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Good Risk or Bad Risk: Development of a Holistic Assessment of Risk Perception

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By

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ABSTRACT

The goal of the current project was to create a measurement tool that could be used to assess all aspects of risk perception with one measure. There is a wide variety of risk-perception measures currently available; however, the vast majority of these measures assess a very specific risky activity, and many only assess a person's perception of the possible negative consequences from the risk.

There are notable exceptions, such as measures that assess risk in various domains (e.g., DOSPERT scale; Weber et al., 2002) and assess perception of possible benefits (e.g., Fromme et al., 1997). There has also been research into the various dimensions or facets of risk perception, such as whether a person believes that they have more control in one activity over another (e.g., Benthin et al., 1993; Fischhoff et al.,1978; Hampson et al., 2001). Grounded in Balance Theory (Janis & Mann, 1977), the current project utilized knowledge from these previous studies to create the Holistic Assessment of Risk Perception (HARP Scale) that assesses possible negative consequences, possible positive benefits, and the various facets of risk perception across risk domains.

This project involved a series of studies that collectively used thematic analyses of interview data to identify the various facets involved in risk perception (e.g., controllability of situation, past experience) while ensuring that the identified facets were not conflated with cognitive biases or risk-taking

behaviour, and then used the identified facets to create a scale and perform a psychometric evaluation to determine the reliability and validity of the new scale. Specifically, Study 1 was performed in two parts. Study 1-A assessed the extent of possible confounds using participant scores on various measures, such as measures of cognitive bias and risk propensity. The participants from Study 1-A were then used as the sampling frame for Study 1-B, which recruited participants in order to form four groups that were relatively equal in gender and other possible confounds. Participants in these four groups were then interviewed for the purpose of identifying risk-perception facets (e.g., controllability of the situation) that were common across the four groups. In Study 2 the scale items were refined, and an unsuccessful attempt was made to use quantitative data to verify the weighting of the facets that had been identified in Study 1-B. The final scale was brought forward for psychometric evaluation in Study 3, which provided evidence in support of the convergent validity, discriminant validity, concurrent validity, and internal reliability of the new HARP Scale.

In sum, the current project has provided a relatively parsimonious measurement tool that enables research into various risk domains, acknowledges both potential consequences and benefits, assesses facets that contribute to risk perception, and does not conflate cognitive bias or risk-taking behaviour with risk perception. The resulting HARP Scale is able to assess whether people perceive an activity as a good risk, or a bad risk.

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CHAPTER 1

Good Risk or Bad Risk: Development of a Holistic Assessment of Risk Perception

Risk is ubiquitous in life. For example, Pietrasik (2020) reported an annual rate of approximately 1.35 million global deaths from road traffic crashes. Yet, a large proportion of people still choose to travel in motor vehicles daily. A person who invests their personal savings in a business venture runs the risk of losing their financial security, and yet business investments are made daily (Zaleskiewicz et al., 2020). A young person entering post-secondary education risks reducing their opportunity for immediate financial gain through active employment, yet there were over 2.1 million students enrolled in Canadian post-secondary institutions during the 2017/2018 academic year (Statistics Canada, 2020).

In addition to the possible negative consequences, risky situations offer a possibility for positive benefits. For example, motor vehicle transportation offers the possibility of getting a person to a preferred location, investing in a business venture offers the possibility of financial gain (Zaleskiewicz et al., 2020), and post-secondary education offers the possibility of securing a preferred occupation in the future (Côté et al., 2008). Therefore, each day people face multiple situations that involve an element of risk that could be perceived as a good risk or a bad risk, and the same situation may be perceived as a good risk by one individual, and a bad risk by another individual, due to the personal nature of risk perception (Fleming & Slank, 2015).

In our society, some risky activities are discouraged, such as the use of illicit drugs. At the same time, some risky activities are encouraged, such as pursuing challenging goals (Cooke et al.,2020). A holistic conceptualization of risk perception

could provide a better understanding of why some people make choices that differ from the general society's judgment of the activity as a good risk or a bad risk. This knowledge could be used to improve current interventions for bad risks, or to improve promotional efforts for good risks. However, empirical research requires the use of measurements that will elicit the appropriate information that is required to answer specific research questions. The current project involves the development of a scale that will facilitate research in the area of risk perception.

