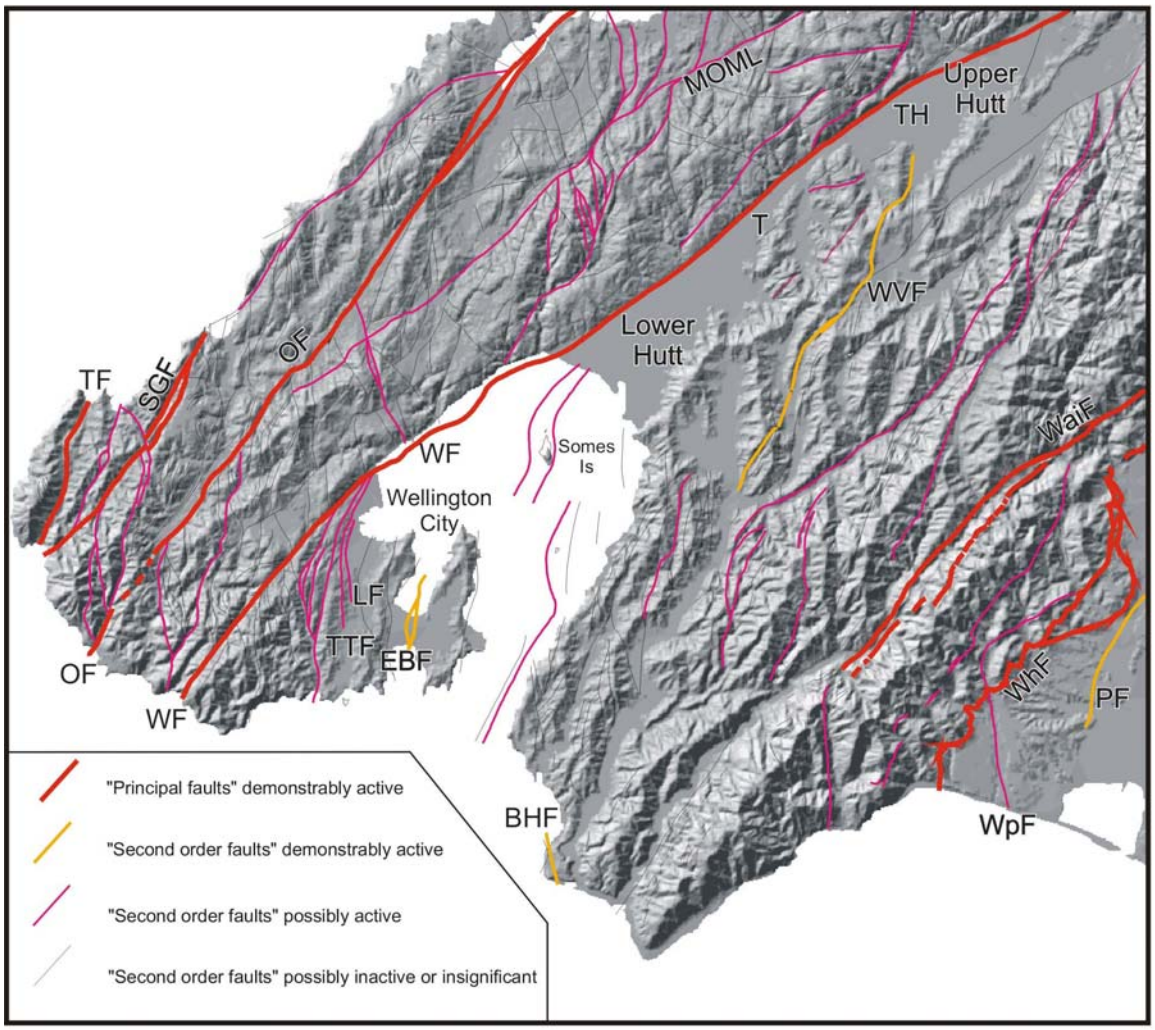
Similarly, Lake Taupo, situated in the central North Island of New Zealand, has been an active volcano for 300,000 years. An eruption there 26,000 years ago was

one of the largest eruptions ever to occur on the planet, throwing out 800 km^3 of volcanic material, and burying the entire country in a centimetre of ash (Cox & Hayward, 1999). A more recent eruption in 186 AD lasted several weeks. Subsequent volcanic activity has produced the lake as it is today, but it is unknown when Taupo will erupt again or what the consequences of the eruption will be. Researchers are currently investigating the complex network underneath the lake to determine the likelihood of another eruption.

New Zealand's capital city, Wellington, sits near to six fault lines (Ansell & Taber, 1996). The largest earthquake in recent times was in 1855 (Downes & Grapes, 1999) estimated to have been 8.2 in magnitude on the richter scale. In this earthquake, the fault ruptured the land over 75 km and lifted the ground on the western side by up to 6.5 m. The coastline was moved upwards by 1.5 m. Two more recent, but smaller, earthquakes were recorded in 1942, but there have been no major earthquakes since. Of the six faults, the one that is of greatest concern is the Wellington fault (Figure 1.1). This lies one kilometre from downtown Wellington and runs along the foreshore of Port Nicholson through to Lower and Upper Hutt. The region's road, rail, water, sewage, and electricity supply all run along the Wellington fault. The fault breaks on average every six hundred years, with an expected magnitude of 7.5 on the richter scale. Typically, the Wellington fault moves 4 m horizontally and 1 m vertically. Should such an event occur it would be compounded by the soil composition that much of Wellington is built on. Lambton Quay, a major part of the Central Business District, is situated on reclaimed land. Under certain circumstances, the soil composition could either magnify the effects of an earthquake or the ground could liquefy, causing buildings to sink. Current estimates suggest that the likelihood of any one of the six faults breaking in the next 50 years is between 40 and 45 percent.

Figure 1.1

Wellington Region Fault Lines (courtesy of the Institute of Geological and Nuclear Sciences)



TF = Terawhiti Fault; SGF = Shepherds Gully Fault; OF = Ohariu Fault; MOML = Moonshine/Otaki/Mangaroa lineation; WF = Wellington Fault; TTF = The Terrace Fault; LF = Lambton Fault; EBF = Evans Bay Fault; BHF = Baring Head Fault; WVF = Whitemans Valley Fault; WaiF = Wairarapa Fault; WhF = Wharekauhau Fault; WpF = Wharepapa Fault; PF = Papatahi Fault; T = Taita; TH = Trentham-Heretaunga area.

Human Response to Natural Disasters

Although natural disasters such as earthquakes cannot be prevented from occurring, the damage caused by these events can be reduced (e.g., Ansell & Taber, 1996; Kreps, 1984; McClure & Williams, 1996; Sorenson & Mileti, 1987). How well people prepare for a disaster before it occurs can determine the scale of the damage (Kunreuther, 1974). Where little or no preparation is made for a natural disaster then the losses suffered can be catastrophic. However, when steps are taken to prepare for natural disasters, the losses can be substantially reduced.

Preparation for a natural disaster can occur at a number of different levels, from Government agencies, to local bodies such as city councils, through to preparation at a household or individual level. At a national and local governmental level, standards for the design of new buildings can be enforced and existing structures can be upgraded. Areas of high risk can be identified and zoning requirements developed to reflect that risk. Government can provide help for victims after disaster has struck. But while government may play a role in reducing vulnerability, individuals also need to act to limit casualties and property damage. Individuals can prepare for a natural disaster before it happens either by ensuring that their homes meet current building standards or by making sure that they have the appropriate provisions for survival after a disaster. Individuals can also live in low risk buildings and locations.

However, a key finding to emerge from natural disaster research is the lack of preparation that many individuals have made for such disasters (e.g., Edwards, 1993; Farley, Barlow, Finklestein, & Riley, 1993; Kunreuther, 1974; McClure, Walkey, & Allen, 1999; McClure & Williams, 1996; Mileti & Sorenson, 1987; Sorenson & Mileti, 1987; Weinstein, 1987a). Jackson and Mukerjee (1974) found that only 7.5% of their sample had made structural changes to their homes or purchased insurance, and Rustemli and Karanci (1999) found that their participants had adopted an average of only two precautions for an earthquake. Turner, Nigg, and Paz (1986) found that although many California residents surveyed had undertaken simple preparations for a major

earthquake, nearly 50% of participants would be without first aid supplies following such a disaster.

Although no comprehensive theory has yet been developed to explain why some people prepare for a natural disaster while others do not, a number of theorists have attempted to identify the psychological processes that contribute to a lack of preparation. Explanations have been offered from a cost – benefit perspective (e.g., Mileti & Sorenson, 1987) and from a risk framework (e.g., Slovic, Kunreuther, & White, 1974). Researchers have examined the role of traits such as locus of control (e.g., Schiff, 1977) and related constructs such as fatalism (e.g., Turner et al., 1986) and helplessness. Recent research has also examined the construct of unrealistic optimism in relation to earthquakes (e.g., Helweg-Larson, 1999).

Cost – Benefit Explanations

Early conceptualisations of decision-making were based on models of expected utility (e.g., Coombs, Dawes, & Tversky, 1970), whereby decisions were made with the likely costs and benefits considered. Since it is impossible to make a decision that will turn out best for every eventuality, decision theorists viewed choice alternatives as gambles where individuals chose according to the 'best bet'. Applied to natural disasters, people can make decisions based on the probability of harm if a precaution is adopted or not, the amount of harm that would be experienced with and without taking the precaution, and the cost of adopting the precaution (Slovic, Fischhoff, & Lichtenstein, 1987). Von Neumann and Morgenstern (1953) developed a formal justification for the expected utility criterion by showing that if an individual's preference satisfied certain basic axioms of rational behaviour, then their decisions could be described as the maximisation of expected utility. However, a criticism of the expected utility model is the problem of listing all the alternative behaviours and scaling the subjective outcomes and their likelihoods, so that subjective utility can be calculated for each alternative. In many situations there is often a wide range of theoretical

alternative behaviours and the number of possible outcomes is varied and complex, thus it may often be inappropriate to apply the expected utility model.

Slovic, Kunreuther, and White (1974) and Mileti and Sorenson (1987) describe an ideal process that people should engage in when faced with a potential natural disaster. In this process, individuals first assess the probability of a hazardous event, and second, review the behaviours available to them to reduce the risk. At the third step, an evaluation is made of the impact of these behaviours on reducing the risk and also on the consequences of adopting these behaviours on other aspects of their lives. Finally, individuals decide which precautions, if any, they adopt.

However, there is often a poor relationship between awareness and action. Flood-plain dwellers often remain in their homes when the floodwaters are visibly rising around them (Turner et al., 1986). McClure et al. (1999) found no relationship between judgements of the likelihood of a major earthquake and the precautionary measures adopted. Jackson (1981) examined the link between an awareness of the possible actions to reduce risk from an earthquake and the actual precautions adopted. Of all the possible actions that people could take to prepare for an earthquake, participants could only identify a narrow range. Furthermore, the range of precautions actually adopted by participants was even smaller than the perceived range of available behaviours. These results suggest that, at an individual level, decisions about preparation against natural disasters are not well explained by cost – benefit models.

Risk Perspectives

The term ‘risk’ is used widely in psychological, sociological and geographical research. However, the meaning of the term is often unclear. Often there is an interchangeable use of the terms risk and accident rate. The term risk is also used to indicate danger, stressing the more subjective aspects of risk (Oppe, 1988). Most definitions of risk involve the issue of loss. For example “the chance of loss” (Furby & Beyth-Marom, 1992, p. 2) or the “expected loss of an alternative to be chosen” (Oppe,

1988, p. 435). Yates and Stone (1992) offered a more comprehensive definition which considers the additional risk characteristics of "(a) losses, (b) the significance of these losses, and (c) the uncertainty associated with these losses" (p. 23). Similarly Tonkin, Cox, Blackman, and Sheps (1990, p. 29) proposed that "Risk includes any behaviour involving a lifestyle choice that increases the potential for physical and/or psychological harm to the individual who makes that choice". In using the term "lifestyle choice", Tonkin et al. implied that risk is both a conscious decision and that there is also some degree of volition in such decisions (Anstiss, 1998). While an element of choice is present for many risks, there are other risks where choice is not so evident (e.g., living in an area subject to natural disasters). A suitable definition that encompasses this aspect of risk is given by Manuele (1994, p. 71) "Risk is a measure of the probability and severity of adverse effects." In this definition, decisions to engage in risk taking behaviours and issues of free will are not considered when assessing exposure to risk.

Underlying the rational model of decision-making is the presumption that people are well-informed, utility-maximising decision-makers (Slovic et al., 1987). An alternative to this model has been proposed by Slovic and colleagues (e.g., Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978; Slovic, 1987, 1993; Slovic, Fischhoff, & Lichtenstein, 1976; Slovic, Fischhoff, & Lichtenstein, 1977; Slovic et al., 1987; Slovic, Fischhoff, Lichtenstein, Corrigan, & Combs, 1977; Slovic et al., 1974), whereby people's perceptions of risk influence the precautions adopted (Mileti & Sorenson, 1987). Early work in this paradigm examined the cognitive components of risk, while more recent work has examined the affective components of risk and the sociopolitical dimensions. Researchers have also examined risk from the viewpoint of a relatively stable trait (e.g., Lambert, Burroughs, & Nguyen, 1999; Zuckerman, 1994).

Researchers studying the cognitive aspects of risk perception have identified a number of heuristics, or mental shortcuts, that people use to make judgements (Johnson & Tversky, 1984; Kahneman, Slovic, & Tversky, 1982; Kahneman & Tversky, 1973; Tversky & Kahneman, 1973, 1974). These heuristics are employed under

conditions of high mental load to reduce complex judgements to simple judgements. For example, residents of floodplains have difficultly conceptualising floods that have never occurred, and instead use a mental representation of the most recent flood to estimate potential damage for future floods (Slovic et al., 1974).

Tversky and Kahneman (1974) identified three heuristics which they argue are influential in the perception of risk. One heuristic, the availability heuristic, is employed when people assess the probability of an event by the ease with which instances or occurrences can be brought to mind. Greening, Dollinger, and Pitz (1996) found that adolescents who had experienced lightning disasters subsequently had elevated risk judgements for similar future events. In that study, they proposed that the availability heuristic mediated the relationship between experience of the disaster and estimates of risk. A second heuristic people employ is the representativeness heuristic, whereby probabilities are evaluated by the degree to which one event is judged to resemble another. This heuristic can lead to biases in judgements of risk when people ignore the prior probabilities with which events have occurred or the sample of events from which they are sampling from, e.g., a judgement that the previous earthquake which occurred is representative of potential earthquakes in the future. A final mental shortcut used to make judgements is the 'anchoring and adjustment' heuristic. In this process, a natural starting point is used as an anchor for a first approximation of an event occurring and the anchor is then adjusted to accommodate additional information. When this heuristic is used for decision-making, people tend to believe that they are 100 percent correct in their judgements, although they often fail to take into account the numerous errors that could exist in their computation (Slovic et al., 1974).

Laboratory studies have provided support for the view that people use these heuristics when making judgements. Tversky and Kahneman (1973), for example, asked participants to judge whether the letter k appeared more often as the first letter in a word, or as the third letter. Tversky and Kahneman argued that it is easier to think of words beginning with the letter k then it is to think of words that have k as the third

letter. In support of this prediction, participants judged that there were more of the former type of words then there were of the latter, even though the English language contains about twice as many words that have the letter k in the third position.

Evidence that these heuristics operate when people make judgements of risk have also been documented. Fischhoff, Slovic, and Lichtenstein (1978) found that people often fail to appreciate the limits of available data. Three groups of university students evaluated the completeness of a fault tree showing the risk associated with starting a car. Participants who viewed a reduced fault tree failed to appreciate the extent to which there were alternative risks, indicating an 'out of sight, out of mind' mentality.

A related area of research has identified two additional biases that influence judgements of risk. These biases are identified as primary bias, which is the tendency to overestimate small ratios and underestimate large ratios, and secondary bias, which involves misjudging the frequency of two events which have the same likelihood of occurring (Lichtenstein et al., 1978). Together, these biases can lead to errors of judgement. For example, Lichtenstein et al. found that events which were dramatic and sensational tended to be overestimated, whereas unremarkable events were underestimated. Applied to natural disasters, individuals can expend a great deal of effort preparing for hazards which are unlikely to occur, but can make no preparations for events which occur frequently.

While early work on risk studied the cognitive components of risk perception, recent work has begun examining the affective components of risk (Slovic, 2000). According to Slovic, affect is "a subtle form of emotion, defined as positive (like) or negative (dislike) evaluative feelings towards an external stimulus (such as a cigarette, or the act of smoking)" (p xxxi). Finucane, Alhakami, Slovic, and Johnson (2000) proposed that people use an affect heuristic to make judgements, so that people tag their representations of objects and events with varying degrees of affect. Individuals then consult this pool of positive and negative tags when making judgements.

Finucane et al. reasoned that this process is easier and more efficient than weighing the pro and cons, or retrieving relevant examples from memory, especially when the required decision is complex or mental resources are limited.

This heuristic appears to be relevant to judgements of risk. Risk analysts view costs and benefits as distinct concepts, such that the benefits gained from mountain climbing (e.g., walking in an area of spectacular scenery) are different from the associated costs (e.g., injury from falling). Finucane et al. (2000) hypothesised that risks and benefits tend to be positively correlated such that activities that bring great benefits can be high or low in risk, but activities that are low in benefits are unlikely to be high in risk. A number of studies, however, have shown that people perceive risks and benefits to be negatively related. For example Fischoff, Slovic, Lichtenstein, Read, and Combs (1978) reported that for many hazards, the greater the perceived benefit, the lower the perceived risk. Smoking and alcohol consumption were seen as low in benefit, but high in risk, whereas vaccines, antibiotics, and X-rays were judged as high in benefit, but low in risk. Finucane et al. (2000) argued that affective components may explain this finding. Finucane et al. found that if an activity was 'liked', then people tended to judge it as low risk and high benefit. If the activity was 'disliked', people judged it to be high in risk and low in benefit.

To what extent does this pattern relate to natural disasters? If people like the house they live in, or the city where they live, they may judge that there are many benefits from living where they do, but very few costs. This evaluation may operate regardless of what the actual costs and benefits are from living where they do. Some evidence supports this contention. Jackson and Mukerjee (1974) reported that residents of San Francisco had a strong attachment to their city. When asked to list the advantages and disadvantages of living in San Francisco, only 10 percent could identify any disadvantages at all. No participants included earthquakes when listing disadvantages, despite the city being close to the destructive San Andreas fault.

While one line of research has examined the importance of cognitive and affective components in perceptions of risk, another line of research has explored the role of sociopolitical factors in perceptions of risk. This research stems from a consistent finding that gender is strongly related to risk judgements, whereby men tend to judge risks as smaller and less problematic than women do (e.g., Brody, 1984; Steger & Witt, 1989; Stern, Dietz, & Kalof, 1993). Steger and Witte (1989) propose an explanation for this finding based on biological and social factors. They argue that women judge risk differently because they have been socialised to nurture and maintain life, and as such, are more concerned with health and safety.

Slovic (1997) has offered an alternative explanation for this difference based on a person's sociopolitical orientation. Flynn, Slovic, and Mertz (1994) presented participants with a list of 25 hazards and asked them to judge how much risk each hazard posed to society. While gender and racial differences consistent with other research were observed, Flynn et al. found that not all males perceived the risks as low. Rather, about 30% of the white male sample skewed the results, while the remaining white males' responses were not too different from the other subgroups surveyed. When compared with the remainder of the sample, this small group of white males were better educated, had higher household incomes, and were politically more conservative. With regard to their world view, this group were more likely than other groups to agree that future generations can take care of themselves when facing risks imposed on them from today's technology, and that government and industry can be trusted with making the proper decisions to manage the risks from technology. This group was more likely to disagree that technological development is destroying nature, or that they have very little control over risks to their health. These results suggest that a person's sociopolitical orientation is related to their judgements of risk.

The previous discussions have focused on the cognitive, affective, and sociopolitical dimensions of risk. Another possibility, however, is that there might be (some) relatively stable individual differences in people's response to risk (e.g.,

Lambert et al., 1999; Zuckerman, 1994). Many people have the desire to experience challenges or to face situations of some uncertainty (Trimpop, Kerr, & Kirkcaldy, 1999). McClure et al. (1999) found a positive relationship between risk-taking propensity and preparation for earthquakes. Several theories dealing with personality and individual differences have been developed to explain risk taking behaviour, although Zuckerman's (1979; 1994) theory of sensation seeking has dominated this area of research. Zuckerman suggests that a number of biological factors influence a person's drive to engage in sensation seeking behaviour. Low sensation seekers are risk aversive, and see no rewards in participating in activities that they perceive as having high levels of risk. High sensation seekers, on the other hand, underestimate or accept risk as the price of the reward provided by the sensation or experience itself (Zuckerman, 1994). Sensation seeking has been correlated with a number of risk taking activities, such as scuba diving (Heyman & Rose, 1979), driving over the speed limit (Zuckerman & Neeb, 1980), and hazardous combat simulation tasks (Jobe, Holgate, & Sorapansky, 1983).

Schiff (1977) examined the relationship between sensation seeking and preparation for four natural disasters (floods, hurricanes, blizzards, and tornadoes). No relationship was found between these variables, but sensation seeking was related to adjustments for non-natural hazards. Using a more general measure of risk attitudes, McClure et al. (1999) found that risk attitudes was the best predictor of earthquake preparation, with higher risk takers being less prepared for a major earthquake. Although individual differences in risk-taking have been studied in relation to activities such as dangerous driving and unsafe sex, few studies have examined this aspect of risk with regard to natural disasters. It is possible that people who prepare for natural disasters may have a general disposition to be risk aversive, whereas people who do not prepare may have a disposition to be risk takers. However, research is needed to test this hypothesis.

Locus of Control

The perception that individual effort can affect the outcome of events rather then being determined by chance or fate appears to be related to preparation for natural disasters. Such a perception is referred to as locus of control, the idea that people have generalised beliefs about whether outcomes in life reflect causal factors that lie either within themselves, or outside of themselves (Rotter, 1966). People who believe that outcomes in their life are largely dependent on their own effort or intelligence are described as having an internal locus of control. Conversely, people who believe outcomes are mostly dependent on external and environmental circumstances, including fate and chance, are described as having an external locus of control. Typical beliefs associated with an internal locus of control are that hard work will lead to obtaining the desired goal, or that ability will help to achieve a particular goal. For those with an external locus of control, characteristic beliefs are that success is due to being at the right place at the right time, or that decisions are best made by flipping a coin.

How is this construct related to preparation for natural disasters? Internal and external beliefs can translate into actions (Strickland, 1989), in that people with an internal locus of control tend to exert more control over their environment than those with an external outlook. This tendency extends to actions taken to prevent damage from natural hazards. Sims and Baumann (1972) found that an internal locus of control was related to preparation for tornados. In a later study Baumann and Sims (1978) found that 60% of people with an internal locus of control had purchased flood insurance, but 65% of people with an external locus of control were uninsured. McClure et al. (1999) found that locus of control predicted judgements about earthquakes and actions relating to earthquake preparation.

Other studies have found locus of control to be unrelated to preparation for natural disasters. Schiff (1977) used a shortened version of the Rotter (1966) I-E scale and found no correlation with adjustments for weather related disasters. Using the full

version of the I-E scale, Simpson-Housley, Lipinski, and Trithardt (1978) tested the prediction that those who lived away from the floodplains in Saskatchewan would have an internal locus of control, while those who lived on the floodplains would have an external locus of control. This prediction was not supported.

As will be discussed in some detail in Chapter 3, a number of studies have identified limitations with the I-E scale. The assumption that locus of control is a unidimensional construct has not been supported by research (e.g., Lefcourt, 1991; Mirels, 1970; Watson, 1981). Also, the use of a shortened version of the I-E scale is problematic as this tends to reduce the scale's reliability (an estimate of the scale's unsystematic error).

One issue not examined by the research is the difference between personal expectations of control, and generalised expectations of control. The studies mentioned above have examined personal control, the belief that people have control over outcomes that effect them personally (i.e., interactions with others, achieving good grades, winning games of chance). Applied to natural disasters, there are some aspects of a disaster that people can have control over, but others that they have little control of. For example, by choosing to live in a wooden house without a chimney people control the level of damage resulting from an earthquake. However, there are other aspects of a disaster that people do not have much control over, e.g., people have less control over the seismic safety of the building they work in. Thus, people may have high personal control, illustrated by the first example, but very low generalised control, demonstrated by the second example. This suggests that personal control may be related to preparation, but that generalised control may not.

Helplessness and Fatalism

Locus of control is conceptualised as a general personality measure of perceived control. A related construct is learned helplessness, whereby negative attributions associated with uncontrollable events are generalised to controllable

events, resulting in a state of helplessness (Peterson, Maier, & Seligman, 1993). This generalisation may occur in relation to natural disasters (McClure & Williams, 1996). For instance, people may believe that because an earthquake itself is uncontrollable, so are the effects of the earthquake (i.e. damage to buildings). This may lead to a belief that there is little point in preparing for such an eventuality.

Turner et al. (1986) investigated a related construct called earthquake fatalism, a belief that there is little point preparing for an earthquake because the impact of the disaster is beyond the potential victim's control. Most respondents endorsed the statement 'I believe earthquakes are going to cause widespread loss of life and property, whether we prepare for them or not'. Over 40% of participants agreed with the statement 'there is nothing I can do about earthquakes, so I don't try to prepare for that kind of emergency', and 32% agreed that 'the way I look at it, nothing is going to help if there were an earthquake'. These fatalistic beliefs translated into actions. A fatalistic attitude was related to ignoring earthquake warnings, and to judgements that a damaging earthquake would not occur anytime soon.

Self-Other Biases

People often make appraisals of themselves and their peers that are logically impossible. When individuals compare their abilities, traits, and health risks with those of others, they often believe that they are smarter, better at their jobs, and less likely to have poor health (Weinstein, 1980; 1984; 1987b). They tend to believe that they engage in risk-increasing behaviour less often than their peers, and that they adopt precautionary behaviours more often than their peers (Perloff & Fetzer, 1986). Judgements of this type are typically referred to as a self-other bias (the belief that negative events or outcomes are less likely to happen to oneself than to others, and that positive events are more likely to happen to oneself than to others). A concept closely related to this is unrealistic optimism, which is often characterised as an underestimation of the actual likelihood of experiencing a negative event (Weinstein & Klein, 1996).

Self-other biases have been examined in relation to a number of risky activities. Motorcyclists believe that they are less likely than other motorcyclists to need hospital treatment in the following year (Rutter, Quine, & Albery, 1998). People about to 'bungy jump' for the first time report that they are less likely than the typical bungy jumper to become injured (Middleton, Harris, & Surman, 1996). Research has also examined self-other biases in relation to susceptibility to health risks. Radon, a radioactive gas produced by the decay of small amounts of naturally occurring uranium in soil, is thought to be one of the most serious environmental health hazards in the United States. There is a high probability that many American homes contain high levels of radon. Yet, Weinstein, Sandman, and Roberts (1990) found that respondents consistently claimed that their own risk of having a home radon problem was less then the risk faced by their neighbours.

Research has investigated whether these biases apply to natural disasters. Burger and Palmer (1992) tested whether self-other biases would be shattered or maintained following a destructive earthquake. At Time 1 (72 hours after a major

earthquake), 24 students rated the extent to which they believed each of the nine negative life events were likely to happen to them someday. The items included cancer, heart attack, and a key question 'seriously hurt in a natural disaster (flood earthquake, storm)'. At Time 2 (3 months after the same earthquake), a group of 19 different students completed the same survey. The results showed that at time 1 the participants did not display a self-other bias towards natural disasters, but at time 2, a self-other bias towards natural disasters was present.

Helweg-Larson (1999) extended Burger and Palmers' (1992) findings. Following the 1994 Northridge Earthquake, a longitudinal design was employed to examine likelihood judgements of injury stemming from the earthquake. Participants responded to the survey on eight occasions over a five month period. While a self-other bias was present towards nine other negative life events, no bias regarding risk of injury from earthquakes was present shortly after the earthquake, and no bias appeared during the follow up periods. Helweg-Larson proposed that the likely explanation for the differences between this finding and Burger and Palmers' results was due to methodological differences in the question asked. Burger and Palmer used a non-specific question about natural disasters whereas Helweg-Larson directly asked participants about earthquakes.

Few studies have examined whether people have self-other biases about a likely disaster which has not yet occurred. Lehman and Taylor (1987) surveyed students who lived in buildings with either very poor seismic ratings or very good seismic ratings. A general pattern of denying the seriousness of the earthquake threat was observed, but it was more evident for the students who were living in the buildings with very poor seismic ratings. Jackson (1981) asked participants in earthquake prone areas about potential earthquake damage. 23% believed that they would not experience an earthquake in their area at all, and 33% said that they expected an earthquake, but that they did not think it would result in any personal damage. Similarly, Mileti and Fitzpatrick (1993) found that 80% of their participants believed that

they would experience a major earthquake, but only 33% said that they thought it would harm them or their property.

These findings suggest that people display a self-other bias towards disasters that are highly probable, but have not yet occurred. This finding needs clarification. In the studies mentioned, unrealistic optimism has been indirectly inferred from participants displaying an illogical judgement (e.g., Mileti & Fitzpatrick, 1993); however, in typical self-other studies, participants usually estimate the likelihood of experiencing an event relative to the likelihood that members of a peer group will experience the same event (Helweg-Larson & Shepperd, 2001). Thus, assessing people's judgements about their susceptibility to harm relative to their peers could provide a more direct, and accurate, measurement of a self-other bias.

Other Variables

Researchers have examined a number of other variables in relation to earthquake preparation. Some can be broadly categorised as psychological variables, while others are demographic characteristics.

Briefly, personal experience of disasters generally leads individuals to see natural disasters as more frequent and to see themselves as potential victims. Consequently, prevention is increased. In many cases, however, people's experience with a natural disaster is mild (for instance, many 'hurricane experienced' people are only exposed to the fringes of the storm), and they do not adopt as many precautions for future disasters as they should (Weinstein, 1989). Knowledge of the hazard has also been examined in relation to preparation. Hurnen and McClure (1997) found that people who had a complex understanding of earthquakes were more likely to prepare for such a disaster. This results suggests that one of the reasons people may not prepare for a natural disaster is that they do not have sufficient understanding of the necessary steps to increase their safety. With regard to communicating the risks

posed by natural disasters, Mileti and Darlington (1995) noted that people are most inclined to recall recommendations that are easy, quick, and inexpensive to perform.

Research has also examined a range of demographic variables in relation to earthquake preparation. Age is positively related to preparation for earthquakes, with older people being more prepared than younger people (Dooley, Catalano, Mishra, & Serxner, 1992; Edwards, 1993; McClure et al., 1999). Number of children living at home (Dooley et al., 1992; Edwards, 1993), educational attainment (Edwards, 1993; Farley et al., 1993; Russell, Goltz, & Bourque, 1995), and household income (Edwards, 1993; Russell et al., 1995) all have a positive relationship to preparation. Marital status (Dooley et al., 1992) and owning a home are also positively related to preparation for earthquakes (Russell et al., 1995) and tornadoes (Mulilis, Duval, & Bovalino, 2000).

It is unclear from the studies mentioned above how much of a role demographic variables play in influencing preparation for a natural disaster, as researchers typically report only the means and p values. It would be useful to identify the strength of the relationship between preparation and demographic variables.

Psychometric Issues

Self-report scales are the principal source of data in social psychology and the social sciences (Schwarz, 1999). Despite their widespread use, self-report scales can have a number of limitations. In particular, a given scale may contain a large amount of measurement error, or it may not actually measure the construct under investigation.

Various techniques have been developed to estimate the level of measurement error. Underlying this work is the concept of reliability, defined by Nunnally (1967) as "the extent to which [measurements] are repeatable and that any random influence which tends to make measurements different from occasion to occasion is a source of measurement error" (p. 206). Internal consistency, one of several types of reliability, refers to the degree of interrelatedness among items (Green, Lissitz, & Mulaik, 1977). Internal consistency is estimated by the Cronbach's alpha coefficient (Cronbach, 1951),

whereby values approaching 1.0 suggest high internal consistency, and consequently little measurement error.

In general, reliability increases with the length of a test (Cortina, 1993; Miller, 1995; Schmitt, 1996), so that the more items there are in a test, the greater its reliability. Furthermore, a longer test is often preferred to a shorter test because a small number of items are unlikely to cover a whole spectrum of the variable under investigation (Kline, 1998).

A second psychometric issue that needs addressing is the concept of validity. According to Cronbach (1990) "validation is inquiry into the soundness of interpretations proposed for scores from a test" (p. 145). Kline (1998) proposes a more specific definition of validity, arguing that a test is valid if it can be used "for all purposes to which the test legitimately might be put" (p. 34). Encapsulated within these definitions is the idea that a test must be evaluated against some criterion to determine whether it measures the concepts to which it was intended to measure.

An examination of much of the natural disaster literature indicates that there are several recurring methodological issues within this body of work. The first is a reliance on the use of scales where the reliability and validity of the instruments has not been clearly established (e.g. De Man & Simpson-Housley, 1987; Dolinski, Gromski, & Zawisza, 1987; Rustemli & Karanci, 1999) or where the instruments have poor reliability (e.g. Faupel & Styles, 1993; Lehman & Taylor, 1987). For instance, in Faupel and Styles' (1993) study of preparedness and stress following Hurricane Hugo, household planning (having family meetings, identifying a safe spot in one's home, etc) was assessed by a scale with a reliability estimate of only .54. Adaptive response, a second key variable that examines preparation activities undertaken in response to a specific hurricane threat, was assessed by an eight item scale with a similarly low reliability estimate (α = .57). Rustemli and Karanci (1999) explored the relationship between earthquake-related cognitions and preparedness behaviour 16 months after a major earthquake in the area. Perceived control (a concept related to locus of control)

and social support, were assessed by single item measures. No information was presented to estimate the reliability of these items or to evaluate their validity.

A second theme to emerge from the research on natural disasters is the reliance on a single item measure to examine a multifaceted construct. In Rustemli and Karanci (1999) the conceptualisation of perceived control did not consider the possibility that this variable may be multidimensional in nature, as has been proposed by Levenson (1974, 1981) and Paulhus (1983). Theoretically, a single item measure may not adequately capture the construct under investigation. For example, Sullivan, Mustart, and Galehouse (1977) assessed preparation for an earthquake only on the basis of purchasing insurance. However, purchasing insurance is not the only component of earthquake preparation. Ensuring that the property will not collapse and the storage of emergency supplies such as food and water are also important facets. One item cannot adequately capture all these aspects of preparation.

A related issue concerns the amount of measurement error contained in the measures. Some researchers have used a single item measure to assess a dependent variable (e.g., Sullivan et al., 1977), whereas others have used a single item measure to examine their independent variables (e.g., Simpson-Housley & Curtis, 1983). As mentioned previously, a major problem with the use of a single item measure concerns the reliability of the item. Generally, a large set of items grouped together is more reliable than a small set (Schmitt, 1996). A single item, however, is almost always very unreliable and contains a large amount of unsystematic measurement error (Kline, 1993). Consequently, how an individual responds to an item on one occasion may be quite different from how they respond on another occasion.

Even when larger clusters of items are used, there may still be measurement problems. Often researchers group together only a small number of items (e.g., Dooley et al., 1992; Farley et al., 1993), and often the estimates of reliability are not reported (Lindell & Perry, 2000). While several studies have reported the reliability

coefficient for the dependent variable (e.g., Mulilis, Duval, & Lippa, 1990), few studies have reported the reliability of the predictor variables.

In addition to the problems of unreliability, there is also an issue to do with the clustering of items together. Briefly, techniques such as factor analysis have been developed to identify items that are similar to one another, and items that are dissimilar to one another. Grouping like items together can reduce measurement error and increase reliability, but this also allows for better assessment of multifaceted constructs (see Russell et al., 1995 for an example of clustering techniques applied to a preparation measure). Unfortunately, it is common for researchers when examining human response to natural disasters to use questionnaires of key constructs in which there is disagreement over the precise factor structure of a scale. For example, the I-E scale is probably the most frequently used measure of locus of control, but the number of factors proposed for this scale range from one to nine.

In sum, a major weakness of many studies on natural disasters is the lack of attention paid to psychometric issues. A major component of this thesis will be to resolve some of these problems in regard to the measures used.

Thesis Objectives

In the preceding review, there are several themes that appear important in understanding differences in individuals' preparation for a major earthquake. Individual differences in judgements of risk and in locus of control appear to be related to preparation for natural disasters. Does this finding extend to preparation for earthquakes? There is some evidence to suggest that it does (e.g., McClure et al., 1999), although many studies have used psychometrically questionable instruments. Another theme that also appears to be related to preparation is self-other biases. Several studies have examined this bias following a natural disaster (e.g., Burger & Palmer, 1992; Helweg-Larson, 1999), but none have systematically studied self-other judgements towards a likely disaster that has not yet occurred.

The first and primary aim of this thesis is to examine the relationships between two theoretically relevant dimensions of personality (risk propensity and locus of control) and earthquake preparation in a substantial sample of Wellington residents using psychometrically sound measures. The second aim of this thesis is to investigate whether Wellington residents hold unrealistically optimistic beliefs about their chances of being injured or their property being damaged in the event of a major earthquake.

The remainder of the thesis is organised as follows: Chapter 2 records the development of a new questionnaire to assess risk. This questionnaire, which taps into two related constructs, risk taking and risk precaution, which was developed in three studies. Chapter 3 details the evaluation and refinement of an existing measure of locus of control – the Spheres of Control scale. In this chapter, the results of four studies are presented, in which the psychometric properties of this scale were assessed using a variety of statistical techniques. Chapter 4 describes the construction of a new questionnaire to measure preparation for a major earthquake – the Wellington Earthquake Preparation Scale. It presents the results of a study which examined the psychometric properties of this scale using a sample of Wellington residents.

These refined measures of risk, locus of control, and earthquake preparation were bought together in a field study, which is documented in Chapter 5. In this study, the responses of 356 Wellington residents were obtained from ten locations chosen to represent different average income levels across the population of Wellington City. The results of the study are also discussed in detail in this chapter, and policy issues for emergency managers are presented. In the final chapter the key findings of the thesis are discussed.

CHAPTER 2 – DEVELOPMENT OF A MEASURE OF RISK-RELATED BEHAVIOURS

Chapter Overview

This chapter focuses on some of the psychological aspects of risk that relate to people's preparation for natural disasters. Two conceptually related constructs were identified: risk-taking and risk-precaution. To assess these constructs, a pool of items was generated and refined in Studies 1 and 2 using exploratory factor analysis. The factorial validity, and the convergent and discriminant validity of the scales were then tested in Study 3 using a substantial sample of university students. The results of this Study indicated that risk-taking consisted of two elements: major risk and minor risk. Risk-precaution was factorially discriminable from the constructs of major and minor risk.

Two Aspects of Risk

On a daily basis people often face the possibility of many different threats, ranging from events with a low probability of occurrence, or with a minor outcome (e.g., a small cut from using a knife), to major technological or natural disaster (e.g., nuclear war, hurricane). An understanding of the nature and probability of occurrence of these different threats is necessary for people to respond to the risk appropriately. From the example above, cutting oneself with a knife is more likely than experiencing a nuclear war.

People frequently do not assess their exposure to risk accurately (e.g., Brun, 1992; Greening, Dollinger, & Pitz, 1996; Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978; Weinstein, 1980) and as a consequence engage in behaviours that may increase, rather than decrease, the likelihood of negative events happening to them. People also often fail to take advice on ways of reducing their risk of harm; and they suffer illness, injury, financial loss, and emotional trauma that could have been avoided (Weinstein, 1987).

Much of the work by Slovic and colleagues (e.g., Fischhoff, Slovic, & Lichtenstein, 1977; Lichtenstein et al., 1978; Slovic, 1987) has examined how most people form perceptions of risk. This research, reviewed in Chapter 1, suggests that people consider a number of characteristics of a hazard when evaluating the risk to themselves. How do these perceptions translate into actions? One useful way of studying risk is to examine people's response to risk. When faced with a risky gamble, some people have a tendency to 'play it safe' and choose a gamble which nets a small, but guaranteed payoff. Others 'take a punt', hoping that a streak of good luck will result in a substantial win. Lopes (1987) characterizes these two approaches as risk-aversion, and risk-seeking. In the context of risk-preference gambling studies, people who are risk-aversive consistently choose a safe no-risk gamble, whereas risk-seekers consistently select a high-risk gamble. Do these constructs generalize outside laboratory settings? Certainly individuals can respond to hazards in different ways. For some, climbing high rock faces is an exciting recreational activity. For others, this as an unnecessarily risky activity. These two constructs are investigated in the present chapter.

In the research presented in this chapter, the terms risk-taking and risk-precaution are used instead of risk-seeking and risk-aversion, reflecting slightly different meanings. Both risk-seeking and risk-aversion are terms that are associated with gambling studies conducted in a laboratory setting. Risk-taking and risk-precaution are associated with risk-related behaviours that occur outside the laboratory: the terms reflect specific actions and behaviours that people perform to alter their exposure to risk. Risk-taking refers to actions that increase the probability and severity of adverse effects; risk preparation refers to actions that people take to reduce their own vulnerability to harm.

Risk-Taking

Risk-taking refers to actions that increase the probability and severity of adverse effects. A number of personality and individual difference theories have been

developed to explain risk-taking behaviour. Zuckerman's (1979, 1994) theory of sensation seeking suggests that a number of biological factors influence a person's drive to engage in sensation-seeking behaviours. The questionnaire developed out of this research, the Sensation Seeking Scale (SSS), has been widely used in research to examine the relationship between sensation seeking and other dimensions of personality: for example, impulsivity (Gerbing, Ahadi, & Patton, 1987), liberalism and conservatism (Levin & Schalmo, 1974), and anger and aggression (Zuckerman, 1994).

In addition to Zuckerman's theory of sensation seeking there are a number of alternative explanations for risk-taking, some based on general theories of personality, such as the psychodynamic perspective (Henry, 1996) or systemic theory (Anderson & Carter, 1978). Other explanations are based on broad risk-taking theories, for example risk motivation theory (Trimpop, 1994) and problem behaviour theory (Jessor & Jessor, 1977). Risk homeostasis theory (Wilde, 1988), and decision theory (Oppe, 1988) also offer explanations for risk-taking. Although a number of theories have been developed to explain risk-taking, the measurement of this construct has largely been limited to the development of measures for specific populations. For example, measures have been created for pathological gamblers (Kassinove, 1998), gay men (Forsyth, Carey, & Fuqua, 1997), adolescents (Brown, 1999), and motorists (Kidd & Huddleston, 1994). Other measures have been developed for specific behaviours, such as unsafe sex (Shah, Thornton, & Burgess, 1997), hypodermic needle use (Stimson, Jones, Chalmers, & Sullivan, 1998) or for predicting HIV infection (e.g., Chawarski, Pakes, & Schottenfeld, 1998; Kalichman & Rompa, 1995).

In contrast to the large number of specific measures of risk-taking, very few global measures have been developed. Researchers have most often adopted the Sensation Seeking Scale (Zuckerman, 1979; 1994) as a measure of risk, although it only examines some aspects of risk-taking. Other less used scales have also been developed, which include the Tension Risk Adventure Inventory (Keinan, Meir, & Gome-Nemirovsky, 1984), the Telic Dominance Scale (Murgatroyd, Rushton, Apter, &

Ray, 1978), the Arnett Inventory of Sensation Seeking (Arnett, 1994) and several subscales from the Personality Research Form (Jackson, 1974). With regard to the global measures of risk, only the SSS has been substantially scrutinised against psychometric criteria. While the SSS provides a good measure of sensation seeking, it provides a measure of only one aspect of risk, namely risk-taking for the sake of high arousal. Therefore, one goal of this research was to develop a broader measure of risk incorporating further aspects of risk-taking – specifically, financial, legal, and social risk-taking.

Risk-Precaution

Actions that people take to reduce their own vulnerability to harm, or the vulnerability of the group which they belong to are defined as risk-precaution (Weinstein, 1987). Examples of risk-precautionary behaviour include using a safety mat in the bathtub or shower, locking up poisonous materials, getting a dental check-up every six months, and having double locks on the door. Self-protective behaviour and risk-adjustment are two equivalent terms, and as such are used interchangeably. In risk-preference gambling studies, people who are risk aversive prefer low-risk outcomes in a gambling task (Schneider & Lopes, 1986). Risk-precaution shares at least one aspect of risk aversion, namely that people who are cautious have a preference for low-risk outcomes. However, people who are cautious not only avoid risk, but they also seek out ways to increase their safety.

Bermudez (1999) suggested that just as some personality variables predispose individuals to participate in behaviours that could be dangerous to their health, there is another set of personality variables that may be associated with self-protective behaviours. Therefore, the psychological processes that underlie risk preparation may well be different from the processes that influence risk-taking. Briefly, locus of control is one such variable that has been related to risk-precaution (e.g., Simpson-Housley & Bradshaw, 1978) while personal experience may also impact on risk-precaution (e.g.,

Weinstein, 1989). Risk-taking activities, on the other hand, often involve high arousal (e.g., Horvath & Zuckerman, 1993), or other biological processes (e.g., Zuckerman, 1979, 1994).

The assessment of risk-precaution is somewhat problematic as there are no existing questionnaires that directly assess this construct. Therefore a goal of the research on risk was to develop a questionnaire which examines risk-precaution. The risk actions scale used by Schiff (1977) and McClure et al. (1999) have some items which deal with risk-precaution (e.g., have home fire drill). Some of the items from these scales were used as a starting point for the development of a new measure of risk-precaution.

Research Objectives

In the preceding discussion, two components of risk were identified. These were actions that increase the probability and severity of adverse effects (risk-taking) and actions that reduce vulnerability to harm (risk-precaution). Two of the goals of the present study have been outlined already. These are to develop a global measure of risk-taking, and to develop a global measure of risk-precaution. The additional goals of this research were to construct the scale in Likert type format and to develop a scale that is as short as possible without unduly compromising reliability and validity.

For the purposes of meeting these objectives, an initial pool of items was constructed and evaluated using two samples of university students (Studies 1 and 2). This evaluation included identifying items that were poor measures and removing them from the scale. These shortened versions of the risk-taking and risk-precaution scales were then administered to a larger sample of students (Study 3). The factorial validity and reliability of these reduced scales were then examined, together with their convergent and discriminant validity.

Study 1: Development of a Risk-taking Scale

The development of risk-taking measures has been largely limited to the development of measures for specific populations. Many studies have used the Sensation Seeking Scale as a measure of risk-taking (e.g., MacCrimmon & Wehrung, 1985; Schiff, 1977; Schrader & Wann, 1999; Trimpop, Kerr, & Kirkcaldy, 1999), although this scale examines only some aspects of risk-taking. Several other scales have also been developed. These include the Arnett Inventory of Sensation Seeking (Arnett, 1994), the Tension Risk Adventure Inventory (Keinan et al., 1984) and the Telic Dominance Scale (Murgatroyd et al., 1978). However, these scales have been conceptualised to measure arousal avoidance, planning orientation, serious mindedness, thrill and adventure seeking, boredom susceptibility; hence they represent the impulsivity aspect of risk-taking. Risks that are also important, but not included in these scales, include social risks (e.g., talking to a stranger), legal risks (e.g., stealing), and financial risks (e.g., buying a house). As it appeared that no existing questionnaire examined these aspects of risk, it was decided to construct a questionnaire to measure these components of risk-taking.

The aim of Study 1 was to develop a brief global measure of risk-taking that incorporates social, financial, legal, and adventure risks. As all the items were designed to measure risk-taking, it was hypothesised that there would be an underlying general factor within the scale. Since this study is developmental in nature, it was anticipated that the sequential removal of items that have a low correlation with the general factor would both strengthen the general factor and increase the reliability of the scale.

Method

Participants

The participants in this study were 176 (80 Male, 87 female, 9 not reported) students from Victoria University of Wellington. The mean age was 21 years for both males and females. No information was gathered to determine the questionnaire

response rate and it is undetermined how representative the sample is of Victoria University of Wellington students[1].

Materials

The items used by Lichtenstein et al. (1978) in their study of judgements of lethal events were used as the basis for developing items which measured risk-taking. Lichtenstein et al. presented subjects with a list of activities that were major causes of death in the United States between 1968 and 1973. Although the causes of death listed are over thirty years old, they provided a useful starting point for the development of items, as the listed causes of death comprise a record of actual risky activities and hazards. The 41 activities and technologies that Lichtenstein et al. identified were used to write an initial pool of items. As an example of the development of an item, Lichtenstein et al. identified "drowning" as a cause of death. While there were several

[1] Underlying the strategy used to recruit students was desire to collect as many responses as possible as efficiently as possible. In earlier work conducted by the author (Spittal, 1998), the strategy of surveying the 'student on the street' proved to be very effective in gaining a large number of responses in a short period of time. Second, this procedure had the advantage of being considered an anonymous questionnaire by the Human Ethics Committee, and consequently was exempt from requiring participants' written consent. Rather, completion of the questionnaire was taken to indicate consent. Given the nature of the task, it was felt that this was less invasive than asking the participant to read and sign a letter of consent before completing the questionnaire. For these reasons, this method was adopted for participant recruitment in Study 1 and 2.

activities that can result in drowning, swimming was considered to be one of the most frequent activities. As such, the item that appeared in the risk-taking questionnaire was "Swim".

The three other domains of risk that were of interest were financial, legal, and social risks. As no existing questionnaire appeared to examine these aspects of risk, items were generated from several research sessions with members of a psychometric research group. The criterion for inclusion as an item was that the risky behaviour could be expressed on a Likert scale measuring the frequency with which the respondent would engage in the behaviour. Items that were generated in this manner included: financial risks, e.g., "Buy an expensive product from a door to door salesperson"; legal risks: e.g., "Shoplift"; and social risks; e.g., "Have a heated argument".