When making a decision that involves risk, a person's choice can result in life-changing benefits or life-changing consequences. Utility theory states that rational decision-makers should always choose the option that provides the maximum expected utility; wherein, the term "utility" refers to a measure of how attractive the outcome is to the decision maker (Bernoulli, 1738/1954; Fishburn, 1970; Quiggin, 1982). Utility theory was the dominant theory guiding research on risky decision making. Kahneman and Tversky (1979) proposed prospect theory as an alternative to utility theory, by suggesting that value is found in the changes in wealth or welfare, rather than final states. In other words, prospect theory suggested that risky decision making is not merely a mathematical calculation of possible gains versus possible losses; a person's current situation is an important consideration when he or she is making a risky decision.

Kahneman and Tversky (1979) found that prospect theory better accounted for risky decision making that was inconsistent with utility theory, such as the certainty effect, the reflection effect, and the isolation effect. The certainty effect refers to decision makers' propensity to underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty, which leads to risk-seeking in decisions

that involve sure losses, and risk-aversion in decisions that involve sure gains. The reflection effect is similar to the certainty effect, but refers to the tendency to seek risk or avoid risk, depending on whether the choices are framed as possible losses or gains, respectively. The isolation effect refers to a situation where the decision maker is choosing between two or more risky options. It is the tendency to ignore information that is common to all choices, and only focus on information that is different (Kahneman & Tversky, 1979).

Earlier work by Tversky and Kahneman (1974) had discussed the influence of heuristics on risky decision making. The three heuristics discussed in their report included availability, representativeness, and adjustment/anchoring. Availability is a heuristic in which people judge the probability of an event by the ease with which they bring the event to mind. For example, air travel may be judged as riskier than it actually is, because people's memories of plane crashes are easily brought to mind due to the catastrophic nature of these incidents. Representativeness is a heuristic in which people evaluate probabilities by the degree to which a specific event is prototypical of a known feature or process, while simultaneously ignoring base rate information. For example, if a scenario is provided in which Man X is described as very tall, with excellent hand-eye coordination, someone may guess that there is a high probability that Man X is a professional basketball player, ignoring the fact that professional basketball players account for a very small proportion of the population. Adjustment and anchoring is a heuristic in which people make estimates by starting from an initial value (anchor) that is adjusted to yield the final answer. The adjustment value is usually insufficient, as the

person tends to keep the adjustment fairly close to the initial value, or anchor (Tversky & Kahneman, 1974).

This past work on heuristics (Tversky & Kahneman, 1974), and prospect theory (Kahneman &Tversky, 1979) sparked a surge of research on heuristics and cognitive biases that can influence decisions involving risk. During a comprehensive review of the literature, Craig (2016) found that a large proportion (49%) of that research investigated the relationship between cognitive biases and gambling behaviours (e.g., Ariyabuddhiphongs & Phengphol, 2008; Ball, 2012). However, cognitive biases have not only been implicated in gambling, but also in many other risky activities (e.g., Bränström et al., 2006; Busenitz, 1999; Glaser & Weber, 2007). Many risk-taking behaviours can result in serious consequences, such as possible health problems from smoking behaviours, or the loss of money, belongings, and even social connections from problem gambling. For this reason, it is important that we understand the relationship between cognitive biases, risk perception, and risk behaviour. Risk perception is distinct from risk-taking behaviour or risk propensity. Risk perception is defined as an individual's subjective assessment of the level of risk associated with a particular hazard (American Psychological Association, n.d.), rather than an objective or observable behaviour.

Cognitive Biases

The influence of cognitive biases on risk-taking behaviour has been investigated in many academic disciplines and occupational sectors, including business, economics, psychology, communications, computer science, emergency preparedness, and medical/health research (e.g., Gilovich, 1983; Robinson & Marino, 2015; Salmon et al., 2003; Strecher et al., 1995). Therefore, there is a variety of terminology used to describe

similar phenomena. For example, one phenomenon (representativeness) was defined as a heuristic by Busenitz (1999) and a bias by Golin (2001). Similarly, another phenomenon (the ratio-bias effect) was referred to as a heuristic by Denes-Raj and Epstein (1994), and a bias by Pacini and Epstein (1999). The choice of terminology varies between disciplines and between authors. The term cognitive bias will be used throughout this dissertation to describe these phenomena. The following is a brief description of some cognitive biases that have been described in past literature. This is not a comprehensive list of all cognitive biases, but rather an overview of some of the biases that are relevant to the current project, as well as those biases that have commonly been studied in relation to risk-taking behaviour.