This procedure generated a pool of 45 items that were piloted on a group of 16 postgraduate psychology students. These participants were instructed that the goal of the pilot study was to develop items that measured how frequently they participated in various risky activities. They were asked to evaluate the wording of the items and the suitability of the items for measuring risk. Items that postgraduate students judged to be unclear, ambiguous, or not risky behaviours were either removed or rewritten. This resulted in a 36 item scale that was used in Study 1. Participants were instructed as follows:

Listed below are various activities people sometimes do involving varying degrees of risk. Please rate the extent to which you would do each of these things, given the opportunity. If the behaviour is something that you would never do, then place a tick in the circle I would never do this. However, if the behaviour is something that you would do frequently, then place a tick in the circle I would often do this. You may place a tick in any circle in between.

Participants could respond by ticking a circle that corresponded to a five point scale. A copy of the questionnaire appears in Appendix A.

Procedure

Victoria University of Wellington students were approached and asked if they would be willing to complete a questionnaire. Those who were willing to participate were given a copy of the questionnaire which they completed in around five minutes. When participants had completed the scale, they were debriefed as to the nature of the study, and any questions or comments they had were addressed. Participants were offered a wrapped sweet as a token of appreciation for their participation. A summary of the study's findings were posted in the School of Psychology.

Results

The following data analyses were conducted using the SPSS package. A principal components analysis was performed on all 36 items of the risk-taking scale, and, as an estimate of internal consistency, Cronbach's alpha. To evaluate the presence of a general factor within the scale, the unrotated factor loadings were converted to z-scores, using Fisher's r to z transformation, and then averaged. This follows the recommendations of Guilford (1954). One of the goals of Study 1 was to reduce the number of items in the item pool, while ensuring that the general factor and the internal consistency were not diminished. To achieve this goal, items with lowest loadings on the unrotated factor were sequentially removed and the average of the principal components recalculated, using Fisher's z coefficient, until a solution was produced which had the fewest possible items yet maintained the high estimates of reliability.

The principal components factor analysis showed that one factor accounted for 18% of the variance. An examination of the unrotated factor disclosed the presence of an underlying general factor as indicated by a mean loading of .42 and a standard deviation of .14 (Table 2.1). Cronbach's alpha was .86.

Sequential removal of items with the lowest loading on the unrotated factor until the number of items was minimised and the internal reliability was maximised produced a 24 item scale. A summary of these results is also presented in Table 2.1. A 24 item scale derived from the original 36 items explained 25% of the variance. The unrotated factor indicated the presence of a strong general factor as indicated by a mean loading of .49 and a standard deviation of .09. Cronbach's alpha was .87.

The mean score for the 24 item Risk-taking scale was M = 68.70 (SD = 13.34). Males had a higher score than females, M = 71.61, SD = 14.20 for males; M = 66.01, SD = 11.96 for females. This difference was significant, t (165) = 2.76, p < .001.

Discussion

The purpose of Study 1 was to develop an instrument that measured risk-taking. In developing this questionnaire, a 36 item scale was administered to a large sample and the responses analysed. Sequential removal of items with a low loading on the unrotated factor resulted in a 24 item scale. The results show that the shortened scale has a strong underlying general factor influencing responses to the items[2], and high internal consistency. The content of the 24 item risk-taking scale largely includes items that measure adventure risks (e.g., ride a bicycle, go hunting) and legal risks (e.g., park on a yellow line). Items that measured financial risk (e.g., not pay your visa bill) were removed on the basis of their low loadings on the unrotated factor. One explanation for this may be that the participants in this sample may be less

[2] Some preliminary analysis was conducted to investigate the possibility that Risk-taking was a multidimensional construct; however, the small sample size (N = 176) provided few opportunities to test the replicability of the derived factor solutions within the sample. In addition to this, the principle purpose of this study was to identify a set of candidate items for measuring risk-taking; whereas the purpose of the later study (Study 3) was to test the multidimensionality of the scale. As such, details of the tests of multidimensionality are not reported here.

Table 2.1

Study 1: Unrotated First Principal Component Loadings of the Risk-taking Scale

Item		PC-36	PC-24
1	Swim	38	45
2	Ride a bicycle	37	45
3	Drive without wearing a seatbelt on a short journey	38	--
4	Binge drink	50	44
5	Use a gun	52	56
6	Play a contact sport (e.g. rugby)	42	56
7	Go hunting	50	55
8	Ride in a home made aircraft or microlight aircraft	53	58
9	Ride a motorbike	62	66
10	Fly as a passenger in a single engine light plane	59	64
11	Go mountain climbing	48	57
12	Go tramping in the bush	41	50
13	Fly in a helicopter	54	64
14	Drive a car	33	37
15	Go skiing	39	45
16	Practise “Unsafe Sex”	28	--
17	Drive an uninsured car	52	47
18	Place a bet using a sum of money that is more then your weekly pay	20	--
19	Start a small business	17	--
20	Buy an expensive product from a door to door salesperson	23	--
21	Spend all your earnings without saving any money	30	--
22	Buy a lotto ticket	14	--
23	Shoplift	39	--
24	Not pay a fine	48	39
25	Take something that doesn’t belong to you	45	37
26	Drive well over the speed limit	51	46
27	Excessive drinking and driving	27	--
28	Fail to fill in a tax return	31	--
29	Not pay your Visa bill	36	--
30	Fail to declare all your income	43	--
31	Drive off the forecourt of the petrol station without paying for petrol	43	34
32	Have a physical fight	47	46
33	Park on a yellow line	47	45
34	Not put money in the parking meter	53	50
35	Coast downhill with your car in neutral	68	65
36	Have a heated argument	42	39
M $\underline{r}$		42	49
% of variance		18	25
Reliability α		86	87

Note: Decimal points omitted

concerned about taking financial risks than the general population, and consequently do not perceive many of the financial risks listed as being risky activities. This effect may be particularly evident when compared with some of the more dramatic and sensational risks in the questionnaire (e.g., ride a motorbike). Thus, the use of a student sample to develop a test of the incidence of risk-taking in the population may have impacted on the item selection process: age could be related to a high endorsement rate of items that are specific to the student demographic; whereas these items may not appropriately measure risk-taking in other demographic groups. However, the process has not produced a set of items that are unique to students (for instance there are no items that measure cheating on a university examination). Therefore, although the items have been developed on a student sample, the items appear to be relevant to the general population as well.

Nevertheless, the results of the present study provide tentative support for the risk-taking scale as a measure of global risk-taking, as evidenced by both the strong general factor, and the measurement of risk from a variety of situations.

Study 2: Development of a Measure of Risk-Precaution

Risk-taking actions can increase one's exposure to harm (e.g., riding a motorbike), but the absence of such actions only maintains the current level of exposure. Another category of actions occurs when the absence of an action increases the exposure to harm (e.g., not wearing a bike helmet), while the presence of such actions reduces the exposure to harm (e.g., wearing a bike helmet). Actions of this type are called risk-precautions. Examples of risk-precautionary behaviours are wearing a seat belt while travelling in a car, eating healthy food, or using sunscreen when outside. Failure to perform actions like these can result in an increase in the likelihood of harm.

Risk-taking and risk-precaution differ in another respect. Conceptually, the absence of performing a risk-taking activity is different from engaging in a risk-

precaution action. For example, not firing a gun only maintains the current exposure to harm, it does not result in an increase in safety, which would happen if the actor engaged in a risk-precaution activity. Likewise, the absence of a risk-precaution activity is not the same as a risk-taking action (e.g., not learning first aid will result in a maintenance in the level of risk, not an increase in it).

In general, a risk-taking behaviour involves the performance of an action (e.g., driving well over the speed limit, swimming in the ocean, using a gun), but there are some exceptions where inaction is a risk-taking activity, for example, not putting money in the parking meter, or not applying the safety catch on a loaded gun.

No scale has been previously developed that directly assesses the construct of risk precaution, although there are some items from the risky activities scale used by Schiff (1977) and McClure et al. (1999) that appear to be related to the construct. The goal of Study 2 was therefore to develop a global scale to measure risk-precaution.

Both McClure et al. (1999) and Schiff (1977) assessed risk-precaution as the number of items participants endorsed as a percentage of the total. However, scales of this type often have low inter-item correlations and little variance (Kline, 1993; Nunnally, 1978) which prevents a clear factor structure from emerging. One method of overcoming this problem is to use a Likert scale, which increases the variance.

A second consideration in the development and use of a risk-precaution scale was the consistency of format with the risk-taking scale. Thus, the use of a Likert scale provides similarity of format with the risk-taking scale developed in Study 1 while at the same time increasing the variance in participant responses. A further limitation in the format of the risk preparation scale used by Schiff (1977) and McClure et al. (1999) was that responses could only be expressed as yes or no. Thus, there was no possibility of measuring how often a person performed a risk preparation activity. For example, for the item “Wear a seatbelt”, there was no difference in measurement between those who had failed to wear a seatbelt only once and someone who consistently did not wear a seatbelt. The goal of the present study was to further

develop the risk-precaution scale developed by Schiff (1977) and adapted by McClure et al. (1999). It was hypothesised that there would be an underlying general factor within the scale, and that the sequential removal of items that have a low correlation with the general factor would both increase the strength of the general factor and the internal consistency of the scale.

Method

Participants

Participants were 168 (70 males, 84 females, 14 unknown) students at Victoria University of Wellington, who were seated in public locations in the University campus. Demographic data collected indicated that the mean age was 20 years for male participants and 21 for female participants. No information was gathered to determine the questionnaire response rate and it is undetermined how representative the sample is of Victoria University of Wellington students.

Materials

The item pool for the risk-precaution scale was developed from the scale used by McClure et al. (1999) which was in turn based on risky activities scale used by Schiff (1977). In its original format, as developed by Schiff (1977), the scale contains 71 items, twenty-one of which relate directly to natural hazards and 50 to other hazards. The scale was adapted by McClure et al. but still maintained the focus of the original items.

Several additions were made to the 50 item version of the risk preparation scale adapted by McClure et al. (1999). First, the 21 items that require a simple yes/no response were removed, as they did not provide a measure of the frequency of occurrence. For example, “Fire extinguisher in home” was removed from the item pool on the grounds that an extinguisher could only be bought once and consequently respondents could not state how often they would do this. Second, several items

contained references to frequencies (e.g. “Always use a seat belt in car”). These were rewritten slightly so that respondents could answer how often they would do this (e.g. “Use a seat belt in the car”). The theme of the original item was retained. Finally, some of the items contained verbs referring to the action (e.g., use, have, etc.) while others did not. Where appropriate, verbs were added to the items that did not contain verbs (e.g., “Annual chest X-ray” was replaced with “Have an annual chest X-ray”). These changes to the scale resulted in a 25 item questionnaire. The instructions read as follows:

Listed below are various activities people sometimes do involving varying degrees of risk. Please rate the extent to which you would do each of these things given the opportunity**.** If the behaviour is something that you would never do, then place a tick in the circle I would never do this. However, if the behaviour is something that you would do frequently, then place a tick in the circle I would often do this. You may place a tick in any circle in between.

Participants could respond by ticking a circle on a five point scale. A copy of the questionnaire appears in Appendix A.

Procedure

The procedure in the present study was identical to that used in Study 1 of this chapter. Students were approached and asked if they would be willing to complete a questionnaire. Those who were willing to participate were given a copy of the scale; they completed their responses in around five minutes. When participants had completed the questionnaire, they were debriefed as to the nature of the study, and any questions or comments they had were addressed. Participants were offered a wrapped sweet as a token of appreciation for their participation in this study. A summary of the study’s findings were posted in the School of Psychology.

Results

The following data analyses were performed. Unrotated factor loadings were computed for the 25 item Risk-Precaution scale. Cronbach's alpha was calculated as an estimate of internal consistency. To examine the strength of the general factor, the unrotated factor loadings were converted to z-scores using Fishers' r to z transformation, and then averaged. Items with a low loading on the unrotated factor were sequentially removed and the above analyses repeated until the number of items was at a minimum and estimates of reliability at a maximum.

The principal components analysis for all 25 items indicated the presence of a general factor as shown by a mean loading of .38 and a standard deviation of .17 on the first unrotated factor (Table 2.2). This first unrotated factor accounted for 16% of the variance and coefficient alpha was .75.

The sequential removal of items and the recalculation of the principal components and Cronbach's alpha produced a 19 item scale. A summary of these results is shown in Table 2.2. For the 19 item scale, the mean loading on the unrotated factor was .45 with a standard deviation of .10, indicating the presence of a strong underlying general factor. The first unrotated factor accounted for 20% of the variance and Cronbach's alpha was calculated at .78.

Table 2.2

Study 2: First Principal Component Loadings of the Risk-Precaution Scale

Item		PC-25	PC-19
1	Use a seat belt in the car	27	--
2	Have an annual chest X-ray	40	42
3	Have an annual medical check-up	59	62
4	Carry a spare set of keys	39	41
5	Get a dental check-up every six months	33	33
6	Double locks on doors	50	52
7	Eye examination every two years	47	48
8	Get exercise	16	--
9	Have home fire drills	40	41
10	Insist car or vehicle passengers use seatbelts	52	52
11	Leave keys in car ignition	-06	--
12	Leave spare house key with neighbour	41	40
13	Lock car when not in it	36	32
14	Lock up poisonous materials	48	46
15	Mark contents of medicine bottles	60	61
16	Take travellers cheques on vacation (not just cash)	50	51
17	Eat healthy food	38	37
18	Take first aid course	39	39
19	Throw out old medicines or unmarked medicine bottles	44	47
20	Transfer medicines from one bottle to another	08	--
21	Use insecticides in garden	27	--
22	Use insecticides in house	24	--
23	Use safety mat in bathtub or shower	37	38
24	Use sunscreen when outside in summer	42	41
25	Use step ladder to reach high places	45	45
M $\underline{r}$		38	45
% of variance		16	20
Reliability α		75	78

Note: Decimal points omitted.

Discussion

Study 2 was concerned with the development of a scale to measure risk-precaution. The basis of this scale was a measure of risk preparation developed by Schiff (1977) and adapted by McClure et al. (1999). The major alterations made to the scale in the present study were as follows: (1) the items were modified so that responses were measured on a Likert scale; and (2), items were removed where the activity described could only be performed once (e.g. Fire extinguisher at home). The results indicate that a 25 item version of the scale had an underlying general factor influencing the responses to the items. However, a brief 19 item scale which was a subset of the 25 item scale had a stronger general factor and higher reliability than the longer scale. The removal of the items that did not measure the construct of risk-precaution (e.g., use insecticides in house) therefore produced an improved measure. The resulting 19 item risk-precaution scale includes items related to medical risk-precaution (e.g., have an annual chest X-ray); precautions against theft of possessions (e.g., lock car when not in it); and avoidance of hurting oneself (e.g., use a step ladder to reach high places).

The new Likert scale version of the risk-precaution scale has two particular advantages for research purposes. First, the Likert scale format allows participants to express how often they engage in a given risk prevention measure, thus allowing variation in responses to be measured more accurately. Second, as the scale is a global measure of risk-precaution, it should be possible to use it for research purposes in a wide variety of contexts.

Study 3: Construct Validation of the Risk-Taking and Risk-Precaution Scales

In the two previous studies, measures of risk-taking and risk-precaution were developed using independent samples. In both of these studies, some support was found for the factorial validity of the scales as indicated by a general factor in each scale. However, these results provide only limited support for the usefulness of the

scales because responses to the different questionnaires cannot be compared with one another. This suggests a need to test the construct validity of the Risk-Taking and Risk-Precaution scales.

Although there are a number of different ways of testing the construct validity of an instrument, two of the most commonly used methods involve examining the factorial validity of a scale, and the convergent and discriminant validity. Factorial validity of the Risk-Taking and Risk-Precaution scales could be demonstrated by showing the presence of two underlying factors, one of which represents risk-taking, and the other that represent risk-precaution.

Convergent validity is established by showing high agreement between independent measures; discriminant validity is established by demonstrating that a test does not correlate too highly with measures from which it should differ (Campbell, 1960). Convergent validity could be established by showing a high level of agreement between the Risk-Taking, Risk-Precaution, and the Sensation Seeking Scale. Sensation seeking has been found to be related to behaviours such as the use of alcohol (Schwarz, Burkhart, & Green, 1978), illegal drugs (Kohn & Coulas, 1985), food preference and driving habits (Zuckerman & Neeb, 1980), and the variety and frequency of sexual experience (Zuckerman, 1994).

With regard to discriminant validity, Zuckerman (1979) found that there was generally no relationship between sensation seeking and trait anxiety, although there was a low negative correlation between Thrill and Adventure Seeking and trait fears of physical harm. These findings may generalise from sensation seeking to risk-taking. Few researchers have examined the role of anxiety in the adoption of precautionary behaviours. However, it is likely that anxiety is linearly unrelated to risk-precaution because people who are very anxious and people who are less anxious may not consider risk-precaution as an appropriate response. Less anxious people may consider a response to risk unnecessary while very anxious people may be unable to respond to risk.

The aim of Study 3 is to test the construct validity of the Risk-Taking and Risk-Precaution scales. This is done though an examination of the scales factorial validity, and the convergent and discriminant validity. As a test of factorial validity, it was hypothesised that analyses of responses to the combined Risk-Taking/Risk-Precaution scales would reveal two independent factors that would represent the risk-taking and risk-precaution items respectively. As a test of convergent validity, the Risk-Taking scale should be positively correlated with the Sensation Seeking scale, and its subscales, while the Risk-Precaution scale should be negatively correlated with that scale. The discriminant validity of the Risk-Taking and Risk-Precaution scales will be tested by correlating these variables with trait anxiety. It was anticipated that there would be no relationship between anxiety and either risk-taking or risk-precaution.

Method

Participants

Participants were 370 undergraduate psychology students at Victoria University of Wellington (125 males, 217 females, 28 not reported). Participants were recruited through their weekly laboratory class and received a wrapped sweet as a token of appreciation for taking part in the study; participants did not receive course credit[3]. No information was gathered to determine the response rate of the survey.

[3] At the time this study was conducted, first year psychology students participated in a number of studies as part of the laboratory course work. Each researcher was assigned a number of classes in which to collect data. This section of the laboratory programme was run over two weeks. In the first week the researcher administered the questionnaire booklet to class members who agreed to participate in the study; in the second week, they returned to debrief all class members as to the nature of the study. As the data collection phase was scheduled as the last part of the class, those who did not want to participate were free to leave early.

Measures

A booklet containing three questionnaires was administered to participants. The questionnaires were Version V of the Sensation Seeking Scale version (Zuckerman, 1979), the Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988), and the Risk-taking and Risk-precaution scales. The Sensation Seeking Scale (SSS) is a 40 item forced choice scale, with four subscales. The subscales are Thrill and Adventure Seeking (TAS), Experience Seeking (ES), Disinhibition (DIS), and Boredom Susceptibility (BS). Zuckerman (1994) reported that reliabilities for the total scale are typically in the range of .83 to .86, while for individual subscales reliabilities range from .77 to .82 (TAS), .61 to .67 (ES), .74 to .78 (DIS), and .56 to .65 (BS). The Beck Anxiety Inventory (BAI) is a 21 item inventory for measuring the severity of anxiety. Beck et al. (1988) reported that the scale has an internal consistency of .92, and test-retest reliability of .75 over one week. The questionnaires were counterbalanced to prevent any order effects.

Procedure

Participants were given between 15 and 20 minutes to complete questionnaires. Upon completion of the questionnaires, participants were debriefed as to the nature of the study.

Data Analysis

To establish the factorial validity of the Risk-Taking and Risk-Precaution scales it is first necessary to specify the criteria used to determine the number of factors within the scale. This is important as it is possible to specify the rotation of any number of factors when rotating the principal components of a correlation matrix. The problem of deciding the number of factors in a correlation matrix has been solved in a variety of ways (Walkey, 1983), such as the number of factors with an eigenvalue greater than 1.00 or by rotating only statistically significant factors. The decision as to the number

of factors to rotate has been based on criteria which are varied, subjective, and sometimes unstated (Siegert, 1988). Frequently the decision is based on some mathematical criterion, which may reflect adequate mathematical conditions, but which fails to reflect the psychological properties of the data (Walkey, 1983). Walkey (1983) and Walkey and McCormick (1985b) developed the method adopted in this study to determine the number of factors. Due to the originality and utility of the method, the underlying theory will be summarised here.

Walkey (1983) argued that the rotation of a large number of factors typically led to a factor solution that was unstable. In contrast, when the number of factors is rotated in accord with the expected or theoretical scale structure, factor solutions are both more interpretable and more stable. In a subsequent development, Walkey and McCormick (1985b) showed that factor-matching indices allow the comparison of factor structures across samples to establish a replicable factor solution. This procedure is particularly useful in situations where either the researcher has no expectations of the number of factors, or where the proposed factor solution is not found. Using the s-index (Cattell, Balcar, Horn, & Nesselroade, 1969), Walkey and McCormick (1985a) developed the computer programme FACTOREP to compare factor solutions across groups of subjects for different numbers of factors. FACTOREP also allows the setting of different hyperplane cut offs to make comparisons on the basis of the size of the factor loadings.

The s-index is a non-parametric statistic similar to the chi-square test. The calculation involves placing the results of a comparison of the loadings of each variable in turn on any two factors from different factor analytic solutions into a three by three contingency table, depending on whether each is a positive salient, a non-salient (hyperplane), or negative salient variable, in relation to each factor. The similarity or 's' index is then calculated from the formula:

$$\underline{s} = (f_{11} + f_{33} - f_{13} - f_{31})/(f_{11} + f_{33} + f_{13} + f_{31} + \tfrac{1}{2}(f_{12} + f_{21} + f_{23} + f_{32})) \quad [1]$$

where *f*ij are the cell frequencies.

The s-index values can range from 1.00 representing perfect agreement between factor loadings on all variables in the two solutions being compared, through zero where no relationship exists, to –1.00 where perfect replication exists but where the signs of the loadings are reversed. In addition to this, FACTOREP allows the setting of different criteria for a 'salient' loading so that the researcher can systematically examine rotated factor loadings above different prescribed hyperplane cut off levels e.g., .30, .40, .50. FACTOREP has been particularly useful in establishing the factor structure of the following questionnaires: the General Health Questionnaire (Siegert & Chung, 1995; Siegert, McCormick, Taylor, & Walkey, 1987); the WAIS-R (Siegert, Patten, Taylor, McCormick, 1988); the Inventory of Socially Supported Behaviors (Walkey, Siegert, McCormick, & Taylor, 1987); and the ATT39, a measure of psychological adjustment to diabetes (Welch, Smith, & Walkey, 1992).

Given the utility of FACTOREP and its suitability as a tool to determine a replicable factor structure, the following analyses were performed to test the hypotheses. First, participants were randomly divided into two groups of 185 and varimax rotation was performed, extracting 2, 3, and 4 factors from the responses of each group. These rotated factor loadings were then analysed using FACTOREP procedures using hyperplane cut-off points of .20, .30, and .40. Second, to interpret the factor solutions derived from the previous analysis, all participant responses were used to perform a principal components analysis with varimax rotation (Kaiser, 1958) on all 43 items of the risk-taking and risk-precaution scales. Gender differences were examined in the obtained factor solution by examining the factor loadings derived from male and female responses. Third, Cronbach's alpha was calculated as an estimate of internal consistency. Finally, to test the convergent and discriminant validity of the risk-taking and risk-precaution scales, the subscales which were identified as relating to the replicable factors identified by FACTOREP procedures were correlated, using Pearson's r, with the BAI and the four subscales of the SSS.

Results

Factorial Validity

The results of the FACTOREP comparisons are presented in Tables 2.3 to 2.5. Table 2.3 shows the s index values for a two-factor solution and suggests that a two-factor solution can be replicated across samples as indicated by the high s index value for corresponding factors in the lead diagonal cell (1.00) and low values in the off diagonal cells for non-corresponding factors (ranging from .00 - .25).

Table 2.3

S Index Values for a Two Factor Solution across Two Groups using Three Cut-Off Points for the Risk-Taking and Risk-Precaution Scale

	Cut Off Points					
	.20		.30		.40	
Factors	1	2	1	2	1	2
1	1.00	.25	1.00	.05	1.00	.00
2	.25	1.00	.05	1.00	.00	1.00

A similar pattern is revealed for the s index analysis of a three-factor solution (Table 2.4) whereby a high s index value of 1.00 was obtained for the corresponding factors in the lead diagonal and low values ranging from .00 to .37 for the off diagonal cells for the non-corresponding cells. Noteworthy are the low values (.00 - .08) obtained for the hyperplane cut off of .40 signifying a high degree of similarity in the factor structures of the two samples.

Table 2.4

S Index Values for a Three Factor Solution across Two Groups using Three Cut-Off Points for the Risk-Taking and Risk-Precaution Scale

	Cut Off Points								
	.20			.30			.40		
Factors	1	2	3	1	2	3	1	2	3
1	1.00	.30	.00	1.00	.13	-.06	1.00	.08	.00
2	.30	1.00	.37	.13	1.00	.29	.08	1.00	.08
3	.00	.37	1.00	-.06	.29	1.00	.00	.08	1.00

The results obtained from the calculation of the s index for a four-factor rotation do not show such good evidence of a replicable solution. Although a high degree of similarity was obtained between the corresponding factors down the lead diagonal, the values recorded for the non-corresponding factors in the off diagonal cell are relatively high (ranging from .00 to .25 at the .40 hyperplane cut off level) suggesting over-factoring (Table 2.5).

In sum, the calculation of the s-index using two groups derived from randomly dividing a sample of 370 responses, and rotating of 2, 3, and 4 factors indicated that a two and three factor solution could be replicated across groups. Table 2.6 shows the rotated factor solution using all 370 responses for a two and three factor solution.

Table 2.5

S Index Values for a Four Factor Solution across Two Groups using Three Cut-Off Points for the Risk-Taking and Risk-Precaution Scale

	Cut Off Points											
	.20				.30				.40			
Factors	1	2	3	4	1	2	3	4	1	2	3	4
1	1.00	.32	.00	.17	1.00	.19	.00	.33	1.00	.00	.00	.25
2	.31	1.00	.42	.06	.19	1.00	.30	.17	.00	1.00	.08	.00
3	.00	.42	1.00	-.06	.00	.30	1.00	.15	.00	.08	1.00	.10
4	.17	.06	-.06	1.00	.33	.17	.15	1.00	.25	.00	.10	1.00

Table 2.6

Study 3: First Principal Component Loadings of the Risk-Precaution and Risk-Taking Items, and Two and Three Factor Rotated Solutions

		PC	Two Factor Varimax Rotation		Three Factor Varimax Rotation		
Item			Factor I	Factor II	Factor I	Factor II	Factor III
RP 1	Have an annual chest X-ray	-03	--	--	--	31	--
RP 2	Have an annual medical check up	15	--	47	--	61	--
RP 3	Carry a spare set of keys	19	--	35	--	53	--
RP 4	Get a dental check up every six months	12	--	41	--	46	--
RP 5	Double locks on doors	30	--	44	--	43	--
RP 6	Eye examination every two years	17	--	37	--	40	--
RP 7	Have home fire drills	16	--	39	--	50	--
RP 8	Insist car or vehicle passengers use seatbelts	42	--	55	--	40	39
RP 9	Leave a spare house key with neighbour	26	--	47	--	43	--
RP 10	Lock car when not in it	30	--	34	--	--	--
RP 11	Lock up poisonous materials	36	--	52	--	43	--
RP 12	Mark contents of medicine bottles	34	--	59	--	49	33
RP 13	Take travellers' checks on vacation (not just cash)	18	--	41	--	52	--
RP 14	Eat healthy food	14	--	--	--	40	--
RP 15	Take first aid course	04	--	39	--	46	--
RP 16	Throw out old medicines or unmarked medicine bottles	37	--	53	--	43	31
RP 17	Use a safety mat in bathtub or shower	18	--	--	--	--	--
RP 18	Use sunscreen when outside in summer	20	--	39	--	42	--
RP 19	Use step ladder to reach high places	22	--	30	--	42	--

Note: RP = Risk-Precaution, RT = Risk-Taking items. Decimal points omitted. Only values >.30 reported. Risk-Precaution items have been repolarized so that all items are scored in the same direction.

Table 2.6, continued
Study 3: First Principal Component Loadings of the Risk-taking and Risk-precaution Items, and Two and Three Factor Rotated Solutions

Item		PC	Two Factor Varimax Rotation		Three Factor Varimax Rotation		
RT 20	Swim	37	54	--	51	--	--
RT 21	Ride a bicycle	35	51	--	52	--	--
RT 22	Binge drink	33	--	37	--	--	45
RT 23	Use a gun	47	53	--	57	--	--
RT 24	Play a contact sport (e.g., rugby)	42	51	--	54	--	--
RT 25	Go hunting	45	53	--	57	--	--
RT 26	Ride in a home made aircraft or microlight aircraft	47	61	--	67	--	--
RT 27	Ride a motorbike	59	68	--	69	--	--
RT 28	Fly as a passenger in a single-engine light-plane	55	68	--	71	--	--
RT 29	Go mountain climbing	54	71	--	74	--	--
RT 30	Go tramping in the bush	43	63	--	60	--	--
RT 31	Fly in a helicopter	54	68	--	67	--	--
RT 32	Drive a car	30	35	--	--	--	30
RT 33	Go skiing	49	64	--	60	--	--
RT 34	Drive an uninsured car	55	31	49	--	--	57
RT 35	Not pay a fine	32	--	45	--	--	53
RT 36	Take something that doesn't belong to you	33	--	38	--	--	51
RT 37	Drive well over the speed limit	53	--	54	--	--	60
RT 38	Drive off the forecourt of the petrol station without paying for petrol	34	--	35	--	--	42
RT 39	Have a physical fight	46	34	31	32	--	--
RT 40	Park on a yellow line	42	--	46	--	--	70
RT 41	Not put money in the parking meter	47	--	47	--	--	68
RT 42	Coast downhill with your car in neutral	57	44	36	34	--	50
RT 43	Have a heated argument	19	--	--	--	--	42

The results of a two-factor rotation do not show a clear distinction between risk-taking and risk-precaution. A two-factor solution accounted for 24.3% of the variance. Factor I consists of 16 items purported to measure risk-taking, Factor II consists of 26 items, 16 of which are risk-precaution items and 10 of which are risk-taking items. Of the 44 items, 4 had loadings below .30. Cronbach's alpha was computed at .85 for Factor I and .80 for Factor II. Finally, a correlation of r=.17 was found between Factor I and Factor II. In labelling these factors, Factor I consists of items that involve serious risk with the potential for loss of life (e.g., use a gun, go hunting). These risk-taking items are titled 'major risk'. Factor II contains a mixture of items which sample the domains of risk-taking and risk-precaution. These items are characterised by risk in everyday situations (e.g., drive an uninsured car, throw out old medicines or unmarked medicine bottles) and as such this factor is titled 'daily risk-taking'.

Analysis of the three-factor rotation provides a clearer distinction between risk-taking and risk-precaution. Three factors accounted for 29.6% of the variance. Factor I consists of 13 items from the risk-taking scale. Typical items were "swim", "ride a bicycle", "fly as a passenger in a single engine light plane", and "go mountain climbing".

As with the two-factor solution, this factor represents items that involve potential loss of life, and is also labelled major risk. Factor II encompasses 17 of the 20 items from the risk-precaution scale, and is titled risk-precaution. Finally, Factor III is comprised of 11 items from the risk-taking scale. Typical items from this scale are "park on a yellow line", "coast downhill with your car in neutral", and "binge drink". As this factor consists of items which measure risk in a non-lethal context, it is titled minor risk. Internal consistency was estimated at .85 for the major risk-taking factor, .77 for the risk-precaution factor, and .75 for the minor risk-taking factor. With regard to the relationship between the factors, a correlation of r= .01, ns, was found between major risk and risk preparation, r= -.37, p<.001 between risk-precaution and minor risk, and a correlation of r= .28, p<.001, between major risk-taking and minor risk-taking.

Table 2.7

Two Factor Rotated Solution of the Risk Scale for Male and Female respondents

	Males		Females	
	F 1	F 2	F 1	F 2
Have an annual chest X-ray	--	53	--	--
Have an annual medical check up	--	56	--	33
Carry a spare set of keys	--	47	--	--
Get a dental check up every six months	--	42	--	36
Double locks on doors	--	44	--	42
Eye examination every two years	--	53	--	--
Have home fire drills	--	47	--	35
Insist car or vehicle passengers use seatbelts	--	60	--	48
Leave a spare house key with neighbour	--	41	--	50
Lock car when not in it	--	51	--	--
Lock up poisonous materials	--	58	--	48
Mark contents of medicine bottles	--	66	--	51
Take travellers' checks on vacation (not just cash)	--	51	--	36
Eat healthy food	--	--	--	--
Take first aid course	-38	47	--	31
Throw out old medicines or unmarked medicine bottles	--	56	--	46
Use a safety mat in bathtub or shower	--	--	--	36
Use sunscreen when outside in summer	--	39	--	32
Use step ladder to reach high places	--	--	--	31

Table 2.7 Continued

	Males		Females	
	F 1	F 2	F 1	F 2
Swim	66	--	50	--
Ride a bicycle	60	--	46	--
Binge drink	--	34	--	39
Use a gun	49	--	50	--
Play a contact sport (e.g., rugby)	46	--	53	--
Go hunting	50	--	51	--
Ride in a home made aircraft or microlight aircraft	52	--	62	--
Ride a motorbike	71	--	65	--
Fly as a passenger in a single-engine light-plane	68	--	65	--
Go mountain climbing	73	--	72	--
Go tramping in the bush	74	--	64	--
Fly in a helicopter	73	--	68	--
Drive a car	51	--	--	--
Go skiing	69	--	62	--
Drive an uninsured car	39	51	--	51
Not pay a fine	--	43	--	52
Take something that doesn't belong to you	--	40	--	37
Drive well over the speed limit	42	52	--	55
Drive off the forecourt of the petrol station without paying for petrol	--	40	--	31
Have a physical fight	--	40	30	--
Park on a yellow line	40	53	--	47
Not put money in the parking meter	42	45	--	45
Coast downhill with your car in neutral	47	41	40	30
Have a heated argument	--	--	--	--

Table 2.8

Three Factor Rotated Solution of the Risk Scale for Male and Female Respondents

	Males			Females		
	F 1	F 2	F 3	F 1	F 2	F 3
Have an annual chest X-ray	--	48	--	--	--	--
Have an annual medical check up	--	--	67	--	43	--
Carry a spare set of keys	--	--	55	--	55	--
Get a dental check up every six months	--	--	55	--	37	--
Double locks on doors	--	--	47	--	39	--
Eye examination every two years	--	--	46	--	--	--
Have home fire drills	--	--	50	--	56	--
Insist car or vehicle passengers use seatbelts	--	57	32	--	41	--
Leave a spare house key with neighbour	--	--	57	--	50	--
Lock car when not in it	--	42	32	--	--	--
Lock up poisonous materials	--	43	41	--	57	--
Mark contents of medicine bottles	--	40	54	--	53	--
Take travellers' checks on vacation (not just cash)	--	--	50	--	53	--
Eat healthy food	--	--	--	--	31	--
Take first aid course	-40	--	40	--	42	--
Throw out old medicines or unmarked medicine bottles	--	30	48	--	36	--
Use a safety mat in bathtub or shower	--	--	--	--	44	--
Use sunscreen when outside in summer	--	--	38	--	31	--
Use step ladder to reach high places	--	--	35	--	44	--

Table 2.8 Continued

	Males			Females		
	F 1	F 2	F 3	F 1	F 2	F 3
Swim	73	--	--	51	--	--
Ride a bicycle	65	--	--	48	--	--
Binge drink	--	50	--	--	--	39
Use a gun	61	--	--	46	--	--
Play a contact sport (e.g., rugby)	58	--	--	52	--	--
Go hunting	62	--	--	47	--	--
Ride in a home made aircraft or microlight aircraft	47	--	--	65	--	--
Ride a motorbike	65	32	--	67	--	--
Fly as a passenger in a single-engine light-plane	58	38	--	70	--	--
Go mountain climbing	70	--	--	74	--	--
Go tramping in the bush	72	--	--	63	--	--
Fly in a helicopter	60	35	--	69	--	--
Drive a car	45	--	--	--	--	--
Go skiing	64	--	--	62	--	--
Drive an uninsured car	--	65	--	--	--	50
Not pay a fine	--	38	--	--	--	55
Take something that doesn't belong to you	--	49	--	--	--	54
Drive well over the speed limit	--	60	--	--	--	59
Drive off the forecourt of the petrol station without paying for petrol	--	45	--	--	--	52
Have a physical fight	37	--	--	--	--	45
Park on a yellow line	--	63	--	--	--	65
Not put money in the parking meter	--	57	--	--	--	65
Coast downhill with your car in neutral	--	66	--	34	--	40
Have a heated argument	--	50	--	--	--	43

The two and three factor rotations for males and females are presented in Tables 2.7 and 2.8. Although there is some item instability, both solutions show that a similar structure was obtained between male and female respondents. That is, the factors identified from the whole sample are also largely borne out for these sub-groups.

Convergent and Discriminant Validity

Table 2.9 shows the intercorrelations between the scales and subscales of the two-factor solution of the risk-taking and risk-precaution scale with the BAI and the SSS. Table 2.10 shows the intercorrelations for the three-factor solution. With regard to convergent validity, intercorrelations between the SSS subscales and the risk subscales range from .08 to .53 with major risk-taking for the two-factor solution. Intercorrelations of -.05 to .01 were found between these subscales and daily risk-taking. An examination of the discriminant validity shows a significant correlation between the BAI and daily risk-taking (r=.18) but no significant correlation with major risk-taking (r=.01).

As is apparent form Table 2.10, the extraction of three factors produces a solution that shows good convergent validity. Major risk-taking is significantly positively correlated with the total SSS score (r=.32), as is minor risk-taking (r=.47). A strong positive relationship was observed between the SSS subscale thrill and adventure seeking and major risk-taking (r=.52) while a smaller, but positive relationship, was observed with minor risk-taking (r=.20). Positive correlations were obtained between all the subscales of the SSS and major risk-taking (range .08 to .52). Likewise, positive correlations were observed with minor risk-taking (range .20 to .45). Risk-precaution is significantly negatively correlated with the total SSS score (r = -.34). All the subscales of the SSS were negatively correlated with risk-precaution (range -.11 to -.31).

Table 2.9

Intercorrelations between the Two Factors of the Risk-Taking and Risk-Preparation Scale and Other Instruments

		1	2	3	4	5	6	7
1	Major	*						
2	Daily	.17*	*					
3	BAI	.01	.18**	*				
4	SS-TAS	.52**	.01	-.11*	*			
5	SS-ES	.12*	-.03	-.02	.26**	*		
6	SS-DIS	.11	-.04	.01	.16**	.37**	*	
7	SS-BS	.08	-.01	-.02	.08	.23**	.33**	*
8	SS-TOT	.32**	-.05	-.04	.60**	.67**	.75**	.61**

Major = major risk; Daily = daily risk; SS-TAS = Sensation Seeking Scale Thrill and Adventure Seeking subscale; SS-ES = Sensation Seeking Scale Experience Seeking subscale; SS-DIS = Sensation Seeking Disinhibition subscale; SS-BS = Sensation Seeking Scale Boredom Susceptibility subscale; SS-Tot = Sensation Seeking Scale; BAI = Beck Anxiety Inventory;

* p<.05, **p<.01

Table 2.10

Intercorrelations between the Three Factors of the Risk-Taking and Risk Preparation Scale and Other Instruments

		1	2	3	4	5	6	7	8
1	Major	*							
2	Minor	.28**	*						
3	Risk Prec.	-.01	-.37						
4	BAI	.01	.13*	.08	*				
5	SS-TAS	.52**	.20**	-.11*	-.11*	*			
6	SS-ES	.12*	.31**	-.24**	-.02	.26**	*		
7	SS-DIS	.11	.45**	-.31**	.01	.16**	.37**	*	
8	SS-BS	.08	.31**	-.19**	-.02	.08	.23**	.33**	*
9	SS-TOT	.32**	.47**	-.34**	-.04	.60**	.67**	.75**	.61**

Major = Major risk-taking; Minor = Minor risk-taking; Risk Prec. = Risk-precaution; SS-TAS = Sensation Seeking Scale Thrill and Adventure Seeking subscale; SS-ES = Sensation Seeking Scale Experience Seeking subscale; SS-DIS = Sensation Seeking Disinhibition subscale; SS-BS = Sensation Seeking Scale Boredom Susceptibility subscale; SS-Tot = Sensation Seeking Scale; BAI = Beck Anxiety Inventory;

* p<.05, **p<.01

To test the discriminant validity of the scales, major risk-taking, minor risk-taking, and risk-precaution were correlated with the Beck Anxiety Inventory (BAI). No significant correlations were obtained between the BAI and major risk-taking and risk-precaution; however a small but significant correlation of -.12 was obtained between minor risk-taking and the BAI.

Discussion

To test the factorial validity of the Risk-Taking and Risk-Preparation scales, FACTOREP procedures were applied to responses obtained from a sample of 370 undergraduate students. The results showed that a two factor solution and a three factor solution could be replicated across two independent groups of responses. Analysis of the two factor rotation indicated that some risk-taking items had high salient loadings on the same factor as the risk-preparation items. These two factors were labelled major risk and daily risk. An examination of the three factor rotation showed that the risk-taking items had high loadings on Factors I and III, while risk-precaution items loaded on Factor II. Factor I was labelled major risk-taking, Factor II was labelled risk-precaution, and Factor III was labelled minor risk-taking.

Gender was examined as a source of variation in the development of the risk scales. Two and three factors were extracted to determine whether the factors identified from the responses of the whole sample would be borne out separately for male and female participants. The results show a high degree of replicability: the factor structures found using all responses could also be identified from both the male and female responses.

In examining the rotated factor patterns of the two and three factor solutions, it is clear that Factors II and III (risk-precaution and minor risk-taking) of the three-factor rotation, both consist of items from Factor II of the two-factor rotation (daily risk-taking). That is, the difference between the two factor rotation and the three factor rotation is the splitting of the daily risk factor into two separate factors to produce the risk-

precaution and minor risk-taking scales. Intercorrelations between the three-factor solutions shows a marginally stronger correlation between risk-precaution and minor risk-taking then the correlation between major risk-taking and minor risk-taking. When a two-factor rotation is specified in the equation, the two factors with the stronger correlation load onto one factor, while the factor with the weaker correlation loads on a separate factor. Although the two-factor rotation could be replicated across independent groups, it does not provide a useful factor solution as the daily risk-taking factor consists of two conceptually different domains of risk: risk-precaution and minor risk-taking. The three factor rotation was also replicated across independent samples, and provided a more sophisticated interpretation of risk, as a distinction can be made between risk-precaution and minor risk-taking[4]. Based on this, only the three factor solution will be used in future analyses.

The intercorrelations between the derived factors shows that major risk-taking and risk-precaution are unrelated. Minor risk-taking and risk-precaution were significantly negatively correlated, indicating that as precaution increases, minor risk-taking decreases. Finally, minor risk-taking and major risk-taking were positively correlated suggesting that the more likely a person is to engage in minor risk-taking activities, the more likely they are to engage in major risk-taking activities.

As a test of the convergent and discriminant validity of the Risk-Taking and Risk-Precaution scales, responses to the questionnaire were correlated with responses to the Sensation Seeking Scale and the Beck Anxiety Inventory. It was predicted that

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[4] As mentioned earlier, in the development of the Risk-taking scale (Study 1), it was not possible to rigorously test whether a multidimensional model could be applied to the scale: the relatively small sample size in that study prevented split-half comparisons between factor solutions. However, once the two components of risk-taking had been identified from the data collected in this study, an additional factor analysis was performed on the responses from Study 1 to determine whether the same two factors were borne out in the data. A very similar pattern was observed supporting the contention that Risk-taking comprises two components: major risk and minor risk.

the Risk-Taking scale and the Sensation Seeking Scale. In line with previous research convergent validity would be established by showing a positive relationship between (e.g., Schaninger, 1976; Zuckerman, 1979), it was proposed that trait anxiety would be unrelated to Risk-Taking and Risk-Preparation, indicating support for discriminant validity. The intercorrelations between the SSS and the three factor solution shows evidence of discriminant validity. As expected, a positive relationship was observed between major risk-taking, minor risk-taking and sensation seeking. The results show that thrill and adventure seeking was strongly related to major risk, but not to minor risk. Conversely, experience seeking, disinhibition, and boredom susceptibility were all more highly correlated with minor risk-taking than major risk-taking. A negative relationship was found between risk-precaution and sensation seeking, indicating that the more people make preparations for risky events, the less likely they are to engage in sensation seeking activities. An examination of the relationship between the subscales of the SSS and the risk-precaution scale also shows significant negative correlations with all the SSS subscales. Thus, people who prepare for risk tend to avoid seeking novel sensations and experiences through social situations such as parties, social drinking and casual sex.

General Discussion

The development of the risk-taking and risk-precaution scales was guided by the proposition that there are individual differences in how people respond to risk (Lambert, Burroughs, & Nguyen, 1999; Zuckerman, 1979, 1994). The structure of the scale was based on the conceptualisation of two different types of risk related behaviours: those that involve an increase in the exposure to harm (risk-taking), and those that involve a decrease in the vulnerability to harm (risk-precaution). In Study 1, a measure of risk-taking was developed from an initial pool of items and refined through the use of factor analysis. A similar research design was used in Study 2 to develop a measure of risk-precaution that was initially used by Schiff (1977). Study 3

examined the factorial validity as well as the convergent and discriminant validity of the risk-taking and risk-precaution scales. It was hypothesised that clusters of risk-taking and risk-precaution items would comprise two independent factors: a factor consisting of risk-taking items and a factor consisting of risk-precaution items.

Although these two factors were not supported by the results of Study 3, the application of FACTOREP procedures to two independent sets of responses indicated that both two factor, and three factor rotations, could be replicated. The two-factor rotation proved to be difficult to interpret because one factor contained a mixture of risk-taking and risk-precaution items. However, the three-factor rotation provided a clearer interpretation of risk, whereby the factors of major risk-taking, minor risk-taking, and risk-precaution could be identified from the item pool. This new questionnaire is titled the Risk Scale.

The research in Study 3 also attempted to test the convergent and discriminant validity of the Risk scale. The major risk and minor risk subscales were positively correlated with the Sensation Seeking Scale and its subscales, while risk-precaution was negatively correlated. Because previous research indicated that there was no relationship between risk-taking and trait anxiety (e.g., Zuckerman, 1979), the discriminant validity of the scale was tested by studying the relationship between the three risk factors and the Beck Anxiety Inventory. Trait anxiety was not significantly related to major risk or to risk-precaution. However, a small but significant correlation was obtained with minor risk-taking. Overall, these results support the convergent and discriminant validity of the Risk scale.

The three-factor solution is useful for two reasons. First, it satisfies two salient psychometric criteria (high reliability, robust and replicable factor structure), and second, it can be interpreted in a way that is consistent with the conceptualisation of risk-taking and risk-precaution. That is, risk-precaution activities, which involve a decrease in the vulnerability to harm, differ from risk-taking activities, which involve an

increase in the exposure to risk. Risk-taking activities consisted of two elements – major risk-taking and minor risk-taking.

The present scale has several advantages over previous measures. Most importantly, the scale developed has been designed as a global measure of risk-related activities, and can be applied to a variety of situations to examine people's response to risk. Second, the scale examines both risk-taking, which has been researched widely, and risk-precaution, an aspect of risk that has been largely ignored by research examining individual differences in response to risk. Third, the developed scale has been subjected to psychometric evaluation to test its factorial stability, and convergent and discriminant validity. Finally, the Risk Scale has been developed in Likert format to increase the variability in responses, and should be able to better examine individual differences in risk-related behaviours than earlier scales (e.g., Schiff, 1977).

However, the extent to which the items comprising the Risk scales are generalizable from a student sample to other demographic groups has not been addressed by the research presented in this chapter. While students – like all residents of Wellington City – need to prepare for a major earthquake, it is unclear to what extent tests developed using a single demographic group can be applied to other groups. Given the high incidence of risk-taking among younger people, it is likely that the inclusion of responses from other demographic groups would have added informative value to the test development. This consideration suggest that the Risk scale is probably a better test for a student sample than other groups as the measurement error is likely to be greater for non-students. This reflects the fact that some items are likely to be less suitable indicators of risk for non-students.

Conclusion

This chapter has documented the development of a questionnaire that examines two aspects of risk-related behaviours. The first aspect, risk-taking, is concerned with the actions that people take to increase the probability and severity of adverse effects. The second aspect, risk-precaution, is concerned with the actions that people take to reduce their own vulnerability to harm. As no existing measure examined both these aspects of risk, a new scale – titled the Risk scale – was developed over three studies. The scale developed differentiates between minor risk-taking activities, major risk-taking activities, and risk-precaution. The convergent and discriminant validity of these subscales was supported using the Sensation Seeking Scale and the Beck Anxiety Inventory.

CHAPTER 3 – THE IDENTIFICATION AND EVALUATION OF A QUESTIONNAIRE TO ASSESS LOCUS OF CONTROL

Chapter Overview

Although locus of control has been widely researched in psychology, questions remain about the psychometric properties of many scales used to assess this construct. Five frequently used Locus of Control scales were examined, and, based on a review of the literature, three of these scales were selected for psychometric evaluation using the responses of a substantial sample of university students. Of the three questionnaires, only the Spheres of Control scale (SOC) showed evidence of a factor structure that conformed to the theoretically expected solution; however even one subscales had low estimates of reliability. Additional research using university students as participants, indicated that a combination of subscales from two versions of the SOC produced the best indication of the three theoretically derived dimensions.

Background

The term locus of control (LOC) originated from Rotter's social learning theory (Rotter, 1966). It refers to the idea that people have generalized beliefs about whether most people's outcomes in life reflect causal factors that lie within themselves or causal factors that lie outside themselves. People who perceive that outcomes are dependent on effort or intelligence are described as having an internal locus of control. People who believe that outcomes are mostly dependent on external or environmental circumstances, including fate, are described as having an external locus of control. Typical beliefs associated with an internal locus of control are that hard work will lead to obtaining the desired goal or that ability will help to achieve a particular goal. For those with an external locus of control, typical beliefs are that success is due to being at the right place at the right time, or that decisions are best made by flipping a coin.

There is currently a wide variety of locus of control scales, and these can be broadly classified either as general adult scales or domain specific scales. General adult locus of control scales examine locus of control from the viewpoint of a general trait influencing a wide variety of behaviours (Burger, 1993). Scales that are used include the Internal-External locus of control scale (Rotter, 1966), the Adult Nowicki-Strickland Internal-External Control scale (Nowicki & Duke, 1974), the Internal Control Index (Duttweiler, 1984), the Internality, Powerful Others and Chance scales (Levenson, 1974), and the Spheres of Control scale (Paulhus & Christie, 1981).

A recent trend in locus of control measurement, however, has been the development of scales for narrowly defined, or domain specific situations (Burger, 1993). The domain specific scales developed include scales for parenting (Campis, Lyman, & Prentice-Dunn, 1986), health (Wallston & Wallston, 1981), drinking (Donovan & O'Leary, 1983), and weight-loss (Saltzer, 1982). However, the utility of these domain specific scales is limited for research when it comes to people's response to natural disasters.

This chapter begins with a review of the research dealing with the psychometric properties of the general locus of control scales. Based on this review, three scales were selected for inclusion in a study to further evaluate their psychometric properties, and to determine their usefulness for further research. The results of that study provided the impetus for additional research, which is reported here, designed to meet the goals of identifying a locus of control scale that had a clear and replicable factor structure, and acceptable estimates of reliability.

The Internal-External Locus of Control Scale

The first measure used to assess locus of control, the Internal-External scale (I-E scale: Rotter, 1966), assumed that locus of control could be measured on a single continuum, with internal control at one end of the spectrum, and external control at the other. The scale consists of 23 question pairs and 6 filler items, although a number of

shorter and longer versions of the scale exist. For example, Valecha and Ostrom (1974) developed an 11-item version of the I-E scale which contained no filler items, and Zuckerman, Gerbasi and Marion (1977) developed a 46-item agree/disagree scale based on the original 23-items of the I-E scale. Summary psychometric properties of the I-E scale are presented in Table 3.1.

Reliability

Rotter (1966) examined the reliability of the I-E scale and reported an internal consistency of .70 (Kuder-Richardson) from a sample of 400 students. Similarly, O'Brien and Kabanoff (1981) found an internal consistency of .69 using a sample of 1473 Australians, and Fleming and Spooner (1985) reported a reliability of .76 for a sample of 256 University students. Test-retest reliabilities were estimated at .72 for 60 college students after one month, and .55 for 117 students after two months (Rotter, 1966). Zerega, Tseng, and Greever (Zerega, Tseng, & Greever, 1976) found a test-retest reliability of .55 after eight months. Layton (1985) found that the I-E scale had a test-retest reliability of .53 for a 6 to 7 month interval, and .57 for an 11 to 12 month interval.

Validity

Studies of convergent and discriminant validity have found that the I-E scale correlates negatively with the Levenson (1974) Internal scale (-.55) and correlates positively with the Powerful Others (.54) and Chance scales (.68) (Fleming & Spooner, 1985). These results have been supported by a number of other studies (e.g., Levenson, 1974; Walkey, 1979) indicating that the scale does discriminate between internal and external locus of control. Similarly, the I-E scale has also been found to be

Table 3.1

Summary Psychometric Properties of the I-E Scale

Study	n	Reliabiliy α	Test-retest Reliabilty	Interval (Months)	Correlation with IPC			Correlation with ANSIE	Number of Factors	% of Variance
					Internal	Powerful Others	Chance			
O'Brien & Kabanoff (1981)	1473	.69								
Fleming & Spooner (1985)	256	.76			-.55	.54	.68			
Layton (1985)	186		.57	11 to 12						
	101		.53	6 to 7						
Zerega et al. (1976)	541		.55	8						
Waters et al. (1987)	168							.47		
Rotter (1966)	400	.70							1	53.0
	60		.72	1						
Prociuk (1977)									1	8.90
Mirels (1970)	159								2	19.5
	157								2	18.8
Viney (1974)	159								2	15.0
	134								2	19.0
Dixon et al. (1976)	98								3	28.3
	123								3	22.2
Little (1977)	500								4	
Garza & Widlak (1977)	203								5	42.8
	244								5	37.8
McInish & Srivastave (1982)	253								9	

moderately correlated to other locus of control scales. For example, a correlation of .47 was reported with the Adult Nowicki-Strickland Internal-External Scale (Waters, Popovich, & Martelli, 1987).

The I-E scale has been used in a number of interesting and important studies (Lefcourt, 1991). In a study of the leisure time of internals and externals, Kabanoff and O'Brien (1980) found a tendency for internals to engage in a number of activities requiring greater skill and allowing more personal control. Julian and Katz (1968) conducted a study of competitive game behaviour and found externals were more likely to rely on the skill of the opponent while internals preferred to rely on themselves. With respect to goal setting, Yukl and Latham (1978) found that internals set harder goals than externals, and locus of control appeared to play a role in job satisfaction.

One threat to the validity of the I-E scale is a high correlation found with measures of social desirability (Cone, 1971; Kestenbaum, 1976; Vuchinich & Bass, 1974). For example, Cone found correlations between -.29 and -.70 with the Edwards Social Desirability Scale indicating that people with an internal locus of control tended to respond in a socially desirable manner.

Factor Structure

According to Rotter (1966), locus of control is a unidimensional construct whereby internal and external orientation represent endpoints on a continuum. Rotter and Franklin (1963) analysed the I-E scale and found that one factor explained 53% of the common variance, providing support for the unidimensional nature of the scale. However, subsequent research has raised questions about this finding. Using the correlation matrix first computed by Franklin (1963), Prociuk (1977) found that one factor only accounted for 8.9% of the total scale variance. Further analysis by Prociuk found that the 53% value reported by Franklin represented the percentage of common variance and not the total scale variance accounted for by the general factor, thus exaggerating the variance one factor accounted for. While many studies have reported

variances ranging from 8% to 20% (e.g., Lange & Tiggemann, 1981; Little, 1977; O'Brien & Kabanoff, 1981; Watson, 1981), none have reported variances as high as the 53% value obtained by Rotter (1966) and Franklin (1963).

Although there seems little support for the unidimensionality of the I-E scale, there is little agreement among researchers over the precise number of factors in the scale. Mirels (1970) identified two factors that were later labeled General Control and Political Control by Cherlin and Bourque (1974). The first factor was described as a belief in control, in which one endpoint represented a belief in internal control (e.g., “In my case getting what I want has little or nothing to do with luck”). The other endpoint represented a belief in external control (e.g., “Many times we might as well decide what to do by flipping a coin”). By contrast, the second factor was described as control over political and world affairs, where one endpoint refers to an acceptance of control, and the other endpoint refers to a rejection of control. The two-factor solution proposed by Cherlin and Bourque was supported by Watson (1981), who found that a similar two-factor solution could be replicated as shown by a coefficient of congruence (Harman, 1967).

Dixon, McKee and McCae (1976) rotated three factors based on the criterion of eigenvalues greater than 1.00 and total variance greater than 5%. Factor I was characterized by control of world-political affairs, Factor II was concerned with a generalised control of personal mastery, although there were gender differences in the factor rotation. Finally, Factor III was concerned with control of leadership success. Similar results were obtained by Abrahamson, Schludermann and Schludermann (1973).

In another factor rotation performed by Watson (1981), a four-factor solution was found to account for 18 of the 23 items. These four factors were labeled fate, liability, work ethic, and politics, and were similar to the factors obtained by Little (1977). Garza and Widlak (1977) found that a five-factor solution accounted for 42.8% of the variance. These factors were described as (a) luck/fate, (b) leadership/success,

(c) academic, (d) politics, and (e) respect. Finally, McInish and Srivastava (1982) found a nine-factor solution using the responses from a sample of stock-market investors.

Evaluative Conclusion

The I-E scale is one of the most widely used measures of locus of control, having been employed in nearly 50% of studies researching the construct up till 1990 (Lefcourt, 1991). Studies examining the reliability of the I-E scale have found the scale to have moderate internal consistency and to be reasonably reliable over time. However, a number of limitations with the scale have been identified. Several studies have reported significant correlations between the I-E scale and measures of social desirability (e.g., Cone, 1971; Kestenbaum, 1976), hence limiting the usefulness of the scale. Although Rotter (1966) claimed that the scale measured a unidimensional construct, research has failed to support this contention. Attempts to describe the scale with a differing number of factors have failed to produce a clear factor structure that can be replicated across samples (i.e., solutions are offered from two to nine factors). Although this scale has been crucial in the development of the locus of control construct, it appears that its use as a measurement instrument is somewhat limited and that it has been superseded by more recent scales.

The Adult Nowicki-Strickland Internal-External Control Scale

The Adult Nowicki-Strickland Internal-External Control Scale (ANSIE) measures locus of control conceptualised as generalised expectancy of control. The scale is a unipolar measure of locus of control and adapted from the Childrens's Nowicki-Strickland Internal-External Scale (CNSIE) developed by Nowicki and Strickland (1973). The ANSIE is a 40-item questionnaire; the participants indicate their response using a Yes/No format. The language is regarded as being less difficult than the I-E scale, allowing for better comprehension by a non-student sample. Scores can range

from 0 (internal LOC) to 40 (external LOC). Typical scores among college students are M=9.1, (SD=3.9) and for non-college adults M=11.0 (SD=5.6). Dixon, McKee and McRae (1976) found no gender difference in the scale, with males and females recording similar scores. A summary of the psychometric properties is presented in Table 3.2.

Reliability

The ANSIE has an internal consistency of .70 using a sample of 267 introductory psychology students (Goodman & Waters, 1987). Nowicki & Duke (1974) report split half reliability indexes of .74 to .86 and test-retest reliabilities of .83 (six-week interval), .65 (seven-week interval), and .56 (one year interval). This represents modest internal consistency, given the length of the test (40 items).

Validity

Tests of convergent validity have shown that the ANSIE is related to the I-E scale, with correlations ranging from .44 (Lindbloom & Faw, 1982) to .68 (Nowicki & Duke, 1974). With respect to the Internality, Powerful others, and Chance scales, the ANSIE was significantly correlated with the Internality factor (-.24), Powerful Others (.24), and Chance (.40) using a sample of n=1195 (Nowicki & Duke, 1983). Lindbloom and Faw (1982) report similar findings. In studies testing the discriminant validity of the scale, the ANSIE has been found to be relatively free of social desirability bias (Nowicki & Duke, 1974).

Table 3.2

Summary Psychometric Properties of the ANSIE Scale

Study	n	Reliability α	Test-retest Reliability	Interval	Correlation with I-E	Number of factors	% of Variance
Goodman & Waters (1987)	267	.70					
Nowicki & Duke (1974)	158	.74 to .86			.68		
	48		.83	6 weeks			
			.65	7 weeks			
			.56	1 year			
Lindbloom & Faw (1982)	175				.44		
Dixon et al. (1976)	98					2	12.8
	123					2	14.5
Piotrowski et al. (1983)	174					4	50.7
Finch et al. (1981)	120					5	60.3

Factor Structure

Results of factor analyses on the responses to the scale present a confusing picture. Lefcourt (1991) claimed that factor analytic studies have mostly reported one large general factor that accounts for 30% of the variance. However, Dixon et al. (1976) found two factors. Factor I was concerned with interaction with others and Factor II was concerned with luck for males and futility of effort for females. Piotrowski, Dunn, Sherry and Howell (1983) reported that four factors accounted for 50.7% of the variance. Finch, Kendall, Spirito and Mikulka (1981) found evidence of a five factor solution. Factor I (four items) reflected an inability to protect oneself, Factor II (three items) was related to a lack of social power, Factor III (three items) was related to superstition, Factor IV (two items) suggested passivity or a 'why bother' attitude, and Factor V (three items) was related to a tendency to view effort as useless. These five factors utilized only 15 items in the scale; the other 25 items that comprise the ANSIE were not included in this solution. Finally, Kearney and Kearney (1983) found evidence of a five-factor solution where Factors I and II had a similar solution to Finch et al.

Gender differences reported in the factor solutions (e.g., Dixon et al., 1976; Kearney & Kearney, 1983) may, in part, be due to a reliance on sample sizes that are too small. Guilford (1954) recommends that a minimum sample of 200 should be used: as the sample size is reduced, the likelihood of the factor solution providing consistent results across samples is lessened. For example, Dixon et al. (1976) performed factor analysis using the responses of 98 participants and extracted three factors. In the same study, an additional set of 123 responses was also used. The factor structure that emerged from the first set of data was markedly different from the solution obtained from the second set. Similarly, Kearney and Kearney (1983) used two small samples (86 males and 108 females) and reported a different factor structure for males and females. Finally, Piotrowski et al. (1983) performed a factor analysis on a sample of 71 respondents, yielding four factors. In all these studies, however, the sample size

was below the recommended number of 200 suggested by Guilford (1954), indicating that the solutions proposed might not be replicated in another sample.

Confusion over the number of factors in the ANSIE may also be a result of a poor choice of analytic method used to identify the number of factors. For example, all the studies cited above used the minimum eigenvalues greater than 1.0 criterion to identify the number of factors. However, the use of eigenvalues greater than 1.0 to identify the number of factors has attracted criticism because it fails to produce stable, robust solutions that can be replicated in other samples (Walkey, 1983). Using eigenvalues greater than 1.0 as a method of identifying the number of factors tends to lead to a result that overestimates the number of factors extracted for rotation (Kline, 1993). Nonetheless, the majority of analyses of the ANSIE questionnaire have used this criterion to establish the number of factors, but have failed to provide a robust result. It would be useful for future analyses of this scale to use a computational method that produces results that could be replicated across different samples.

Evaluative Conclusion

The advantage of using the ANSIE scale over other measures such as Rotter's I-E scale is that it is worded for ease of comprehension. It has reasonably good internal consistency and test-retest reliability. Validity studies have shown that the scale does measure similar constructs to Rotter's (1966) I-E scale and Levenson's (1974) IPC scale. Disadvantages are the length of the scale (40 items) and the fact that many of the items have not been selected in any systematic way, making the extraction of a replicable number of factors difficult (Lefcourt, 1991). It is unclear how many factors are assessed in the scale and research is needed to address this issue. If efforts can be made to clearly identify the number of factors using a large sample, then this instrument may provide a good measure of locus of control that can be used locally.

The Internal Control Index

The Internal Control Index (ICI: Duttweiler, 1984) is a unidimensional measure of locus of control and consists of 28 items. Responses fall along a five point scale, ranging from (A) “rarely” to (E) “usually”. Items are worded so that highly internal subjects are expected to answer half the items at the “usually” end of the scale, and answer the other half of the items at the “rarely” end of the scale. The score can range from 28 to 140, with high scores reflecting an internal locus of control. The psychometric properties of the scale are presented in Table 3.3.

Reliability

The ICI has good estimates of reliability. Duttweiler (1984) found the ICI had a reliability of .84 using a sample of 684 non-students, and .85 using a sample of 133 Junior College students. Similarly, in a sample of university students Goodman and Waters (1987) found a reliability of .83. Jacobs (1993), Meyers and Wong (1988), and Maltby and Cope (Maltby & Cope, 1996) found similar findings supporting the scales reliability.

Validity

Data assessing the validity of the ICI is limited. Duttweiler (1984) and Goodman and Waters (1987) reported a correlation of -.38 between the ICI and Mirels Factor 1 of the I-E scale. Results of the Goodman and Waters study also showed a correlation of -.29 between the ANSIE and the ICI. Furthermore, the ICI correlated negatively with Levenson’s (1974) Internality (-.36), Powerful Others (-.28), and positively correlated with Chance (.33), indicating that the ICI does distinguish somewhat between internal and external locus of control.

Table 3.3

Summary Psychometric Properties of the ICI

Study	n	Reliability α	Correlation with I-E	Correlation with ANSIE	IPC Internal	IPC Powerful Others	IPC Chance	Number of factors	% of Variance
Duttweiler (1984)	684	.84						2	27
	133	.85	-.38					2	29
Goodman & Waters (1987)	267	.83	-.38	-.29	-.36	-.28	.33		
Meyers & Wong (1988)	240	.85	-.44					3	34
Maltby & Cope (1996)	160	.87							
	108	.86							
	92	.86							
Jacobs (1993)	85	.82							

Factor Structure

Factor analytic studies of the ICI show mixed results. Duttweiler (1984) found evidence for a two-factor solution, whereas Meyers and Wong (1988) found that a three-factor solution was more easily interpreted. Jacobs (1993), and Maltby and Cope (1996), calculated item-to-total correlations for the ICI and suggested that several items should be removed from the scale. Further use of this scale will require additional psychometric evaluation to determine more precisely the factor structure of the scale.

Evaluative Conclusion

The ICI is a relatively new measure of locus of control. Research indicates that the scale has good internal consistency, however few studies have yet examined the test-retest reliability, or the convergent and discriminant validity. Thus while the ICI may have promise as a research tool, its usefulness has not yet been adequately assessed. Theoretically, the ICI is a unidimensional scale, however several studies have reported two and three factor solutions. If this scale is to be used as a measure of locus of control, the number of factors will need to be clearly identified.

Internal, Powerful Others, and Chance Scales

Whereas the three scales reviewed in the preceding sections have been developed from the viewpoint that locus of control can be measured along a single continuum, other research has questioned this assumption, suggesting a variety of more complex versions of the construct (Carver, 1997). One such approach, taken by Levenson (1974), has seen the development of a measure that reflects the view that people assign control to three different sources. These sources are described as powerful others, and chance, which represent two distinct aspects of external control, and the self, which represents internal control. The questionnaire developed from this, the IPC scale, reflects the view that that those who believe that powerful others control events will behave and think differently from those who feel that the world is random

and unpredictable. Therefore the IPC scale was derived from a theoretical basis, not an inductive approach (Levenson, 1981).

Many of the IPC scale items were adapted from the I-E scale, although other items were written specifically to assess different aspects of external control. According to Levenson (1981), the IPC scale is largely a revision of the I-E scale; however, there are a number of important differences. First, items are presented using a Likert response scale instead of a forced choice format. Second, a personal-ideological distinction is made so that all statements are phrased only to pertain to the person answering the question, not people in general. Third, the scales are constructed in such a way that there is a high degree of parallelism in every three-item set. For example, one I scale item reads: Whether or not I get into a car accident depends mostly on how good a driver I am; the P scale item reads: Whether or not I get into a car accident depends mostly on the other driver; and the C scale item reads: Whether or not I get into an accident is mostly a matter of luck. Finally, unlike the I-E scale, correlations with the Marlowe-Crowne Social Desirability Scale are negligible (Levenson, 1974, 1981).

Reliability

Consistent reliability scores have been obtained, indicating that the IPC scale has moderate internal consistency (e.g., Goodman & Waters, 1987; Levenson, 1974; Presson, Clark, & Benassi, 1997; Walkey, 1979; Ward & Thomas, 1985). A summary of findings is presented in Table 3.4. Test-retest reliabilities with a 1-week interval show scores of .64 (I), .74 (P), and .78 (C) (Levenson, 1974), while a seven-week interval produced values between .66 and .73 (Lefcourt, 1991), indicating that the scale has acceptable stability over time.

Table 3.4

Reliability Estimates of the IPC Scale

Study	n	Reliabiliy α			Test-Retest Reliability			
		Internal	Powerful Others	Chance	Internal	Powerful Others	Chance	Interval
Presson et al. (1997)	1925	.71	.75	.68				
Walkey (1979)	156	.72	.65	.71				
Levenson (1974)	329	.64	.77	.78	.64	.74	.78	1 week
Goodman & Waters (1987)	267	.73	.75	.67				
Ward & Thomas (1985)	197	.70	.70	.82				

Validity

The validity of the IPC scales has been tested using convergent and discriminant validation methods (Campbell & Fiske, 1959). With respect to the relationship among the scales, the P and C subscales have been found to correlate with each other (.41 to .60), while the P and C scales correlate with the I scale between -.25 and .19 (Lefcourt, 1991). Levenson (1974) found a substantial correlation between the P and C scales (.59); similarly, Walkey (1979) found a correlation of .40 between the scales, indicating that the external scales of chance and powerful others do measure similar constructs. The I scale has been repeatedly found to be independent from the P and C scales. For example Levenson (1974) found no significant correlation between the I scale and either the P and C scales (-.14 to -.17). The independence of the P and C scales from the I scale was also confirmed by Walkey (1979), who found non significant correlations of .01 and -.19. This finding has been supported by other studies (e.g., Fleming & Spooner, 1985; Goodman & Waters, 1987; Sosis, Strickland, & Haley, 1980). Studies examining the convergent validity of the IPC scales have generally found that the P and C scales correlate positively with the I-E scale while the I scale correlates negatively (Levenson, 1981). For example, Walkey (1979) found correlations between the IPC scales and the I-E scale to be -.52, .17 and .65 respectively.

Similarly, significant correlations have been obtained between the I scale and the Internal, Ability and Effort subscales of the Multidimensional-Multiattributional Causality Scale, (Lefcourt, von Baeyer, Ware, & Cox, 1979) indicating that ability and effort are internal factors. The P scale was also correlated with other 'external' subscales such as Task, Luck, and External (Hyman, Stanley, & Burrows, 1991). Larger correlations were obtained between these factors and the C scale in the same study. Finally, Hymen et al. (1991) reported positive correlations between the I scale and the Internal and Effort subscales of the Trent Attributional Profile (Wong & Sproule,

1984). The P scale was correlated with Luck and External subscales while the C scale was correlated with these two factors as well as the Task subscale.

The majority of discriminant validity studies have examined the relationship between the IPC scales and social desirability. The IPC scales have been found to be uncorrelated to the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960). Levenson (1974) found that Marlowe-Crowne correlated with the IPC scales around zero with the maximum correlation being .19. Similarly, Walkey (1979) found correlations were generally low, ranging from -.26 to .16, indicating that measurements of the locus of control construct using this scale are not influenced by social desirability.

Factor Structure

Using a university student sample, Walkey (1979) found support for the three factor structure of the IPC scales proposed by Levenson (1974), with only two items out of 24 loading on an inappropriate factor. Lindbloom and Faw (1982) found similar findings with 21 of 24 items loading primarily on the same factors as those originally proposed. Finally, using a sample of 1925 participants, Presson, Clark and Benassi (1997) found that 20 items loaded on the theoretically expected factors.

Evaluative Conclusion

The IPC scale was one of the first scales to reflect the notion that locus of control was a multidimensional construct. Reported problems with the IPC scale have been that several items load on different factors to the expected factor or that items did not load on any factor at all. Nevertheless, the three-factor structure proposed by Levenson (1974) has been replicated consistently over a variety of samples. The scale does have moderate reliability and acceptable concurrent validity.

The Spheres of Control Scale

An alternative approach to that employed by Levenson (1974) has investigated the possibility that internal and external control can vary across different domains of a person's life (Paulhus, 1983; Paulhus & Christie, 1981; Paulhus & Van Selst, 1990). To assess this idea, Paulhus and Christie (1981) developed a new measure of locus of control, which they labeled Spheres of Control (SOC). The theory underlying the scale holds that personal efficacy (PE), interpersonal control (IPC) and sociopolitical control (SPC) are conceptually independent dimensions of perceived control. Within this framework, individuals have different expectancies with respect to the degree of control they are able to exert in different domains of their interaction with the world. Thus, the theory covers not only beliefs about personal control and sociopolitical control, facets measured by the I-E scale (Rotter, 1966), but also beliefs relating to interpersonal control, an area largely ignored in other measures of perceived control (Parkes, 1988). The SOC is therefore a three dimensional measure, sampling the domains of personal efficacy, interpersonal control, and sociopolitical control, with 10 items in each subscale. The scale has been used in research examining career-related interests (Park & Harrison, 1995), occupational role ambiguity (Von Emster & Harrison, 1998), paranormal beliefs (Davies & Kirkby, 1985), and computer use (Hill, Smith, & Mann, 1987). A summary of research investigating the psychometric properties is presented in Table 3.5.

Reliability

Paulhus (1983) reported internal reliabilities for the SOC of .75 (PE), .77 (IPC), and .81 (SPC). Using a sample of trauma survivors, Charlton and Thompson (1996) found reliabilities of .52, .79 and .73 for the PE, IPC and SPC scales, respectively. Test-retest correlations over a four-week period were above .90, and over a six-month period above .70, for all three subscales (Paulhus, 1983).

Table 3.5

Summary Psychometric Properties of the SOC Scale

Study	n	Reliabiliy α			Test-retest		Number of Factors
		PE	IPC	SPC	4 weeks	6 months	
Paulhus (1983)	110	.75	.77	.81	.90	.70	3
Parkes (1988)	576	.50	.71	.67			3
Hill et al. (1987)	133	.60	.70	--			
Charlton & Thompson (1996)	107	.52	.79	.73			

Note: PE = Personal Efficacy, IPC = Interpersonal Control, SPC = Sociopolitical Control.

Validity

In examining the relationship among the subscales, Parkes (1988) found the PE and IPC scales correlated significantly with one another (r=.45). A small but significant correlation of .12 was also found between the PE and SPC subscales. A similar significant correlation of .13 was found between the IPC scale and the SPC scale.

With respect to convergent validity, each SOC scale correlates negatively with the I-E scale (-.37 for PE, -.28 for IPC, and -.50 for SPC). This indicates that the I-E scale and the SOC scale do measure similar constructs. Tests of discriminant validity have found that the Marlowe-Crowne Social Desirability Scale was not strongly correlated with the SOC scales: the correlations were .19, .11, -.03 for the PE, IPC, and SPC scales respectively (Paulhus & Christie, 1981). Similarly, Paulhus and Christie examined the relationship between the SOC and the Machiavellianism Scale (Christie & Geis, 1970). Consistent with theory regarding the Machiavellianism construct, there was a negative relationship to sociopolitical control (-.24), a positive relationship to interpersonal control (.35), and no relationship to personal efficacy (.04).

The construct validity of the SOC was supported in a study by Paulhus, Molin, and Schuchts (1979). The SOC was administered to a sample of football players, tennis players, and non-athletes. The results showed that the PE and IPC subscales could identify whether respondents played a team-sport (football), an individual sport (tennis), or no sport at all.

Factor Structure

Confirmatory factor analysis by Paulhus (1983) suggested that a three-factor model provided a better fit to the data than a one factor model.

Evaluative Conclusion

Based on current research, the SOC scale appears to be a useful measure of the locus of control construct. Reported reliabilities are higher than those of any of the other scales reviewed. Although relatively few studies have tested the validity of the scale, those that have done this, provide promising support for its convergent and discriminant validity. However, more research is needed to confirm the factor structure of the three subscales.

Study 1

One of the research questions in this thesis is whether the personality construct referred to as locus of control is related to preparation for a major earthquake. The purpose of this chapter is to evaluate psychometrically a number of scales that measure the locus of control construct, to identify the scales which have a robust, replicable factor structure, and sufficient internal consistency.

Although Rotter's (1966) conceptualization of locus of control was fundamental in the development of the I-E scale, the review here identified a number of limitations with the instrument; specifically, modest estimates of reliability, and an unclear number of factors. These limitations raise the question of whether the I-E scale should be used for further research. Similarly, some limitations are evident in the ICI. Few validity studies have been conducted, and there is disagreement as to the factor structure of the scale. Three other scales, however, offer promise as useful tools to measure the locus of control construct. These are the ANSIE, the IPC scale, and the SOC scale. Study 1 examines the psychometric properties of these scales.

The following predictions are tested in Study 1. First, If the ANSIE is in fact a uni-factorial measure, as proposed by Nowicki and Strickland (1973), then there will be a strong general factor within the scale with most items having a high loading on the first unrotated factor. It is anticipated that when the items comprising of the ANSIE are subjected to factor analysis, an examination of the unrotated factor solution will show a

general factor within the ANSIE, as evidenced by loadings above .30 on the first unrotated factor for most items. If the ANSIE is a multidimensional scale, as proposed by Lindbloom and Faw (1982), Piotrowski et al. (1983), and Finch et al. (1981), then the application of FACTOREP procedures (Walkey & McCormick, 1985a, 1985b) should identify a replicable factor structure.

Second, Levenson (1974) argued that the IPC scale contained three subscales (Internal, Powerful Others, and Chance). It is proposed that three factors corresponding to these subscales will be borne out when factor analytic techniques are applied to the IPC questionnaire.

Finally, prior research (e.g., Paulhus, 1983), suggests that there are three factors in the SOC scale, which are labeled Personal Efficacy, Interpersonal Control, and Sociopolitical Control. It is hypothesized that these three factors will be identified when factor analytic procedures are applied to responses to the SOC questionnaire.

Method

Participants

Participants were 280 students at Victoria University of Wellington (116 males, 158 females, 6 unknown) who were seated in public places around the university campus. Participants had a mean age of 21 years for males and 20 years for females.

Materials

The materials used in this study were a questionnaire booklet containing three measures of locus of control. These measures were the ANSIE (Nowicki & Duke, 1974), the IPC scale (Levenson, 1974), and the SOC scale (Paulhus & Christie, 1981). The SOC scale was modified slightly for this study. In its original format the scale utilizes a seven point scale with endpoints ‘Disagree’ and ‘Agree’. Due to a concern over the possible polarization of responses, the anchor points used by Charlton and Thompson (1996) were employed instead. Thus, the seven-point scale was retained,

but the anchor points were labeled “Strongly Disagree”, “Disagree”, “Slightly Disagree”, “Neither Disagree nor Agree”, “Slightly Agree”, “Agree”, and “Strongly Agree”. For all scales, the questionnaire presentation was counterbalanced to prevent any order effects.

Procedure

Victoria University of Wellington students were approached and asked if they would be willing to complete an anonymous questionnaire. Those who volunteered were given copies of the three questionnaires and allowed approximately ten minutes alone to answer the questions. Once participants had completed the three measures, they were debriefed as to the nature of the study, and any questions or comments they had were addressed. Participants received a wrapped sweet as a token of appreciation for taking part in the study. A summary of research findings was posted in the School of Psychology.

Results

The responses were analysed using the SPSS package. Results are presented in order of analysis for individual questionnaires.

1. For the ANSIE, a principal component analysis was performed to examine the value of the loadings on the first unrotated factor. To estimate the strength of the general factor, unrotated loadings were converted to z-scores using Fisher’s r to z transformation. These z-scores were averaged, and then converted back to a correlation coefficient. As a consequence of the results of this analysis, FACTOREP procedures were applied to the ANSIE scale. Participants were randomly divided into two groups and a varimax rotation was performed on participant responses, extracting two, three, and four factors. These rotations were compared with hyperplane cut-off

points set at .20, .30, and .40.

2. For the IPC scale, principal components analysis was undertaken followed by a varimax rotation of the three theoretically expected number of factors. The strength of the general factor was again estimated using Fisher's r to z transformation.

3. For the SOC scale, principal components analysis with varimax rotation was undertaken extracting three factors. Again, Fisher's r to z transformation was used to estimate the strength of the general factor.

4. Coefficient alpha reliabilities were calculated for individual subscales and for the total scales for all measures.

The Adult Nowicki Strickland Internal-External Scale

Principal components analysis of the ANSIE did not identify the presence of a general underlying factor, as shown by a mean loading of .26 and a standard deviation of .15 on the first unrotated factor (Table 3.6). Associated with this, 16 items from a total of 40 had a unrotated factor loading below .30. One factor accounted for only 8% of the variance. Cronbach's alpha was calculated at .63, indicating weak to moderate reliability.

Attempts to identify a stable, replicable factor solution were unsuccessful. Comparison of a two-factor solution across two independent groups did not indicate that this solution could be replicated (Table 3.7). The s index values using were typically low at each hyperplane cutoff point with no values greater than .29 at the .40 criterion. Similarly, s index values comparing a three-factor solution across two groups

Table 3.6

Study 1: First Principal Component Factor Loadings of the Adult Nowicki-Strickland Internal-External Scale

Item	First Principal Component	Item	First Principal Component
1	28	21	16
2	18	22	14
3	29	23	48
4	17	24	01
5	36	25	07
6	05	26	18
7	32	27	33
8	07	28	12
9	26	29	48
10	02	30	18
11	36	31	55
12	12	32	20
13	12	33	45
14	30	34	24
15	08	35	26
16	54	36	42
17	27	37	29
18	25	38	21
19	48	39	35
20	35	40	30
M r			26
SD r			16

Note: Decimal points omitted

revealed a pattern of unrelated factors (Table 3.8). At the .40 criterion level no corresponding factor had a value greater than .44, indicating poor similarity across independent subject groups.

Table 3.9 gives the s index values for comparing a four-factor solution across two groups. As in previous analysis there was no indication of similarity in the corresponding factor structures at the .20, .30, or .40 hyperplane cut-off points. At all criterion levels no value exceeded .55; however, in some instances s index values of zero, or near zero were obtained.

Table 3.7

Study 1: S Index Values for Two Factor Solutions across Two Groups using Three Cut Off-Points for the Adult Nowicki-Strickland Internal-External Scale

	Cut Off Points					
	.20		.30		.40	
Factors	1	2	1	2	1	2
1	.64	.29	.40	.08	.25	.17
2	.57	.15	.42	.20	.29	.00

Table 3.8

Study 1: S Index Values for Three Factor Solutions across Two Groups using Three Cut-Off Points for the Adult Nowicki-Strickland Internal External Scale

	Cut Off Points								
	.20			.30			.40		
Factors	1	2	3	1	2	3	1	2	3
1	.61	.33	.19	.39	.33	.09	.29	.17	.20
2	.44	.39	.25	.50	.18	.20	.44	.38	.14
3	-.11	.18	-.20	-.18	.20	-.33	-.14	.00	.00

Table 3.9

Study 1: S Index Values for Four Factor Solutions across Two Groups using Three Cut-Off Points for the Adult Nowicki-Strickland Internal External Scale

	Cut Off Points											
	.20				.30				.40			
Factors	1	2	3	4	1	2	3	4	1	2	3	4
1	.50	.00	.44	.38	.33	.00	.00	.40	.25	.00	.00	.33
2	.37	.23	.47	.00	.46	.20	.25	-.10	.44	.00	.33	.00
3	.50	.44	-.11	-.12	.55	.50	-.25	.10	.29	.40	-.20	.00
4	-.18	.00	.27	-.36	-.20	.00	.43	-.33	-.14	.00	.40	.00

Internal, Powerful Others, and Chance Scales

Based on the findings of Levenson (1974) and other subsequent studies, three factors were extracted from the responses to the IPC scale. Analysis of the scale shows that a three-factor solution accounted for 35.1% of the variance. The unrotated factors (Table 3.10) indicate the presence of a moderate general factor, as demonstrated by a mean loading of .40 and a standard deviation of .25 for the first unrotated factor; a mean loading of .11 and a standard deviation of .31 for the second unrotated factor, and a mean loading of .02 and a standard deviation of .25 for the third unrotated factor.

Table 3.11 shows the rotated factor solution. Factor I contains seven P scale items and four C scale items. Factor II is a mixture of four C scale items and three I scale items. Factor III encompasses seven I scale items, two C scale items, and one P scale item. The value of coefficient alpha was .68 for the total 24-item scale. For the individual subscales alphas were .56, .69, and .67 for the I, P, and C scales respectively.

Table 3.10

Study 1: Unrotated Factor Loadings of the Internal, Powerful Others, and Chance Scales

Item	Factor I	Factor II	Factor III
I 1	15	46	23
I 4	-01	41	19
I 5	37	46	04
I 9	-08	39	32
I 18	27	51	-40
I 19	32	53	06
I 21	63	-11	04
I 23	42	-06	-05
P 3	66	-12	18
P 8	59	-03	21
P 11	56	-35	16
P 13	59	-09	30
P 15	15	-38	-03
P 17	55	-35	20
P 20	45	26	-45
P 22	50	14	-17
C 2	52	05	-40
C 6	17	-32	-44
C 7	49	-03	-30
C 10	60	08	-08
C 12	55	-16	10
C 14	45	15	34
C 16	15	46	23
C 24	-01	41	19
M r	40	11	02
SD r	25	31	25

Note: Decimal points omitted, items are arranged in the order of the factor structure proposed by Levenson (1974).

Table 3.11

Study 1: Three Factor Varimax Rotation of the Internal, Powerful Others, and Chance Scales

Item	Factor I	Factor II	Factor III
I 1	--	--	52
I 4	--	--	45
I 5	--	35	44
I 9	--	--	49
I 18	--	64	--
I 19	--	33	51
I 21	--	--	52
I 23	--	--	45
P 3	57	--	--
P 8	34	--	--
P 11	67	--	--
P 13	60	--	--
P 15	65	--	--
P 17	66	--	--
P 20	--	--	-33
P 22	66	--	--
C 2	--	68	--
C 6	30	46	--
C 7	--	60	--
C 10	--	--	-49
C 12	--	48	--
C 14	44	42	--
C 16	56	--	--
C 24	48	--	33

Only values above 0.30 are presented, decimal points are omitted.

The Spheres of Control Scale

A principal components analysis of the SOC scale indicated the presence of a general factor, shown by a mean loading of .37 and a standard deviation of .19 on the first unrotated factor (Table 3.12). Associated with this was a mean loading of .01 and a standard deviation of .29 for the second unrotated factor and a mean and standard deviation of .07 and .26 for the third unrotated factor. This three-factor solution accounted for 31% of the variance.

Results of the varimax rotation show that the three factors reported by Paulhus (1983) are clearly evident (Table 3.13). Factor I consists of 11-items of which nine items are from the ten-item interpersonal control scale (items 11-20). Factor II consists of 10 items of which nine are from the ten-item sociopolitical control scale (items 21-30). Finally Factor III consists of eight items which are all from the ten-item personal efficacy scale (items 1-10). Coefficient alpha was calculated at .79 for all 30-items of the SOC. For individual subscales, coefficient alpha was .59 (PE), .75 (IPC), and .70 (SPC).

Discussion

The purpose of Study 1 was to evaluate the psychometric properties of three measures of locus of control. The scales examined were the ANSIE, a scale purported to have a single underlying factor, the IPC scale and the SOC scale. The latter two scales are conceptualized as multidimensional instruments: both have three underlying factors.

This analysis failed to establish clearly whether the ANSIE was a uni-factorial or a multi-factorial scale. With respect to the uni-factorial nature of the scale, the unrotated factor loadings did not indicate the presence of a single latent variable influencing responses to the items as a whole. As the unifactorial model was clearly

Table 3.12

Study 1: Unrotated Factor Matrix of the Spheres of Control Scale

Item	Factor I	Factor II	Factor III
PE1	34	-18	58
PE2	50	-20	37
PE3	02	-28	14
PE4	31	-17	30
PE5	25	-09	62
PE6	43	-24	16
PE7	18	-09	40
PE8	20	-23	32
PE9	-04	09	35
PE10	43	-26	05
IPC11	53	-27	-17
IPC12	48	-33	-02
IPC13	35	-22	-23
IPC14	45	-11	-14
IPC15	36	20	06
IPC16	51	-31	-18
IPC17	56	-10	-34
IPC18	56	-23	-26
IPC19	34	-19	-16
IPC20	54	-20	-21
SPC21	52	36	-02
SPC22	50	56	02
SPC23	42	51	01
SPC24	49	48	05
SPC25	30	32	18
SPC26	04	34	29
SPC27	39	22	-14
SPC28	52	44	-04
SPC29	25	25	-20
SPC30	09	09	16
M r	37	02	07
SD r	19	29	26

Note: Decimal points are omitted

Table 3.13

Study 1: Three Factor Varimax Rotation of the Spheres of Control Scale

Item	Factor I	Factor II	Factor III
PE1	--	--	69
PE2	--	--	56
PE3	--	--	--
PE4	--	--	43
PE5	--	--	67
PE6	36	--	37
PE7	--	--	44
PE8	--	--	42
PE9	--	--	27
PE10	42	--	--
IPC11	61	--	--
IPC12	53	--	--
IPC13	48	--	--
IPC14	45	--	--
IPC15	--	37	--
IPC16	62	--	--
IPC17	62	--	--
IPC18	65	--	--
IPC19	42	--	--
IPC20	60	--	--
SPC21	--	60	--
SPC22	--	75	--
SPC23	--	66	--
SPC24	--	69	--
SPC25	--	45	--
SPC26	--	31	--
SPC27	--	41	--
SPC28	--	66	--
SPC29	--	35	--
SPC30	--	--	--

Note: Decimal points are omitted, and only values above 0.30 reported.

inappropriate for this scale, FACTOREP procedures were applied to successive rotations of the instrument using two independent subject groups. Analysis of two, three and four factor solutions failed to provide a solution that could be replicated across independent subject groups. Thus, the ANSIE scale is neither uni-factorial, as shown by the low loadings on the first unrotated factor, nor multi-factorial, as shown by a poor replication of various factor structures across two independent groups. Judged by the psychometric criteria of replicable factor structure, the presence of an underlying latent factor, and moderate-to-high internal consistency, it appears that the ANSIE is a poor measure of locus of control.

Previous research indicated that the extraction of three factors provided a good fit with the underlying scale theory for the IPC Scale (e.g., Levenson, 1974; 1981; Walkey, 1979). In this administration of the scale, the three factors were not clearly borne out. It appears that some items loaded unsystematically onto different factors from those proposed by Levenson (1974). Low estimates of internal consistency were obtained for each subscale.

Finally, an examination of the responses to the SOC scale indicated that this is a more promising instrument for the measurement of locus of control. Analysis of the unrotated factor loadings indicated the presence of a general factor influencing responses to the items as a whole. A three-factor varimax rotation revealed a solution that provided a good fit with the solution proposed by Paulhus and Christie (1981), with 26 of the 30 items loading on the theoretically expected factor. The calculation of coefficient alpha as an estimate of reliability supported these results, with a relatively high value for the Interpersonal and Socio-political control scale, although the Personal Efficacy scale had a lower value, in accord with the findings of earlier research (see Table 3.5).

Study 2

Since Paulhus and Christie (1981) first published the SOC measure, the scale has been revised, initially by Paulhus (1983), and more recently by Paulhus and Van Selst (1990). The most notable changes made to the 1983 version (titled the SOC-2) were the rewriting of four items and the simplification of several others. Subsequent psychometric evaluation of the scale by Furnham (1987) and Parkes (1988) found that the personal efficacy subscale still suffered from low reliability. This subscale has also been criticised by Palenzuela (1987) who claimed that the personal efficacy subscale is a mixture of self-efficacy items and locus of control items. In response to these observations, Paulhus and Van Selst (1990) modified the items in the personal efficacy subscale, and renamed this subscale as perceived control (PC) subscale, reflecting the sharpened emphasis on control. This full revised scale is referred to as the SOC-3.

Paulhus and Van Selst (1990) recommend that the SOC-3 be used in place of earlier versions of the scale, because the internal consistency of the PC subscale is improved over that of the earlier PE subscale, and the norms for SOC-3 are indistinguishable from earlier versions of the scale. However, no published research has yet reported an examination of the factor structure of the SOC-3. The present study attempted to address this issue by administering both the SOC-1 and the SOC-3 versions to a large group of respondents, in order to examine in detail any changes in the factor structure of the SOC as it has been revised. A positive outcome of this initial examination of the two versions of the scale, was the identification of a procedure through which the original goal of a clear three-factor structure might be achieved.

Method

Participants

Participants were 354 students at Victoria University of Wellington who were seated in public places around the University Campus. All participants received a wrapped sweet as a token of appreciation for taking part in this study.

Materials

The questionnaires used, consisted of the SOC-1 (Paulhus & Christie, 1981) and the SOC-3 (Paulhus & Van Selst, 1990). With the SOC-1, participants were asked to indicate their responses to each statement on a seven-point scale ranging from disagree to agree. For the SOC-3, participants rated the extent to which each statement was an adequate description of their view of themselves on a seven-point scale, ranging from totally inaccurate to totally accurate. This is the format for each scale proposed by the original authors. In each case, items were presented in subscale groups. The order of presentation was counterbalanced, with each version of the SOC printed on a single page and separate from the other questionnaire. Participants used an individual code to allow responses to different versions of the questionnaires to be matched.

Procedure

Victoria University of Wellington students were approached and asked if they would be willing to complete an anonymous questionnaire. Those who volunteered for the study were given a copy of either the SOC-1 or the SOC-3; they completed the scale alone in approximately five minutes. At the completion of this first scale, participants returned the questionnaire to the researcher who asked if they would be willing to complete a second questionnaire. Those who agreed were given the alternative scale. Participants were informed that many of the items were similar to the

previous questionnaire, but that they should complete this scale, as far as possible, independently of their responses to the previous scale.

Results

Data Analysis

For each questionnaire, principal components analysis with varimax rotation was performed extracting three factors. Coefficient alpha was computed as an estimate of internal consistency for each subscale. Following a close examination of the results of these analyses, an additional analysis was undertaken, in an attempt to identify a factor structure and subscale structure that would conform to the underlying theory on which the scale was based. The items from the IPC and SPC subscales of the SOC-1 and the PC subscale from the SOC-3, were included in a principal components analysis and subject to varimax rotation.

Spheres of Control – 1

In the three-factor rotation of the SOC-1, the three factors proposed by Paulhus and Christie (1981) were clearly evident, although a total of four out of the 30 items loaded significantly on an inappropriate factor (Table 3.14). Factor I had salient loadings on nine of the ten IPC subscale items (items 11-14 and 16 to 20). Factor II had salient loadings on nine items of the 10 items that are reported to measure SPC, Factor III loaded significantly on seven PE subscale items. Overall, these three factors accounted for 31% of the variance. Coefficient alpha was calculated at .60 for the PC subscale, .71 for the IPC subscale, and .77 for the SPC subscale.

The Spheres of Control – 3

The results of a three-factor varimax rotation (also given in Table 3.14) showed considerably less support for the factor structure proposed by Paulhus and Van Selst

Table 3.14

Study 2: Three Factor Varimax Rotations of the Spheres of Control Scale –1 and the Spheres of Control – 3

Spheres of Control Scale – 1				Spheres of Control Scale – 3			
Item	F I	F II	F III	Item	F I	F II	F III
PE1	--	--	57	PC1	66	--	--
PE2	39	--	46	PC2	47	--	--
PE3	--	--	--	PC3	--	--	--
PE4	--	--	42	PC4	64	--	--
PE5	--	--	66	PC5	48	--	--
PE6	56	--	--	PC6	34	54	--
PE7	--	--	50	PC7	34	--	--
PE8	--	--	36	PC8	59	--	--
PE9	--	--	37	PC9	34	36	--
PE10	54	--	--	PC10	--	--	--
IPC11	62	--	--	IPC11	--	30	--
IPC12	31	--	--	IPC12	48	--	--
IPC13	57	--	--	IPC13	--	--	--
IPC14	39	--	--	IPC14	52	--	--
IPC15	--	--	--	IPC15	56	--	--
IPC16	51	--	--	IPC16	31	35	--
IPC17	45	--	--	IPC17	51	--	--
IPC18	69	--	--	IPC18	38	--	--
IPC19	51	--	--	IPC19	--	41	--
IPC20	54	--	--	IPC20	47	--	--
SPC21	--	68	--	SPC21	--	--	74
SPC22	--	77	--	SPC22	--	--	79
SPC23	--	47	--	SPC23	--	51	--
SPC24	--	69	--	SPC24	--	64	--
SPC25	--	62	--	SPC25	--	--	63
SPC26	--	34	--	SPC26	--	--	55
SPC27	--	55	--	SPC27	--	61	--
SPC28	--	69	--	SPC28	--	61	36
SPC29	--	43	--	SPC29	--	--	35
SPC30	--	--	43	SPC30	--	--	49

Note: Decimal points omitted, only values above .30 reported.

(1990). Factor I had salient loadings on 15 items. These included a mixture of eight PC and seven IPC items. Factor II consisted of nine items with loadings above .30. Three of these items were from the IPC subscale, four from the SPC subscale, and two from the PC subscale. Factor III contained seven items with loadings at a significant level, all of them from the SPC subscale. Overall, the three factors accounted for 31% of the variance. Reliability, as measured by coefficient alpha, was estimated at .71 for the PC subscale, .68 for the IPC subscale, and .75 for the SPC subscale.

Factor rotation of the PC subscale (SOC-3) and the IPC and SPC subscales (SOC-1)

The relatively high estimate of reliability for the PC subscale of the SOC-3 suggested that the items within this subscale largely measured the same construct. Furthermore, most of the IPC and SPC items of the SOC-1 had loadings above .30 on the rotated factor, indicating a close correspondence between the theory and the measure of the construct. A three-factor varimax rotation was therefore undertaken using the 10 PC items from the SOC-3, and the 20 IPC and SPC items from the SOC-1. The results of this analysis are presented in Table 3.15, and show a close fit to the theoretically expected structure of the SOC. The solution was also considerably closer to the expected structure than either of the individual scales. Factor I showed salient loadings on nine SPC items but no loadings on other items, and clearly represented the sociopolitical construct. Factor II had ten significant loadings, all on PC items. The variable represented by this factor therefore appears to be personal control. Finally, Factor III had salient loadings on 11 items, ten of which were items from the IPC subscale. This factor may be reasonably identified as representing interpersonal control. These three factors accounted for 31% of the variance.

Table 3.15

Study 2: Three Factor Varimax Rotation of the Composite Spheres of Control Scale

Item	F I	F II	F III
PC1	--	74	--
PC2	--	50	--
PC3	--	34	--
PC4	--	65	--
PC5	--	62	--
PC6	--	37	34
PC7	--	45	--
PC8	--	65	--
PC9	--	37	--
PC10	--	30	--
IPC11	--	--	59
IPC12	--	--	32
IPC13	--	--	60
IPC14	--	--	52
IPC15	--	--	36
IPC16	--	--	40
IPC17	--	--	53
IPC18	--	--	67
IPC19	--	--	42
IPC20	--	--	63
SPC21	67	--	--
SPC22	76	--	--
SPC23	47	--	--
SPC24	69	--	--
SPC25	62	--	--
SPC26	34	--	--
SPC27	55	--	--
SPC28	70	--	--
SPC29	44	--	--
SPC30	--	--	--

Note: Only values above .30 presented, and decimal points omitted.

Discussion

The purpose of Study 2 was to compare the psychometric properties of the original Spheres of Control scale (SOC--1: Paulhus & Christie, 1981) with the revised version of the Spheres of Control scale (SOC-3: Paulhus & Van Selst, 1990). The SOC-3 differs from earlier versions of the scale in that the Personal Efficacy subscale has been modified to measure only one aspect of personal control. To reflect this sharpened emphasis, the scale was renamed Personal Control (PC), by Paulhus and Van Selst (1990).

An analysis of the SOC-1, developed by Paulhus and Christie (1981), shows that the three subscales of Personal Efficacy (PE), Interpersonal Control (IPC), and Sociopolitical Control (SPC) are clearly evident, with 25 of the 30 items having loadings above .30 on the theoretically expected factor. In contrast, the rotated factor loadings of the SOC-3 failed to produce a fit that represented the dimensions of personal control, interpersonal control, and sociopolitical control. Rather, the PC and IPC items loaded unsystematically on Factors I and III, while SPC items grouped together on Factor II. These results indicate that the SOC-3 retains some limitations as a measurement instrument.

These results present a clear problem. One the one hand, the earlier SOC-1 version of the questionnaire has a clear factor structure, yet one subscale suffers from poor internal consistency. On the other hand, the solution, proposed by Paulhus and Van Selst (1990) in the form of a re-written Personal Control subscale, and the modification of several other items, overcame the reliability issue, but the factor structure of the questionnaire clearly suffered in the process. Guided by this pattern of results, an alternative analysis was undertaken that utilised the best components of both versions of the SOC. Specifically, when items from the PC subscale of the SOC-3 were included in the analyses along with IPC and SPC items from the SOC-1, a clear factor solution, corresponding precisely with the theoretical subscale structure emerged. In this solution, all three subscales proposed by the authors were clearly

evident. Thus, the solution proposed here, using a composite of items from the SOC-1 and the SOC-3, provides an excellent fit with the theoretical structure of the Spheres of Control scale.

Study 3

Cattell et al. (1969) reasoned that the derivation of a particular factor solution from one sample is not sufficient to demonstrate the underlying structure of a questionnaire. Rather, if the pattern of loadings on the rotated factors is to be relied upon, then the solution should be robust across separate administrations of the questionnaire. In Study 3, the replicability of the factor structure obtained in Study 2 is examined, by obtaining the responses of a substantial, independent group of participants on the composite of items from the SOC-1 and the SOC-3 developed in Study 2.

Method

Participants

The participants were 341 students of Victoria University of Wellington (151 males, 184 females, 6 not reported). The mean age was 20 years.

Materials

The questionnaire used, consisted of the PC subscale from the SOC-3 (Paulhus & Van Selst, 1990) and the IPC and SPC subscales from the SOC-1 (Paulhus & Christie, 1981). In Study 2 the endpoints for each version of the questionnaire differed slightly. The SOC-3 used a seven-point 'Totally Inaccurate' to 'Totally Accurate' format, while the SOC-1 used a seven point 'Disagree' to 'Agree' format. As such, it was decided to adopt the Disagree-Agree endpoints used for the SOC-1 as this format had been previously used for the majority of items in the scale.

Procedure

Victoria University of Wellington students were approached and asked if they would be willing to participate in the study. Those who agreed were given a copy of the questionnaire and allowed approximately five minutes alone to complete the scale.

Results

Principal components analysis with a three-factor varimax rotation was performed to examine the factor structure of the SOC. As a measure of internal consistency, Cronbach's alpha was computed for individual subscales.

The results of the three-factor rotation failed to show evidence of a fit with the three factors reported in Study 2 (see Table 3.16). Factor I consisted of 15 items with salient loadings above .30. These were largely PC and IPC items. Factor II included 8 items with loadings above .30. These were SPC items. Finally, Factor III had 10 items with salient loadings above .30. These items represent a mixture of PC and IPC items. Cronbach's alpha was computed at .54 for the Personal Control subscale, .72 for the Interpersonal Control subscale, and .70 for the Socio-political Control subscale.

Discussion

The purpose of Study 3 was to test the robustness and replicability of a three-factor rotation of the Spheres of Control scale found in Study 2. The solution reported in Study 2 was unique as it utilised the subscales from two different versions of the SOC, and the factor structure corresponded precisely with theoretical structure of the scale. In the present study, the composite SOC was administered to a large sample, so that independent responses to the questionnaire could be collected. It was anticipated that the three-factor structure would show a clear differentiation between personal control, interpersonal control, and sociopolitical control subscales, and that each subscale would have moderate to high reliability.

The results of Study 3 do not show a clear distinction between these three subscales. Only Factor II could clearly be identified as consisting of items from one of the subscales (the SPC subscale). The majority of items had unsystematic loadings on Factors I and III, and, while good reliability was found for the IPC and SPC subscales, a low reliability estimate was found for the PC subscale. Thus, the results from Study 2 have not been replicated here.

One key difference between Study 2 and Study 3 was the use of different endpoints for the PC subscale of the SOC-3 items. A 'totally inaccurate' to 'totally accurate' endpoint was used in Study 2 for SOC-3 items, whereas a 'disagree' to 'agree' format was used for these items in Study 3. The changes to the format of the questionnaire may have affected the way that participants responded to the question. In a review of the methodological issues associated with self-report questionnaires, Schwarz (1999) argued that minor changes in question format can have major changes in the obtained results. This could be tested in relation to the Spheres of Control Scale using the original disagree-agree endpoints for the SOC-1 PC items.

Study 4

The purpose of Study 4 was to attempt again to replicate the factor structure obtained in Study 2. In this study, however, the endpoints proposed by Paulhus and Christie (1981) and Paulhus and Van Selst (1990) were retained in their original format. As there were clear expectations as to the structure of the scale, confirmatory factor analysis was undertaken, using the responses of a substantial independent group. The AMOS 4 Structural Equation Modelling procedure (Arbuckle & Wothke, 1999) in SPSS, was used to show whether with overall goodness of fit criteria, a three-

Table 3.16

Study 3: Three Factor Varimax Rotation of the Spheres of Control Scale

Item	Factor 1	Factor II	Factor III
PC1	51	--	--
PC2	47	--	--
PC3	--	--	45
PC4	35	--	--
PC5	--	--	--
PC6	31	--	53
PC7	--	--	48
PC8	44	--	--
PC9	--	--	-52
PC10	--	--	34
IPC11	48	--	37
IPC12	57	--	--
IPC13	57	--	--
IPC14	62	--	--
IPC15	33	--	--
IPC16	31	--	31
IPC17	55	--	--
IPC18	35	--	54
IPC19	--	--	37
IPC20	61	--	--
SPC21	34	57	--
SPC22	--	68	--
SPC23	--	62	--
SPC24	--	72	--
SPC25	--	36	--
SPC26	--	--	-46
SPC27	--	50	--
SPC28	--	65	--
SPC29	--	48	--
SPC30	--	--	--

Note: decimal points omitted, only values above 0.30 reported.

factor model would reflect data derived from an independent sample more adequately than four alternative, competing models. These alternatives included a single factor unidimensional model, together with two-factor, four-factor and five-factor models derived from the original composite scale data set in Study 2.

Eight indices of fit were examined. These indices are described in some detail in most texts on structural equation modelling, including Hair, Anderson, Tatham, and Black (1995), Pedhazur (1997), and Tabachnick and Fidell (1996). They included the chi square, (an index of badness of fit, and the only index for which significance tests have been derived), four indices of goodness of fit, the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI), the Normed Fit Index (NFI), and the Comparative Fit Index (CFI). Two estimates of residuals were also examined, the Root Mean Square Error of Approximation (RMS) and the Root Mean Square Residual (RMR) which, like the chi square, are essentially indices of badness of fit. A high level of correlation may be expected among these indices. However, given the relatively small variations seen in the values of some of the indices across various models, it appears safer to avoid the possibility that a particular index will lead to a chance aberrant conclusion, by including a group of such indices for examination. To confirm a proposed model, the measures of goodness of fit should be highest for the three factor model and lower for the competing models, while the measures of badness of fit (chi square and the estimates of residuals) should show lowest values for the proposed model, and higher values for the alternatives.

Following the confirmatory factor analyses, a three-factor principal components analysis with varimax rotation was undertaken to show the factor structure on an item by item basis for comparison with the results of the original analysis. Finally, a group of summary statistics was calculated for each of the three proposed subscales.

Method

Participants

The participants were 382 undergraduate students at Victoria University of Wellington who voluntarily completed the questionnaire before attending a lecture. The participants had a mean age of 20 years, and included 256 females, 122 males, and four people whose gender was not reported. All participants were offered a wrapped sweet in appreciation of their taking part in this study.

Materials and Procedure

The questionnaire used in this study was a composite version of the SOC. It consisted of items 1 to 10 of the SOC-3 (Paulhus & Van Selst, 1990), and items 11 to 30 of the SOC-1 (Paulhus & Christie, 1981). For SOC-3 items, participants responded on a seven-point scale ranging from Totally Inaccurate to Totally Accurate. For SOC-1 items, participants responded on a seven-point scale using a Disagree-Agree format. The participants were given a copy of the questionnaire at the beginning of the lecture and took approximately five minutes to complete the scale.

Results and Discussion

Results of the confirmatory factor analyses are given in Table 3.17, where the expected pattern is seen in the values calculated for all eight indices.

With a large sample and single item data, it is generally accepted that the chi square value is unlikely to be low enough, reflecting a bad enough fit, to be non significant (Kline, 1998). In this context, chi square is best used as a simple measure of badness of fit, rather than as a statistic. However, the overall pattern of chi square values across the models is exactly as expected, decreasing from the one-factor, unidimensional model (the worst fit of all), through the two-factor model, to the three-

factor model, then increasing again through the four-factor model to the five-factor model.

It is possible to make a direct comparison between each of these chi square values, evaluating the observed difference between them against the differences in the degrees of freedom using a conventional chi square table. Such an assessment revealed that in every case, the differences observed are significant at the .05 level. Thus the fit to the three factor model is significantly less bad than that to any of the four competing models. An alternative use of the chi square in determining goodness of fit has been suggested by Ullman in Tabachnick and Fidell (1996), page 748. It is suggested, as a rough rule of thumb, that a good fit of the data to the model is achieved when the ratio of the chi square to the degrees of freedom is less than two. Examination of Table 3.17 shows that while the three factor model meets this criteria, none of the of the four competing models do so.

The two residual estimates also show that the three-factor model accounts for responses to the observed variables more effectively than any of the other models. They follow the same pattern as the chi square values, falling comparatively sharply from the single-factor through the two-factor to the three-factor models, and rising slightly through the four-factor to the five-factor models.

All four goodness of fit indices showed the expected pattern, with a comparatively rapid change (in this case an increase) from the single-factor through the two-factor to the three-factor model, followed by a fall (albeit a small one) through each of the two remaining competing models.

All eight indices therefore systematically supported the three-factor model over the four competing models at a global level.

To clarify the relationship between the results found in Study 2 and the present study on a factor by factor basis, a three-factor principal components analysis of the replication study was undertaken, and subjected to varimax rotation. The three-factor

Table 3.17

Study 4: Eight Structural Equation Modelling Indices of Fit for Five Alternative Model Factor Structures for the Composite Spheres of Control Scale

Index	Number of Factors in the Model				
	1	2	3	4	5
Chi Square*	1477.66	1056.04	794.84	829.49	840.37
df	405	404	402	399	395
Chi Square / df	3.65	2.61	1.98	2.08	2.13
GFI	.74	.82	.87	.87	.87
AGFI	.70	.79	.85	.85	.84
CFI	.46	.67	.80	.79	.78
NFI	.39	.57	.67	.66	.66
RMS	.08	.07	.05	.05	.05
RMR	.23	.17	.15	.16	.17

* Note that all differences between these chi square values are significant, with $p < .05$

varimax rotation showed clear evidence of the factor structure identified in the initial study (see Table 3.18). Factor I had significant loadings only on items 21 to 30, which represents sociopolitical control. Factor II loaded only on items 11-20. These are the ten items designed to represent interpersonal control. Finally, Factor III loaded on nine items with loadings above .30. All these items represent the construct of personal control.

In addition, reliability, measured by Cronbach's alpha was computed for all three subscales for both Study 2 and Study 4. These results are presented in Table 3.19, which also shows the summary statistics and subscale intercorrelations for the three subscales from both studies.

General Discussion

This series of studies has focused on the identification of a measure of locus of control that satisfies a number of psychometric criteria. In particular, high internal consistency, good validity, and a clear, stable and robust factor structure. In Study 1, the ANSIE (Adult Nowicki-Strickland Internal-External scale: Nowicki & Duke, 1974), the IPC scale (Internal, Powerful Others and Chance scales: Levenson, 1974) and the SOC (Spheres of Control: Paulhus & Christie, 1981) were concurrently administered to a large sample of University students. The results of Study 1 showed that ANSIE and the IPC scale did not meet the set criteria. The ANSIE could not be identified as either a uni-factorial measure or as a multi-factorial measure using an analysis of the principal components and of factor matching indices. For the IPC scale, factor analysis did not disclose the presence of an underlying general factor. Analyses of the rotated factor solution showed that the factors, labeled Internal, Powerful Others, and Chance, were clearly not borne out in a three factor extraction. Encouraging results were obtained from an analysis of the responses to the SOC. The results show that the SOC did have a factor structure that closely resembled the theoretical structure

Table 3.18

Study 4: Three Factor Varimax Rotation using the PC Subscale of the SOC-3 and the IPC and SPC Subscales of the SOC-1

	Factor I	Factor II	Factor III
PC1	--	--	72
PC2	--	--	42
PC3	--	--	35
PC4	--	--	61
PC5	--	--	62
PC6	--	--	41
PC7	--	--	--
PC8	--	--	60
PC9	--	--	54
PC10	--	--	39
IPC11	--	56	--
IPC12	--	70	--
IPC13	--	65	--
IPC14	--	46	--
IPC15	--	33	--
IPC16	--	48	--
IPC17	--	57	--
IPC18	--	55	--
IPC19	--	35	--
IPC20	--	70	--
SPC21	60	--	--
SPC22	71	--	--
SPC23	55	--	--
SPC24	72	--	--
SPC25	51	--	--
SPC26	33	--	--
SPC27	46	--	--
SPC28	71	--	--
SPC29	48	--	--
SPC30	32	--	--

Note: Decimal points omitted, only values above .30 reported.

Table 3.19

Summary Statistics for the Three Subscales of the Composite Spheres of Control Scale

	PC	IPC	SPC
Study 2 (N=354)			
Mean	51.0	48.1	35.9
Standard Deviation	7.3	7.9	8.9
Cronbach's alpha	.71	.71	.77
Intercorrelations			
PC	*		
IPC	.38	*	
SPC	.21	.17	*
Study 4 (N=382)			
Mean	50.0	48.5	37.3
Standard Deviation	7.5	8.9	9.5
Cronbach's alpha	.69	.75	.75
Intercorrelations			
PC	*		
IPC	.33	*	
SPC	.27	.16	*

Note: all correlation coefficients are significant at $p < .01$

underlying the scale. The three subscales, Personal Control, Interpersonal Control, and Sociopolitical control were clearly identified using factor analysis. Two of the three subscales had acceptable levels of reliability.

In Study 2, the psychometric properties of the SOC-1, tested in Study 1, were examined in comparison with a more recent version of the scale, the SOC-3 (Paulhus & Van Selst, 1990). The SOC-3 differs from earlier versions of the scale in that the PE subscale has been refined so that it measures only perceived control. Both versions of the scale were administered to a large sample at the same time. Although the factor structure found in Study 1 for the SOC-1 was confirmed, low estimates of reliability were again found for the PE subscale. An analysis of the SOC-3 showed that the anticipated three-factor solution was not reproduced for the SOC-3, but an improved reliability estimate was computed for the PC subscale. Based on these findings, a further analysis was conducted, using the PC subscale from the SOC-3 and the IPC and SPC subscales from the SOC-1. The results from this analysis showed that the PC, IPC, and SPC subscales were clearly evident, with 29 of the 30 items loading on the expected factor. These results suggested that an analysis using this combination of items produced a clear factor solution that corresponded precisely with the theoretical subscale structure.

In Study 3 the robustness and stability of the composite SOC was tested by independently administering the composite SOC scale to an additional group of participants. Contrary to the results of Study 2, the three-factor structure was not reproduced. Only the SPC subscale could clearly be identified from the factor matrix, while items from the PC and IPC were intermixed on two factors. In addition to this, a low reliability estimate of .54 was found for the PC subscale. One explanation offered for these findings was that using the same endpoints for all 30 items, in contrast with Study 2, resulted in participants responding slightly differently to items in the PC subscale.

Study 4 involved the presentation of the composite SOC to a sample of university students. In this study, the items used in Study 3 were retained, but the endpoints used in the original published scales were utilised (as in Study 2). Thus, for PC items, participants were asked to respond on a scale with the endpoints 'Totally Inaccurate' and 'Totally Accurate', and for IPC and SPC items, possible responses ranged from 'Disagree' to 'Agree'. The results of Study 4 show that the factor structure identified in Study 2 was successfully replicated. In this analysis, confirmatory factor analysis revealed that the three factor model was a better fit to the data than a single factor, unidimensional model, or two, four, or five factor models, derived from the Study 2 data. Here, 29 of the 30 items load at or above the .30 level on the expected factor, suggesting an excellent level of stability and robustness in this proposed composite version of the SOC scale. Analysis of the correlations between the scales reveals the same pattern in both Study 2 and Study 4. The correlation between PC and IPC subscales was above .30 in both studies, and the correlation between SPC and IPC was below .20 in both. All three scales were significantly correlated in both studies. The estimates of reliability, detailed in Table 3.19, range from .69 to .77 across the two independent samples. This indicates a satisfactory level of stability between studies and a satisfactory level of internal consistency within the scales.

At a conceptual level the SOC scale provides a useful distinction between the personal expectations of control and generalised expectations of control that is useful for the prediction of earthquake preparation. In Chapter 1, it was proposed that personal control (which is examined in most natural disaster studies) is likely to be related to preparation given that many steps are performed at an individual or household level (e.g., fastening a chimney, storing water). However, there is another category of preparatory behaviours that are preformed not by individuals, but by local and national government, and by employers, on behalf of its citizens and employees. Such behaviours include the strengthening or relocation of core infrastructure (e.g., key roads, buildings), providing appropriate assistance immediately following a disaster,

and ensuring that sufficient resources are available to repair and rebuild damage. When the government or an employer undertakes these types of behaviours, ultimately it is not the organisation itself which is performing the preparatory behaviours, but rather individuals representing the organisation. This consideration suggests that there are people who have generalised control over a city or nation's preparation for a disaster, just as others may have control over other aspects of government policy.

The SOC scale examines locus of control in three different domains of an individual's life, and people are regarded as having different expectancies with respect to the degree of control they are able to exert in the different domains of their interaction with the world. In this regard the SOC is unique since few other scales attempt to examine both personal expectancies of control, and generalised expectancies of control (as described in the preceding paragraph). As such, the SOC scale is both conceptually useful and psychometrically useful as a measure in a community study of earthquake preparation.

These four studies report an attempt to identify a locus of control scale that meets the criteria of high reliability, acceptable validity, and a robust and stable factor solution. This attempt was eventually successful. The composite version of the SOC has a number of advantages over the SOC-1 and the SOC-3. First, Studies 2 and 4 showed that a three-factor rotation of the composite SOC has more items loading on the expected factor than the SOC-1 or the SOC-3. Second, the PC scale has a higher level of internal consistency than the earlier PE subscale, making it more useful for research purposes.

CHAPTER 4 – DEVELOPMENT OF THE WELLINGTON EARTHQUAKE PREPAREDNESS SCALE

Chapter Overview

The present chapter describes the development and evaluation of a questionnaire designed to measure people's preparedness for a major earthquake: the Wellington Earthquake Preparedness Scale (WEPS). The chapter commences with a review of existing measures of earthquake preparation. A theme to emerge from this is the lack of emphasis given to psychometric issues when constructing scales. Based on the review, a 23 item unifactorial questionnaire was developed and tested, using the responses of 106 residents of Wellington City. The results of this investigation supported the theory underlying the development of the questionnaire, with a unifactorial model fitting the data perfectly.

The Measurement of Earthquake Preparation

People's preparedness for natural disasters such as earthquakes has been examined as a dependent variable in a number of studies, although there are wide differences in the way earthquake preparation is assessed. Table 4.1 shows the study, sample, and measures of earthquake preparation used in 19 studies conducted between 1974 and 1999.

Early studies used a free response method to examine the steps individuals had taken to prepare for an earthquake (e.g., Jackson, 1981; Jackson & Mukerjee, 1974). Other studies have examined a single category, such as insurance purchases (e.g., Sullivan, Mustart, & Galehouse, 1977), or intention to live elsewhere (e.g., Kiecolt & Nigg, 1982). Some studies have used brief measures with four or five items (e.g., Dooley, Catalano, Mishra, & Serxner, 1992; Farley, Barlow, Finklestein, & Riley, 1993; McClure, Walkey, & Allen, 1999; Showalter, 1993). Eight of the nineteen studies presented in Table 4.1 have used longer scales (between 12 and 27 items) to assess earthquake preparation

Table 4.1

Summary of Study, Sample, and Earthquake Preparation Measures

Study	Sample	Earthquake Preparation Measure	Comment
De Man & Simpson-Housley (1987)	130 residents of San Francisco	An unspecified number of questions examining precautions taken	
Dooley, Catalano, Mishra, & Serxner (1992)	1600 California residents	5 item checklist	Items used in the study were not specified.
Edwards (1993)	544 Tennessee residents	14 item checklist	
Farley, Barlow, Finklestein, & Riley (1993)	559 householders	4 item checklist	
Hirose & Ishizuka (1983), Hirose (1986)	1018 Japanese participants	13 item checklist	
Hurnen (1997)	181 Wellington residents	17 item checklist	Questions were grouped into three categories: structural questions, household preparedness, and geological questions.
Hurnen & McClure (1997)	96 Wellington citizens	12 item checklist	

Jackson & Mukerjee (1974)	120 San Francisco residents	8 item checklist	Only one item, structural changes to home, examines pre-earthquake preparation. Other items examined post-impact purchasing (e.g. earthquake insurance).
Jackson (1981)	302 householders	Open ended questionnaire	Participants completed two lists. The first detailed all the things that can or should be done to prepare for an earthquake. For the second list, participants indicated what actions they had carried out to prepare for an earthquake.
Kiecolt & Nigg (1982)	1450 California residents	Intention to move away from the area in the next 5 years.	Single item measure used to assess intention to live elsewhere.
McClure, Walkey & Allen (1999)	100 Wellington students (Study 1), 124 Wellington residents (Study 2)	5 item earthquake preparation checklist	
Mileti & Darlington (1997)	806 California residents	13 item Readiness Action checklist	
Mileti & O'Brien (1992)	1652 residents of San	6 item earthquake preparedness checklist	

	Francisco and Santa Cruz		
Mullis, Duval, & Lippa (1990)	296 students and 154 homeowners	27 Item Mullis-Lippa Earthquake Preparedness Scale	Reliability estimates for the scale ranged from .68 to .97.
Mullis & Lippa (1990)	114 California homeowners	27 Item Mullis-Lippa Earthquake Preparedness Scale	
Russell, Goltz, & Bourque (1995)	690 residents interviewed after the Whittier Narrows earthquake and 656 residents interviewed after the Loma Prieta earthquake	17 item scale	Examination of the scree plot suggested the rotation of three factors. Reliabilities for these three factors ranged from .42 to .73.
Sullivan, Mustart, & Galehouse (1977)	1400 residents from California	Insurance purchase	
Turner, Nigg, & Paz (1986)	Five samples of between 516 and 1450 participants from California.	16 earthquake preparedness actions	

(e.g., Hirose, 1986; Hirose & Ishizuka, 1983; Mileti & Fitzpatrick, 1992, 1993; Turner et al., 1986).

The studies mentioned above have yielded important insights into people's preparation for and response to natural disasters such as earthquakes. Unfortunately, few of these studies have reported either estimates of reliability for their scales, or other relevant psychometric data (Lindell & Perry, 2000); and any interpretation of the results is limited therefore by a the absence of a numerical estimate of the amount of unsystematic measurement error within the scales. These data, however, are available for some studies.

Russell, Goltz, and Bourque (1995) used exploratory factor analysis to identify three factors: survival, planning, and hazard mitigation. Reliability estimates for these factors ranged from .42 to .73. More substantial reliability coefficients were obtained by Mulilis et al. (1990), who developed a 27 item scale for measuring the level of earthquake preparation by individuals and small businesses. In addition to measuring preparedness for earthquakes, the Mulilis Lippa Earthquake Preparedness Scale (ML-EPS) measures the perceived difficulty of preparing for an earthquake. For each item, participants state whether they are prepared by answering Yes, No, or Unsure, and also indicate the difficulty of performing each item using a five point scale. Using four samples of respondents, Mulilis et al. (1990) reported estimates of internal consistency (Cronbach's alphas) ranging from .68 to .97 for the preparedness items and estimates of .84 to .94 for the difficulty items. Test-retest reliabilities ranged from .78 for a four to six week interval, down to .64 for a three month period for both preparedness and difficulty items.

Despite the use of psychometric criteria to assess the usefulness of the ML-EPS, this scale has two possible limitations. First, in the recent Kobe and Turkey earthquakes, the major cause of death was from buildings collapsing on people (McGeary, 1999). Unfortunately, there are no questions in the ML-EPS to examine whether people have ensured that their homes are structurally sound to prevent them

collapsing. However, several questions examine whether the contents of the home have been secured e.g., fastening tall furniture. As one of the major goals of earthquake preparation is to prevent the loss of life, and since one of the major causes of loss of life in recent earthquakes has been buildings collapsing, the absence of a measure of this aspect of preparation represents a limitation of the scale. Second, the ML-EPS includes items which may be unrelated to earthquake survival. In particular, the items “Do you attentively listen to or watch radio or television messages about earthquake preparedness” and “Do you vote on bills dealing with earthquake resistant buildings” may not necessarily aid in the identification of those who have adequately prepared for an earthquake.

In sum, a review of the existing measures of earthquake preparation shows that 19 scales have been published in the last 25 years. Only a small number of these studies have reported data that indicates the level of measurement error within the scales. Of the studies that report psychometric data, Russell et al. (1995) found poor estimates of reliability for two of their three subscales, while Mulilis et al. (1990) found much higher estimates for a 27 item scale. An examination of the content of the items used by Mulilis et al. also shows two conceptual limitations in their scale. First, it does not include a measure of relevant strengthening to the structure of a dwelling, and second, it includes items that may not be directly related to household preparation.

To overcome the difficulties identified in earlier earthquake preparation measures, it was decided to develop a new scale to assess household preparedness for a major earthquake. In developing a new measure of earthquake preparation, a number of goals were identified. These were (a) to develop a unidimensional questionnaire that assessed the amount of preparation people have done for a major earthquake; (b) to develop a scale which has a high level of internal consistency; and (c) to develop a scale which has an approximately normal spread of responses. This final criterion was considered important, as many of the parametric tests likely to be

performed in a later field study that included this scale (Chapter 5) depend on the assumption that responses are normally distributed.

Recent studies (e.g., Schmitt, 1996) have criticised the use of coefficient alpha as a measure of unidimensionality. Coefficient alpha is an estimate of internal consistency, which refers to the interrelatedness of a set of items (Schmitt, 1996), whereas unidimensionality refers to the existence of one latent trait underlying the data (Hattie, 1985). The development of this scale provided an opportunity to develop an earthquake preparation measure using goodness of fit procedures to assess unidimensionality. Thus, this aspect of the present study is unique to research on this issue.

Method

Participants

Participants totalled 105 residents of Wellington City. Of these, 38.6% were female and 61.4% male. 23.6% were between the age of 18 and 25, 41.8% were between 26 and 40, 30.9% were between 41 and 60, and 3.6% were 61 or older. 46.3% owned their own home whereas 53.7% did not.

Questionnaire Development

Three steps were undertaken before the construction of the questionnaire to assess the amount of preparation that people have made for a major earthquake.

To gather information on the steps commonly regarded as necessary to prepare for a major earthquake, an Internet search was performed to examine the recommendations made by various agencies responsible for earthquake preparation. The websites that were examined in detail included the New Zealand Earthquake Commission, which publishes an extensive and detailed list of activities for making residential property more secure from earthquakes, and the American Red Cross, which also provides information about how to prepare for earthquakes and other

natural disasters. The Wellington Emergency Management Office (WEMO), a branch of the Wellington City Council, also publishes information on earthquake preparedness, as does New Zealand's Ministry of Civil Defence and Emergency Management.

Parallel to this search, a review of existing measures of earthquake preparation was also conducted. Five questionnaires were identified as containing items that could be useful as a source of ideas for the generation of a new scale. These were the 27 item Earthquake Preparedness Scale (ML-EPS: Mulilis et al., 1990), a 17 item earthquake preparedness checklist developed by Hurnen (1997), a 13 item scale used by Hirose (1986), a 16 item checklist developed by Turner, Nigg and Paz (1986), and a five item checklist used by McClure et al. (1999). The recommendations suggested on the Internet websites and the checklists listed above shared a high degree of similarity with regard to the most appropriate steps to prepare for a major earthquake, although the Earthquake Commission's suggestions had a greater emphasis on structural changes to enhance damage prevention.

Finally, to identify steps people had taken to prepare for a major earthquake, a pilot study using a group of 280 students from Victoria University of Wellington were asked "What have you, or the people you live with, done to prepare for a major earthquake?". [5] [6] This opened ended question produced a list of 20 earthquake preparation activities which was used as a guide in the generation of items.

Based on the review of the recommended necessary steps to prepare for a major earthquake, two sets of items were generated. The first set of items included actions that are specifically intended to limit earthquake damage. The second set of

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[5] This question was included in Study 1 of the locus of control research (Chapter 3).

[6] The use of large number of students for multiple studies raises the issue of respondent independence: specifically, the extent to which a given respondent may have participated in more than one study. Although the development studies were conducted over a three year period, it is possible that some individuals could have participated in more than one study. However, it is not possible to determine how many people participated in multiple studies, and it is unclear what effect this would have on the results. Nonetheless, the studies were conducted independently from a pool of approximately 16, 000 students, with in-flows and out-flows of

items consisted of actions that are intended to facilitate survival following a major earthquake. For this second set of items it was acknowledged that not all the actions would be solely performed for the purpose of earthquake preparation (Dooley et al., 1992; Weinstein, Lyon, Rothman, & Cuite, 2000); for example, access to an alternative cooking source.

Several different formats for the earthquake preparation questionnaire were written in order to produce a scale which would assess accurately people's preparation. For instance, an early draft of the questionnaire consisted of two parts to each question, a checking component and a doing component. A typical item in this version of the questionnaire was:

(a) I have checked that the hot water cylinder is securely fastened (Yes / No)

(b) The hot water cylinder is securely fastened (Yes / No)

However, this format was abandoned for several reasons. First, it proved to be difficult to generate a uniform set of questions for all the steps necessary to prepare for an earthquake, and second, the wording of the questions was often clumsy and complicated. The format finally adopted for the earthquake preparation questionnaire was one that focused on the outcomes of safe behaviour. An example of an item in one earlier (draft) version of the questionnaire had examined:

(a) whether the participant had a chimney in their house

(b) whether or not they had checked to see if the chimney could fall down in a major earthquake

(c) an evaluation by the participant about whether the chimney would fall down in a major earthquake or not

(d) whether they had taken steps to ensure that the chimney would not fall down in an earthquake.

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around 4, 000 people per annum. As such, the participants represent a small percentage of the

These four questions were all designed to examine whether or not the participant had either strengthened their chimney or ensured that it would not fall down. To address this issue within a single question, the final item that appeared in the earthquake preparation questionnaire was “I have either strengthened my chimney, or satisfied myself that it will not fall down in a major earthquake”.

Using the data gathered from the three sources described above, a set of 23 items was developed to examine people’s earthquake preparation. To indicate the occurrence of the preparatory behaviour, each item was phrased in the form of “I have” followed by a verb (e.g., considered, fastened, ensured, etc), followed by the preparatory behaviour. Each question was designed to be answered with a ‘yes’ or ‘no’ response. The items which were included in the Wellington Earthquake Preparedness Scale (WEPS) are presented in Table 4.2.

Procedure

Members of the public sitting in parks in the central business district of Wellington city were approached and asked if they would be willing to complete a questionnaire. Those who agreed were given a copy of the questionnaire and allowed approximately five minutes alone to complete the scale. The questionnaire was presented on a single page and participants were asked the 23 items comprising the WEPS, together with several other questions. Before answering the WEPS questions, participants were asked “Do you think that you are prepared for a major earthquake?”. Participants responded to this question on a 7 point scale ranging from 1 (not at all prepared) to 7 (very prepared) with a midpoint of 4 (somewhat prepared). After the WEPS items, participants answered three demographic items: Do you own your own home? (Yes/No); age (18-25, 26-40, 41-60, 61+), and their gender.

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university population.

Results

To assess the psychometric properties of the WEPS, the following analyses were performed:

1. Using the methodology recommended by Hattie (1985), confirmatory factor analysis was performed to examine the unidimensionality of the WEPS. In this analysis, items were parcelled (Kishton & Wildaman, 1994) into three groups of 6 items and one group of 5 items. Eight indices of fit were examined (described in Chapter 3), together with the ratio of the chi square to the degrees of freedom. This model contrasted against a two-factor model derived from items relating to damage limitation (items 1, 2, 3, 4, 5, 6, and 19) and facilitating survival (items 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 20, 21, 22, 23). Item parcels were used to conduct this analysis.
2. To evaluate the strength of the underlying factor within the scale, the item-to-total correlations were converted to z-scores using Fisher's z-coefficient. The coefficients were then averaged, and the result converted back to a correlation coefficient.
3. Cronbach's alpha was computed as a measure of internal consistency.
4. Norms were calculated to examine the spread of responding for the total scale score.
5. As a measure of criterion validity, total score differences were examined between home owners and non-home owners, and between different age groups in the sample.
6. Participants' judgements of how prepared they were for a major earthquake were correlated with the steps they reported that they had done.
7. An item by item analysis was conducted to examine the types of activities participants reported having performed to prepare for an earthquake.

Confirmatory factor analysis revealed that a one factor model fitted the data perfectly, as evidenced by a non-significant chi square statistic, χ^2 (2) = 0.083, p = 0.959, excellent indices of fit (GFI = 1.00, CFI = 1.00, NFI = 0.99, AGFI = 0.99), and a low level of error (RMSEA = 0.00, RMR = 0.01). The ratio of the chi square to the degrees of freedom was 0.04. Although the competing two-factor model was not significantly different from the one factor model, χ^2 (9) = 10.992, p > .05, poorer indices of fit were observed for the two-factor model, χ^2 (11) = 11.075, p = 0.61; GFI = 0.97, CFI = 1.00, NFI = 0.96, AGFI = 0.94; RMSEA = 0.00, RMR = 0.03. The ratio of the chi square to the degrees of freedom was 1.00. The correlation between the two latent variables for the two factor model was r = .83, p < .001.

Cronbach's alpha for the WEPS was computed at .87 for the full 23 item scale. Table 4.2 shows the item to total correlations.

The mean score for the WEPS was calculated at 9.87 with a standard deviation of 5.42. The decile norms for the WEPS are presented in Table 4.3 and the distribution of WEPS scores in Figure 4.1.

A comparison between the level of preparedness, as assessed by the WEPS, between home owners and non-home owners showed that home owners (M = 12.20, SD = 5.25) were more prepared for an earthquake than non home owners (M = 8.11, SD = 4.93). This difference was significant, t (51) = 2.93, p < .01. WEPS scores increased significantly with age also (M = 7.31, SD = 4.07 for 18-25 year olds; M = 9.17, SD = 5.85 for 26-40 year olds; M = 12.95, SD = 4.48 for 41 years of age and over; F (2, 52) = 5.44, p < .01.

Table 4.2

Item-to-Total Correlations and Scale Alpha Coefficient if Item Deleted from the WEPS

	Item	Corrected Item -Total r	Alpha if Item Deleted
1	I have considered the risk of a major earthquake when deciding to live in the house that I do now.	.34	.87
2	I have fastened tall furniture to the wall.	.34	.87
3	I have fastened my hot water cylinder.	.48	.87
4	I have either strengthened my chimney, or satisfied myself that it will not fall down in a major earthquake.	.46	.87
5	I have either strengthened my house to increase its earthquake resistance, or satisfied myself that it will probably not fall down in a major earthquake.	.43	.87
6	I have ensured that my roof will probably not collapse in a major earthquake.	.61	.86
7	I have arranged the cupboards so that heavy objects are stored at ground level.	.41	.87
8	I have securely fastened cupboards with latches.	.34	.87
9	I have ensured that objects which contain water have not been stored on top of electrical equipment (e.g. a pot plant or fishbowl on top of the television).	.63	.86
10	I have ensured that heavy objects are stored on the floor.	.54	.87
11	I have stored water for survival.	.44	.87
12	I have put aside spare plastic bags and toilet paper for use as an emergency toilet.	.53	.87
13	I have accumulated enough tools to make minor repairs to the house following a major earthquake.	.52	.87
14	I have obtained a supply of tinned food that could be used in an emergency.	.50	.87
15	I have purchased a first aid kit.	.57	.86
16	I have a supply of essential medicines for illness and allergies.	.54	.87
17	I have obtained a working battery radio.	.55	.87
18	I have obtained a working torch.	.40	.87
19	I have secured movable objects in my home e.g. computer, television.	.30	.87
20	I have access to an alternative cooking source (e.g. gas barbecue).	.35	.87
21	I have arranged a place to meet after an earthquake.	.35	.87
22	I have obtained a working fire extinguisher.	.33	.87
23	I have taken some steps at work. The steps taken were (name)	.30	.87

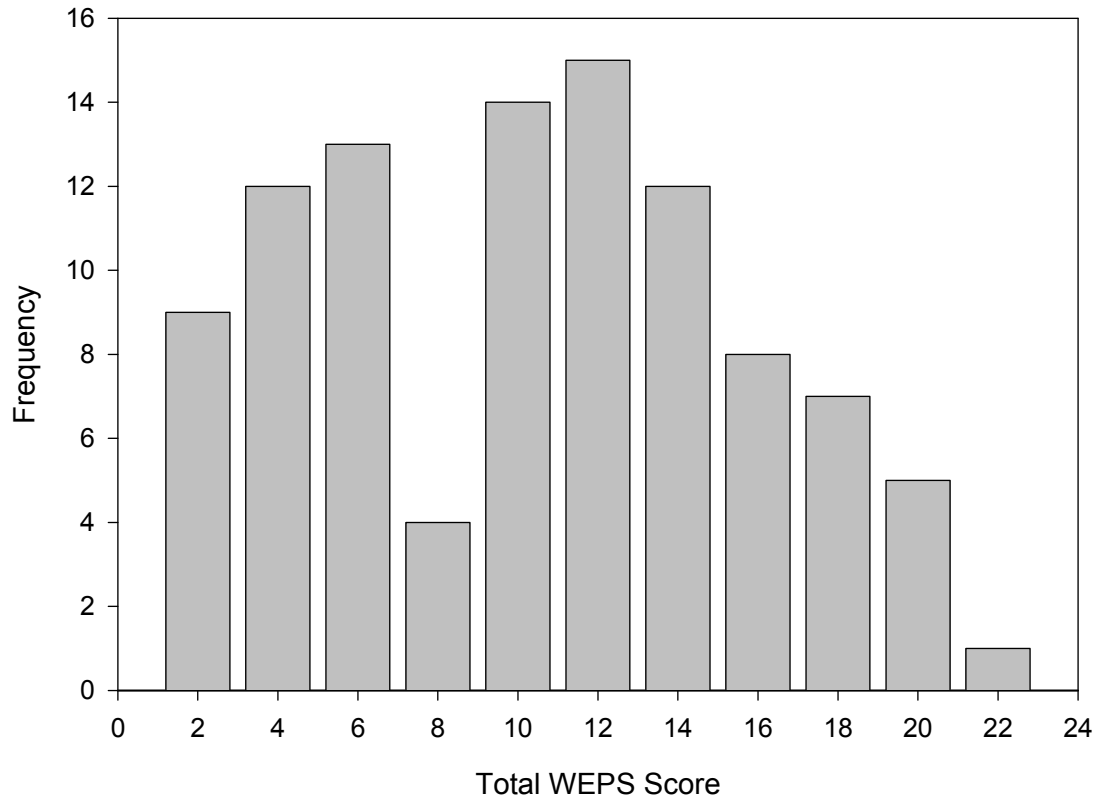
Table 4.3

Decile Norms for the 23 Item WEPS (n=105)

Decile	Total Scale Score
1	0 - 3
2	4
3	5 - 6
4	7 - 9
5	10
6	11
7	12 - 13
8	14 - 15
9	16 - 18
10	19 - 23

Figure. 4.1.

Distribution of Total WEPS Scores



The correlation between how prepared individuals thought they were for an earthquake and their actual level of preparation was positive, large, and significant (r = .50, p < .01). Finally, an item-by-item analysis of the proportion of participants who report having undertaken each earthquake preparation activity is presented in Table 4.4.

Discussion

This investigation focused on the development and testing of a unidimensional questionnaire designed to assess the amount of preparation that people have undertaken for a major earthquake. Coupled with this, a goal of the present study was to demonstrate that the developed scale has a high level of reliability, and to show that it has a normal spread of responses. To achieve these goals, the development of the Wellington Earthquake Preparedness Scale (WEPS) was based on guidelines and recommendations made by various agencies responsible for earthquake preparation (e.g., The NZ Earthquake Commission, Wellington Emergency Management Office, etc) and also the steps regarded as necessary by other researchers (e.g., Hirose, 1986; McClure et al., 1999; Turner et al., 1986).

The results of this study indicate that the WEPS is both a unidimensional measure and has high level of internal consistency. The former has been demonstrated in four different ways. First, confirmatory factor analysis shows a perfect fit between the data and a single latent trait. Second, the item-to-total correlations show that each item contributes significantly to the total scale score. Third, the mean item-to-total correlation is .46, indicating a strong general factor within the scale. Fourth, the computation of coefficient alpha for each item if it is deleted from the scale shows only very small departures from the total scale alpha. Thus, each item contributes to the measurement of the underlying scale construct.

Table 4.4.

Percentage of Participants who Report having Undertaken each of the Earthquake Preparation Activities listed in the WEPS

	Item	Yes (%)
18	I have obtained a working torch.	83.8
14	I have obtained a supply of tinned food that could be used in an emergency.	74.3
9	I have ensured that objects which contain water have not been stored on top of electrical equipment (e.g. a pot plant or fishbowl on top of the television).	66.7
10	I have ensured that heavy objects are stored on the floor.	66.3
20	I have access an alternative cooking source (e.g. gas barbecue).	63.8
13	I have accumulated enough tools to make minor repairs to the house following a major earthquake.	58.1
16	I have a supply of essential medicines for illness and allergies.	57.3
15	I have purchased a first aid kit.	57.1
17	I have obtained a working battery radio.	55.2
11	I have stored water for survival.	47.6
7	I have arranged the cupboards so that heavy objects are stored at ground level.	43.8
4	I have either strengthened my chimney, or satisfied myself that it will not fall down in a major earthquake.	39.0
1	I have considered the risk of a major earthquake when deciding to live in the house that I do now.	38.1
12	I have put aside spare plastic bags and toilet paper for use as an emergency toilet.	38.1
5	I have either strengthened my house to increase its earthquake resistance, or satisfied myself that it will probably not fall down in a major earthquake.	35.2
22	I have obtained a working fire extinguisher.	30.5
23	I have taken some steps at work. The steps taken were (name)	30.5
3	I have fastened my hot water cylinder.	29.5
6	I have ensured that my roof will probably not collapse in a major earthquake.	28.6
8	I have securely fastened cupboards with latches.	21.9
21	I have arranged a place to meet after an earthquake.	21.0
2	I have fastened tall furniture to the wall.	16.2
19	I have secured movable objects in my home e.g. computer, television.	8.6

CFA analysis was conducted to determine whether a two-factor model, based on a separation between items that measure damage limitation and those that measure facilitating survival following a disaster, provided a better fit to the data. The chi square test revealed no significant differences between the one and two-factor models; however, lower fit indices and higher error estimates were found for the two factor model (although all statistics were acceptable). The two sets of items were very highly correlated (i.e. above .80), suggesting that the parsimonious one-factor model is more appropriate as a measure of earthquake preparation.

Of particular interest in the present study was the distribution of total scores (endorsements) on the WEPS. Scales with an even spread of responses and an approximately normal distribution are more useful as research instruments because a wider variety of statistical tests can be applied to the responses. Figure 4.1 shows that scores on the WEPS closely approximate a normal distribution. Norms for the WEPS have been presented for the purpose of interpretation of the results of future research.

As a method of establishing validity, total WEPS scores were compared for groups who would be expected to differ in their scores. In previous research, home-owners have been found to be more prepared for natural disasters such as tornadoes than non-homeowners (Mulilis, Duval, & Bovalino, 2000). In this investigation significant differences were found in the scores of home-owners and non-homeowners with respect to earthquake preparation. Second, previous research has found that age is related to preparation, with older people on average being more prepared than younger people (Dooley et al., 1992). Here age was related to WEPS scores, such that 18 to 25 year olds were significantly less prepared than other age groups, for instance people aged 41 years and over. Additional findings relevant to the validity of the scale were that those who thought they were prepared for an earthquake did in fact report having prepared more.

Finally, an item-by-item analysis of the earthquake preparation activities endorsed, shows which steps a large number of participants have taken, and which

ones only a few individuals have taken. Most participants reported that they had obtained a working torch and tinned food, and ensured that heavy objects were stored on the floor. By contrast, relatively few people had fastened tall furniture to the wall, secured cupboards with latches, or ensured that their roof would not collapse in an earthquake. All or many of the items of the items which had a low endorsement rate represent the steps which largely are performed specifically for the purpose of earthquake preparation. The inclusion of these items is useful as the results of this investigation suggest that they are discriminating items. These results of this investigation also suggest that people are more likely to adopt the necessary steps to prepare for an earthquake when these steps have more than one purpose. In sum, the results of this investigation provide general support for the potential utility of the Wellington Earthquake Preparedness Scale.

CHAPTER 5 – PREDICTORS OF PREPARATION FOR EARTHQUAKES

Chapter Overview

This chapter will describe the objectives and hypotheses of a substantial field study, in which the measures that were developed and evaluated in the three preceding chapters were administered, together with some additional questions, to a significant sample of Wellington residents. A full description of the research procedure is included, together with a detailed description of the characteristics of the participants. The chapter also includes a comprehensive analysis of the responses to the measures, and of the relationships between the constructs under investigation. The results of the study are then discussed in detail in terms of the research goals and hypotheses. Following this, the policy implications of this research are tabled.

Nature of the Field Study

The studies in the preceding chapters have focused on the evaluation and development of measures to assess propensity towards risk preparation and risk taking, locus of control, and earthquake preparation. The focus of this chapter is quite different. Whereas the preceding studies have largely examined the psychometric properties of the questionnaires, here the links between these variables are examined using the responses of a sample of Wellington residents. Specifically, the Risk scale and the Spheres of Control scale were administered, together with some demographic questions, for the purposes of predicting scores on the Wellington Earthquake Preparedness Scale.

The study also included items that measure self-other biases: the tendency to believe that negative outcomes are less likely to happen to oneself than to others, and that positive outcomes are more likely to happen to oneself than to others. These items are not conceptualised as a psychometric scale, rather they should be seen as individual items. This conceptualisation is consistent with other research (e.g., Klein,

1996; Horswill & McKenna, 1999). Participants were asked to make comparative judgements about their own level of preparation, the level of preparation of an acquaintance, and that of other Wellingtonians. Similar judgements were also made by participants about their vulnerability to harm and to property damage. The primary aim of the field study was to study the relationship between the following variables.

Earthquake Preparation

There is evidence that many people are not well prepared for the consequences of a natural disaster. Ansell and Taber (1996) report that only 30% of people have made some preparations for an earthquake, and Turner et al. (1986) found that 46% of their participants would be without first aid supplies following an earthquake. The first goal of the present study was to measure the level of preparation for a major earthquake in Wellington City in a sample of Wellington citizens.

Demographic Variables

Demographic characteristics, representing the groups with which people are identified in society may predict earthquake preparation (or lack of preparation). The second goal of the field study was to examine the relationships between demographic variables – gender, age, marital status, number of dependent children, educational level, home ownership, length of residence at current address – and earthquake preparation. These variables were also considered as covariates in any multivariate analysis.

Risk

Using a modified version of the risk scale developed by Schiff (1977), McClure et al. (1999) showed that a risk taking propensity was related to the level of earthquake preparation. The third goal of the field study is examine the relationship between the responses to the risk-related scale developed in Chapter 2 and reported earthquake

preparation. It was hypothesised that propensity to take both minor risks and major risks would be negatively correlated with earthquake preparation. It is also predicted that propensity to take risk-precautions would be positively related to earthquake preparation.

Locus of Control

The research outline in Chapter 1 suggests that locus of control may be related to preparation for natural disasters. The fourth goal of the field study is to examine the link between this construct and earthquake preparation. It was predicted that an internal locus of control, as assessed by the composite version of the Spheres of Control scale developed in Chapter 3, would be related to higher levels of earthquake preparation.

Likelihood of an Earthquake

Cost – benefit models suggest that people's judgements of the likelihood of a negative event influence the precautions adopted (e.g., Mileti & Sorenson, 1987; Slovic, Kunreuther, & White, 1974). The fifth goal of the field study was to measure people's judgements about the likelihood of a major earthquake occurring in Wellington. It was predicted that judgements of earthquake likelihood and the level of earthquake preparation would be positively correlated, in that people who believe that a major earthquake is likely would be more prepared than those who believe that a major earthquake is unlikely.

Self-Other Bias

Chapter 1 reviewed research comparing people's judgements about their own vulnerability to harm with their judgements about other people's vulnerability to harm. Generally, people think that they are less at risk from negative events than their peers. Although research has examined people's perceived vulnerability relative to others

after a disaster (e.g., Burger & Palmer, 1992; Helweg-Larson, 1999), no research has systematically examined the presence of a self-other bias in anticipation of a natural disaster. The sixth goal of the present study was to examine whether people display an optimistic bias towards their own level of preparation, and to their own safety. Two types of judgements were examined – an assessment of one's preparation, relative to others, and an assessment of the likelihood of harm (either to oneself or one's property), relative to others. It was predicted that people would judge themselves to be more prepared for a major earthquake than either an acquaintance, or other Wellingtonians. Similarly, it was predicted that respondents would judge that they were less likely to suffer either harm, or damage to their property, than an acquaintance or other Wellingtonians.

Predicting Earthquake Preparation

In addition to examining the relationships between these individual variables and earthquake preparation, the further aim of this study is to use regression analyses to determine which of the variables are the best predictors of earthquake preparation. Analysis of this type is useful, because it is possible to examine the relative importance of each variable in predicting preparation. Furthermore, it is possible to determine whether psychological variables improve prediction above and beyond the levels achieved using demographic variables alone.

Indirect Effects: Identifying Mediation Effects

In addition to examining direct effects, the identification of indirect effects has important implications for investigating the mechanisms that influence earthquake preparation. Indirect effects occur when a variable influences an outcome via an intervening variable. This third variable is responsible for the transmission of the effect (Baron & Kenny, 1986, Parkes, 1994).

The investigation of mediation effects was based on theoretical grounds. It is possible that perceptions of control are associated with risk-related behaviours. Weinstein and Klein (1996) argued that perceptions of control attenuate judgements of harm for negative events: if people believe they can control a negative event then they tend to believe the probability of them suffering harm is less than if they believe the negative event is uncontrollable. This may be related to the present study in a general sense. Locus of control (which is conceptualised as a broad aspect of controllability) is likely to be related to risk-reducing behaviour such that those who believe they can control the outcome of events are likely to undertake activities that reduce their exposure to risk (as measured by the Risk scale). As earthquake preparation is a specific type of risk-reducing behaviour, then Risk scores are likely to be related to earthquake preparation. Thus, the indirect effects of locus of control and attitudes to risk were focused on in the prediction of earthquake preparation.

Method

Participants

For the purposes of collecting and processing data, Statistics New Zealand partitions New Zealand into a succession of different sized units. The smallest unit, mesh-blocks, vary in both population and size and can range from an area of sparsely populated land to a small city block. The next unit of analysis, area units, are aggregates of mesh-blocks. Area units are single geographic entities with a unique name referring to a geographical feature. Area units generally coincide with suburbs or

parts thereof and normally contain a population of between 3,000 and 5,000 people. At a still higher level, area units are combined to create territorial authorities. Wellington City represents one such territorial authority.

In the present study, the 63 area units which comprise Wellington City were used as the basis for sampling participants. Using the 1996 Census data, the average household income was calculated for each area unit and then segmented into quintiles. The purpose of this procedure was to produce groups of area units which had comparable mean household income. After the five groups were produced, the two area units with the highest population were selected from each quintile. This procedure reduced the possibility that a single street, unrepresentative of the area unit, could unduly influence the average income of a small area. The selected area units and their associated average household income levels are presented in Table 5.1.

Using the Supermap database (a Statistics New Zealand product that allows area unit boundaries to be superimposed onto a street map of Wellington City), a starting point was selected for delivering questionnaires. An example of a map with the area unit boundary is presented in Figure 5.1.

A total of 1,000 questionnaire booklets were delivered to the ten area units that comprise the sampling frame for the field study. From this, 358 Wellington residents completed and returned the questionnaire booklet. Eighty five were from the highest mean income quintile (46 from Kelburn, 39 from Churton), 76 were from the second quintile (38 from Wrights Hill, 38 from Hataitai), 77 were from the third quintile (39 from Mt Victoria West , 38 from Wilton-Otari), 56 were from the fourth quintile (28 from Newland North, 28 from Strathmore Park) and 64 were from the fifth quintile (30 from Miramar North, 34 from Newtown East). Overall, this produced a response rate of 35.8 percent[7].

[7] The response rate for this study is comparable to that obtained for similar studies conducted in the Wellington region (e.g., Allen, 1997, Wilson, 1999). Schuman and Kalton (1985) note that typical response rates for face-to-face surveys conducted by non government survey organisations are between 20 and 30 percent, with response rates generally being lower for

Table 5.1.

Average Household Income of Selected Area Units

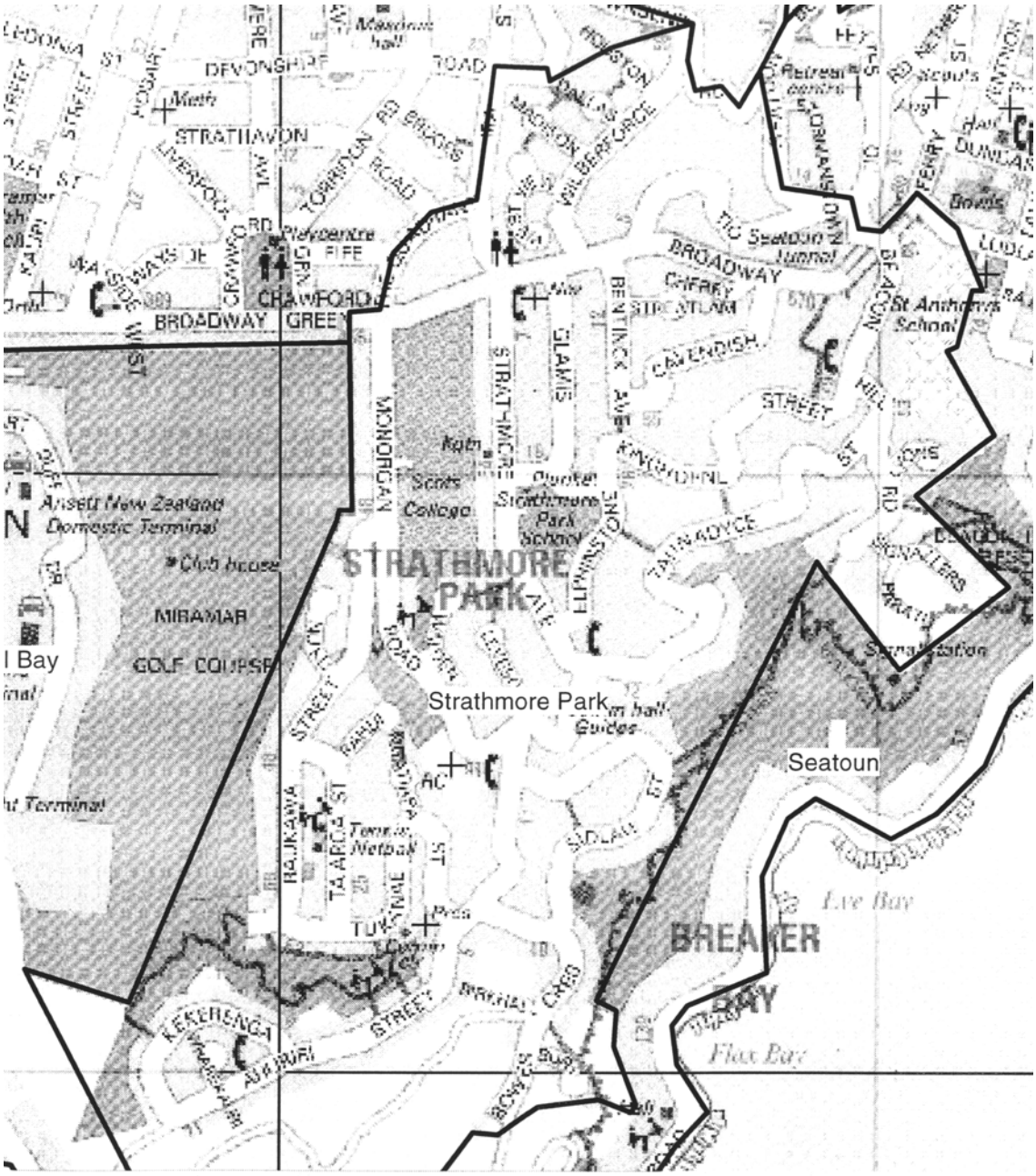
Quintile	Area Unit	Average Household Income
1	Kelburn	$76, 046
	Churton	$74, 249
2	Wright Hill	$64, 895
	Hataitai	$63, 969
3	Mt Victoria West	$62, 213
	Wilton-Otari	$61, 975
4	Newlands North	$52, 734
	Strathmore Park	$47, 461
5	Miramar North	$46, 753
	Newtown East	$38, 594

The respondents included 212 females (59.2%), 145 males (40.5%) and one person who did not indicate their gender. Of the sample, 40 (11.2%) were between the age of 15 and 24, 149 (41.6%) were between 25 and 44, 133 (37.2%) were between 45 and 64, and 34 (9.5%) were over the age of 65. Two participants did not specify their age. With regard to marital status, 88 (24.6%) described themselves as single, 57 (15.9%) were in a long term relationship, 175 (48.9%) were married, 17 (4.7%) were divorced, and 21 (5.9%) chose the 'other' category. The majority of participants (219 or 61.2%) had no dependent children, while 42 (11.7%) had one child, 71 (19.8%) had two children, and 25 (7.0%) had three or more children. This

Figure. 5.1

Typical Area Unit Boundary Superimposed onto a Street Map of Wellington City using the Supermap Database

mail-out surveys. Folkman and Lazarus (1988) found that between 44 and 46 percent of prospective participants who received mail-out letters agreed to participate in the study, but that there was an additional attrition rate of around 12 percent. Thus, the response rate for this study (35.8 percent) is not untypical for research of this kind.


Strathmore Park
Seatoun

information was not provided by one participant.

Ethnically the group consisted of 292 (81.5%) NZ Europeans or Pakehas, 8 (2.4%) Maori, 22 (6.1%) people who categorised themselves as New Zealanders, 18 (5.0%) Europeans, and 18 (5.0%) people who fell into the 'other' category.

In all, 30 (8.4%) reported having no formal qualifications, 103 (28.8%) indicated that they had obtained a secondary school qualification (e.g., School Certificate, Bursary, or equivalent), and 225 (62.8%) had obtained a University / Polytechnic diploma or degree.

Finally, 249 (69.6%) indicated that they owned their own home, while 108 (30.2%) reported that they did not. One person did not provide this information. Seventy people (19.6%) said they had lived at their current address for less than a year, 177 (49.4%) between 1 and 10 years, and the remaining 111 (31.0%) participants had lived at their current address more then 10 years.

A comparison with the 2001 Census revealed that the responding sample does to some degree differ from the population of Wellington City in regard to the age distribution of the sample, the proportion of males and females, and the educational attainment of participants. These comparisons, which are given in Appendix D, show that the sample would need to be weighted (adjusted) to account for differences between the population and the resultant sample in order to more closely match the Census.

Weighting has been used successfully in other research to account for the effects of probability of selection, non-response, and sample stratification (e.g., Jensen, Spittal, Crichton, Sathyandra & Krishnan, 2002), but was not attempted on the data used here for several reasons. In particular, the procedure requires the knowledge of a specialist survey statistician to produce estimates of the population. Unfortunately, there was no access to such knowledge at the time. Second, much of the data that was collected was unsuitable for such a purpose. For instance, responses to the open-ended ethnicity question could not be compared to Census data due to differences in

the question format (Statistics New Zealand used prioritised ethnicity for the Census which could account for membership in more than other ethnic group, whereas this research did not).

Finally, even though this sample is not representative of the population, it is likely that it is superior to other samples collected for this purpose. For instance Mulilus and Lippa (1990) collected data from only n = 154 home owners in one suburb of Los Angeles; Helweg-Larson conducted her analysis on samples of n = 43 and n = 60 university students; Sattler et al. (2000) used samples of n = 257 and n = 180 mainly university students and members of staff (woman were highly over-represented in both surveys); and McClure et al. (1999) surveyed students and non-student adult acquaintances of first year psychology students (n = 100 and 124). Of these studies, only Mulilus and Lippa attempted to investigate the representativeness of their sample.

These considerations suggest that if similar research was to be conducted in the future, then further work would need to be undertaken to ensure that the obtained sample was more representative of the population from which responses were drawn.

Materials

The order of the questionnaires was counterbalanced so that half the participants answered the risk and locus of control questions first, and the earthquake likelihood, self-other bias, and preparation questions second. The other half of the participants answered the earthquake likelihood, self-other bias, and preparation questions first and the risk and locus of control questions second. The demographic items appeared last in all cases. The questionnaire booklet used in the study is reproduced in Appendix E and includes the following measures.

Earthquake Preparation

Earthquake preparation was assessed using the Wellington Earthquake Preparedness Scale (WEPS). Information concerning the development of this scale is contained in Chapter 4. It is a 23 item scale which examines the steps that people have taken to prepare for a major earthquake. The WEPS is a unidimensional measure and has a high level of reliability (α = 0.87).

Demographic Items

A number of general items were used to record gender, ethnicity, age, marital status, number of dependent children, and educational qualifications. In addition to these questions, participants were asked about home ownership "Do you own your own home?" (yes / no), and length of residence at their current address "How long have you lived at your current address?" (less than a year / between 1 and 10 years / more than 10 years).

Risk

The Risk scale assessed three components of risk – major risk, minor risk, and risk precaution. This scale has a robust three factor structure, and high levels of reliability (range 0.75 to 0.85). To counter potential experimenter effects, the Risk scale was labelled 'Lifestyle Activities', and the term 'risk' was removed from the stem and replaced with a more general term – 'activities'. This change did not alter the meaning of the instructions.

Items were presented in two blocks – one block contained the Risk-precaution items, and the second contained the major-risk and minor risk items. Items were presented in this order as it gave a sense of continuity between items[8]. Further details concerning this scale can be found in Chapter 2.

[8] The gold-standard by which paper and pencil tests are judged against is the structured interview, where one question leads onto the next. If, in this setting however, the interviewer

Locus of Control

Locus of Control was assessed by the composite version of the Spheres of Control scale developed in Chapter 3. Briefly, this scale comprises of three subscales (personal control, interpersonal control, and sociopolitical control). It has a stable three factor structure, and acceptable levels of reliability (range 0.69 to 0.75).

Earthquake Likelihood

Respondents also completed a question concerning the probability of a major earthquake. Participants were asked "How likely do you think it is that a major earthquake will occur in the Wellington region in the next 30 years?". Responses were given on a 7 point scale ranging from very unlikely to very likely. This question was taken from McClure et al. (1999).

Self-Other Bias

Self-other comparisons that define the other person as 'the average other' can create a source of ambiguity in the social comparison process because the average other person is an abstract concept (e.g., Alicke, Klotz, Breitenbecher, Yurak, & Vredenburg, 1995; Klar & Giladi, 1997), To counter this, questions were developed to examine the difference between attributions to the self, to an acquaintance, and to most people who live in Wellington. Participants completed nine questions relating to their judgements about preparedness and the likelihood of harm from a major earthquake. The first set of three questions examined the possibility of a self-other bias in the level of preparation for a major earthquake. Participants were asked (1) "How prepared do you think you are for a major earthquake"? (2) "Think of an acquaintance (someone you know only slightly) who lives in the Wellington region.

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were to ask questions in a random order – which is what many researchers assert should be done with paper and pencil tests – then the level of measurement error would likely increase due to poor continuity between items.

How prepared do you think they are for a major earthquake"? and (3) "How prepared do you think most people who live in the Wellington region are for a major earthquake"? Participants responded on a seven point scale with anchor points labelled as not prepared and very well prepared.

A second set of questions examined respondents' optimistic biases with regard to two different consequences of a major earthquake – injury and damage to property. The question read: "If a major earthquake were to occur in the Wellington region, how likely do you think it is that it would cause (1) harm to you? (2) damage to your property? (3) harm to the person you thought of when answering Question 3 [the acquaintance]; (4) damage to the property of the person you thought of when answering Question 3; (5) harm to most people who live in Wellington; and (6) damage to the property of most people who live in Wellington". Participants could respond on a seven point scale with anchor points labelled as very unlikely and very likely.

Procedure

Questionnaire booklets were hand-delivered to the letterboxes of households within the selected area unit during July 2001. Houses were excluded from being surveyed if (a) a no circulars sign was displayed on the letterbox, (b) the property was advertised as being for sale, (c) the property was larger than three stories, (d) there was already a large amount of uncollected mail. The questionnaire booklets were delivered over two weeks on Thursdays and Fridays as this provided an opportunity for participants to complete the surveys during the following weekend.

Questionnaires were not assigned an identifying code in order to preserve the anonymity of respondents (and non-respondents). There were several factors that guided this decision to conduct the fieldwork as an anonymous survey – principally a need to attain a high response rate but also ethical considerations.

As with the previous studies, financial restrictions necessitated gathering the data as efficiently as possible. Considerable effort was made to encourage a high

response rate (the major cost driver in this project was printing, therefore it was considered desirable to avoid additional printing to increase the sample size). For instance, one way in which a high response rate was sought was by packaging the questionnaire booklet and the information sheet in a large A4 envelope with a Victoria University of Wellington logo. It was hoped that the size of the envelope and the logo would have sufficient novelty value to encourage the recipient to open the envelope. A key method used to obtain a high response rate was to clearly signal to the householder that the questionnaire was anonymous. This information was communicated through the information sheet, through a header on each page of the questionnaire saying 'Confidential Research Questionnaire', and through the final instructions on the last page of the questionnaire. It was hoped that potential participants would be willing to answer intrusive questions (e.g., 'I can usually establish a close personal relationship with someone I find sexually attractive', or 'Take something that doesn't belong to you') if it was clear that they could not be identified.

There were two ethical considerations that reinforced the decision to conduct the fieldwork as an anonymous survey: (1) the acknowledgement that a person has the right not to participate in research if they wish, and (2) the issue of respondent burden. By conducting the fieldwork in an anonymous manner, it recognised the fact that people have every right not to participate in research. Second, there was a concern that although a reminder system may have increased the response rate of the survey, it was possible that participants would feel compelled to complete the questionnaire but do so unwillingly.

Results

The results section is organised as follows:

1. Questionnaire evaluation – confirmatory factor analyses of the subscale structures for the risk and locus of control scales.

2. Earthquake preparation – confirmatory factor analysis and descriptive analyses of the responses to the Wellington Earthquake Preparedness Scale (WEPS).

3. Demographic variables and earthquake preparation – a statistical analysis of the relationship between the demographic variables and people's preparedness for a major earthquake.

4. Psychological variables and earthquake preparation – a statistical analysis of the relationship between subscales derived from the self-other bias questions, the Spheres of Control scale, the Risk scale, the cognitive variables, and the WEPS.

5. Predictors of earthquake preparation – a regression analysis of demographic variables and psychological variables to predict household earthquake preparation.

6. Mediators of earthquake preparation – an analysis of risk as a mediating factor between locus of control and preparation.

7. Self-other judgements – a statistical analysis of self–other biases with regard to judgements about earthquakes.

Questionnaire Evaluation

The first section confirms the factor structure and reliability of the Risk scale and the Spheres of Control (SOC) scale using the sample of Wellington residents. It also includes the presentation of descriptive scores for both scales as well as the internal consistency of each.

Risk

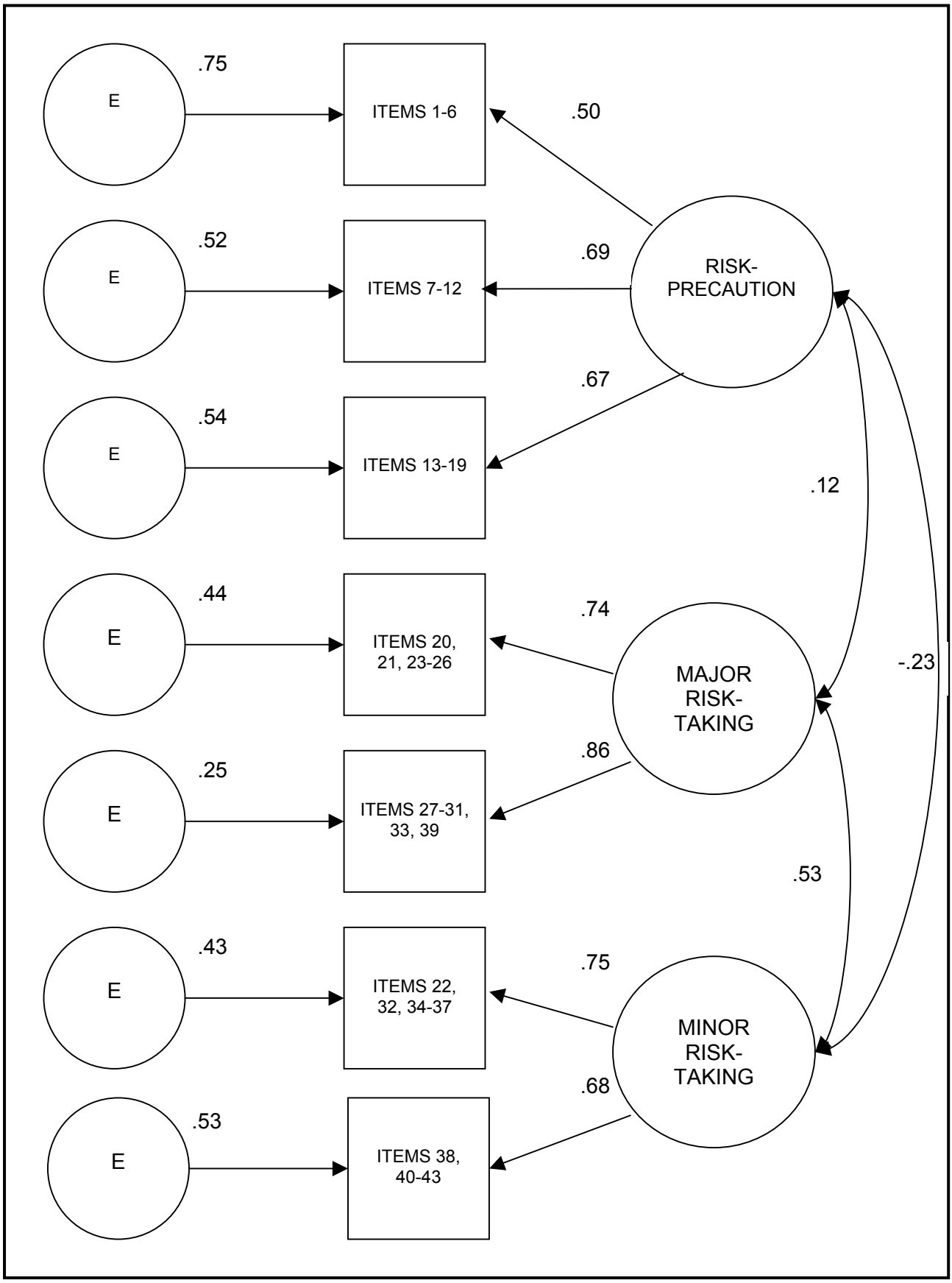
A confirmatory factor analysis of the Risk scale revealed that the three factor structure fitted the data well (Figure 5.2), as evidenced by the non-significant chi square statistic, χ^2 (11) = 26.597, ns; excellent indices of fit (GFI = 0.98, CFI = 0.97, NFI = 0.95, AGFI = 0.95), and a small level of error (RMSEA = 0.06, RMR = 0.04). The chi square/df (a rule of thumb for the goodness of fit) was 2.42. Cronbach's alpha was computed at 0.76 for the risk precaution scale, 0.81 for the major risk scale, and 0.70 for the minor risk scale. For the total scale, Cronbach's alpha was calculated at 0.76.

The means, standard deviations and minimum and maximum scores for the Risk scale are presented in Table 5.2. Variations in the sample size are due to missing data. In presenting these data, scores have been recoded so that the Risk scale is scored on a five point scale from 0 to 4, where 0 represents I would never do this and 4 represents I would often do this. Thus, the minimum possible score a participant could obtain is 0, which would indicate that they had never undertaken any of the listed risk precaution activities or the major and minor risk taking activities.

In considering these scores, it should be noted that the subscales are different lengths. The risk precaution subscale consists of 19 items, the major risk scale comprises 13 items and the minor risk scale contains 11 items. Consequently some of the differences in the rates of risk taking activities may be due to different numbers of items within each subscale. To facilitate comparison between the subscales, the

Figure 5.2

Fitted Model of the Risk Scale



means converted to a five point scale are 1.59 (Total Risk score), 2.26 (Risk Precaution), 1.04 (Major Risk), and 1.09 (Minor Risk).

Table 5.2

Descriptive scores of Wellington Residents on the Risk Scale and its Subscales

Measure	N	Mean	S.D.	Minimum	Maximum
Risk	358	112.86	17.14	24	154
Risk Precaution	358	42.96	10.68	18	69
Major Risk	356	13.50	8.01	0	40
Minor Risk	356	11.95	5.50	0	35

Spheres of Control Scale

For the sample of Wellington residents, confirmatory factor analysis of the Spheres of Control scale (see Figure 5.3) indicated that a three factor model had an excellent fit to the data, $\chi^2(2) = 7.321$, ns, GFI = 0.97, CFI = 0.99, NFI = 0.98, AGFI = 0.98, RMSEA = 0.03, RMR = 0.02. Internal consistency, using Cronbach's alpha, was estimated at .72 for the Personal Control (PC) subscale, .77 for the Interpersonal Control (IPC) subscale, .79 for the Sociopolitical Control (SPC) subscale, and .82 for the total scale.

Table 5.3 contains the means and standard deviations of the SOC and its subscales as well as the minimum and maximum scores obtained from the sample. The PC subscale is scored from 1 to 7, with 1 representing totally inaccurate and 7 reflecting totally accurate. For the IPC and SPC subscales, 1 indicates disagree and 7 denotes agree. Differences in the number of participants are due to missing data. Scores for the subscales can range from 10 to 70, with higher numbers indicating an internal locus of control.

Figure 5.3

Fitted Model of the Spheres of Control Scale

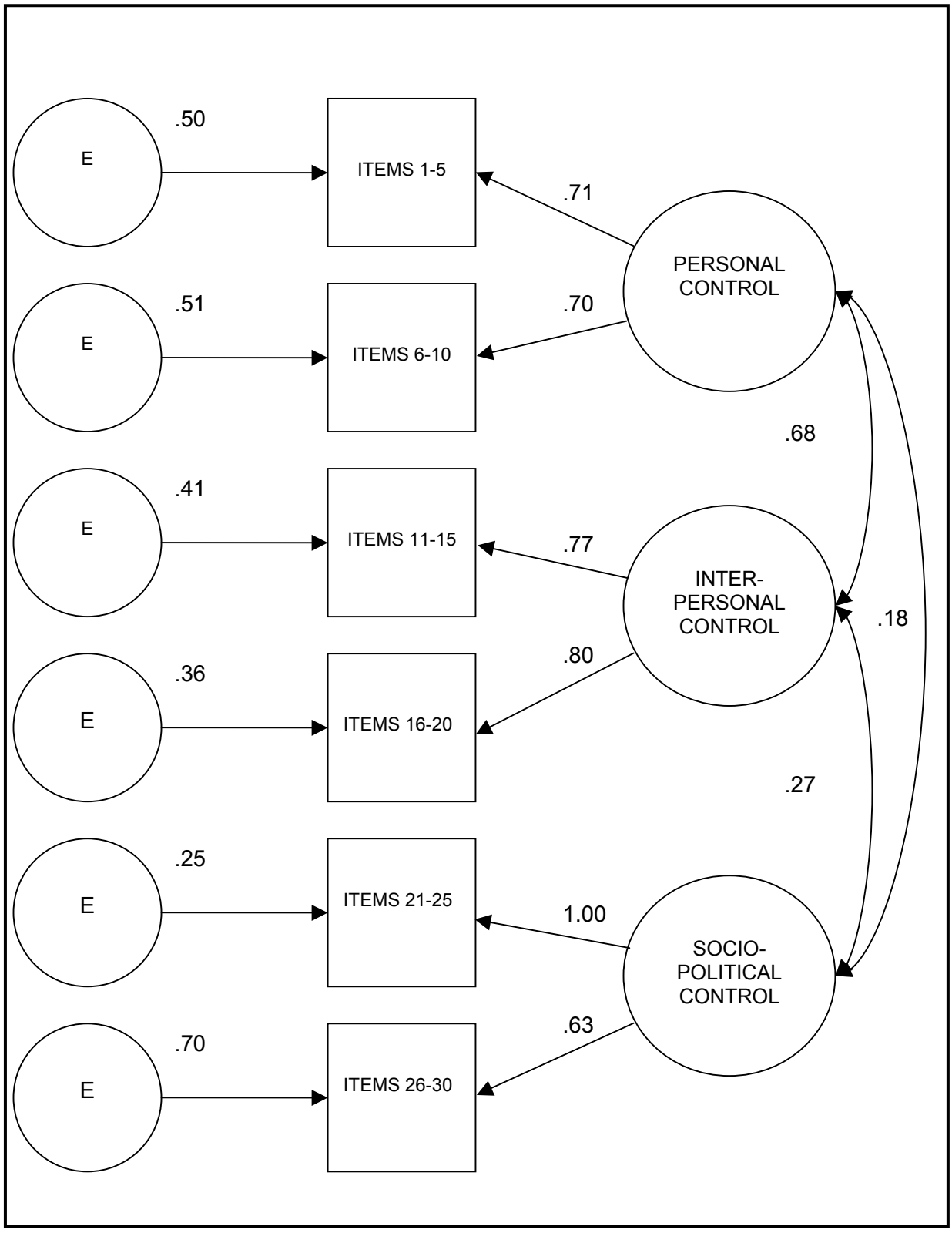


Table 5.3

Descriptive Scores of Wellington Residents on the Spheres of Control Scale and its Subscales

Measure	N	Mean	S.D.	Minimum	Maximum
SOC	357	133.50	21.31	28	189
PC	355	52.28	7.91	21	70
IPC	354	48.47	9.37	18	70
SPC	356	33.54	9.64	9	61

Note: SOC = Spheres of Control, PC = personal Control, IPC = Interpersonal Control, SPC = Sociopolitical Control.

The Wellington Earthquake Preparedness Scale

This section describes the responses of Wellington residents to the Wellington Earthquake Preparedness Scale (WEPS). It provides a confirmatory analysis of the factor structure and internal consistency of the scale as well as a presentation of the types of activities that participants reported performing to prepare for a major earthquake. Also, the scale mean and standard deviation are presented, together with normative data.

For the sample of Wellington residents, the GFI (0.99), CFI (0.99), NFI (0.98), AGFI (0.96), RMSEA (0.07) and RMR (0.03) all indicated that the one factor model had an excellent fit to the data, $\chi^2(2) = 5.773$, NS (see Figure 5.4). Reliability for the scale, using Cronbach's alpha was calculated at .85.

Table 5.4 shows the percentage of participants who indicated that they had undertaken each activity listed in the WEPS. It is clear from a comparison of the responses of the sample of Wellington residents, in Chapter 4, with the responses in the present study, that there is a high degree of similarity in the preparation activities that people report having undertaken to prepare for a major earthquake. It is possible to statistically test the similarities between the rank orders using Spearman's Rank-

Figure 5.4

Fitted Model of the Wellington Earthquake Preparedness Scale

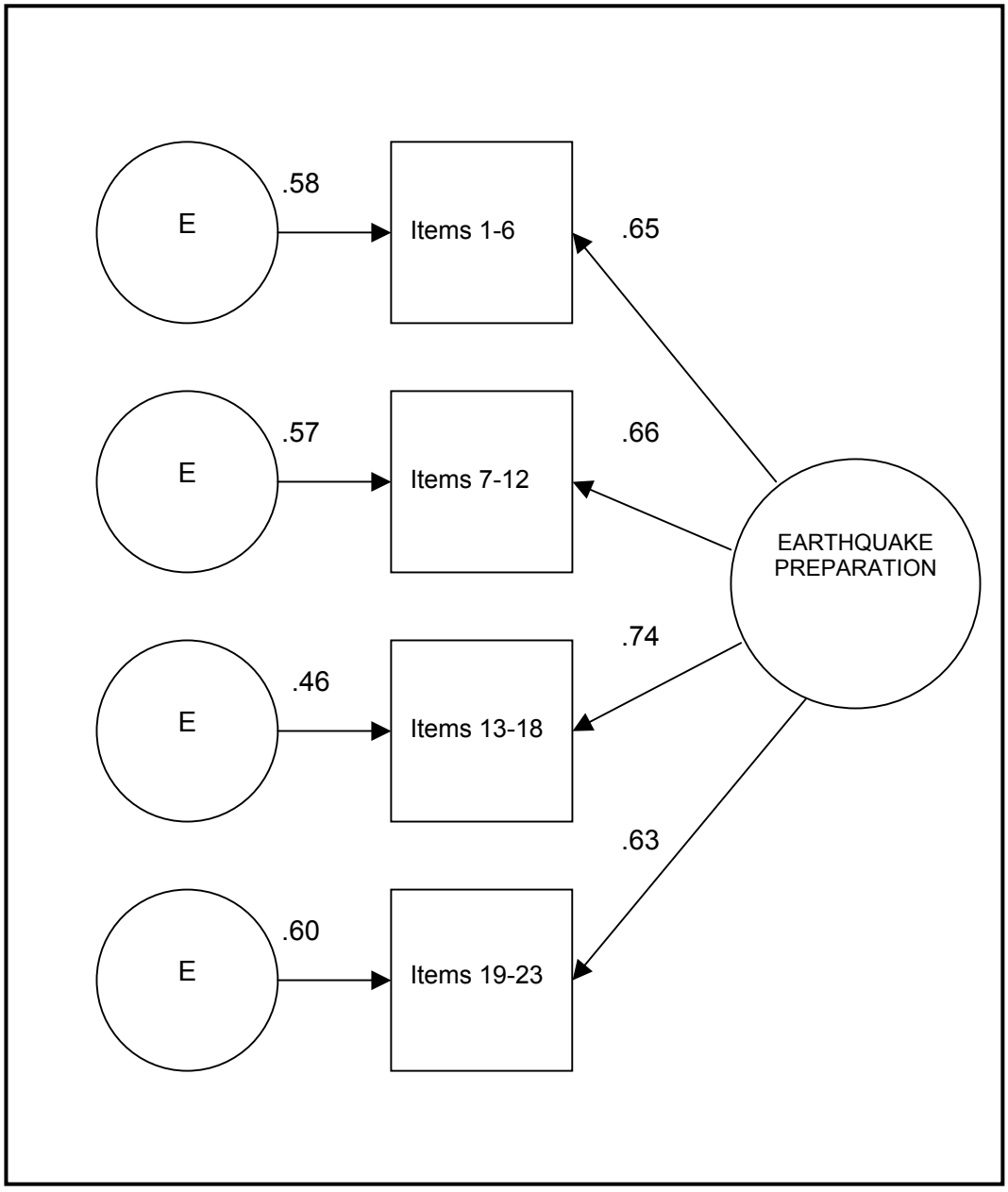


Table 5.4

Percentage of Participants Who Report Having Undertaken Each of the Earthquake Preparedness Activities Listed in the WEPS (N = 303 to 357)[9]

	Item	Yes (%)
18	I have obtained a working torch.	89.9
9	I have ensured that objects which contain water have not been stored on top of electrical equipment (e.g. a pot plant or fish bowl on top of the television).	75.4
14	I have obtained a supply of tinned food that could be used in an emergency.	73.0
20	I have access to an alternative cooking source (e.g. gas barbecue).	70.5
16	I have a supply of essential medicines for illness and allergies.	69.5
17	I have obtained a working battery radio.	69.2
13	I have accumulated enough tools to make minor repairs to the house following a major earthquake.	69.1
15	I have purchased a first aid kit.	67.5
10	I have ensured that heavy objects are stored on the floor.	66.6
11	I have stored water for survival.	56.3
4	I have either strengthened my chimney, or satisfied myself that it will not fall down in a major earthquake.	53.2
5	I have either strengthened my house to increase its earthquake resistance, or satisfied myself that it will probably not fall down in a major earthquake.	50.3
7	I have arranged the cupboards so that heavy objects are stored at ground level.	44.7
12	I have put aside spare plastic bags and toilet paper for use as an emergency toilet.	44.3
1	I have considered the risk of a major earthquake when deciding to live in the house that I do now.	38.3
6	I have ensured that my roof will probably not collapse in a major earthquake.	37.4
3	I have fastened my hot water cylinder.	36.0
22	I have obtained a working fire extinguisher.	32.7
23	I have taken some steps at work. The steps were (name)	26.0
2	I have fastened tall furniture to the wall.	23.9
21	I have arranged a place to meet after an earthquake.	22.3
8	I have securely fastened cupboards with latches.	18.9
19	I have secured movable objects in my home e.g. computer, television.	5.4

[9] N = 350 to 357 for items 1 to 22; N = 303 for item 23.

difference correlation method. Such an analysis reveals a correlation of r_p = .96, p < .01 between the responses presented in Chapter 4 and the responses presented here.

Thus, in both samples most people report that they have obtained a working torch, a supply of tinned food, or that they have access to an alternative cooking source. These activities represent a low level of financial commitment and can be carried out for purposes other than preparation for earthquakes. Conversely, few participants in either study report that they have secured movable objects in their home, fastened tall furniture to the wall or securely fastened cupboards with latches. While these activities do not represent a high degree of financial commitment on the part of the participants, they do demand time.

The mean total score on the WEPS was 10.68 and the standard deviation was 5.01. Again, it is of interest to compare these data with the mean obtained from the sample of Wellington residents with whom this questionnaire was previously evaluated in Chapter 4. For that group the mean total score was 9.87 and the standard deviation was 5.42.

Demographic Variables and Earthquake Preparation

This section reports the relationship between the demographic variables and earthquake preparation, and is organised as follows. First, it reports a correlational analysis examining the relationship between demographic variables and earthquake preparation, and second, it reports a regression analysis where demographic variables were entered as predictors of earthquake preparation. The Pearson's product moment correlations are presented in Table 5.5 and show that several variables are significantly correlated with earthquake preparation (see variables 2 to 8). There were significant positive correlations between preparation and both home ownership, and length of residence at current address. Participant age and marital status were also significantly correlated, although these correlation coefficients were smaller.

Table 5.5

Correlation Matrix: All Study Measures

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Preparation	*												
2	Gender	-.04	*											
3	Age	.34	-.22	*										
4	Marital Status	.29	.01	.48	*									
5	Dependent Children	.12	.08	-.08	.30	*								
6	Education Level	-.07	.03	-.19	-.12	-.01	*							
7	Home ownership	.44	-.07	.52	.40	.18	-.09	*						
8	Length of Residence	.38	-.06	.50	.24	.01	-.23	.41	*					
9	Probability of Earthquake	.03	.19	-.17	.01	.14	.10	.00	-.14	*				
10	Self Prepared	.64	-.02	.23	.16	.12	-.05	.30	.27	.01	*			
11	Acquaintance Prepared	.35	-.01	.10	.04	.00	.10	.13	.14	.00	.39	*		
12	Wellingtonian Prepared	.21	.08	.00	-.02	.06	.08	.05	.05	.07	.34	.48	*	
13	Self Harm	.04	.18	-.12	.00	.09	.00	-.04	-.09	.31	.06	.00	.06	*
14	Self Property Damage	-.01	.12	-.29	-.06	.12	.06	-.08	-.15	.26	-.03	.01	.04	.54
15	Acquaintance Harm	.08	.18	-.13	-.06	.03	-.03	-.01	-.06	.27	.10	-.02	.00	.75
16	Acquaintance Property Damage	.03	.11	-.28	-.11	.10	.09	-.03	-.12	.24	.03	-.06	-.03	.51
17	Wellingtonian Harm	-.04	.24	-.19	-.09	.06	-.03	-.14	-.08	.27	-.02	-.06	-.01	.66
18	Wellingtonian Property Damage	-.03	.15	-.29	-.12	.09	.06	-.12	-.14	.18	-.03	-.07	.00	.48
19	Spheres of Control	.16	-.05	-.06	-.06	.05	.20	.01	-.06	.04	.10	.11	.09	-.03
20	Personal Control	.12	.00	-.11	-.02	.08	.16	.02	-.04	.02	.10	.05	.06	-.02
21	Interpersonal Control	.05	-.09	-.08	-.09	.06	.19	.07	-.04	.01	.01	-.03	-.05	-.03
22	Sociopolitical Control	.16	.00	.08	.05	-.04	.19	.00	.00	.06	.09	.19	.20	-.01
23	Risk	.37	.16	.33	.16	.05	-.09	.25	.26	.00	.27	.10	-.01	.03
24	Risk Precaution	.39	.17	.14	.12	.12	.02	.16	.10	.13	.28	.12	.02	.04
25	Major Risk	-.13	-.13	-.38	-.21	.02	.18	-.22	-.30	.06	-.11	.01	.03	.00
26	Minor Risk	-.26	-.05	-.36	-.13	.10	.01	-.23	-.29	.13	-.17	-.13	-.02	.00

Table 5.5 Continued

		14	15	16	17	18	19	20	21	22	23	24	25	26
1	Preparation													
2	Gender													
3	Age													
4	Marital Status													
5	Dependent Children													
6	Education Level													
7	Home ownership													
8	Length of Residence													
9	Probability of Earthquake													
10	Self Prepared													
11	Acquaintance Prepared													
12	Wellingtonian Prepared													
13	Self Harm													
14	Self Property Damage	*												
15	Acquaintance Harm	.51	*											
16	Acquaintance Property Damage	.80	.63	*										
17	Wellingtonian Harm	.37	.71	.43	*									
18	Wellingtonian Property Damage	.63	.47	.64	.62	*								
19	Spheres of Control	.06	.02	.09	-.03	.05	*							
20	Personal Control	.12	.03	.13	-.01	.07	.70	*						
21	Interpersonal Control	.12	.06	.18	.02	.10	.77	.48	*					
22	Sociopolitical Control	-.07	-.03	-.06	-.03	-.02	.64	.14	.21	*				
23	Risk	-.09	.11	-.05	.03	-.09	.19	.03	-.03	.01	*			
24	Risk Precaution	-.02	.09	.00	.04	-.08	.18	.09	.07	.07	.68	*		
25	Major Risk	.11	-.09	.07	-.06	.03	.14	.11	.12	.07	-.58	.07	*	
26	Minor Risk	.11	-.05	.07	.00	.08	.00	-.03	.06	.00	-.65	-.17	.39	*

Note: All correlations greater than .10 significant at α = .05, correlations greater than .13 significant at α = .01, and correlations greater than .17 significant at α = .001.

The average number of steps taken to prepare for an earthquake by each age group was M = 7.10, SD = 3.92 (15 to 24 year olds), M = 10.69. SD = 4.73 (25 to 44 year olds), M = 12.67, SD = 4.32 (45 to 64 year olds), and M = 13.03, SD = 4.33 (65 years and older). The ANOVA revealed a significant difference between these groups $F(3, 352) = 18.64$, $p<.0001$. Tukey's test indicated that 15 to 24 year olds were significantly less prepared than the three older age groups. People aged 25 to 44 were less prepared then 45 to 64 year olds, but did not differ significantly from those 65 and older. Those aged between 45 and 64 had undertaken significantly more steps than the two younger groups, but did not differ from those aged 65 and over (all tests at the .01 level). This relationship is plotted in Figure 5.5[10]

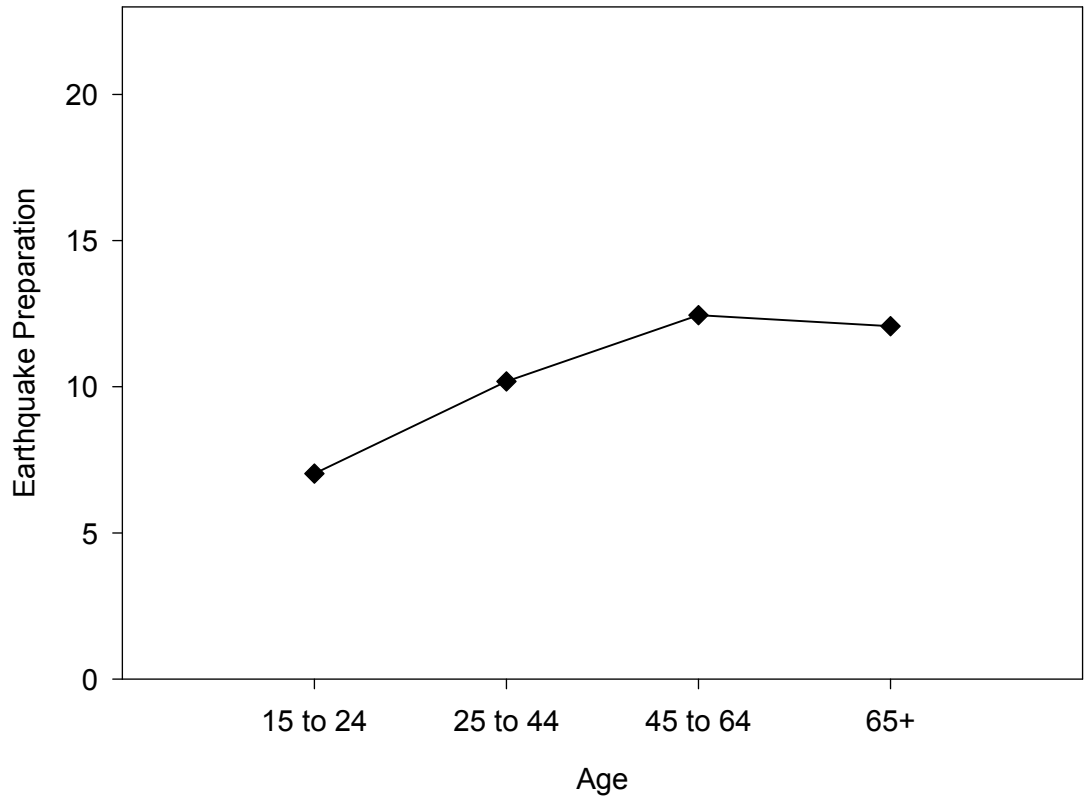
An ANOVA examining the level of earthquake preparation between people who classified themselves as either single, in a long term relationship, married, or divorced showed a significant difference between these groups $F(4, 353) = 13.79$, $p<.0001$. However, post-hoc Tukey's tests revealed that the only significant differences, with $p<.05$, were between those who were married and those who classified themselves as either single or in a long term relationship. People who were single or in a long term relationship were the least prepared (M = 9.11, SD = 4.95 for single, M = 9.30, SD = 4.67 for long term relationship, versus M = 12.81, SD = 4.13 for married). No differences were observed between people who were married and those who were divorced (M = 10.82, SD = 4.53), or who classified themselves as other (M = 12.86, SD = 4.40)[11].

[10] Although Figure 5.5 suggests a curvilinear relationship between age and preparation, regression analyses comparing linear and curvilinear terms indicates that a linear term fits the data better, $F (1, 355) = 47.48$, $p < .001$, $R^2 = .12$ $\beta = .34$ for a linear term; $F (1, 355) = 37.67$, $p < .001$, $R^2 = .10$, $\beta = .31$ for a curvilinear term.

[11] Marital Status was coded as follows: 1 = single, 2 = long term relationship, 3 = married, 4 = divorced, 5 = other.

Figure 5.5

Mean Number of Earthquake Preparation Steps Undertaken by Age



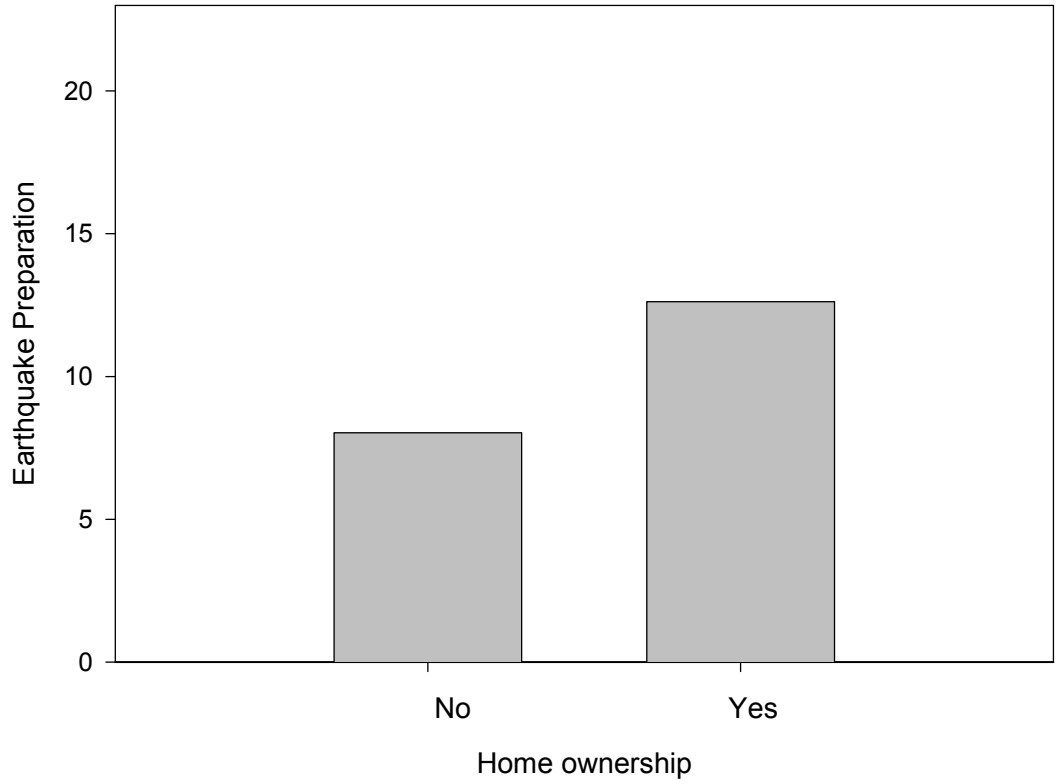
The level of earthquake preparation did not vary significantly as a function of the number of dependent children, F(5, 351) = 1.95, ns. For people with no dependent children the mean WEPS score was M = 10.71, SD = 5.00; for people with one child M = 11.69, SD = 4.52; for two children M = 12.52, SD = 3.89; and for 3 or more children M = 11.72, SD = 4.91.

A t-test revealed that home owners reported having taken more steps to prepare for an earthquake than non home owners (M = 12.61, SD = 4.28 for home owners, M = 80.3, SD = 4.28 for non home owners). This difference was significant, t (355) = 9.28, p < .0001, and is plotted in Figure 5.6. Also, a one way ANOVA indicated a significant relationship between preparation and length of residence, F(2, 355) = 31.99, p<.0001. Post-hoc Tukey's tests, with p < .05, indicated that those who have lived at their current address less than a year (M = 7.86, SD = 4.60) are less prepared

than those who having been living there between 1 and 10 years (M = 11.32, SD = 4.51), and those who have been there more than 10 years (M = 13.26, SD = 4.11). These means are plotted in Figure 5.7.

Figure 5.6

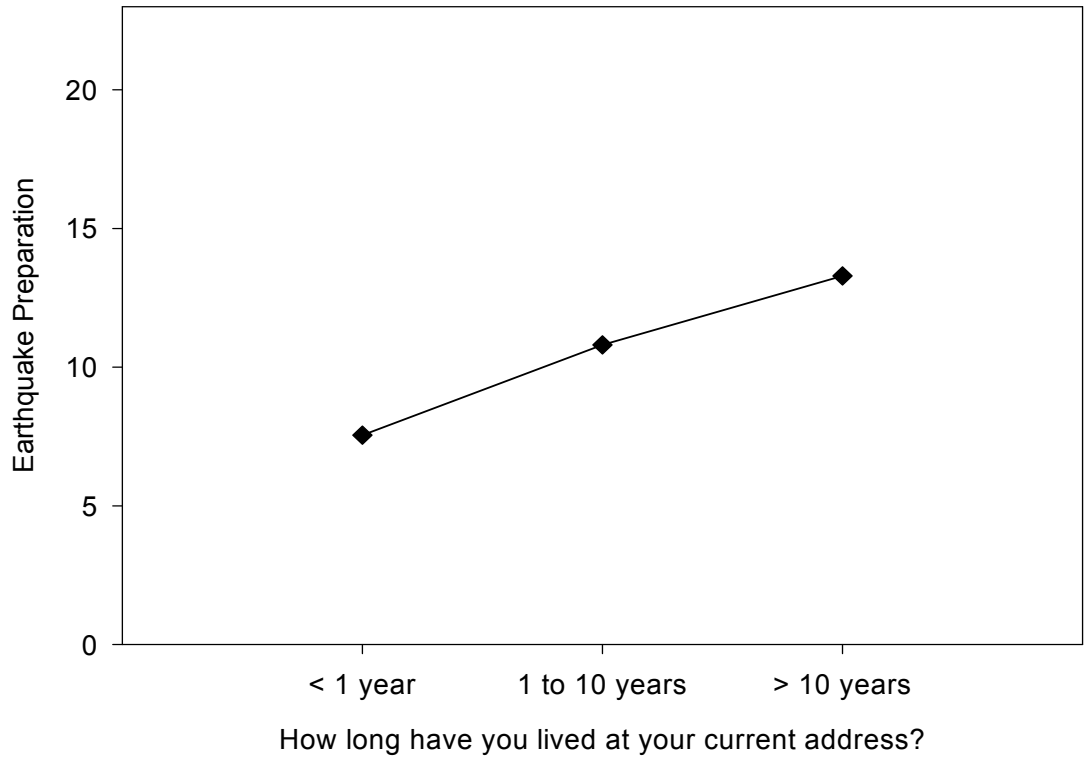
Home Ownership and Earthquake Preparation



Having examined the differences in preparation in relation to individual variables, a multiple linear regression analysis was performed to examine which demographic variables are the best predictors of preparation. This analysis is useful for several reasons. First, it can determine the proportion of variance that demographic variables account for in predicting earthquake preparation, and second, it is possible to examine the relative importance of each variable in predicting earthquake preparation. Before performing this analysis, ethnicity was removed from the analysis because of

Figure 5.7

Length of Residence at Current Address and Earthquake Preparation



the limitations of this data. This issue is discussed in more detail in Appendix D in relation to the sample representativeness.

Table 5.6 shows the unstandardised beta (B), standard error of the beta (SE B), and standardised beta (β) from a multiple linear regression analysis where seven demographic variables were entered as predictors of earthquake preparation. This regression was significant $F(7, 345) = 17.373$, $p < .001$ and accounted for 27% of the variance (adjusted R^2). As can be seen in Table 5.6, two variables were significant predictors of earthquake preparation: home ownership and length of residence at current address. Gender, age, marital status, education level, and number of dependent children were not significant predictors.

Table 5.6

Summary of Multiple Linear Regression Analysis for Demographic Variables Predicting Earthquake Preparation (N = 353)

Variable	B	SE B	β
Gender	-0.06	0.47	-.01
Age	0.29	0.39	.05
Marital status	0.35	0.25	.08
Dependent children	0.27	0.25	.06
Education level	0.26	0.36	.04
Home ownership	3.00	0.61	.29**
Length of residence	1.53	0.38	.22**

Note: adjusted R^2 = .25; * p < .05, ** p < .01

Psychological Variables and Earthquake Preparation

The section above has reported on the relationship between demographic variables and earthquake preparation. A similar analysis is presented in the following section, examining the relationship between psychological variables and earthquake preparation. This section is organised in three parts. The first part examines the relationship between the responses to the items that assessed self-other bias, and reported earthquake preparation. The second part examines the relationships between risk, locus of control, and earthquake preparation. In the third section, psychological variables are used to predict WEPS scores using multiple regression.

Judgements about Earthquakes and Preparation

A correlation matrix showing the relationships between the individual items that assessed a self-other bias and preparation is presented in Table 5.5 (variables 10 to 18).

Correlations were also performed on subscales derived from these items. Judgements of self preparation, acquaintance preparation, and Wellingtonian preparation were summed to produce a single variable. This variable was labelled "preparation appraisal" and had a reliability estimate of .65. Similarly, likelihood estimates of harm to oneself and one's property were summed together along with the estimates made about harm to an acquaintance and damage to the property of acquaintances and of other Wellingtonians. This variable was called "damage likelihood" and had a reliability of .89. Preparation appraisal was strongly positively correlated with earthquake preparation ($r = .55$, $p < .01$). There was no relationship between damage likelihood and earthquake preparation ($r = .05$, ns) or between likelihood of an earthquake in the next 30 years and preparation ($r = .03$, ns).

An inspection of Table 5.5 shows a strong positive relationship between the actual preparation for a major earthquake and perceived preparation. As the target becomes more distant from the participant, the correlation with preparation is reduced. Table 5.5 also shows a strong positive correlation between judgements of harm to oneself and harm to an acquaintance, but a somewhat more attenuated relationship with harm to other Wellingtonians. This pattern was also found with regard to property damage, with a strong relationship between damage to one's own property and an acquaintance's property, and a smaller relationship with damage to other Wellingtonians' property. In contrast to the strong correlations observed between preparation and perceived preparedness, there were no significant relationships between preparation and judgements of harm or potential damage and preparation. This pattern was consistent across different targets.

Locus of Control, Risk, and Preparation

A correlation of .16 ($p < .01$) was found between the total Spheres of Control score and earthquake preparation, and a correlation of .37 ($p < .01$) was obtained between the total Risk score and preparation. A more detailed analysis examining the relationship between the subscales of these measures is presented in Table 5.5 and shows that Personal Control and Interpersonal Control were not correlated with preparation, but Sociopolitical Control was significantly correlated. Table 5.5 also shows that the risk-taking subscales (Major risk and Minor risk) were significantly negatively correlated with preparation, and that Risk Precaution was significantly positively correlated with preparation. The risk variable used in this analysis was the sum of the risk-precaution items, and the sum of the major and minor risk-taking items (reverse scored). Thus this variable measures propensity to engage in risk-precaution activities and propensity to avoid engaging in risk-taking activities.

Psychological Predictors of Preparation

A multiple linear regression analysis was performed to determine which variables are significant predictors of earthquake preparation. In this analysis, the Preparation Appraisal and Damage Likelihood subscales, derived from the self-other bias items, were entered along with judgements about the probability of an earthquake, and the total Risk and SOC scales. The results of this analysis are presented in Table 5.7, and show that the psychological variables account for 39% of the variance (Adjusted R^2). This equation is significant, $F(5, 350) = 45.728$, $p < .0001$. Of the five parameters entered into the model, three were significant (Appraisal of Preparation, Risk, and SOC).

Table 5.7

Summary of Multiple Linear Regression Analysis for Psychological Variables Predicting Earthquake Preparation (N = 356)

Variable	B	SE B	β
Preparation Appraisal	0.80	0.07	.49**
Damage Likelihood	0.01	0.03	.01
Earthquake Probability	0.04	0.14	.01
Risk	0.08	0.01	.29**
SOC	0.01	0.01	.05

Note: adjusted R^2 = .39; * p < .05, ** p < .01

Demographic and Psychological Predictors of Earthquake Preparation

The preceding sections have examined, in separate analyses, demographic and psychological variables and their relationship to earthquake preparation. In this section demographic variables and psychological variables are examined together. Sequential regression (also called hierarchical regression) was employed to determine whether psychological information improved prediction above and beyond that afforded by demographic information alone. This analysis was performed using all the variables that were evaluated in the previous sections. Demographic variables were entered at Step 1, and psychological variables were entered at Step 2.

Table 5.8 displays the standardised regression coefficients (β), the R^2, and adjusted R^2 after entry of both blocks of data. At the first step the demographic variables were significant predictors, $F(7, 344) = 17.624$, $p < .0001$, giving an R^2 of .25. At Step 2, the psychological variables added significantly to the prediction of earthquake preparation, $F(12, 339) = 28.217$, $p < .0001$, with an R^2 of .48; an increase

Table 5.8

Summary of Sequential Regression Analysis for Demographic and Psychological Variables Predicting Earthquake Preparation (N = 352)

Variable	B	SE B	β
Step 1			
Gender	-0.01	0.47	.01
Age	0.31	0.39	.05
Marital status	0.32	0.25	.07
Dependent children	0.28	0.24	.06
Education level	0.24	0.35	.03
Home ownership	3.08	0.61	.30**
Length of residence	1.51	0.38	.22**
Step 2			
Gender	-0.72	0.41	-.07
Age	-0.09	0.35	.02
Marital status	0.53	0.21	.12**
Dependent children	0.01	0.21	.01
Education level	-0.20	0.30	-.03
Home ownership	2.01	0.52	.19**
Length of residence	0.94	0.32	.14**
Preparation Appraisal	0.69	0.07	.42**
Damage Likelihood	0.04	0.03	.06
Earthquake Probability	0.11	0.13	.03
Risk	0.05	0.01	.19**
SOC	0.02	0.01	.08

Note: adjusted R^2 = .25 for Step 1; adjusted R^2 = .48 for Step 2; * $p < .05$, ** $p < .01$

of .23 over the demographic variables. This difference was significant at the .01 level, indicating that psychological variables account for a significant amount of the variance in earthquake preparation after controlling for demographic variables. The variables that were significant predictors of earthquake preparation at Step 1 were home ownership and length of residence at current address. At Step 2, marital status, home ownership, time living at current address, Preparation Appraisal, and Risk was significant. Locus of control approached significance.

The previous analysis was repeated with the Preparation Appraisal variable omitted due to (a) it being conceptually similar to the dependent variable, and (b) its high correlation with the dependent variable. This analysis is presented in Table 5.9. At Step 1, home ownership and length of residence were significant predictors of earthquake preparation, $F(7, 344) = 17.624$, $p < .0001$, and accounted for 25% of the variance. After Step 2, marital status, home ownership, length of residence, preparation appraisal and Risk significantly added to the prediction of earthquake preparation, $F(11, 340) = 15.541$, $p < .0001$, and accounted for an additional 7% of the variance. All variables entered into the equation accounted for 32% of the variance in earthquake preparation.

To examine in more detail the contribution of individual components of locus of control and risk to the variance in earthquake preparation scores, a further regression analysis was performed in which demographic variables were entered at the first steps and risk and locus of control subscales were entered individually into the equation in the second step. Such an analysis involves a loss of explanatory power, as the shared variance is not attributed to individual variables. However, it does give extra information about individual contributions and interrelationships of the risk and locus of control variables that were measured.

Table 5.9

Summary of Sequential Regression Analysis for Demographic and Psychological Variables Predicting Earthquake Preparation (N = 352)

Variable	B	SE B	β
Step 1			
Gender	-0.01	0.47	.01
Age	0.31	0.39	.05
Marital status	0.32	0.25	.07
Dependent children	0.28	0.24	.06
Education level	0.24	0.35	.03
Home ownership	3.08	0.61	.30**
Length of residence	1.51	0.38	.22**
Step 2			
Gender	-0.64	0.47	-.07
Age	-0.06	0.40	-.01
Marital status	0.43	0.24	.10
Dependent children	0.11	0.24	.02
Education level	0.02	0.35	.01
Home ownership	2.75	0.59	.26**
Length of residence	1.35	0.36	.20**
Damage Likelihood	0.04	0.03	.06
Earthquake Probability	0.15	0.15	.05
Risk	0.07	0.01	.24**
SOC	0.03	0.01	.12**

Note: adjusted R^2 = .25 for Step 1; adjusted R^2 = .32 for Step 2; * $p < .05$, ** $p < .01$

This analysis is presented in Table 5.10. At Step 1, home ownership and length of residence were again significant predictors of earthquake preparation $F(7, 350) = 106.745$, $p < .0001$. At Step 2, gender, home ownership, length of residence, Sociopolitical Control and Risk Precaution were significant predictors, $F(13, 344) = 16.258$, $p < .0001$.

Table 5.10

Summary of Sequential Regression Analysis for Demographic, Locus of Control and Risk Variables Predicting Earthquake Preparation (N = 358)

Variable	B	SE B	β
Step 1			
Gender	-0.07	0.46	-.01
Age	0.33	0.38	.06
Marital status	0.42	0.25	.10
Dependent children	0.24	0.23	.05
Education level	0.15	0.35	.02
Home ownership	2.58	0.58	.25**
Length of residence	1.61	0.37	.24**
Step 2			
Gender	-0.92	0.45	-.10*
Age	-0.20	0.36	-.04
Marital status	0.39	0.24	.09*
Dependent children	0.12	0.21	.03
Education level	-0.24	0.34	-.03
Home ownership	2.48	0.54	.24**
Length of residence	1.41	0.34	.21**
Personal Control	0.05	0.03	.09
Interpersonal Control	-0.03	0.03	-.06
Sociopolitical Control	0.06	0.02	.13**
Risk Precaution	0.14	0.02	.32**
Major Risk	-0.01	0.03	-.02
Minor Risk	0.07	0.04	-.09

Note: adjusted $R^2 = .25$ for Step 1; adjusted $R^2 = .38$ for Step 2; * $p < .05$, ** $p < .01$

For the purposes of developing a more parsimonious set of predictors of earthquake preparation, one final regression analysis was performed, examining the effect of the variables that were consistently significant. An analysis of this type also allows a comparison between the amount of variance accounted for by all the predictors with the variance accounted for by the reduced number of predictors. Table 5.11 shows a summary of the results where Home Ownership and Length of Residence were entered at Step 1, and Sociopolitical Control and Risk Precaution were entered at Step 2. At the first step the demographic predictors were significant, $F(2, 355) = 54.128$, $p < .0001$ giving an R^2 of .23. With the addition of the psychological variables at the second step, the predictors remained significant, $F(4, 353) = 48.195$, $p < .0001$, with an R^2 of .35, an increase of .12. This increase was significant at the .01 level and indicated that these psychological variables accounted for a significant amount of the variance in earthquake preparation after accounting for demographic variables.

Table 5.11

Sequential Regression Analysis Predicting Preparation (N = 358)

Variable	B	SE B	β
Step 1			
Home ownership	3.26	0.51	.32**
Length of residence	1.76	0.34	.26**
Step 2			
Home ownership	2.86	0.47	.28**
Length of residence	1.65	0.31	.24**
Sociopolitical Control	0.14	0.02	.32**
Risk Precaution	0.01	0.02	.12**

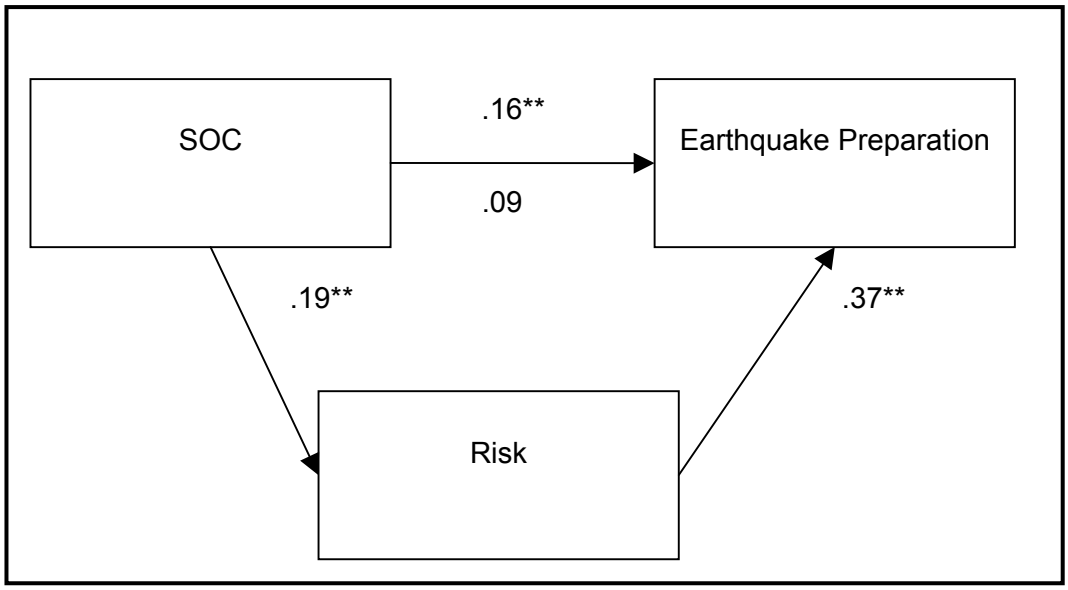
Note: adjusted R^2 = .23 for Step 1; adjusted R^2 = .35 for Step 2; * $p < .05$, ** $p < .01$

Mediators of Earthquake Preparation

In addition to the tests of direct effects, of interest also was the role of risk-reducing behaviours (i.e. reduced risk-taking and increased risk-preparation) as a mediator of the relationship between locus of control and preparation. To evaluate this prediction, multiple regression techniques were used to determine whether Risk was a possible mediator of the relation between SOC scores and WEPS scores following the procedure presented by Baron and Kenny (1986). SOC scores were regressed onto Risk, $F(1, 355) = 13.51$, $p < .0001$; and SOC and Risk scores were regressed onto earthquake preparation scores $F(2, 354) = 29.76$, $p < .0001$. The results indicated that Risk directly mediated the effects of locus of control on earthquake preparation, $\beta = 0.16$, $p < .01$ to $\beta = .09$, ns, Sobel's test = 3.17, $p < .001$. This is displayed in Figure 5.48

Figure 5.8

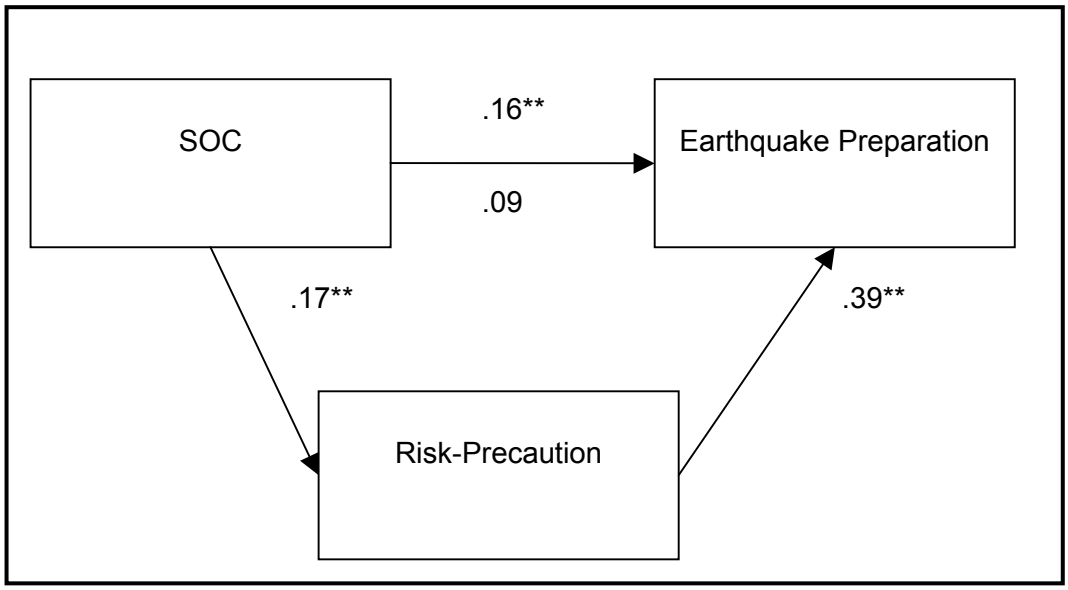
Standardized Regression Coefficients Estimating the Mediating Effect of Risk on the Relation between Spheres of Control Scores (SOC) and Earthquake Preparation Scores.



The same procedure was followed for Risk-precaution scores. SOC scores were regressed onto Risk-Precaution scores F(1, 355) = 11.67, p < .0001; and SOC and Risk-Precaution scores were regressed onto earthquake preparation scores F(2, 354) = 34.17, p < .0001. Consistent with the previous result, Risk-Precaution mediated the relationship between locus of control and earthquake preparation, β = 0.16, p < .01 to β = .09, ns, Sobel's test = 3.10, p < .001. This is displayed in Figure 5.9.

Figure 5.9

Standardized Regression Coefficients Estimating the Mediating Effect of Risk-Precaution on the Relation between Spheres of Control Scores (SOC) and Earthquake Preparation Scores.



Self-Other Bias in Earthquakes Judgements

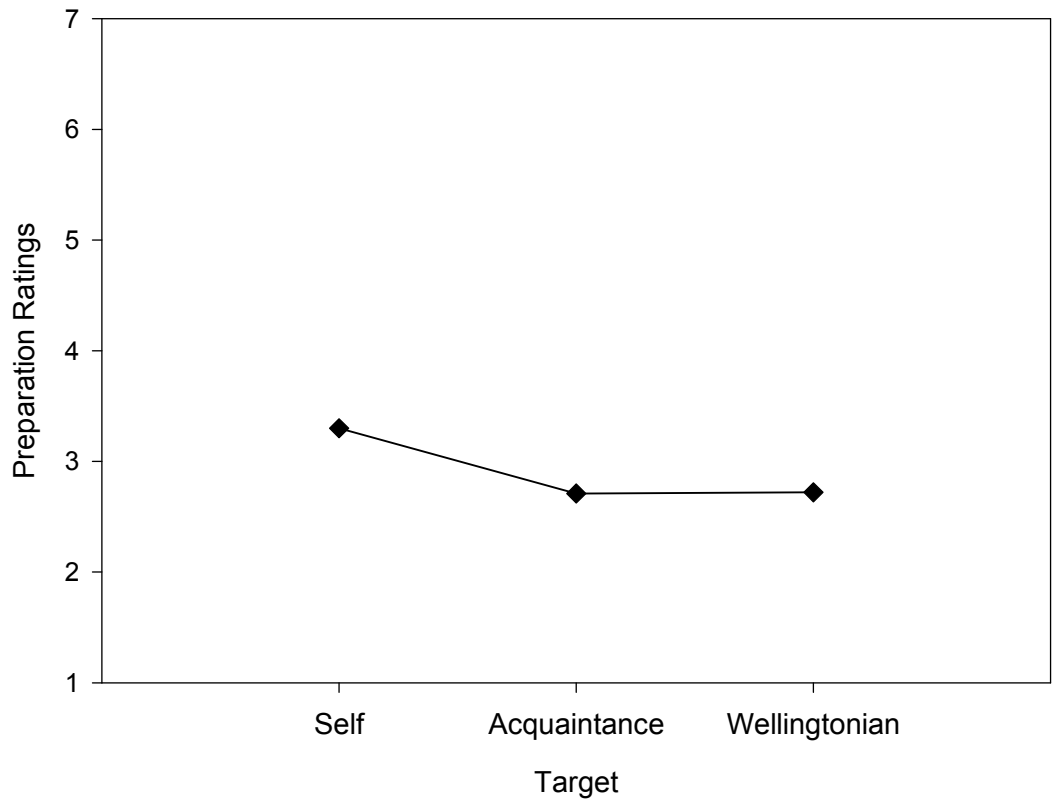
Information about people's judgements about earthquakes was also analysed. Of interest here is the difference between judgements of the self, a specific target (an acquaintance), and other Wellingtonians. Data was also collected regarding participants' judgements of the probability of a major earthquake.

The mean judgement of the likelihood of an earthquake occurring in the next 30 years is 5.03 (SD = 1.52) on a 7 point scale, with higher values representing a higher likelihood of the earthquake occurring.

The mean judgements for self, acquaintance, and other Wellingtonians are shown in Figure 5.10. A comparison was made between how prepared individuals think they are for a major earthquake and how prepared they think an acquaintance or other Wellingtonians are. The results show that people judged that the levels of preparedness was higher for the self (M = 3.29, SD = 1.50) than for an acquaintance (M = 2.71, SD = 1.28), or other Wellingtonians (M = 2.72, SD = 1.00). This difference was significant $F(2, 696) = 38.54$, $p<.01$. and is plotted in Figure 5.4.

Figure 5.10

Judgements of Preparation



Participants also made judgements about the likelihood of a major earthquake causing harm to them, to an acquaintance, and to other Wellingtonians, and also to make judgements about damage to their property. These means and standard deviations are presented in Table 5.12 where higher values indicate a higher likelihood. This information is also presented graphically in Figure 5.11.

A 3 (target: self, acquaintance, other Wellingtonian) X 2 (harm type: self, property) within subjects ANOVA was performed to examine differences between the comparison target and harm type. This analysis revealed no main effect for target, $F(2, 700) = 1.225$, ns, but a significant main effect for harm type, $F(1, 350) = 208.96$, $p<.01$, and a significant interaction between target and harm type, $F(2, 700) = 13.41$, $p<.01$. A further 2 (Target: self, acquaintance) X 2 (harm type: self, property) ANOVA was conducted to examine the self and acquaintance target in comparison to the harm type. This analysis yielded similar results, with no main effect for target, $F(1, 351) = 0.155$, ns, but a significant effect for harm type, $F(1, 351) = 197.37$, $p < .01$, and a significant interaction, $F(1, 351) = 27.12$, $p < .01$. A one-tailed paired sample t-test showed a significant difference between harm to the self and harm to an acquaintance, $t(353) = 2.35$, $p < .01$ and a significant difference between damage to their own property and damage to an acquaintance's property, $t(352) = 3.65$, $p < .01$.

Table 5.12

Self, Acquaintance and Other Wellingtonian Mean Likelihood Judgements in an Earthquake (SDs in brackets)

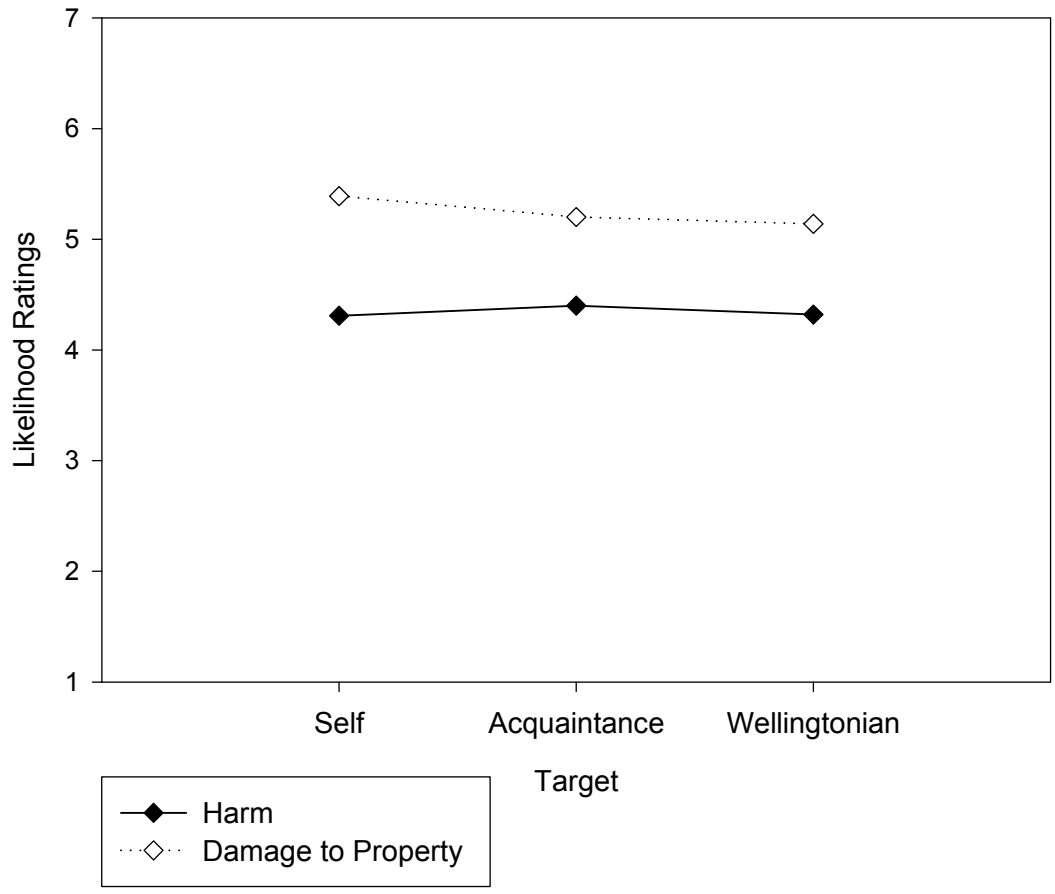
	Harm	Damage to Property
Self	4.29 (1.59)	5.38 (1.43)
Acquaintance	4.42 (1.57)	5.20 (1.50)
Wellingtonian	4.33 (1.64)	5.18 (1.41)

These results show first, that people believe a major earthquake is more likely to lead to property damage than to personal harm. Second, the results suggest that people believe that their acquaintances are more likely to suffer harm in a major earthquake than themselves, but that they are more likely to suffer property damage than their acquaintances.

Overall, these results present a clear picture. People believe that they are better prepared for a major earthquake than their acquaintances or other Wellingtonians, and that they are less likely to suffer harm in an earthquake.

Figure 5.11

Mean Likelihood Judgements of Harm Type by Target



Discussion

A number of studies have suggested that personality dimensions such as propensity to take risks and locus of control are related to preparation for natural disasters such as earthquakes (e.g., McClure et al., 1999; Russell, Goltz, & Bourque, 1995; Schiff, 1977; Simpson-Housley & Curtis, 1983; Turner et al., 1986). At least two researchers, however, have criticised this work on the grounds that key constructs are measured using either scales with single-items or a small number of items (Dooley, Catalano, Mishra, & Serxner, 1992; Lindell & Perry, 2000). Such scales often contain a large amount of measurement error, they may assess a complex construct too crudely, or they may not have established validity. The present study attempted to address this problem by using carefully developed psychometrically sound measures to assess risk, locus of control, and earthquake preparation. The details of the development of the risk scale and the earthquake preparation scale were presented in Chapters 2 and 4, respectively, while the modification of a locus of control scale was presented in Chapter 3. These scales all have good psychometric properties, as evidenced by replicable factor structures and high estimates of reliability. Where appropriate, tests of validity support the scale's use.

A number of other variables were considered which could be related to preparation. These included demographic items, such as age, gender, number of dependent children, and home ownership. A number of items were developed to measure self-other comparisons: judgements about the likelihood of harm to oneself or to other people, and the likelihood damage to ones own property, and to other people's property. Age, home ownership, and length of residence at current address were all significantly correlated with earthquake preparation. With regard to the psychological variables, risk precaution and locus of control were related to preparation. Risk precaution, an assessment of how often a person engages in risk reducing activities, had a particularly strong relationship with earthquake preparation, with more cautious people being more prepared. Finally, there was no relationship between people's

judgement of the likelihood of a major earthquake and their preparation. These findings will be discussed in the following order: level of earthquake preparation; demographic differences in earthquake preparation; psychological correlates of earthquake preparation; and self-other comparisons.

Level of Earthquake Preparation

Previous research suggests that many people are not well prepared for the consequences of natural disasters such as earthquakes (Ansell & Taber, 1996; Turner et al., 1986). In the present study, earthquake preparation was assessed using a 23 item scale, the development of which is described in Chapter 4. This scale, the Wellington Earthquake Preparedness Scale (WEPS), is a unidimensional measure that examines the amount of preparation that people have undertaken to prepare for a major earthquake. In the present investigation, participants reported having undertaken an average of 10.68 steps out of a possible 23 steps. This value is similar to the mean of 9.87 observed in an earlier sample of Wellington residents (Chapter 4). There was a high degree of consistency between the responses on this measure presented in Chapters 4 and this study. The steps undertaken by the majority of participants included having obtained a torch, tinned food, access to an alternative cooking source, a battery radio, essential medicines, and a first aid kit. Many people also reported that they had avoided storing objects which contain water on or near electrical equipment. These steps are relatively inexpensive, or easy for most people to perform. They are also steps which people undertake for reasons other than preparing for a major earthquake.

Around half of those surveyed reported that they had strengthened their house to increase its earthquake resistance, or that they were satisfied that it would not fall down. A similar percentage reported that they had strengthened their chimney, or ensured that it would not collapse in an earthquake. A smaller number of people said that they had considered the risk of a major earthquake when deciding to live where

they do now. These steps are more costly then the previous set of steps mentioned, but probably have more utility in terms of the prevention of the loss of life.

Less then a quarter of participants reported that they had fastened tall furniture to the wall, arranged a place to meet after an earthquake, or fastened cupboards with latches. Six percent of those surveyed had secured movable objects in their home. These items represent steps which are usually performed specifically for earthquake preparation.

Of interest also is the variability in the number of steps undertaken to prepare for an earthquake. In this study, the number of steps ranged from 0 to 22, with a mean of 10.68. Thus, some of the participants in this study had undertaken no steps at all to prepare for an earthquake while others had undertaken a large number of steps. There are two implications of this finding. The first is that it shows that the amount of preparation Wellington residents have undertaken to prepare for an earthquake can be approximately modelled by the normal distribution. That is, there are some people who are not at all prepared for an earthquake, some who are very well prepared, and a large group in the middle who have undertaken about half of the steps necessary to prepare for an earthquake.

The second implication of this finding is that it suggests that there is not a response bias in the sample (i.e., only prepared people completing the survey or people saying they are prepared on all items). Rather, people who completed the questionnaire included both people who reported that they had undertaken very few steps and some who had reported completing many steps.

Demographic Differences in Earthquake Preparation

Data were collected from participants concerning gender, age, marital status, number of dependent children, level of education, whether they owned their own home, and length of residence at their current address. Previous research had indicated that these variables are related to earthquake preparation, but it was unclear from previous studies how much these variables contributed to preparation. Figure 5.5 shows the relationship between age and preparation. In line with previous research (e.g., Dooley et al., 1992), age was positively related to preparation, with older people being more prepared. What has become apparent in this study is a trend for preparation to increase linearly with age until people reach 65, at which point preparation eases slightly but not significantly. Thus, people age 15 to 24 are relatively poorly prepared for an earthquake, people aged 25 to 44 show higher levels of preparation, and people 45 to 64 report having undertaken the greatest number of steps to prepare. People over the age of 65 show no difference in preparation from 45 to 64 year olds or 25 to 44 year olds, although they prepare more than 15 to 24 year olds.

Home ownership and length of residence were both significantly related to preparation. Referring back to Figure 5.6, homeowners had undertaken more steps to prepare for an earthquake than non-homeowners. One explanation for this finding is that many of the steps listed in the WEPS are best performed by the person who owns the property (e.g., ensuring that the chimney will not collapse), rather than by the person who rents the property. This finding will be discussed further in the policy implications section.

Figure 5.7 shows the relationship between length of residence and preparation, with preparation increasing positively with length of residence. It is possible that people who have lived at their current address for longer periods have undertaken many of the steps necessary to prepare for an earthquake for reasons other than for earthquake preparation. Dooley et al. (1992) noted that many steps for earthquake preparation can be performed for reasons other than the desire to prepare for an

earthquake. In New Zealand, many people often substantially renovate their property, or build additions to their home as they need more space. When this happens, structural changes may be made to the property which may increase the dwelling's earthquake resistance. These types of changes are unlikely to lead to a decrease in the property's resistance, as all major alterations are supposed to have the approval of the local city council. A second explanation for this finding is that the longer a person lives at a location, the more they are exposed to the vulnerability of the area (by word of mouth or from community newspapers, etc), or the vulnerability of their property. As a result, preparation increases.

Some of the demographic variables described above are intercorrelated with one another. Table 5.5 shows that people who are married are more likely to be older, own their own home, and have a greater length of residence. A multiple linear regression analysis was performed to examine the relative importance of each of these variables in relation to earthquake preparation. The results of this analysis indicate that two demographic variables are significant predictors of earthquake preparation – home ownership and length of residence. Gender, age, marital status, number of dependent children, and educational attainment made very little contribution to the explained variance. As mentioned previously, it was unclear from previous research how much these variables contributed to earthquake preparation. In this case, demographic variables, as a block, accounted for about 27% of the variance.

Of interest is the explanation as to why age is a significant univariate predictor of preparation, but not a significant multivariate predictor. It is likely that much of the variance explained by age can also be explained by length of residence and home ownership. Both these variables are highly associated with age: home owners tend to be older than non-home owners, and likewise length of residence is associated with age.[12]

[12] This hypothesis suggests that home ownership and length of residence mediate the relationship between age and preparation. Additional analysis supports this hypothesis: both

These results corroborate earlier research. Dooley et al. (1992) found that the most important predictor of earthquake preparation in a sample of California residents was the length of residence. It seems that people who are highly mobile – who move frequently from one residence to another – may be at greatest risk from a serious earthquake.

Psychological Correlates of Earthquake Preparation

The principal finding to emerge from this research concerns the role of psychological variables in people's preparation for a major earthquake. Previous research indicated that risk and locus of control were related to preparation for natural disasters. McClure et al. (1999) showed that both these variables were related to preparation, although risk was a stronger and more reliable predictor than locus of control. The present study confirmed these findings. Risk was positively related to preparation. A smaller, but positive relationship was also observed between the Spheres of Control scale and earthquake preparation.

An important aspect of the design of the field study was the use of multifactorial scales with high reliability, replicable factor structures, and good validity. The use of multidimensional scales has the advantage of being able to examine several components of the same construct. For example, the Spheres of Control has three subscales – Personal Control, Interpersonal Control, and Sociopolitical Control – which measure locus of control in different domains of a person's life (Paulhus, 1983). The use of multidimensional scales has allowed a more detailed analysis of the relationship between risk, locus of control, and preparation than has been possible in earlier research. These findings are discussed below.

Risk

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home ownership and length of residence have an indirect mediating relationship with age and preparation (β = .34 to β = .15, Sorbel's test = 5.62, $p < .001$ for home ownership; β = .34 to β = .21, Sorbels test = 4.56, $p < .001$ for length of residence).

In the present study, three components of risk were assessed. These were (1) the tendency to participant in non-fatal risks which occur in everyday circumstances (minor risk), (2) a propensity to engage in potentially life threatening risks (major risk), and (3) a propensity to engage in actions which reduce vulnerability to harm (risk precaution). The present study has clarified the relationship between risk and earthquake preparation. As stated previously, the total risk score (the sum of all three components) was positively related to earthquake preparation. An examination of the correlations between the subscales shows that major risk has a weak negative relationship with preparation. That is, there is some evidence of a trend for high risk takers not to prepare for earthquakes. A stronger negative relationship was observed between minor risk and preparation, suggesting that people who are prepared to take risks in an everyday setting are less likely to make preparations for a major earthquake. Risk-precaution and earthquake preparation had a strong positive correlation – people who take precautions are more likely to prepare for earthquakes.

McClure et al. (1999) suggested that risk-taking was an important factor predicting preparation for earthquakes. The results of the present study support this finding and indicate that risk-taking does comprise one component that predicts earthquake preparation. However, the results of this investigation also suggest that risk-precaution is a more important variable in determining people's level of earthquake preparation.

Locus of Control

Locus of control was assessed using a composite version of the Spheres of Control Scale (SOC: Paulhus & Christie, 1981; Paulhus & Van Selst, 1990). This combination of subscales was derived from research reported in Chapter 3. Briefly, the SOC is a three dimensional measure which assesses expectations of control in separate spheres of a person's life. The subscales are Personal Control, Interpersonal Control, and Sociopolitical Control.

Using unidimensional measures, previous research (e.g., Baumann & Sims, 1978; McClure et al., 1999) found that an internal locus of control was related to preparation for natural disasters. The results of the present study show that the total SOC score is significantly positively related to preparation. Analysis of the subscales shows that personal control and interpersonal control were not related to preparation; whereas sociopolitical control was significantly correlated. It seems that people who believe that they can, to a certain extent, control world events also believe that they can also control the damage resulting from a major earthquake. Put another way, if people believe that the average citizen can have an influence on government decisions, or that political corruption can be wiped out with enough effort, then they also believe that they can control the damage stemming from a major earthquake.

A second possible explanation for the relationship between sociopolitical control and earthquake preparation stems from the previous finding that sociopolitical control was related to political activism (Paulhus, 1983). Individuals with an internal sociopolitical control orientation were found to be more likely to endorse various indices of activism, namely, voting in mayoral elections, participating in student politics, and writing letters to politicians. This finding may be similar to Bateman and Crant's (1993) concept of the proactive personality, in which people who are relatively unconstrained by situational forces, who effect environmental change, scan for opportunities, show initiative, and take action are conceived of as having a proactive personality (Parker & Sprigg, 1999). Thus, people who are proactive towards life events in general, may also be proactive in their preparation for a major earthquake.

In addition to the interesting question of why sociopolitical control is related to preparation, another interesting questions concerns the issue of why personal and interpersonal control are not related to preparation. Most research suggests that general measures of locus of control are related to preparation for natural hazards, such that an internal orientation is related to increased preparation. For instance, using a sentence completion task, Baumann and Sims (1974) found such an effect for

preparation for hurricanes. More recently, McClure at al. (1999) found that responses to the Adult Nowicki-Strickland Internal-External Scale were related to preparation for earthquakes. The results presented in this study show that although the total Spheres of Control score was related to preparation, analysis of the subscales indicated that only sociopolitical control was significantly correlated with the dependent variable. This suggests that the personal control and interpersonal control subscales were not contributing to observed correlation between the full locus of control measure and preparation. It appears that broad beliefs regarding the ability to control political and social systems are more related to preparation for disasters than more specific beliefs regarding control over the self, or others. This finding differs from earlier studies and it is unclear why this is so. Nonetheless, it is an intriguing and interesting finding and warrants further research.

Judgements about Earthquakes

Participants in the present study were asked to make nine judgements about earthquakes. One question examined earthquake likelihood. Three questions examined preparation appraisal (how prepared, they, an acquaintance, or other Wellingtonians were for a major earthquake), and six questions related to damage likelihood (the chance that an earthquake would harm them, an acquaintance and other Wellingtonians, and the chance that an earthquake would damage their property, an acquaintance's property, and other Wellingtonians' property).

An analysis of the relationship between the individual items that comprise the preparation appraisal subscale and preparation for earthquakes shows a very high correlation between how prepared people think they are for a major earthquake, and their actual level of preparation. If future researchers cannot administer the full 23 item earthquake preparation scale, then the single item measure of how prepared a person thinks they are for a major earthquake could be used instead.

As the target becomes more distant from the participant, the correlation with their own level of preparation is reduced. A weaker relationship was observed between judgements of an acquaintance's level of preparation and their own reported preparation, while the smallest correlation was observed between judgements of other Wellingtonians' preparation and their own preparation.

Judgements of earthquake likelihood were not related to preparation for earthquakes. Also, there was no relationship between damage likelihood and preparation. This result is interesting as it suggests that thinking an earthquake is likely to happen, or that the earthquake is likely to cause damage, is not sufficient to motivate people to prepare for such a disaster. Such a finding is contrary to cost-benefit explanations which suggest that these variables should be related to earthquake preparation, as expectancies of earthquake occurrence and resultant damage should correlate with preparatory behaviour. It may be that there are other factors that are better predictors of preparation than judgements of earthquake or damage likelihood.

Predictors of Earthquake Preparation

Analysis of the intercorrelations between individual psychological variables and preparation is useful in determining which variables are related to preparation. However, this analysis does not take into account some of the covariates of the predictor variables. For example, age is closely related to risk taking (Irwin, 1993), as is the perception of invulnerability (Quadrel, Fischhoff, & Davis, 1993), a construct related to the self-other bias. Of interest is identifying the effect of risk, locus of control, and judgements about earthquakes on preparation, after the effects of age, gender, education, home ownership, and length of residence have been accounted for. In addition to this, one of the goals of this study was to pinpoint the amount of variance explained by demographic variables, and how much psychological variables contribute over and above this. Two key findings emerged from this analysis.

When the effect of demographic variables on earthquake preparation is controlled for, two demographic variables: length of residence and preparation appraisal, and two psychological variables: risk and SOC, remain significant predictors of preparation. Demographic variables account for 25% of the variance and psychological variables account for an additional 23%. Preparation Appraisal was the strongest predictor of these variables, suggesting that the best way to find out how prepared people are for an earthquake is to ask them directly. Judgements of harm and earthquake likelihood did not predict preparation. It seems that people's judgements about the likely consequences of a local earthquake are not linked to the steps they have taken to prepare for an earthquake.

A criticism of the analysis presented above is that the earthquake preparation and preparation appraisal questions have a large amount of overlap in their measurement. Both are self report measures assessing the same construct. As stated previously, the preparation appraisal variable could be used in place of the dependent variable, or, it could be used in addition to the earthquake preparation measure. When preparation appraisal is excluded from the analysis, home ownership, length of residence, risk precaution and sociopolitical control remain significant predictors of preparation. Demographic variables accounted for 27% of the variance, and psychological variables accounted for an additional 10%. As in previous analyses, home ownership and length of residence were important demographic predictors. Major Risk Taking and Minor Risk Taking were not significant predictors of preparation. Neither was Personal Control or Interpersonal Control.

These results have theoretical implications. The regression equations shows that both the measured demographic and psychological variables are important factors in predicting people's preparation for earthquakes. Considering only one of these types of variables does not give the full picture. Furthermore, the regression shows which demographic and psychological variables are important predictors, and which are not. Home ownership and length of residence of residence are significant

predictors of preparation, but age, gender, and education are not. Of the measured psychological variables, risk-precaution and sociopolitical control are important in predicting preparation, but major risk-taking and minor risk-taking are not significantly related.

The regression analyses suggest that people who are prepared for an earthquake: take a number of precautions, but may or may not take risks; believe that they can influence world events; own their own home; and have lived there for some time. People who are unprepared for an earthquake tend to live in rental accommodation, and are highly mobile. With regard to psychological factors, they believe that they have little control over world events, and take fewer precautions against a range of risks.

These results are consistent with the findings obtained by Dooley et al. (1992) and Sattler et al. (2000). In the former study, under-prepared individuals were depicted as living without a partner, only recently moved into their present residence, and having little concern for earthquakes. In the latter study, under-prepared people were younger, believe that they have little control over events, do not perceive danger, and do not know or understand the devastation that disasters can create.

Mediators of Earthquake Preparation

Of interest in the present study was the role of risk-reducing behaviours as a mediator of the relation between locus of control and earthquake preparation. Locus of control was not significantly related to preparation when the total Risk score (and also one component of this: Risk-Precaution) were included in the regression equation. Although based on cross-sectional data, these results suggest that an internal locus of control is related to increased risk-precaution behaviour and decreased risk-taking behaviour, which in turn is related to increased earthquake preparation. This finding offers a useful explanation for the relationship between locus of control and preparation: locus of control has an indirect relationship to preparation, and the relationship is mediated largely by propensity to engage in risk-precautionary activities.[13]

Self-Other bias

In addition to the predictors of earthquake preparation, a second goal of the present study was to examine systematically whether a self-other bias existed towards an earthquake that had not yet occurred. It was hypothesised that people would judge themselves to be more prepared for a major earthquake than either an acquaintance, or other Wellington residents. The results support this prediction. Participants' ratings of their own level of preparation were above the ratings they assigned to an acquaintance, or to other Wellingtonians. This finding is consistent with other research that has examined people's perceptions of their vulnerability to negative life events (e.g., Perloff & Fetzer, 1986).

[13] Although not reported here, a number of exploratory analyses were conducted to determine whether there were moderating effects that influenced preparation for earthquakes (i.e., whether there were any interactive effects such as whether locus of control and length of residence predicted preparation over the main effects of these variables). Overall no significant moderating effects were found in the data, with the exception of one analysis where a Risk X SOC interaction was observed. However, visual inspection of this effect did not show a clear interaction: all plotted values were essentially parallel to one another. It is likely that although the effect is significant, it explains only a small part of the variance.

Helweg-Larson (1999) found that personal experience moderated the effect of the self-other bias: people who had experienced the Northridge earthquake in California did not display evidence of a self-other bias 5 months after the quake. Although there are frequent small earthquakes in the Wellington region, there have been no significant earthquakes in the region for over 50 years. It is possible that people's optimism regarding their own safety is a result of lack of personal experience with major earthquakes. To test this prediction this would be a useful variable to consider in future research.

Sattler, Kaiser, and Hittner (2000) found that 80% of participants believed that an impending hurricane would strike and cause moderate to severe property damage to their homes, but almost 80% said that that they believed that the building they lived in was safe and could withstand a hurricane. Mileti and Fitzpatrick (1993) found that although most people expected a major earthquake to occur, only a third of participants thought it would harm them or their property. The field study attempted to expand on these findings. The hypothesis that participants would judge that they were less likely to suffer harm than an acquaintance or other Wellingtonian was partially supported. People judged their own chances of being injured in a major earthquake as less than the chances of an acquaintance. However, this finding did not extend to other Wellingtonians. There was no difference between judgements of harm to oneself and harm to other Wellingtonians.

One unexpected finding to emerge from this study was the lack of support for the hypothesis that participants would judge that their property was less likely to suffer damage in a major earthquake than the property of an acquaintance, or that of other Wellingtonians. Rather, participants judged that there was a greater likelihood of their property being damaged than the property of an acquaintance or of other Wellingtonians. In addition to this, the likelihood of damage was consistently judged to be greater than the likelihood of harm. It appears that people may regard other people's houses as safer than their own. Explanations for this finding are speculative

in nature. One possibility is that people regard other people's houses as safer than their own simply because they have a perception that their own property has poor earthquake resistance. This may stem from a lack of knowledge of what constitutes an 'earthquake safe' property. Hurnen (1997) assessed earthquake knowledge in a sample of Wellington residents, but did not report the mean scores for this set of items. Data of this type would be useful to determine the accuracy of this explanation.

A related explanation is that participants chose to compare themselves with a target acquaintance they believe has a property with good earthquake resistance. Perloff and Fetzer (1986) found that participants in a pilot study selected a different comparison target for each event. It may be that Wellington residents, guided by a belief regarding the inadequacy of their own property, chose an acquaintance they believed had a safer home than them. That is, they maintain a belief that their property is unsafe by selectively focusing on advantaged others. Further research is need to clarify this issue.

Policy Implications

The results of the present study have several implications for the implementation of policy to increase household earthquake preparation. These policy issues are examined here.

First, the results of the field study show that on average, Wellington residents have adopted slightly under half of the steps recommended to prepare for a major earthquake. The precautions adopted by many of the respondents include steps such as obtaining a torch or working battery radio. There are two policy issues that stem from this. The first is that almost all Wellington residents need to prepare more for an earthquake. In particular, people need to adopt the steps that will prevent injury or death from falling objects (e.g., ensuring that the roof will not collapse, fastening tall furniture to the wall). Second, in the event of a major earthquake, emergency managers will need to be aware that many people may be injured as a result of heavy

objects falling on them. Therefore, it is important that resources be directed towards rescuing people who are trapped under heavy objects, and towards treating this type of injury.

Second, it is clear from the results of this investigation that informing people that a major earthquake is going to happen in the region they live in is not an effective tool for increasing preparation – judgements about the likelihood of an earthquake were unrelated to preparation. Campaigns which use slogans such as 'don't think if – think when' to tell people that a major earthquake will occur, may be ineffective in increasing disaster preparation. Perhaps policy makers could focus more on advertising campaigns that decrease people's unrealistic beliefs regarding their own safely. These beliefs can often be diminished either through personal experience (Helweg-Larson, 1999), or from an awareness of similar disasters in other places (McClure & Williams, 1996). One possibility may be to present graphic images of a hypothetical earthquake in Wellington showing individuals with injuries sustained from heavy objects falling on them. This is similar to an advertising campaign currently used by the Land Transport Safety Authority to increase seatbelt compliance.

Third, current education campaigns to increase earthquake preparation appear to be directed at homeowners. One series of advertisements by The Earthquake Commission features two New Zealand celebrities – Havoc and Newsboy – entering people's homes to check that they have secured their hot water cylinder, or made other structural changes to their property. The results of the present study indicate that homeowners are better prepared for a major earthquake than non-homeowners. In addition to this, a shorter length of residence was associated with a lack of preparation. Increases in earthquake preparation could be better achieved by focusing on landlords, renters and people who have only lived at their current address for a short while. The former could be accomplished by placing the responsibility for key structural modifications on the owner/landlord of the property (e.g., securing a hot water cylinder, chimney, etc). This could be through regulatory means, or undertaken voluntarily.

Increasing the preparation of people who have lived at their current address for a short time could be realised by landlords providing information to their tenants about storing water, arranging access to an alternative cooking source, fastening tall furniture to the wall, or securing movable objects.

Fourth, in line with increasing the level of preparation of non-homeowners, it would be useful to identify clusters of rental properties on a geospatial database (a database from which maps are produced). If this information could be combined with a database of seismic risk for the Wellington region (e.g., areas of likely slope failure, liquefaction, ground shaking and fault movement), it would become a very valuable tool for focused disaster prevention and earthquake response. Information of this type would enable the efficient allocation of resources for increasing knowledge about earthquakes. It would aid in the identification of areas where more urban search and rescue volunteers are needed. Finally, it would enable better planning by those responsible for disaster response.

Limitations of the Present Study

Although the present study has provided some valuable insights into the factors that influence Wellington residents level of earthquake preparation, this research has several limitations. These concern the generalizability of the results to other areas in Wellington, the representativeness of the sample, and the unmeasured variables.

The Wellington region includes four territorial authorities (as defined by Statistics New Zealand). These are Wellington City, Lower Hutt, Upper Hutt, and Porirua City. The total population for these four areas combined is approximately 340,000 people. For this project, data was collected only from Wellington City residents. Although Wellington City has the largest population of the four Cities (190,000 people), it is also has the highest income bracket. For example the average household income in Wellington City is $28,981 versus $23,701 (Lower Hutt), $22,377 (Upper Hutt), and $23,120 (Poririua). The results of the present study may not be

generalizable to very low income households because that group was not highly represented in this investigation.

A second limitation of the present study concerns the representativeness of the sample. A comparison between the demographic characteristics of the sample and the total population of Wellington City shows that there were no substantial departures observed for educational qualifications, or martial status. However, women and people aged between 45 and 64 are slightly over-represented in the field study. The extent to which this limits the results is unknown; however, neither gender nor age had significant effects in predicting earthquake preparation in the sequential regression.

The final issue to be addressed relates to a variable that was not measured in the present study. Previous research has found that income does have an influence on earthquake preparation (e.g., Russell et al., 1995). Given that preparation is a type of insurance against a disaster, it is not surprising that those who can afford to prepare do so to a greater extent than those for whom it would pose an economic burden. Income was not measured in the present study because it was felt that this was an intrusive question to ask participants. Furthermore, there was a concern that such a question might discourage people from completing an already lengthy questionnaire. However, a wide range of income groups was covered by the sampling procedure, and it is likely that the potential respondents would have been reasonably representative in this regard.

It might also have been useful to have asked additional questions concerning the probability of a major earthquake. Recall that the question posed to participants was "How likely do you think it is that a major earthquake will occur in the Wellington region in the next 30 years?". In addition to getting this estimate, it would have been interesting to vary the time span in which participants were asked to make judgements. For instance, the likelihood of an earthquake in the next week, the next year, the next 100 years, etc. This could have provided a more fine grained analysis of the relationship between earthquake likelihood and preparation.

CHAPTER 6 – GENERAL DISCUSSION AND CONCLUSIONS

Chapter Overview

In this chapter a general discussion and conclusion of this thesis are presented. This is organised as follows. First, a summary of the psychometric work that comprised a major component of this thesis is given. This is followed by a review of the substantial field study conducted on a representative sample of Wellington residents. The chapter ends with a conclusion of the major findings from the thesis.

Psychometric Issues Examined in the Thesis

Chapter 1 identified two limitations of many studies of natural disasters. The first is a reliance on the use of measures where the reliability and validity of the instruments has not been clearly established (e.g., De Man & Simpson-Housley, 1987; Dolinski, Gromski, & Zawisza, 1987; Rustemli & Karanci, 1999) or where the instruments used have poor estimates of reliability (e.g., Faupel & Styles, 1993; Lehman & Taylor, 1987). A second theme to emerge from this research is the reliance on a single item measure to examine a multifaceted construct. For instance, Rustemli and Karanci (1999), in their conceptualisation of perceived control, did not address the possibility that this variable may be multidimensional in nature, as has been proposed by Levenson (1974, 1981) and Paulhus (1983). One of the major goals of this thesis was to use instruments which have good psychometric properties, such as high reliability and replicable factor structures.

In Chapter 2, a measure that assessed three components of risk was developed and tested using the responses of a substantial sample of participants. Three factors were identified and labelled minor risk, major risk, and risk precaution. Minor risk and major risk referred to risk taking actions: actions that increased the probability and severity of adverse effects; risk precaution actions referred to actions that people take to reduce their vulnerability to harm. The three-factor structure was

clearly replicated in the field study (Chapter 5), using the methods of confirmatory factor analysis. High reliability estimates were obtained for the subscales and for the total scale.

Chapter 3 documented an attempt to identify a measure of locus of control that has a replicable factor structure and high reliability. Through a series of studies, a combination of subscales from two versions of the Spheres of Control scale (Paulhus & Christie, 1981; Paulhus & Van Selst, 1990) was identified that conformed to the theoretically expected structure of the scale. The results of Study 2 and Study 4 (in Chapter 3) show that this combination of items could produce a factor structure that could be independently replicated across independent groups of participants. This three-factor structure was again replicated using the responses of a sample of Wellington residents (Chapter 5). In addition, the reliability estimates suggested good internal consistency for the subscales and for the total scale.

Chapter 4 was devoted to the development of the Wellington Earthquake Preparedness Scale (WEPS). This is a unifactorial questionnaire intended to measure preparation for a major earthquake. In both Chapter 4 and Chapter 5, the unidimensional nature of the scale was supported by confirmatory factor analysis, with a one factor model achieving an excellent fit to the data. This scale had high estimates of reliability.

In sum, the three questionnaires, to which a considerable portion of this thesis was directed at developing and testing, were all shown to have replicable factor structures and high reliability estimates using the responses of independent groups of participants. Hence, the problems identified in Chapter 1, relating to the psychometric properties of the various instruments previously used to assess key constructs, have been largely reduced in this thesis

Predictors of Earthquake Preparation

In addition to developing psychometrically sound measures of key constructs, this thesis also sought to examine the interrelationships between these measures, and other theoretically relevant variables, such as demographic characteristics and self-other comparisons. Using a sample of systematically surveyed residents of Wellington City, responses were obtained from 358 people. Data was gathered from the responses to the measures described above, but also residents judgements about earthquakes, and their judgements regarding their vulnerability to harm stemming from a major earthquake. Data was also gathered on a set of demographic variables such as gender, age, home ownership, and length of residence.

Overall, moderate levels of earthquake preparation were reported but people's response to risk was one of the key predictors of their level of preparation. Specifically, people who took more precautions were more prepared than those who were unwary of risk. Locus of control also had an influence on preparation, with people with an internal locus of control being more prepared than their external counterparts. People's judgements about earthquakes were found to be unrelated to preparation. For example, estimates of earthquake probability were not correlated with levels of earthquake preparation. In addition to these findings, Wellington residents showed evidence of a self-other bias about earthquakes. They believed that they were more prepared for a major earthquake than other people, and less likely to suffer injury. Paradoxically, and counter to predictions, they also judged that other people's homes were safer than their own.

Two demographic factors were also found to be useful in the prediction of earthquake preparation – home ownership and length of residence. People who own their own home, and have lived there for some time, were more likely to be prepared for an earthquake than people who rent their accommodation and/or have only been there a short while.

Several policy issues were discussed and recommendations made. The thrust of these recommendations was towards: (a) reducing people's vulnerability from falling objects such as the roof or chimney of a house; (b) altering advertising campaigns which focus on telling people that a major earthquake will occur, as judgements about the likelihood of a local earthquake are unrelated to preparation; (c) the development of a database that identified areas of high risk based on the level of home-ownership in the area, average age of residence, and other relevant variables. This database could also be used to direct resources more efficiently, once a major earthquake has occurred.

Conclusion

The present thesis attempted to examine the relationships between two theoretically relevant dimensions of personality (risk propensity and locus of control) and earthquake preparation in a substantial sample of Wellington residents using psychometrically sound measures. This thesis also attempted to investigate whether Wellington residents hold unrealistically optimistic beliefs about their chances of being injured or their property being damaged in the event of a major earthquake. Demographic factors were also measured as covariates in multivariate analysis.

Using carefully developed instruments to assess the constructs of risk propensity, locus of control, and earthquake preparation, this thesis found that aspects of both risk and locus of control were related to preparation; people who scored highly on a measure of risk precaution were more likely to prepare for a major earthquake, as were people with high scores on a measure of sociopolitical control. Length of residence and home-ownership were also important predictors of preparation. Judgements regarding the likelihood of a major earthquake were unrelated to preparation. Finally, participants indicated that they were less likely to suffer harm in a major earthquake than an acquaintance or other Wellingtonians, providing evidence of a self-other bias.

REFERENCES

Abrahamson, D., Schludermann, S., & Schludermann, E. (1973). Replication of dimensions of locus of control. Journal of Consulting & Clinical Psychology, 41, 320.

Alicke, M., Klotz, M. L., Breitenbecher, D. L., Yurak, T. J., & Vredenburg, D. S. (1995). Personal contact, individuation, and the better-than-average-effect. Journal of Personality & Social Psychology, 68, 804-825.

Allen, M. W. (1997) The direct and indirect influences of human values on consumer choices. Unpublished Ph. D Thesis, Victoria University of Wellington.

Anderson, R. E., & Carter, I. (1978). Human behavior in the social environment: A social systems approach. (2nd ed). Chicago, Il: Aldine.

Ansell, R., & Taber, J. (1996). Caught in the crunch: Earthquakes and volcanoes in New Zealand. Auckland, NZ: HarperCollins.

Anstiss, B. (1998). The efficacy of sensation seeking as a predictor of multiple risk behaviours among a sample of New Zealand mountain bikers. Unpublished MA thesis, Victoria University of Wellington, Wellington.

Arbuckle, J. L., & Wothke, W. (1999). Amos 4.0 users guide. Chicago, IL: SmallWaters Corporation.

Arnett, J. (1994). Sensation seeking: A new conceptualization and a new scale. Personality & Individual Differences, 16, 289-296.

Bateman, T. S., & Crant, J. M. (1993). The proactive component of organizational behavior: A measure and correlates. Journal of Organizational Behavior, 14, 103-118.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51, 1173-1182.

Baumann, D. D., & Sims, J. H. (1974). Human response to the hurricane. In G. F. White (Ed.) Natural hazards: Local, national, global. New York: Oxford University Press.

Baumann, D. D., & Sims, J. H. (1978). Flood insurance: Some determinants of adoption. Economic Geography, 54, 189-196.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. Journal of Consulting & Clinical Psychology, 56, 893-897.

Bermudez, J. (1999). Personality and health protective behaviour. European Journal of Personality, 13, 83-103.

Brenstrum, E. (1990). Weather forecasting: an example of natural hazard mitigation. Paper presented at the Natural Hazards 90: Natural Hazard Assessment in New Zealand, Wellington, NZ.

Brenstrum, E. (1998). The New Zealand weather book (2nd ed.). Nelson: Craig Potton Publishing.

Brody, C. J. (1984). Differences by sex in support for nuclear power. Social Forces, 63, 209-228.

Brown, R. A. (1999). Assessing attitudes and behaviors of high-risk adolescents: An evaluation of the self-report method. Adolescence, 34, 25-32.

Brun, W. (1992). Cognitive components in risk perception: Natural versus manmade risks. Journal of Behavioral Decision Making, 5, 117-132.

Burger, J. M. (1993). Personality. California: Brooks/Cole Publishing Company.

Burger, J. M., & Palmer, M. L. (1992). Changes in and generalization of unrealistic optimism following experiences with stressful events: Reactions to the 1989 California Earthquake. Personality and Social Psychological Bulletin, 18, 39-43.

Campbell, D. T. (1960). Recommendations for APA test standards regarding construct, trait, or discriminant validity. American Psychologist, 15, 546-553.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56, 81-105.

Campis, L. K., Lyman, R. D., & Prentice-Dunn, S. (1986). The Parental Locus of Control Scale: Development and validation. Journal of Clinical Child Psychology, 15, 260-267.

Carver, C. S. (1997). The Internal-External Scale confounds internal locus of control with expectancies positive outcomes. Personality & Social Psychology Bulletin, 23, 580-585.

Cattell, R. B., Balcar, K. R., Horn, J. L., & Nesselroade, J. R. (1969). Factor matching procedures: An improvement of the S index; with tables. Educational & Psychological Measurement, 29, 781-792.

Charlton, P. F. C., & Thompson, J. A. (1996). Ways of coping with psychological distress after trauma. British Journal of Clinical Psychology, 35, 517-530.

Chawarski, M. C., Pakes, J., & Schottenfeld, R. S. (1998). Assessment of HIV risk. Journal of Addictive Diseases, 17, 49-59.

Cherlin, A., & Bourque, L. B. (1974). Dimensionality and reliability of the Rotter I-E Scale. Sociometry, 37, 565-582.

Christie, R., & Geis, F. L. (1970). Studies in machiavellianism. New York: Academic Press.

Cone, J. D. (1971). Locus of control and social desirability. Journal of Consulting & Clinical Psychology, 36, 449.

Coombs, C. H., Dawes, R. M., & Tversky, A. (1970). Mathematical psychology. Englewood Cliffs, NJ: Prentice-Hall.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. Journal of Applied Psychology, 78, 98-104.

Cox, G. J., & Hayward, B. W. (1999). The restless country: Volcanoes and earthquakes of New Zealand. Auckland, NZ: Harper Collins.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

Cronbach, L. J. (1990). Essentials of psychological testing (5th ed.). New York: HarperCollins.

Crowne, D. P., & Marlowe, D. (1960). The approval motive. New York: Wiley.

Davies, M. F., & Kirkby, H. E. (1985). Multidimensionality of the relationship between perceived control and belief in the paranormal: Spheres of control and types of paranormal phenomena. Personality & Individual Differences, 6, 661-663.

De Man, A., & Simpson-Housley, P. (1987). Factors in the Perception of Earthquake Hazard. Perceptual and Motor Skills, 64, 815-820.

Dixon, D. N., McKee, C. S., & McRae, B. C. (1976). Dimensionality of three adult, objective locus of control scales. Journal of Personality Assessment, 40, 310-329.

Dolinski, D., Gromski, W., & Zawisza, E. (1987). Unrealistic pessimism. The Journal of Social Psychology, 127, 511-516.

Donovan, P. C., & O'Leary, M. R. (1983). Control orientation, drinking behavior, and alcoholism. In H. M. Lefcourt (Ed.), Research with the locus of control construct (Vol. 2). New York: Academic Press.

Dooley, D., Catalano, R., Mishra, S., & Serxner, S. (1992). Earthquake preparedness: Predictors in a community survey. Journal of Applied Social Psychology, 22, 451-470.

Downes, G., & Grapes, R. (1999). The 1855 Wairarapa, New Zealand, earthquake: Historical data. Wellington, NZ: Institute of Geological & Nuclear Sciences.

Duttweiler, P. C. (1984). The Internal Control Index: A newly developed measure of locus of control. Educational & Psychological Measurement, 44, 209-221.

Edwards, M. E. (1993). Social location and self-protective behavior: Implications for earthquake preparedness. International Journal of Mass Emergencies and Disasters, 11, 293-303.

Farley, J. E., Barlow, H. D., Finklestein, M. S., & Riley, L. (1993). Earthquake hysteria, before and after: A survey and follow-up on public response to the Browning forecast. International Journal of Mass Emergencies and Disasters, 11, 305-322.

Faupel, C. E., & Styles, S. P. (1993). Disaster education, household preparedness, and stress responses following Hurricane Hugo. Environment & Behavior, 25, 228-249.

Finch, A. J., Kendall, P. C., Spirito, A., & Mikulka, P. J. (1981). Multidimensionality of the Nowicki-Strickland Locus of Control Scale for Adults. Journal of Personality Assessment, 45, 151-154.

Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The affect heuristic in judgements of risks and benefits. Journal of Behavioral Decision Making, 13, 1-17.

Fischhoff, B., Slovic, P., & Lichtenstein, S. (1977). Knowing with certainty: The appropriateness of extreme confidence. Journal of Experimental Psychology: Human Perception & Performance, 3, 552-564.

Fischhoff, B., Slovic, P., & Lichtenstein, S. (1978). Fault trees: Sensitivity of estimated failure probabilities to problem representation. Journal of Experimental Psychology: Human Perception & Performance, 4, 330-344.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is enough? A psychometric study of attitudes towards technological risks and benefits. Policy Studies, 9, 127-152.

Fleming, J. S., & Spooner, P. S. (1985). Five factor scales for internal external control and their relations to measures of adjustment. Journal of Clinical Psychology, 41, 512-517.

Flynn, J., Slovic, P., & Mertz, C. K. (1994). Gender, race, and perception of environmental health risks. Risk Analysis, 14, 1101-1108.

Folkman, S., & Lazarus, R. (1988). Coping as a mediator of emotion. Journal of Personality and Social Psychology, 54, 466-444.

Forsyth, A. D., Carey, M. P., & Fuqua, R. W. (1997). Evaluation of the validity of the Condom Use Self-Efficacy Scale (CUSES) in young men using two behavioral simulations. Health Psychology, 16, 175-178.

Franklin, R. D. (1963). Youth's expectancies about internal versus external control of reinforcement related to N variables. Dissertation Abstracts, 24.

Furby, L., & Beyth-Marom, R. (1992). Risk taking in adolescence: A decision-making perspective. Developmental Review, 12, 1-44.

Furnham, A. (1987). A content and correlational analysis of seven locus of control scales. Current Psychological Research and Reviews, 6, 244-255.

Garza, R. T., & Widlak, F. W. (1977). The validity of locus of control dimensions for Chicano populations. Journal of Personality Assessment, 41, 635-643.

Gerbing, D. W., Ahadi, S. A., & Patton, J. H. (1987). Toward a conceptualization of impulsivity: Components across the behavioral and self-report domains. Multivariate Behavioral Research, 22, 357-379.

Goodman, S. H., & Waters, L. K. (1987). Convergent validity of five locus of control scales. Educational & Psychological Measurement, 47, 743-747.

Green, S. B., Lissitz, R. W., & Mulaik, S. A. (1977). Limitations of coefficient alpha as an index of test unidimensionality. Educational & Psychological Measurement, 37, 17-21.

Greening, L., Dollinger, S. J., & Pitz, G. (1996). Adolescents' perceived risk and personal experience with natural disasters: An evaluation of cognitive heuristics. Acta Psychologica, 91, 27-38.

Guilford, J. P. (1954). Psychometric Methods. New York: McGraw-Hill.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1995). Multivariate data analysis with readings (4th ed.). New York: MacMillan.

Harman, H. H. (1967). Modern factor analysis. Chicago: Univ. of Chicago Press.

Hattie, J. (1985). Methodology review: Assessing unidimensionality of tests and items. Applied Psychological Measurement, 9, 139-164.

Helweg-Larson, M. (1999). (The lack of) optimistic bias in response to the Northridge earthquake: The role of personal experience. Basic and Applied Social Psychology, 21, 119-129.

Helweg-Larson, M., & Shepperd, J. A. (2001). Do moderators of the optimistic bias affect personal or target risk estimates? A review of the literature. Personality and Social Psychology Review, 5, 74-95.

Henry, R. M. (1996). Psychodynamic group therapy with adolescents: Exploration of HIV-related risk taking. International Journal of Group Psychotherapy, 46, 229-253.

Heyman, S. R., & Rose, K. G. (1979). Psychological variables affecting SCUBA performance. In C. H. Nadeau & W. R. Halliwell & K. M. Newell & G. C. Roberts (Eds.), Psychology of motor behavior and sport -- 1979. Champaign, IL: Human Kenetics Press.

Hill, T., Smith, N. D., & Mann, M. F. (1987). Role of efficacy expectations in predicting the decision to use advanced technologies: The case of computers. Journal of Applied Psychology, 72, 307-313.

Hirose, H. (1986). The psychological impact of the Tokai earthquake prediction: Individual's responses and the mass media coverage. Japanese Psychological Research, 26, 64-76.

Hirose, H., & Ishizuka, T. (1983). Causal analysis of earthquake concern and preparing behavior in the North Izu Peninsula. Japanese Psychological Research, 25, 103-111.

Horswill, M. S., & McKenna, F. P. (1999). The effect of perceived control on risk taking. Journal of Applied Social Psychology, 29, 189-199.

Horvath, P., & Zuckerman, M. (1993). Sensation seeking, risk appraisal, and risky behavior. Personality & Individual Differences, 14, 41-52.

Hurnen, F. R. (1997). Perceived damage preventability, knowledge, and preparation for earthquakes. Unpublished MA thesis, Victoria University of Wellington, Wellington.

Hurnen, F. R., & McClure, J. (1997). The effect of increased earthquake knowledge on perceived preventability of earthquake damage. The Australasian Journal of Disaster and Trauma Studies, 1, Massey University, New Zealand, www.massey.ac.nz/-trauma.

Hyman, G. J., Stanley, R., & Burrows, G. D. (1991). The relationship between three multidimensional locus of control scales. Educational & Psychological Measurement, 51, 403-412.

Irwin, C. E. (1993). Adolescence and risk taking: How are they related? In N. J. Bell & R. W. Bell (Eds.), Adolescent risk taking. Newbury Park, CA: Sage Publications, Inc.

Jackson, D. (1974). Personality research form manual. Goshen NY: Research Psychologist Press.

Jackson, E. L. (1981). Response to earthquake hazard: The West Coast of North America. Environment & Behavior, 14, 387-416.

Jackson, E. L., & Mukerjee, T. (1974). Human adjustment to the earthquake hazard in San Francisco, California. In G. F. White (Ed.), Natural hazards: Local, national and global (pp. 160-166). New York: Oxford University Press.

Jacobs, K. W. (1993). Psychometric properties of the Internal Control Index. Psychological Reports, 73, 251-255.

Jensen, J., Spittal, M., Crichton, S., Sathyandra, S. & Krishnan, V. (2002). The direct measurement of living standards: The New Zealand ELSI scale. Wellington; Ministry of Social Development.

Jessor, R., & Jessor, S. L. (1977). Problem behavior and psychosocial development: A longitudinal study of youth. New York: Academic Press.

Jobe, J. B., Holgate, S. H., & Sorapansky, T. A. (1983). Risk taking as a motivation for volunteering for a hazardous experiment. Journal of Personality, 51, 95-107.

Johnson, E. J., & Tversky, A. (1984). Representations of the perceptions of risks. Journal of Experimental Psychology: General, 113, 55-70.

Julian, J. W., & Katz, S. B. (1968). Internal versus external control and the value of reinforcement. Journal of Personality & Social Psychology, 8, 89-94.

Kabanoff, B., & O'Brien, G. E. (1980). Work and leisure: A task attributes analysis. Journal of Applied Psychology, 65, 596-609.

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. Psychological Review, 80, 237-251.

Kahneman, D., Slovic, P., & Tversky, A. (1982). Judgement under uncertainty: Heuristics and biases. New York: Cambridge University Press.

Kaiser, H. F. (1958). The varimax criterion for analytic rotation in factor analysis. Psychometrika, 23, 187-200.

Kalichman, S. C., & Rompa, D. (1995). Sexual sensation seeking and sexual compulsivity scales: Reliability, validity, and predicting HIV risk behavior. Journal of Personality Assessment, 65, 586-601.

Kassinove, J. L. (1998). Development of the gambling attitude scales: Preliminary findings. Journal of Clinical Psychology, 54, 761-771.

Kearney, M. J., & Kearney, J. F. (1983). Investigation of sex differences and consistency of factor pattern on the Adult Nowicki-Strickland Internal-External Control Scale. Journal of Clinical Psychology, 39, 416-421.

Keinan, G., Meir, E., & Gome-Nemirovsky, T. (1984). Measurement of risk takers' personality. Psychological Reports, 55, 163-167.

Kestenbaum, J. M. (1976). Social desirability scale values of locus of control scale items. Journal of Personality Assessment, 40, 306-309.

Kidd, P., & Huddleston, S. (1994). Psychometric properties of the Driving Practices Questionnaire: Assessment of risky driving. Research in Nursing & Health, 17, 51-58.

Kiecolt, K. J., & Nigg, J. M. (1982). Mobility and perceptions of a hazardous environment. Environment & Behavior, 14, 131-154.

Kishton, J. M., & Wildaman, K. F. (1994). Unidimensional versus domain representative parceling of questionnaire items: An empirical example. Educational & Psychological Measurement, 54, 757-765.

Klar, Y., & Giladi, E. E. (1997). No one in my group can be below the groups average: A robust posivity bias in favor of anonymous peers. Journal of Personality & Social Psychology, 73, 885-901.

Klein, W. B. (1996). Maintaining self-serving social comparisons: Attenuating the perceived significance of risk-increasing behaviours. Journal of Social and Clinical Psychology, 15, 120-142.

Kline, P. (1993). The handbook of psychological testing. London: Routledge.

Kline, P. (1998). The new psychometrics: Science, psychology and measurement. London: Routledge.

Kohn, P. M., & Coulas, J. T. (1985). Sensation seeking, augmenting, reducing, and the perceived and preferred effects of drugs. Journal of Personality & Social Psychology, 48, 99-106.

Kreps, G. A. (1984). Sociological inquiry and disaster research. Annual Review of Sociology, 10, 309-330.

Kunreuther, H. (1974). Disaster Insurance: A tool for hazard mitigation. The Journal of Risk and Insurance, XLI, 287-303.

Lambert, A. J., Burroughs, T., & Nguyen, T. (1999). Perceptions of risk and the buffering hypothesis: The role of just world beliefs and right-wing authoritarianism. Personality & Social Psychology Bulletin, 25, 643-656.

Lambert, A. J., Burroughs, T., & Nguyen, T. (1999). Perceptions of risk and the buffering hypothesis: The role of just world beliefs and right-wing authoritarianism. Personality & Social Psychology Bulletin, 25, 643-656.

Lange, R. V., & Tiggemann, M. (1981). Dimensionality and reliability of the Rotter I-E Locus of Control Scale. Journal of Personality Assessment, 45, 398-406.

Layton, C. (1985). Note on the stability of Rotter's I-E Scale. Psychological Reports, 57, 1165-1166.

Lefcourt, H. M. (1991). Locus of control. In J. P. Robinson & P. R. Shaver & L. Wrightsman (Eds.), Measures of personality and social psychological attitudes. California: Academic Press.

Lefcourt, H. M., von Baeyer, C. L., Ware, E. E., & Cox, D. J. (1979). The multidimensional-multiattributional causality scale: The development of a goal specific locus of control scale. Canadian Journal of Behavioural Science, 11, 286-304.

Lehman, D. R., & Taylor, S. E. (1987). Date with an earthquake: Coping with a probable, unpredictable disaster. Personality & Social Psychology Bulletin, 13, 546-555.

Levenson, H. (1974). Activism and powerful others: Distinctions within the concept of internal-external control. Journal of Personality Assessment, 38 377-383.

Levenson, H. (1981). Differentiating among internality, powerful others, and chance. In H. M. Lefcourt (Ed.), Research with the locus of control construct (Vol. 1). New York: Academic Press.

Levin, B. H., & Schalmo, G. B. (1974). Self-rated liberalism is correlated with sensation seeking. Psychological Reports, 34, 298.

Lichtenstein, S., Slovic, P., Fischhoff, B., Layman, M., & Combs, B. (1978). Judged frequency of lethal events. Journal of Experimental Psychology: Human Learning & Memory, 4, 551-578.

Lindbloom, G., & Faw, T. T. (1982). Three measures of locus of control: What do they measure? Journal of Personality Assessment, 46, 70-71.

Lindell, M. K., & Perry, R. W. (2000). Household adjustment to earthquake hazard: A review of research. Environment & Behavior, 32, 461-501.

Little, C. B. (1977). Dimensionality of the Internal-External Control Scale: Some further evidence. Journal of Genetic Psychology, 131, 329-330.

Lopes, L. L. (1987). Between hope and fear: The psychology of risk. Advances in Experimental Social Psychology, 20, 255-295.

MacCrimmon, K. R., & Wehrung, D. A. (1985). A portfolio of risk measures. Theory & Decision, 19(1), 1-29.

Maltby, J., & Cope, C. D. (1996). Reliability estimates of the internal control index among UK samples. Psychological Reports, 79, 595-598.

Manuele, F. A. (1994). Learn to distinguish between hazards and risks. Safety and Health, 70-74.

McClure, J., & Williams, S. (1996). Community preparedness: Countering helplessness and optimism. In D. Paton & N. Long (Eds.), Psychological aspects of disaster. Palmerston North, NZ: Dunmore Press.

McClure, J., Walkey, F., & Allen, M. (1999). When earthquake damage is seen as preventable: Attributions, locus of control and attitudes to risk. Applied Psychology: an International Review, 48, 239-256.

McGeary, J. (August 30, 1999). Buried alive. Time, 16-21.

McInish, T. H., & Srivastava, R. K. (1982). Multidimensionality of locus of control for common stock investors. Psychological Reports, 51, 361-362.

Meyers, L. S., & Wong, D. T. (1988). Validation of a new test of locus of control: The Internal Control Index. Educational & Psychological Measurement, 48, 753-761.

Middleton, W., Harris, P., & Surman, M. (1996). Give 'em enough rope: Perception of health and safety risks in bungee jumpers. Journal of Social & Clinical Psychology, 15, 68-79.

Mileti, D., & Darlington, J. D. (1995). Societal response to revised earthquake probabilities in the San Francisco Bay area. International Journal of Mass Emergencies and Disasters, 13, 119-145.

Mileti, D., & Darlington, J. D. (1997). The role of searching in shaping reactions to earthquake risk information. Social Problems, 44, 89-103.

Mileti, D., & Fitzpatrick, C. (1992). The causal sequence of risk communication in the Parkfield earthquake prediction experiment. Risk Analysis, 12, 393-400.

Mileti, D., & Fitzpatrick, C. (1993). The great earthquake experiment: Risk communication and public action. Boulder, CO: Westview.

Mileti, D., & O'Brien, P. W. (1992). Warnings during disasters: Normalizing communicating risk. Social Problems, 38, 40-57.

Mileti, D., & Sorenson, J. H. (1987). Natural hazards and precautionary behavior. In N. Weinstein (Ed.), Taking care: Understanding and encouraging self-protective behavior. New York, NY: Cambridge University Press.

Miller, M. B. (1995). Coefficient alpha: A basic introduction from the perspectives of classical test theory and structural equation modelling. Structural Equation Modelling, 2, 255-273.

Mirels, H. L. (1970). Dimensions of internal versus external control. Journal of Consulting & Clinical Psychology, 34, 226-228.

Mulilis, J. P., & Lippa, R. (1990). Behavioral change in earthquake preparedness due to negative threat appeals: A test of protection motivation theory. Journal of Applied Social Psychology, 20, 619-638.

Mulilis, J. P., Duval, T. S., & Bovalino, K. (2000). Tornado preparedness of students, non-student renters, and non-student owners: Issues or PrE theory. Journal of Applied Social Psychology, 30, 1310-1329.

Mulilis, J. P., Duval, T. S., & Lippa, R. (1990). The effects of a large destructive local earthquake on earthquake preparedness as assessed by the Earthquake Preparedness Scale. Natural Hazards, 3, 357-371.

Murgatroyd, S., Rushton, C., Apter, M., & Ray, C. (1978). The development of the Telic Dominance Scale. Journal of Personality Assessment, 42, 519-528.

Norris, F. H. (1992). Epidemiology of trauma: Frequency and impact of different potentially traumatic events on different demographic groups. Journal of Consulting & Clinical Psychology, 60, 409-418.

Nowicki, S., & Duke, M. P. (1974). A locus of control scale for non-college as well as college adults. Journal of Personality Assessment, 38, 136-137.

Nowicki, S., & Duke, M. P. (1983). The Nowicki-Strickland life-span locus of control scales: Construct validation. In H. M. Lefcourt (Ed.), Research with the locus of control construct (Vol. 2). New York: Academic Press.

Nowicki, S., & Strickland, B. R. (1973). A locus of control scale for children. Journal of Consulting & Clinical Psychology, 40, 148-154.

Nunnally, J. O. (1967). Psychometric Theory (1st ed.). New York: McGraw-Hill.

Nunnally, J. O. (1978). Psychometric Theory. New York: McGraw-Hill.

O'Brien, G. E., & Kabanoff, B. (1981). Australian norms and factor analysis of Rotter's Internal-External Control Scale. Australian Psychologist, 16, 184-202.

Oppe, S. (1988). The concept of risk: A decision theoretic approach. Ergonomics, 31, 435-440.

Palenzuela, D. L. (1987). Sphere-specific measures of perceived control: Perceived contingency, perceived competence, or what? A critical evaluation of Paulhus and Christie's approach. Journal of Research in Personality, 21, 264-286.

Park, S. E., & Harrison, A. A. (1995). Career-related interests and values, perceived control, and acculturation of Asian-American and Caucasian-American college students. Journal of Applied Social Psychology, 25, 1184-1203.

Parker, S. K., & Sprigg, C. A. (1999). Minimizing strain and maximizing learning: The role of job demands, job control, and proactive personality. Journal of Applied Psychology, 84, 925-939.

Parkes, K. R. (1988). Locus of control in three behavioural domains: Factor structure and correlates of the "Spheres of Control" scale. Personality & Individual Differences, 9, 631-643.

Parkes, K. R. (1994). Personality and coping as moderators of work stress processes: Models, methods and measures. Work & Stress, 8,110-129.

Paulhus, D. (1983). Sphere-specific measures of perceived control. Journal of Personality & Social Psychology, 44, 1253-1265.

Paulhus, D. L., & Van Selst, M. (1990). The Spheres of Control Scale: 10 yrs of research. Personality & Individual Differences, 11, 1029-1036.

Paulhus, D., & Christie, R. (1981). Spheres of Control: An interactionist approach to the assessment of perceived control. In H. M. Lefcourt (Ed.), Research with the locus of control construct (Vol. 1). New York: Academic Press.

Paulhus, D., Molin, J., & Schuchts, R. (1979). Control profiles of football players, tennis players, and non-athletes. Journal of Social Psychology, 108, 199-205.

Pedhazur, E. J. (1997). Multiple regression in behavioral research: explanation and prediction (3rd ed.). Orlando, FL: Harcourt Brace and Company.

Perloff, L. S., & Fetzer, B. K. (1986). Self-other judgements and perceived vulnerability to victimization. Journal of Personality and Social Psychology, 50, 502-510.

Peterson, C., Maier, S. F., & Seligman, M. E. (1993). Learned helplessness: A theory for the age of personal control. New York: Oxford University Press.

Piotrowski, C., Dunn, B. R., Sherry, D., & Howell, W. L. (1983). Factor structure on the Adult Nowicki-Strickland I-E Scale in a college population. Educational & Psychological Measurement, 43, 1211-1215.

Presson, P. K., Clark, S. C., & Benassi, V. A. (1997). The Levenson Locus of Control Scales: Confirmatory factor analyses and evaluation. Social Behavior & Personality, 25, 93-104.

Prociuk, T. J. (1977). Concerning the evidence for a general factor in the Internal-External Control Scale: A reanalysis of Franklin's data. Journal of Consulting & Clinical Psychology, 45, 1199.

Quadrel, M. J., Fischhoff, B., & Davis, W. (1993). Adolescent (in)vulnerability. American Psychologist, 48, 102-116.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 80, 1-28.

Russell, L. A., Goltz, J. D., & Bourque, L. B. (1995). Preparedness and hazard mitigation actions before and after two earthquakes. Environment & Behavior, 27, 744-770.

Rustemli, A., & Karanci, A. N. (1999). Correlates of earthquake cognitions and preparedness behavior in a victimized population. The Journal of Social Psychology, 139, 91-101.

Rutter, D. R., Quine, L., & Albery, I. P. (1998). Perceptions of risk in motorcyclists: Unrealistic optimism, relative realism and predictions of behaviour. British Journal of Psychology, 89, 681-696.

Saltzer, E. B. (1982). The Weight Locus of Control (WLOC) scale: A specific measure for obesity research. Journal of Personality Assessment, 46, 620-628.

Sattler, D. N., Kaiser, C. F., & Hittner, J. B. (2000). Disaster preparedness: Relationships among prior experience, personal characteristics, and distress. Journal of Applied Social Psychology, 30, 1396-1420.

Schaninger, C. M. (1976). Perceived risk and personality. Journal of Consumer Research, 3, 95-100.

Schiff, M. (1977). Hazard adjustment, locus of control, and sensation seeking: Some null findings. Environment & Behavior, 9, 233-254.

Schmitt, N. (1996). Uses and abuses of coefficient alpha. Psychological Assessment, 8, 350-353.

Schneider, S. L., & Lopes, L. L. (1986). Reflection in preferences under risk: Who and when may suggest why. Journal of Experimental Psychology: Human Perception & Performance, 12, 535-548.

Schrader, M. P., & Wann, D. L. (1999). High-risk recreation: The relationship between participant characteristics and degree of involvement. Journal of Sport Behavior, 22, 426-441.

Schuman, H., & Kalton, G. (1985). Survey methods. In G. Lindzey & E. Aronson (Eds.), The handbook of social psychology, Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Schwarz, N. (1999). Self-reports: How the questions shape the answers. American Psychologist, 54, 93-105.

Schwarz, R. M., Burkhart, B. R., & Green, S. B. (1978). Turning on or turning off: Sensation seeking or tension reduction as motivational determinants of alcohol use. Journal of Consulting & Clinical Psychology, 46, 1144-1145.

Shah, D., Thornton, S., & Burgess, A. P. (1997). Sexual Risk Cognitions Questionnaire: A reliability and validity study. AIDS Care, 9, 471-480.

Showalter, P. S. (1993). Prognostication of doom: An earthquake prediction's effect on four small communities. International Journal of Mass Emergencies and Disasters, 11, 279-292.

Siegert, R. (1988). Unemployment, stress and social support. Unpublished Ph.D. thesis, Victoria University of Wellington, Wellington.

Siegert, R. J., & Chung, R. (1995). Dimensions of distress: A cross-cultural factor replication. Journal of Cross-Cultural Psychology, 26, 169-175.

Siegert, R. J., McCormick, I. A., Taylor, A. J. W., & Walkey, F. H. (1987). An examination of the reported factor structures of General Health Questionnaire and the identification of a stable replicable structure. Australian Journal of Psychology, 39, 89-100.

Siegert, R. J., Patten, M. D., Taylor, A. J. W., & McCormick, I. A. (1988). Factor analysis of the WAIS-R using the factor replication procedure, FACTOREP. Multivariate Behavioral Research, 23, 481-489.

Simpson-Housley, P., & Bradshaw, P. (1978). Personality and the perception of earthquake hazard. Australian Geographic Studies, 16, 65-77.

Simpson-Housley, P., & Curtis, F. A. (1983). Earthquake occurance, experience and appraisal in Wellington, New Zealand. Professional Geographer, 35, 462-467.

Simpson-Housley, P., Lipinski, G., & Trithardt, E. (1978). The flood hazard and Lumsden, Sakatchewan: Residents cognitive awareness and personality. Prairie Forum, 3, 175-188.

Sims, J. H., & Baumann, D. D. (1972). The tornado threat: Coping styles of the north and south. Science, 176, 1386-1392.

Slovic, P. (1987). Perception of risk. Science, 236, 280-285.

Slovic, P. (1993). Perceptions of environmental hazards: Psychological perspectives. In T. Gaerling & R. G. Golledge (Eds.), Behavior and environment: Psychological and

geographical approaches. Advances in psychology (Vol. 96, pp. 223-248). Amsterdam, Netherlands: North-Holland.

Slovic, P. (1997). Trust, emotion, sex, politics and science: Surveying the risk-assessment battlefield. In M. H. Bazerman & D. M. Messick & A. Tenbrunsel & K. Wade-Benzoni (Eds.), Environment, ethics, and behavior (pp. 277-313). San Francisco: New Lexington Press.

Slovic, P. (2000). The perception of risk. London, VA: Earthscan.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1976). Cognitive processes and societal risk taking. In J. S. Carroll & J. W. Payne (Eds.), Cognition and social behavior. Potomac, MD: Lawrence Erlbaum Associates.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1977). Behavioral decision theory. Annual Review of Psychology, 28, 1-39.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1987). Behavioral decision theory perspectives on protective behavior. In N. D. Weinstein (Ed.), Taking care: Understanding and encouraging self-protective behavior. (pp. 14-41). New York, NY, USA: Cambridge University Press.

Slovic, P., Fischhoff, B., Lichtenstein, S., Corrigan, B., & Combs, B. (1977). Preference for insuring against probable small losses: Insurance implications. Journal of Risk and Insurance, 2, 237-257.

Slovic, P., Kunreuther, H., & White, G. F. (Eds.). (1974). Decision processes, rationality, and adjustment to natural hazards. New York: Oxford University Press.

Sorenson, J. H., & Mileti, D. (1987). Programs that encourage the adoption of precautions against natural hazards: Review and evaluation. In N. Weinstein (Ed.), Taking care: Understanding and encouraging self-protective behavior. New York, NY: Cambridge University Press.

Sosis, R. H., Strickland, B. R., & Haley, W. E. (1980). Perceived locus of control and beliefs about astrology. Journal of Social Psychology, 110, 65-71.

Spittal, M. J. (1998). The development and evaluation of the Incidental Concerns Inventory. Unpublished manuscript, Victoria University of Wellington.

Steger, M. A., & Witt, S. L. (1989). Gender differences in environmental orientations: A comparison of publics and activists in Canada and the U.S. Western Political Quarterly, 42, 627-649.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. Environment & Behavior, 25, 322-348.

Stimson, G. V., Jones, S., Chalmers, C., & Sullivan, D. (1998). A short questionnaire (IRQ) to assess injecting risk behaviour. Addiction, 93, 337-347.

Strickland, B. R. (1989). Internal -- external control expectancies. American Psychologist, 44, 1-12.

Sullivan, R., Mustart, D. A., & Galehouse, J. S. (1977). Living in earthquake country. California Geology, 3, 3-8.

Tabachnick, B. G., & Fidell, L. S. (1996). Using multivariate statistics (3rd ed.). New York, NY: HarperCollins College Publishers.

Tonkin, R. S., Cox, D. N., Blackman, A. R., & Sheps, S. (1990). Risk-taking behavior in adolescence. In R. J. McMahon & R. D. Peters (Eds.), Behavior disorders of adolescence: Research, intervention, and policy in clinical and school settings. (pp. 27-37). New York, NY, USA: Plenum Press.

Trimpop, R. M. (1994). The psychology of risk taking behavior (Vol. 107). Amsterdam: Elsevier Science BV.

Trimpop, R. M., Kerr, J. H., & Kirkcaldy, B. D. (1999). Comparing personality constructs of risk-taking behavior. Personality & Individual Differences, 26, 237-254.

Turner, R. H., Nigg, J. M., & Paz, D. H. (1986). Waiting for disaster: Earthquake watch in California. Los Angeles: University of California Press.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. Cognitive Psychology, 5, 207-232.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185, 1124-1131.

Valecha, G. K., & Ostrom, T. M. (1974). An abbreviated measure of internal-external locus of control. Journal of Personality Assessment, 38, 369-376.

von Emster, G. R., & Harrison, A. A. (1998). Role ambiguity, spheres of control, burnout, and work-related attitudes of teleservice professionals. Journal of Social Behavior & Personality, 13, 375-385.

von Neumann, J., & Morgenstern, O. (1953). Theory of games and economic behavior (3rd ed.). Princeton, NJ: Princeton University Press.

Vuchinich, R. E., & Bass, B. A. (1974). Social desirability in Rotter's Locus of Control Scale. Psychological Reports, 34, 1124-1126.

Walkey, F. H. (1979). Internal control, powerful others, and chance: A confirmation of Levenson's factor structure. Journal of Personality Assessment, 43, 532-535.

Walkey, F. H. (1983). Simple versus complex factor analyses of responses to multiple scale questionnaires. Multivariate Behavioral Research, 18(4), 401-421.

Walkey, F. H., & McCormick, I. A. (1985a). FACTOREP: A Pascal program to examine factor replication. Educational & Psychological Measurement, 45(1), 147-150.

Walkey, F. H., & McCormick, I. A. (1985b). Multiple replication of factor structure: A logical solution for a number of factors problem. Multivariate Behavioral Research, 20, 57-67.

Walkey, F. H., Siegert, R. J., McCormick, I. A., & Taylor, A. J. W. (1987). Multiple replication of the factor structure of the Inventory of Socially Supported Behaviors. Journal of Community Psychology, 15, 513-519.

Wallston, K. A., & Wallston, B. S. (1981). Health locus of control scales. In H. M. Lefcourt (Ed.), Research with the locus of control construct (Vol. 1). New York: Academic Press.

Ward, L. C., & Thomas, L. L. (1985). Interrelationships of locus of control content dimensions and hopelessness. Journal of Clinical Psychology, 41, 517-520.

Waters, L. K., Popovich, P. M., & Martelli, T. A. (1987). Congruent validity of the Personal Reaction Scale. Psychological Reports, 61, 314.

Watson, J. M. (1981). A note on the dimensionality of the Rotter locus of control scale. Australian Journal of Psychology, 33, 319-330.

Welch, G., Smith, R. B., & Walkey, F. H. (1992). Styles of psychological adjustment in diabetes: A focus on key psychometric issues and the ATT39. Journal of Clinical Psychology, 48, 648-658.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. Journal of Personality & Social Psychology, 39, 806-820.

Weinstein, N. D. (1984). Why it won't happen to me: Perceptions of risk factors and susceptibility. Health Psychology, 3, 431-457.

Weinstein, N. D. (1987a). Cross-hazard consistencies: Conclusions about self-protective behavior. In N. D. Weinstein (Ed.), Taking care: Understanding and encouraging self-protective behavior. (pp. 325-335). New York, NY, USA: Cambridge University Press.

Weinstein, N. D. (1987b). Unrealistic optimism about susceptibility to health problems: Conclusions from a community-wide sample. Journal of Behavioral Medicine, 10, 481-500.

Weinstein, N. D. (1989). Effects of personal experience on self-protective behavior. Psychological Bulletin, 105, 31-50.

Weinstein, N. D. (Ed.). (1987). Taking care: Understanding and encouraging self-protective behavior. New York, NY, USA: Cambridge University Press.

Weinstein, N. D., & Klein, W. M. (1996). Unrealistic optimism: Present and future. Journal of Social & Clinical Psychology, 15, 1-8.

Weinstein, N. D., Sandman, P. M., & Roberts, N. E. (1990). Determinants of self-protective behavior: Home radon testing. Journal of Applied Social Psychology, 20, 783-801.

Weinstein, N., Lyon, J. E., Rothman, A. J., & Cuite, C. L. (2000). Preoccupation and affect as predictors of protective action following natural disaster. British Journal of Health Psychology, 5, 351-363.

Wilde, G. J. S. (1988). Risk homeostasis theory applied to a fictitious instance of an individual driver's decision making. In T. Rothengatter & R. de Bruin (Eds.), Road user behaviour: Theory and research. (pp. 66-76). Assen, Netherlands: Van Gorcum & Co B.V.

Wilson, M. S. (1999). The social representational theory of symbolic politics. Unpublished Ph. D. Thesis, Victoria University of Wellington.

Wong, P. T. P., & Sproule, C. F. (1984). An attributional analysis of the locus of control construct and the Trent Attributional Profile. In H. M. Lefcourt (Ed.), Research with the Locus of Control Construct (Vol. 3). New York: Academic Press.

Yates, J. F., & Stone, E. K. (1992). Risk appraisal. In J. F. Yates (Ed.), Risk taking behaviour. West Sussex, England: John Wiley and Sons.

Yukl, G. A., & Latham, G. P. (1978). Interrelationships among employee participation, individual differences, goal difficulty, goal acceptance, goal instrumentality, and performance. Personnel Psychology, 31, 305-323.

Zerega, W. D., Tseng, M. S., & Greever, K. B. (1976). Stability and concurrent validity of the Rotter Internal-External Locus of Control Scale. Educational & Psychological Measurement, 36, 473-475.

Zuckerman, M. (1979). Sensation seeking: Beyond the optimal level of arousal. Hillsdale NJ: Erlbaum.

Zuckerman, M. (1994). Behavioral expressions and biosocial bases of sensation seeking. New York NY: Cambridge University Press.

Zuckerman, M., & Neeb, M. (1980). Demographic influences in sensation seeking and expressions of sensation seeking in religion, smoking, and driving habits. Personality & Individual Differences, 1, 197-206.

Zuckerman, M., Gerbasi, K. C., & Marion, S. P. (1977). Correlates of the just world factor of Rotter's I-E Scale. Educational & Psychological Measurement, 37, 375-381.

Appendix A

RISK QUESTIONNAIRES USED IN CHAPTER 2

Study 1 – Risk-Taking Scale

Listed below are various activities people sometimes do involving varying degrees of risk. **Please rate the extent to which you would do each of these things, given the opportunity**. If the behaviour is something that you would never do then place a tick in the circle I would never do this. However, if the behaviour is something that you would do frequently then place a tick in the circle I would often do this. You may place a tick in any circle in between.

		I would never do this ⇩		**I would sometimes do this** ⇩		**I would often do this** ⇩
1	Swim	O	O	O	O	O
2	Ride a bicycle	O	O	O	O	O
3	Drive without wearing a seatbelt on a short journey	O	O	O	O	O
4	Binge drink	O	O	O	O	O
5	Use a gun	O	O	O	O	O
6	Play a contact sport (e.g. rugby)	O	O	O	O	O
7	Go hunting	O	O	O	O	O
8	Ride in a home made aircraft or microlight aircraft	O	O	O	O	O
9	Ride a motorbike	O	O	O	O	O
10	Fly as a passenger in a single engine light plane	O	O	O	O	O
11	Go mountain climbing	O	O	O	O	O
12	Go tramping in the bush	O	O	O	O	O
13	Fly in a helicopter	O	O	O	O	O
14	Drive a car	O	O	O	O	O
15	Go skiing	O	O	O	O	O
16	Practise “Unsafe Sex”	O	O	O	O	O
17	Drive an uninsured car	O	O	O	O	O
18	Place a bet using a sum of money that is more then your weekly pay	O	O	O	O	O
19	Start a small business	O	O	O	O	O
20	Buy an expensive product from a door to door salesperson	O	O	O	O	O
21	Spend all your earnings without saving any money	O	O	O	O	O
22	Buy a lotto ticket	O	O	O	O	O
23	Shoplift	O	O	O	O	O

		I would never do this		I would sometimes do this		I would often do this
24	Not pay a fine	O	O	O	O	O
25	Take something that doesn't belong to you	O	O	O	O	O
26	Drive well over the speed limit	O	O	O	O	O
27	Excessive drinking and driving	O	O	O	O	O
28	Fail to fill in a tax return	O	O	O	O	O
29	Not pay your Visa bill	O	O	O	O	O
30	Fail to declare all your income	O	O	O	O	O
31	Drive off the forecourt of the petrol station without paying for petrol	O	O	O	O	O
32	Have a physical fight	O	O	O	O	O
33	Park on a yellow line	O	O	O	O	O
34	Not put money in the parking meter	O	O	O	O	O
35	Coast downhill with your car in neutral	O	O	O	O	O
36	Have a heated argument	O	O	O	O	O

Study 2 – Risk-Precaution Scale

Listed below are various activities people sometimes do involving varying degrees of risk. **Please rate the extent to which you would do each of these things, given the opportunity**. If the behaviour is something that you would never do, then place a tick in the circle I would never do this. However, if the behaviour is something that you would do frequently, then place a tick in the circle I would often do this. You may place a tick in any circle in between.

		I would never do this ⇩				**I would often do this** ⇩
1	Use a seat belt in the car	O	O	O	O	O
2	Have an annual chest X-ray	O	O	O	O	O
3	Have an annual medical check-up	O	O	O	O	O
4	Carry a spare set of keys	O	O	O	O	O
5	Get a dental check-up every six months	O	O	O	O	O
6	Double locks on doors	O	O	O	O	O
7	Eye examination every two years	O	O	O	O	O
8	Get exercise	O	O	O	O	O
9	Have home fire drills	O	O	O	O	O
10	Insist car or vehicle passengers use seatbelts	O	O	O	O	O
11	Leave keys in car ignition	O	O	O	O	O
12	Leave spare house key with neighbour	O	O	O	O	O
13	Lock car when not in it	O	O	O	O	O
14	Lock up poisonous materials	O	O	O	O	O
15	Mark contents of medicine bottles	O	O	O	O	O
16	Take travelers cheques on vacation (not just cash)	O	O	O	O	O
17	Eat healthy food	O	O	O	O	O
18	Take first aid course	O	O	O	O	O
19	Throw out old medicines or unmarked medicine bottles	O	O	O	O	O
20	Transfer medicines from one bottle to another	O	O	O	O	O
21	Use insecticides in garden	O	O	O	O	O
22	Use insecticides in house	O	O	O	O	O
23	Use safety mat in bathtub or shower	O	O	O	O	O
24	Use sunscreen when outside in summer	O	O	O	O	O
25	Use step ladder to reach high places	O	O	O	O	O

Study 3 – Risk-Taking Scale

Listed below are various activities people sometimes do involving varying degrees of risk. **Please rate the extent to which you would do each of these things, given the opportunity**. If the behaviour is something that you would never do then place a tick in the circle I would never do this. However, if the behaviour is something that you would do frequently then place a tick in the circle I would often do this. You may place a tick in any circle in between.

		I would never do this ⇩		**I would sometimes do this** ⇩		**I would often do this** ⇩
1	Swim	O	O	O	O	O
2	Ride a bicycle	O	O	O	O	O
3	Binge drink	O	O	O	O	O
4	Use a gun	O	O	O	O	O
5	Play a contact sport (e.g. rugby)	O	O	O	O	O
6	Go hunting	O	O	O	O	O
7	Ride in a home made aircraft or microlight aircraft	O	O	O	O	O
8	Ride a motorbike	O	O	O	O	O
9	Fly as a passenger in a single engine light plane	O	O	O	O	O
10	Go mountain climbing	O	O	O	O	O
11	Go tramping in the bush	O	O	O	O	O
12	Fly in a helicopter	O	O	O	O	O
13	Drive a car	O	O	O	O	O
14	Go skiing	O	O	O	O	O
15	Drive an uninsured car	O	O	O	O	O
16	Not pay a fine	O	O	O	O	O
17	Take something that doesn't belong to you	O	O	O	O	O
18	Drive well over the speed limit	O	O	O	O	O
19	Drive off the forecourt of the petrol station without paying for petrol	O	O	O	O	O
20	Have a physical fight	O	O	O	O	O
21	Park on a yellow line	O	O	O	O	O
22	Not put money in the parking meter	O	O	O	O	O
23	Coast downhill with your car in neutral	O	O	O	O	O
24	Have a heated argument	O	O	O	O	O

Study 3 – Risk-Precaution Scale

Listed below are various activities people sometimes do involving varying degrees of risk. **Please rate the extent to which you would do each of these things, given the opportunity**. If the behaviour is something that you would never do, then place a tick in the circle I would never do this. However, if the behaviour is something that you would do frequently, then place a tick in the circle I would often do this. You may place a tick in any circle in between.

		I would never do this ⇩		**I would sometimes do this** ⇩		**I would often do this** ⇩
1	Have an annual chest X-ray	O	O	O	O	O
2	Have an annual medical check-up	O	O	O	O	O
3	Carry a spare set of keys	O	O	O	O	O
4	Get a dental check-up every six months	O	O	O	O	O
5	Double locks on doors	O	O	O	O	O
6	Eye examination every two years	O	O	O	O	O
7	Have home fire drills	O	O	O	O	O
8	Insist car or vehicle passengers use seatbelts	O	O	O	O	O
9	Leave spare house key with neighbour	O	O	O	O	O
10	Lock car when not in it	O	O	O	O	O
11	Lock up poisonous materials	O	O	O	O	O
12	Mark contents of medicine bottles	O	O	O	O	O
13	Take travelers cheques on vacation (not just cash)	O	O	O	O	O
14	Eat healthy food	O	O	O	O	O
15	Take first aid course	O	O	O	O	O
16	Throw out old medicines or unmarked medicine bottles	O	O	O	O	O
17	Use safety mat in bathtub or shower	O	O	O	O	O
18	Use sunscreen when outside in summer	O	O	O	O	O
19	Use step ladder to reach high places	O	O	O	O	O

Appendix B

LOCUS OF CONTROL

QUESTIONNAIRES USED IN CHAPTER 3

Study 1 -- The Adult Nowicki Strickland Internal-External Scale

The following questions contain 40 statements. I am interested in whether you agree with the statements or not. Please answer the following questions by ticking the circle 'yes' if you agree with the item, and 'no' if you disagree.

		Yes	No
1	Do you believe that most problems will solve themselves if you don't just fool with them?	O	O
2	Do you believe you can stop yourself from catching a cold?	O	O
3	Are some people just born lucky?	O	O
4	Most of the time, do you feel that getting good grades meant a great deal to you?	O	O
5	Are you often blamed for things that just aren't your fault?	O	O
6	Do you believe that if somebody studies hard enough, he or she can pass any subject?	O	O
7	Do you feel that most of the time it doesn't pay to try hard because things never turn out the right way anyway?	O	O
8	Do you feel that if things start out well in the morning, it's going to be a good day no matter what you do?	O	O
9	Do you feel that most of the time parents listen to what their children have to say?	O	O
10	Do you believe that wishing can make most things happen?	O	O
11	When you get punished, does it usually seem it's for no good reason at all?	O	O
12	Most of the time, do you find it hard to change a friend's opinion (mind)?	O	O
13	Do you think that cheering more then luck helps a team to win?	O	O
14	Did you feel that it was nearly impossible to change your parents minds about anything?	O	O
15	Do you believe that parents should allow children to make most of their own decisions?	O	O
16	Do you feel that when you do something wrong, there's very little you can do to make it right?	O	O
17	Do you believe that most people are born good at sports?	O	O
18	Are most of the other people your age stronger than you are?	O	O
19	Do you feel that one of the best ways to handle most problems is just not to think about them?	O	O
20	Do you feel you have a lot of choice in deciding who your friends are?	O	O
21	If you find a four-leaf clover, do you believe that it might bring you good luck?	O	O
22	Did you often feel that whether or not you did your homework had much to do with the kinds of grades you got?	O	O
23	Do you feel that when a person your age is angry at you, there's little you can do to stop him or her.	O	O
24	Have you ever had a good-luck charm?	O	O
25	Do you believe that whether or not people like you depends on how you act?	O	O
26	Did your parents usually help you if you asked them to?	O	O
27	Have you felt that when people were angry with you it was usually for no reason at all?	O	O
28	Most of the time, do you feel that you can change what might happen tomorrow by what you did today?	O	O
29	Do you believe that when bad things are going to happen, they just are going to happen no matter what you try do to stop them?	O	O
30	Do you think that people can get their own way if they just keep trying?	O	O

		Yes	No
31	Most of the time do you find it useless to try and get your own way at home?	O	O
32	Do you feel that when good things happen they happen because of hard work?	O	O
33	Do you feel that if somebody your age wants to be your enemy there's little you can do to change matters?	O	O
34	Do you feel that it's easy to get friends to do what you want them to do?	O	O
35	Do you usually feel that you have little to say about what you eat at home?	O	O
36	Do you feel that when someone doesn't like you there is little you can do about it?	O	O
37	Did you usually feel that it was almost useless to try in school because most other children were just plain smarter then you?	O	O
38	Are you the kind of person who believes that planning ahead makes things turn out better?	O	O
39	Most of the time, do you feel that you have little to say about what your family decides to do?	O	O
40	Do you think it's better to be smart than to be lucky?	O	O

Study 1 – The Internal, Powerful Others, and Chance Scales

This page consists of a list of statements. If you strongly disagree with the statement, please place a tick in the strongly disagree circle. If you strongly agree with the statement place a tick in the strongly agree circle. You may tick any circle in between.

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	Whether or not I get to be a leader depends mostly on my ability.	O	O	O	O	O	O
2	To a great extent my life is mostly controlled by accidental happenings.	O	O	O	O	O	O
3	I feel like whatever happens in my life is mostly determined by powerful people.	O	O	O	O	O	O
4	Whether or not I get into a car accident depends mostly on how good a driver I am.	O	O	O	O	O	O
5	When I make plans, I am almost certain to make them work.	O	O	O	O	O	O
6	Often there is no chance of protecting my personal interests from bad luck happenings.	O	O	O	O	O	O
7	When I get what I want, it's usually because I'm lucky.	O	O	O	O	O	O
8	Although I might have good ability, I will not be given leadership responsibility without appealing to those in positions of power.	O	O	O	O	O	O
9	How many friends I have depends on how nice a person I am.	O	O	O	O	O	O
10	I have often found that what is going to happen will happen.	O	O	O	O	O	O
11	My life is chiefly controlled by powerful others.	O	O	O	O	O	O
12	Whether or not I get into an accident is mostly a matter of luck.	O	O	O	O	O	O
13	People like myself have very little chance of protecting our personal interests when they conflict with those of strong pressure groups.	O	O	O	O	O	O
14	It's not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.	O	O	O	O	O	O
15	Getting what I want requires pleasing those people above me.	O	O	O	O	O	O
16	Whether or not I get to be a leader depends on whether I'm lucky enough to be in the right place at the right time.	O	O	O	O	O	O
17	If important people were to decide they didn't like me, I probably wouldn't make many friends.	O	O	O	O	O	O
18	I can pretty much determine what will happen in my life.	O	O	O	O	O	O
19	I am usually able to protect my personal interests.	O	O	O	O	O	O
20	Whether or not I get into a car accident depends mostly on the other driver.	O	O	O	O	O	O
21	When I get what I want, it's usually because I worked hard for it.	O	O	O	O	O	O
22	In order to have my plans work, I make sure that they fit with the desires of people who have power over me.	O	O	O	O	O	O
23	My life is determined by my own actions.	O	O	O	O	O	O
24	It's chiefly a matter of fate whether or not I have a few friends or many friends.	O	O	O	O	O	O

Study 1 – The Spheres of Control Scale –1

This page consists of a number of statements. If you strongly disagree with the statement please place a tick in the strongly disagree circle. If you strongly agree with the statement place a tick in the agree circle. You may tick any circle in between.

		Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
1	When I get what I want it's usually because I worked hard for it.	O	O	O	O	O	O	O
2	When I make plans I am almost certain to make them work.	O	O	O	O	O	O	O
3	I prefer games involving some luck over games requiring pure skill.	O	O	O	O	O	O	O
4	I can learn almost anything if I set my mind to it.	O	O	O	O	O	O	O
5	My major accomplishments are entirely due to hard work and intelligence	O	O	O	O	O	O	O
6	I usually don't make plans because I have a hard time following through on them.	O	O	O	O	O	O	O
7	Competition encourages excellence.	O	O	O	O	O	O	O
8	The extent of personal achievement is often determined by chance.	O	O	O	O	O	O	O
9	On any sort of exam or competition I like to know how well relative to everybody else.	O	O	O	O	O	O	O
10	Despite my best efforts I have few worthwhile accomplishments.	O	O	O	O	O	O	O
11	Even when I'm feeling self-confident about most things, I still seem to lack the ability to control interpersonal situations.	O	O	O	O	O	O	O
12	I have no trouble making and keeping friends.	O	O	O	O	O	O	O
13	I'm not good at guiding the course of a conversation with several others.	O	O	O	O	O	O	O
14	I can usually establish a close personal relationship with someone I find sexually attractive.	O	O	O	O	O	O	O
15	When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.	O	O	O	O	O	O	O
16	If I need help in carrying out a plan of mine, it's usually difficult to get others to help.	O	O	O	O	O	O	O
17	If there's someone I want to meet I can usually arrange it.	O	O	O	O	O	O	O
18	I often find it hard to get my point of view across to others.	O	O	O	O	O	O	O
19	In attempting to smooth over a disagreement I usually make it worse.	O	O	O	O	O	O	O
20	I find it easy to play an important part in most group situations.	O	O	O	O	O	O	O
21	By taking an active part in political and social affairs we, the people, can control world events.	O	O	O	O	O	O	O
22	The average citizen can have an influence on government decisions.	O	O	O	O	O	O	O
23	It is difficult for people to have much control over the things politicians do in the office.	O	O	O	O	O	O	O

		Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
24	This world is run by the few people in power and there is not much the little guy can do about it.	O	O	O	O	O	O	O
25	With enough effort we can wipe out political corruption.	O	O	O	O	O	O	O
26	One of the major reasons we have wars is because people don't take enough interest in politics.	O	O	O	O	O	O	O
27	There is very little we, as consumers, can do to keep the cost of living from going higher.	O	O	O	O	O	O	O
28	When I look at it carefully I realise it is impossible to have any really important influence over what politicians do.	O	O	O	O	O	O	O
29	I prefer to concentrate my energy on other things rather then on solving the worlds problems.	O	O	O	O	O	O	O
30	In the long run we, the voters, are responsible for bad government on a national as well as local level.	O	O	O	O	O	O	O

Study 2 – The Spheres of Control Scale –1

This page consists of a number of statements. If you disagree with the statement please place a tick in the disagree circle. If you agree with the statement place a tick in the agree circle. You may tick any circle in between.

	What are the last four digits of your phone number? __ __ __ __	Disagree						Agree
1	When I get what I want it's usually because I worked hard for it.	O	O	O	O	O	O	O
2	When I make plans I am almost certain to make them work.	O	O	O	O	O	O	O
3	I prefer games involving some luck over games requiring pure skill.	O	O	O	O	O	O	O
4	I can learn almost anything if I set my mind to it.	O	O	O	O	O	O	O
5	My major accomplishments are entirely due to hard work and intelligence.	O	O	O	O	O	O	O
6	I usually don't make plans because I have a hard time following through on them.	O	O	O	O	O	O	O
7	Competition encourages excellence.	O	O	O	O	O	O	O
8	The extent of personal achievement is often determined by chance.	O	O	O	O	O	O	O
9	On any sort of exam or competition I like to know how well I do relative to everyone else.	O	O	O	O	O	O	O
10	Despite my best efforts I have few worthwhile accomplishments.	O	O	O	O	O	O	O
11	Even when I'm feeling self-confident about most things, I still seem to lack the ability to control interpersonal situations.	O	O	O	O	O	O	O
12	I have no trouble making and keeping friends.	O	O	O	O	O	O	O
13	I'm not good at guiding the course of a conversation with several others.	O	O	O	O	O	O	O
14	I can usually establish a close personal relationship with someone I find sexually attractive.	O	O	O	O	O	O	O
15	When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.	O	O	O	O	O	O	O
16	If I need help in carrying out a plan of mine, it's usually difficult to get others to help.	O	O	O	O	O	O	O
17	If there's someone I want to meet I can usually arrange it.	O	O	O	O	O	O	O
18	I often find it hard to get my point of view across to others.	O	O	O	O	O	O	O
19	In attempting to smooth over a disagreement I usually make it worse.	O	O	O	O	O	O	O
20	I find it easy to play an important part in most group situations.	O	O	O	O	O	O	O
21	By taking an active part in political and social affairs we, the people, can control world events.	O	O	O	O	O	O	O
22	The average citizen can have an influence on government decisions.	O	O	O	O	O	O	O
23	It is difficult for people to have much control over the things politicians do in office.	O	O	O	O	O	O	O
24	This world is run by the few people in power and there is not much the little guy can do about it.	O	O	O	O	O	O	O

		Disagree						Agree
25	With enough effort we can wipe out political corruption.	O	O	O	O	O	O	O
26	One of the major reasons we have wars is because people don't take enough interest in politics.	O	O	O	O	O	O	O
27	There is very little we, as consumers, can do to keep the cost of living from going higher.	O	O	O	O	O	O	O
28	When I look at it carefully I realise it is impossible to have any really important influence over what politicians do.	O	O	O	O	O	O	O
29	I prefer to concentrate my energy on other things rather than on solving the world's problems.	O	O	O	O	O	O	O
30	In the long run we, the voters, are responsible for bad government on a national as well as a local level.	O	O	O	O	O	O	O

Study 2 – The Spheres of Control Scale –3

This page consists of a number of statements. If you feel the statement is a totally inaccurate description of you, please place a tick in the Totally Inaccurate circle. If you feel the statement is a totally accurate description of you, please place a tick in the Totally Accurate circle. You may tick any circle in between.

	What are the last four digits of your phone number? __ __ __ __	Totally Inaccurate						Totally Accurate
1	I can usually achieve what I want when I work hard for it.	O	O	O	O	O	O	O
2	Once I make plans I am almost certain to make them work.	O	O	O	O	O	O	O
3	I prefer games involving some luck over games of pure skill.	O	O	O	O	O	O	O
4	I can learn almost anything if I set my mind to it.	O	O	O	O	O	O	O
5	My major accomplishments are entirely due to my hard work and ability.	O	O	O	O	O	O	O
6	I usually do not set goals because I have a hard time following through on them.	O	O	O	O	O	O	O
7	Bad luck has sometimes prevented me from achieving things.	O	O	O	O	O	O	O
8	Almost anything is possible for me if I really want it.	O	O	O	O	O	O	O
9	Most of what will happen in my career is beyond my control.	O	O	O	O	O	O	O
10	I find it pointless to keep working on something that is too difficult for me.	O	O	O	O	O	O	O
11	In my personal relationships, the other person usually has more control over the relationship than I do.	O	O	O	O	O	O	O
12	I have no trouble making and keeping friends.	O	O	O	O	O	O	O
13	I'm not good at guiding the course of a conversation with several others.	O	O	O	O	O	O	O
14	I can usually develop a close personal relationship with someone I find appealing.	O	O	O	O	O	O	O
15	I can usually steer a conversation toward the topics I want to talk about.	O	O	O	O	O	O	O
16	When I need assistance with something, I often find it difficult to get others to help.	O	O	O	O	O	O	O
17	If there is someone I want to meet I can usually arrange it.	O	O	O	O	O	O	O
18	I often find it hard to get my point of view across to others.	O	O	O	O	O	O	O
19	In attempting to smooth over a disagreement I sometimes make it worse.	O	O	O	O	O	O	O
20	I find it easy to play an important part in most group situations.	O	O	O	O	O	O	O
21	By taking an active part in political and social affairs we, the people, can control world events.	O	O	O	O	O	O	O
22	The average citizen can have an influence on government decisions.	O	O	O	O	O	O	O
23	It is difficult for us to have much control over the things politicians do in office.	O	O	O	O	O	O	O

		Totally Inaccurate						Totally Accurate
24	Bad economic conditions are caused by world events that are beyond our control.	O	O	O	O	O	O	O
25	With enough effort we can wipe out political corruption.	O	O	O	O	O	O	O
26	One of the major reasons we have wars is because people don't take enough interest in politics.	O	O	O	O	O	O	O
27	There is nothing we, as consumers, can do to keep the cost of living from going higher.	O	O	O	O	O	O	O
28	It is impossible to have any real influence over what big businesses do.	O	O	O	O	O	O	O
29	I prefer to concentrate my energy on other things rather than on solving the world's problems.	O	O	O	O	O	O	O
30	In the long run we, the voters, are responsible for bad government on a national as well as a local level.	O	O	O	O	O	O	O

Study 3 – The Spheres of Control Scale – Composite Subscales

This page consists of a number of statements. If you disagree with the statement please place a tick in the disagree circle. If you agree with the statement place a tick in the agree circle. You may tick any circle in between.

		Disagree						Agree
1	I can usually achieve what I want when I work hard for it.	O	O	O	O	O	O	O
2	Once I make plans I am almost certain to make them work.	O	O	O	O	O	O	O
3	I prefer games involving some luck over games of pure skill.	O	O	O	O	O	O	O
4	I can learn almost anything if I set my mind to it.	O	O	O	O	O	O	O
5	My major accomplishments are entirely due to my hard work and ability.	O	O	O	O	O	O	O
6	I usually do not set goals because I have a hard time following through on them.	O	O	O	O	O	O	O
7	Bad luck has sometimes prevented me from achieving things.	O	O	O	O	O	O	O
8	Almost anything is possible for me if I really want it.	O	O	O	O	O	O	O
9	Most of what will happen in my career is beyond my control.	O	O	O	O	O	O	O
10	I find it pointless to keep working on something that is too difficult for me.	O	O	O	O	O	O	O
11	Even when I'm feeling self-confident about most things, I still seem to lack the ability to control interpersonal situations.	O	O	O	O	O	O	O
12	I have no trouble making and keeping friends.	O	O	O	O	O	O	O
13	I'm not good at guiding the course of a conversation with several others.	O	O	O	O	O	O	O
14	I can usually establish a close personal relationship with someone I find sexually attractive.	O	O	O	O	O	O	O
15	When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.	O	O	O	O	O	O	O
16	If I need help in carrying out a plan of mine, it's usually difficult to get others to help.	O	O	O	O	O	O	O
17	If there's someone I want to meet I can usually arrange it.	O	O	O	O	O	O	O
18	I often find it hard to get my point of view across to others.	O	O	O	O	O	O	O
19	In attempting to smooth over a disagreement I usually make it worse.	O	O	O	O	O	O	O
20	I find it easy to play an important part in most group situations.	O	O	O	O	O	O	O
21	By taking an active part in political and social affairs we, the people, can control world events.	O	O	O	O	O	O	O
22	The average citizen can have an influence on government decisions.	O	O	O	O	O	O	O
23	It is difficult for people to have much control over the things politicians do in office.	O	O	O	O	O	O	O

		Disagree						Agree
24	This world is run by the few people in power and there is not much the little guy can do about it.	O	O	O	O	O	O	O
25	With enough effort we can wipe out political corruption.	O	O	O	O	O	O	O
26	One of the major reasons we have wars is because people don't take enough interest in politics.	O	O	O	O	O	O	O
27	There is very little we, as consumers, can do to keep the cost of living from going higher.	O	O	O	O	O	O	O
28	When I look at it carefully I realize it is impossible to have any really important influence over what politicians do.	O	O	O	O	O	O	O
29	I prefer to concentrate my energy on other things rather than on solving the world's problems.	O	O	O	O	O	O	O
30	In the long run we, the voters, are responsible for bad government on a national as well as a local level.	O	O	O	O	O	O	O

Study 4 – The Spheres of Control Scale – Composite Subscales

Listed below are ten statements. If you feel the statement is a totally inaccurate description of you, please place a tick in the Totally Inaccurate circle. If you feel that the statement is a totally accurate description of you, please place a tick in the Totally Accurate circle. You may tick any circle in between.

		Totally Inaccurate						Totally Accurate
1	I can usually achieve what I want when I work hard for it.	O	O	O	O	O	O	O
2	Once I make plans I am almost certain to make them work.	O	O	O	O	O	O	O
3	I prefer games involving some luck over games of pure skill.	O	O	O	O	O	O	O
4	I can learn almost anything if I set my mind to it.	O	O	O	O	O	O	O
5	My major accomplishments are entirely due to my hard work and ability.	O	O	O	O	O	O	O
6	I usually do not set goals because I have a hard time following through on them.	O	O	O	O	O	O	O
7	Bad luck has sometimes prevented me from achieving things.	O	O	O	O	O	O	O
8	Almost anything is possible for me if I really want it.	O	O	O	O	O	O	O
9	Most of what will happen in my career is beyond my control.	O	O	O	O	O	O	O
10	I find it pointless to keep working on something that is too difficult for me.	O	O	O	O	O	O	O

For the following twenty statements, if you disagree with the statement please place a tick in the disagree circle. If you agree with the statement place a tick in the agree circle. You may tick any circle in between.

		Disagre						Agree
11	Even when I'm feeling self-confident about most things, I still seem to lack the ability to control interpersonal situations.	O	O	O	O	O	O	O
12	I have no trouble making and keeping friends.	O	O	O	O	O	O	O
13	I'm not good at guiding the course of a conversation with several others.	O	O	O	O	O	O	O
14	I can usually establish a close personal relationship with someone I find sexually attractive.	O	O	O	O	O	O	O
15	When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.	O	O	O	O	O	O	O
16	If I need help in carrying out a plan of mine, it's usually difficult to get others to help.	O	O	O	O	O	O	O
17	If there's someone I want to meet I can usually arrange it.	O	O	O	O	O	O	O
18	I often find it hard to get my point of view across to others.	O	O	O	O	O	O	O
19	In attempting to smooth over a disagreement I usually make it worse.	O	O	O	O	O	O	O
20	I find it easy to play an important part in most group situations.	O	O	O	O	O	O	O

		Disagree						Agree
21	By taking an active part in political and social affairs we, the people, can control world events.	O	O	O	O	O	O	O
22	The average citizen can have an influence on government decisions.	O	O	O	O	O	O	O
23	It is difficult for people to have much control over the things politicians do in office.	O	O	O	O	O	O	O
24	This world is run by the few people in power and there is not much the little guy can do about it.	O	O	O	O	O	O	O
25	With enough effort we can wipe out political corruption.	O	O	O	O	O	O	O
26	One of the major reasons we have wars is because people don't take enough interest in politics.	O	O	O	O	O	O	O
27	There is very little we, as consumers, can do to keep the cost of living from going higher.	O	O	O	O	O	O	O
28	When I look at it carefully I realize it is impossible to have any really important influence over what politicians do.	O	O	O	O	O	O	O
29	I prefer to concentrate my energy on other things rather than on solving the world's problems.	O	O	O	O	O	O	O
30	In the long run we, the voters, are responsible for bad government on a national as well as a local level.	O	O	O	O	O	O	O

Appendix C

EARTHQUAKE PREPARATION QUESTIONNAIRE USED IN CHAPTER 4

Please circle the number which most closely corresponds with your answer.

Do you think that you are prepared for a major earthquake?

1	2	3	4	5	6	7
Not at all prepared			Somewhat prepared			Very prepared

Please indicate by circling either <u>Yes</u>, or <u>No</u>, which of the following steps you have taken to prepare for a major earthquake.

1	I have considered the risk of a major earthquake when deciding to live in the house that I do now.	Yes	No
2	I have fastened tall furniture to the wall.	Yes	No
3	I have fastened my hot water cylinder.	Yes	No
4	I have either strengthened my chimney, or satisfied myself that it will not fall down in a major earthquake.	Yes	No
5	I have either strengthened my house to increase its earthquake resistance, or satisfied myself that it will probably not fall down in a major earthquake.	Yes	No
6	I have ensured that my roof will probably not collapse in a major earthquake.	Yes	No
7	I have arranged the cupboards so that heavy objects are stored at ground level.	Yes	No
8	I have securely fastened cupboards with latches.	Yes	No
9	I have ensured that objects which contain water have not been stored on top of electrical equipment (e.g. a pot plant or fishbowl on top of the television).	Yes	No
10	I have ensured that heavy objects are stored on the floor.	Yes	No
11	I have stored water for survival.	Yes	No
12	I have put aside spare plastic bags and toilet paper for use as an emergency toilet.	Yes	No
13	I have accumulated enough tools to make minor repairs to the house following a major earthquake.	Yes	No
14	I have obtained a supply of tinned food that could be used in an emergency.	Yes	No
15	I have purchased a first aid kit.	Yes	No
16	I have a supply of essential medicines for illness and allergies.	Yes	No
17	I have obtained a working battery radio.	Yes	No
18	I have obtained a working torch.	Yes	No
19	I have secured movable objects in my home e.g. computer, television.	Yes	No
20	I have access to an alternative cooking source (e.g. gas barbecue).	Yes	No
21	I have arranged a place to meet after an earthquake.	Yes	No
22	I have obtained a working fire extinguisher.	Yes	No
23	I have taken some steps at work The steps taken were (name) _____ _____	Yes	No

Do you own your own home? Yes / No Age: 18-25 26-40 41-60 61+

Gender: Male / Female

Appendix D

COMPARISON BETWEEN THE DEMOGRAPHIC AND SOCIAL CHARACTERISTICS OF THE FIELD STUDY PARTICIPANTS AND CENSUS 2001

This appendix provides a comparison of the demographic and social characteristics of the sample used in Chapter 5 with the 2001 Population Census.

Differences between the questions used in the Field Study and the Census have meant that there are only a limited number of variables where legitimate comparisons can be made. The most notable exclusion is a comparison between the ethnicity of the sample and ethnicity of the population. In the Field Study ethnicity was examined using an open-ended question. In the Census, a forced-choice format was used for the major ethnic groups, and an open-ended format used where the participant had membership in other groups. In addition, once the data had been collected for the field study, it was clear that many participants identified themselves as 'New Zealanders' – a category that does not exist in the Census. As such, this variables was not used for comparisons with the Census.

Table D1

Selected Demographic and Social Characteristics

	Field Study (percent)	Census 2001 (percent)
Age		
15-24	11	20
25-44	42	44
45-64	37	25
65	10	11
Total	100	100
Gender		
Male	41	48
Female	59	52
Total	100	100

Table D1

Selected Demographic and Social Characteristics (continued)

	Field Study (percent)	Census 2001 (percent)
Legal Marital Status		
Not Married	41	41
Married (or separated)	49	43
Divorced	5	6
Not elsewhere included	6	10
Total	100	100
Highest Educational Qualification		
No qualification	8	13
Secondary school qualification	29	38
University/Polytechnic qual.	63	48
Total	100	100

Appendix E

FIELD STUDY QUESTIONNAIRE (CHAPTER 5)

Note: measures presented in reverse order

VICTORIA UNIVERSITY OF WELLINGTON
Te Whare Wananga o te Upoko o te Ika a Maui

Earthquake Preparation: Lifestyle Factors

COMPLETING THE QUESTIONNAIRE:

Most of the questions will ask you to choose your answers from a key. Please choose the answer that best describes how you feel. Read each question carefully and give your immediate response to each item.

PLEASE ANSWER ALL THE QUESTIONS

Please circle the number that most closely corresponds to your answer to the following questions.
In your opinion:

1. How likely do you think it is that a major earthquake will occur in the Wellington region in the next 30 years?

   Very unlikely 1 2 3 4 5 6 7 Very likely

2. How prepared do you think you are for a major earthquake?

   Not prepared 1 2 3 4 5 6 7 Very well prepared

3. Think of an acquaintance (someone you know only slightly) who lives in the Wellington region. How prepared do you think they are for a major earthquake?

   Not prepared 1 2 3 4 5 6 7 Very well prepared

4. How prepared do you think most people who live in Wellington are for a major earthquake?

   Not prepared 1 2 3 4 5 6 7 Very well prepared

5. If a major earthquake were to occur in the Wellington region, how likely do you think it is that it would cause:

   a. harm to you?

      Very unlikely 1 2 3 4 5 6 7 Very likely

   b. damage to your property?

      Very unlikely 1 2 3 4 5 6 7 Very likely

   c. harm to the person you thought of when answering Question 3?

      Very unlikely 1 2 3 4 5 6 7 Very likely

   d. damage to the property of the person you thought of when answering Question 3?

      Very unlikely 1 2 3 4 5 6 7 Very likely

   e. harm to most people who live in Wellington?

      Very unlikely 1 2 3 4 5 6 7 Very likely

   f. damage to the property of most people who live in Wellington?

      Very unlikely 1 2 3 4 5 6 7 Very likely

EARTHQUAKE PREPARATION: For the following questions, please indicate by circling either Yes or No which of the following steps you have taken to prepare for a major earthquake.

1	I have considered the risk of a major earthquake when deciding to live in the house that I do now.	Yes	No
2	I have fastened tall furniture to the wall.	Yes	No
3	I have fastened my hot water cylinder.	Yes	No
4	I have either strengthened my chimney, or satisfied myself that it will not fall down in a major earthquake.	Yes	No
5	I have either strengthened my house to increase its earthquake resistance, or satisfied myself that it will probably not fall down in a major earthquake.	Yes	No
6	I have ensured that my roof will probably not collapse in a major earthquake.	Yes	No
7	I have arranged the cupboards so that heavy objects are stored at ground level.	Yes	No
8	I have securely fastened cupboards with latches.	Yes	No
9	I have ensured that objects which contain water have not been stored on top of electrical equipment (e.g. a pot plant or fishbowl on top of the television).	Yes	No
10	I have ensured that heavy objects are stored on the floor.	Yes	No
11	I have stored water for survival.	Yes	No
12	I have put aside spare plastic bags and toilet paper for use as an emergency toilet.	Yes	No
13	I have accumulated enough tools to make minor repairs to the house following a major earthquake.	Yes	No
14	I have obtained a supply of tinned food that could be used in an emergency.	Yes	No
15	I have purchased a first aid kit.	Yes	No
16	I have a supply of essential medicines for illness and allergies.	Yes	No
17	I have obtained a working battery radio.	Yes	No
18	I have obtained a working torch.	Yes	No
19	I have secured movable objects in my home e.g. computer, television.	Yes	No
20	I have access to an alternative cooking source (e.g. gas barbecue).	Yes	No
21	I have arranged a place to meet after an earthquake.	Yes	No
22	I have obtained a working fire extinguisher.	Yes	No
23	I have taken some steps at work The steps taken were (name) _____ _____	Yes	No

LIFESTYLE ACTIVITIES: Listed below are various activities that people sometimes engage in. **Please rate the extent to which you would do each of these things, given the opportunity**. If the behaviour is something that you would never do, then circle the 1. However, if the behaviour is something that you would often do then circle the 5. You may circle any number in between.

		I would never do this ⇩		**I would sometimes do this** ⇩		**I would often do this** ⇩
1	Have an annual chest X-ray	1	2	3	4	5
2	Have an annual medical check-up	1	2	3	4	5

		I would never do this ⇩		I would sometimes do this ⇩		I would often do this ⇩
3	Carry a spare set of keys	1	2	3	4	5
4	Get a dental check-up every six months	1	2	3	4	5
5	Double locks on doors	1	2	3	4	5
6	Eye examination every two years	1	2	3	4	5
7	Have home fire drills	1	2	3	4	5
8	Insist car or vehicle passengers use seatbelts	1	2	3	4	5
9	Leave spare house key with neighbour	1	2	3	4	5
10	Lock car when not in it	1	2	3	4	5
11	Lock up poisonous materials	1	2	3	4	5
12	Mark contents of medicine bottles	1	2	3	4	5
13	Take travelers cheques on vacation (not just cash)	1	2	3	4	5
14	Eat healthy food	1	2	3	4	5
15	Take first aid course	1	2	3	4	5
16	Throw out old medicines or unmarked medicine bottles	1	2	3	4	5
17	Use safety mat in bathtub or shower	1	2	3	4	5
18	Use sunscreen when outside in summer	1	2	3	4	5
19	Use step ladder to reach high places	1	2	3	4	5
20	Swim	1	2	3	4	5
21	Ride a bicycle	1	2	3	4	5
22	Binge drink	1	2	3	4	5
23	Use a gun	1	2	3	4	5
24	Play a contact sport (e.g. rugby)	1	2	3	4	5
25	Go hunting	1	2	3	4	5
26	Ride in a home made aircraft or microlight aircraft	1	2	3	4	5
27	Ride a motorbike	1	2	3	4	5
28	Fly as a passenger in a single engine light plane	1	2	3	4	5
29	Go mountain climbing	1	2	3	4	5
30	Go tramping in the bush	1	2	3	4	5
31	Fly in a helicopter	1	2	3	4	5
32	Drive a car	1	2	3	4	5

		I would never do this ⇩		I would sometimes do this ⇩		I would often do this ⇩
33	Go skiing	1	2	3	4	5
34	Drive an uninsured car	1	2	3	4	5
35	Not pay a fine	1	2	3	4	5
36	Take something that doesn't belong to you	1	2	3	4	5
37	Drive well over the speed limit	1	2	3	4	5
38	Drive off the forecourt of the petrol station without paying for petrol	1	2	3	4	5
39	Have a physical fight	1	2	3	4	5
40	Park on a yellow line	1	2	3	4	5
41	Not put money in the parking meter	1	2	3	4	5
42	Coast downhill with your car in neutral	1	2	3	4	5
43	Have a heated argument	1	2	3	4	5

CONTROL: Listed below are ten statements. If you feel the statement is a totally inaccurate description of you, please circle the 1. If you feel that the statement is a totally accurate description of you, please circle the 7. You may circle any number in between.

		Totally Inaccurate						Totally Accurate
1	I can usually achieve what I want when I work hard for it.	1	2	3	4	5	6	7
2	Once I make plans I am almost certain to make them work.	1	2	3	4	5	6	7
3	I prefer games involving some luck over games of pure skill.	1	2	3	4	5	6	7
4	I can learn almost anything if I set my mind to it.	1	2	3	4	5	6	7
5	My major accomplishments are entirely due to my hard work and ability.	1	2	3	4	5	6	7
6	I usually do not set goals because I have a hard time following through on them.	1	2	3	4	5	6	7
7	Bad luck has sometimes prevented me from achieving things.	1	2	3	4	5	6	7
8	Almost anything is possible for me if I really want it.	1	2	3	4	5	6	7
9	Most of what will happen in my career is beyond my control.	1	2	3	4	5	6	7
10	I find it pointless to keep working on something that is too difficult for me.	1	2	3	4	5	6	7

For the following twenty statements, if you disagree with the statement then circle the 1. If you agree with the statement then circle the 7. You may circle any number in between.

		Disagree						Agree
1	Even when I'm feeling self-confident about most things, I still seem to lack the ability to control interpersonal situations.	1	2	3	4	5	6	7
2	I have no trouble making and keeping friends.	1	2	3	4	5	6	7
3	I'm not good at guiding the course of a conversation with several others.	1	2	3	4	5	6	7
4	I can usually establish a close personal relationship with someone I find sexually attractive.	1	2	3	4	5	6	7
5	When being interviewed I can usually steer the interviewer toward the topics I want to talk about and away from those I wish to avoid.	1	2	3	4	5	6	7
6	If I need help in carrying out a plan of mine, it's usually difficult to get others to help.	1	2	3	4	5	6	7
7	If there's someone I want to meet I can usually arrange it.	1	2	3	4	5	6	7
8	I often find it hard to get my point of view across to others.	1	2	3	4	5	6	7
9	In attempting to smooth over a disagreement I usually make it worse.	1	2	3	4	5	6	7
10	I find it easy to play an important part in most group situations.	1	2	3	4	5	6	7
11	By taking an active part in political and social affairs we, the people, can control world events.	1	2	3	4	5	6	7
12	The average citizen can have an influence on government decisions.	1	2	3	4	5	6	7
13	It is difficult for people to have much control over the things politicians do in office.	1	2	3	4	5	6	7
14	This world is run by the few people in power and there is not much the little guy can do about it.	1	2	3	4	5	6	7
15	With enough effort we can wipe out political corruption.	1	2	3	4	5	6	7
16	One of the major reasons we have wars is because people don't take enough interest in politics.	1	2	3	4	5	6	7
17	There is very little we, as consumers, can do to keep the cost of living from going higher.	1	2	3	4	5	6	7
18	When I look at it carefully I realize it is impossible to have any really important influence over what politicians do.	1	2	3	4	5	6	7
19	I prefer to concentrate my energy on other things rather than on solving the world's problems.	1	2	3	4	5	6	7
20	In the long run we, the voters, are responsible for bad government on a national as well as a local level.	1	2	3	4	5	6	7

BACKGROUND INFORMATION: We would like the following information so that we can check that we have a representative sample of Wellingtonians. **Please note that at no time will this information be used to identify individuals**.

1	What is your gender?	Male ❑ Female ❑
2	What ethnic or cultural group do you belong to? (For example, NZ Maori, NZ European or Pakeha, Other European, Samoan, Cook Island, Tongan, Niuean, Chinese, Indian, etc)	_____
3	How old are you?	15-24 ❑ 25-44 ❑ 45-64 ❑ 65+ ❑
4	What is your current marital status?	Single ❑ Long term relationship ❑ Married ❑ Divorced ❑ Other ❒ Specify _____
5	Do you have any dependent children?	Yes ❑ How many? _____ No ❑
6	Please tick your highest educational qualification	❑ No Formal Qualification ❑ Secondary School Qualification (e.g. School Cert, Bursary, or Equivalent) ❑ University / Polytechnic Diploma or Degree
7	Do you own your own home?	Yes ❑ No ❑
8	How long have you lived at your current address?	Less than a year ❑ Between 1 and 10 years ❑ More than 10 years ❑

Thank you for your participation in this study. Please place your responses to the questionnaire in the pre-paid envelope provided and

RETURN TO VICTORIA UNIVERSITY OF WELLINGTON BY JULY 31.

Your responses to this questionnaire are completely confidential. If you wish to receive a summary of the research findings please write your address on the separate form provided. If you wish to remain anonymous, but would still like a summary of the research findings, please post your address back to me in a separate envelope to the one provided. So that your address will remain confidential, I will store this information in a locked filing cabinet in the School of Psychology and destroy it once I have posted a summary of the findings to you.