Illusory Pattern Detection

Illusory pattern detection is the general term used to describe a cognitive bias in which a person has a tendency to assume that a streak will either continue or reverse in events such as flipping a coin, scoring goals in a sports event, or playing roulette (Wilke et al., 2014). Other terms that have been used to describe similar variations of this bias include negative recency, positive recency, gambler's fallacy, hot hand, and the clustering illusion (e.g., Barron & Leider, 2010; Wilke et al., 2014). While gambler's fallacy and the hot hand effect were originally included under the umbrella term "representativeness" by Tversky and Kahneman (1974), later work (e.g., Ayton & Fischer, 2004; Barron & Leider, 2010; Clotfelter & Cook, 1993) related the gambler's fallacy and hot hand effect to negative and positive recency, which highlighted their relationship to illusory pattern detection.

Illusory pattern detection has been the cognitive bias under study in a large proportion (27%) of past studies that have investigated the relationship between cognitive bias and risk (Craig, 2016). This cognitive bias has been studied by looking at lottery play in relation to previous lottery draws (e.g., Clotfelter, & Cook, 1993; Suetens & Tyran, 2012; Terrell, 1994), and in investment decisions (e.g., Johnson et al., 2005). It has also been studied by observing participants' predictions during games of chance, such as flipping a coin and roulette (e.g., Ayton & Fischer, 2004; Ball, 2012; Huber et al., 2010).

Representativeness

Representativeness is a term that generally refers to a bias that influences a person's tendency to focus on information that is closer to a prototypical exemplar (Tversky & Kahneman, 1974). This bias can influence judgements that involve risk, such as when people assume that a small sample would yield the same statistical properties as a large sample. For example, a person may believe that a risky decision with 50% probability (e.g., flipping a coin) would produce five of each outcome during an activity with ten trials. However, an outcome of exactly 50% for each outcome would only be expected with a much larger number of trials. Other terms used to describe similar phenomena include ratio bias, denominator neglect, belief in small numbers, and belief in large numbers (e.g., Johnson & Kang, 2013; Pacini & Epstein, 1999). Craig (2016) found that these cognitive biases have been studied in approximately 10% of past studies that have investigated the relationship between cognitive bias and risk (e.g., Linnet et al., 2012; Obrecht et al., 2009).

Illusion of Control

Illusion of control is a bias that refers to a tendency some people have to overestimate their ability to control events, and more specifically, an overestimation of their ability to control the outcome of events (Langer, 1975). For example, a person may feel that they can influence the outcome of a slot machine by keeping their hand on the spin mechanism after pulling it; wherein, they believe that the weight of their hand on the mechanism will make the machine spin faster. Illusion of control has been the cognitive bias under study in a large proportion (23%) of past studies that have investigated the relationship between cognitive bias and risk (Craig, 2016). Many of these studies have used a think-aloud method to investigate this cognitive bias (e.g., Coventry & Norman, 1998; Griffiths, 1994; Ladouceur et al., 1995). During these studies, the researchers would have participants vocalize all of their thoughts while taking part in an activity wherein they had minimal control. This cognitive bias can also be measured on a self-report measure (Steenbergh et al., 2002a), which increases the breadth of methodological options that can be used in studies of illusion of control.

Illusion of control has been chosen as one of the cognitive biases under study in the current project. This choice was made based on the ability of this bias to be measured on a self-report scale, as well as the finding that controllability has been identified in past literature as an important facet of risk perception (e.g., Benthin et al., 1993a; Hampson et al., 2001a; Slovic et al., 1979).

Unrealistic Optimism

Unrealistic optimism, or optimism bias are general terms used to describe a bias in which a person believes that they are likely to receive proportionately more positive

outcomes than others (Weinstein, 1980). The relationship between unrealistic optimism and risk perception is unique as compared to other cognitive biases. Unrealistic optimism is measured as the difference between subjective risk perception and objective risk, or the odds of a negative consequence actually occurring (e.g., Bränström et al., 2006; Weinstein, 1987). Therefore, there is an inherent relationship between risk perception and the measure of unrealistic optimism, because researchers use a participant's measure of risk perception to define whether or not they have the cognitive bias. For this reason, unrealistic optimism cannot contribute to studies that investigate the relationship between cognitive biases and risk perception.

Positive Thought-Action Fusion

Positive thought-action fusion is a cognitive bias that has only recently been identified in the literature (Craig & Lafreniere, 2016). Positive thought-action fusion is a cognitive bias in which a person believes that his or her personal thoughts can influence real-life events. For example, if a person has a random thought about winning money, he or she may believe that this thought has improved their chance of winning the lottery. Rachman, (1993) first identified the concept of thought-action fusion (TAF) when working with people who experienced obsessive thoughts and displayed compulsive behaviours. These people showed signs of having an exaggerated sense of responsibility, wherein they ascribed unjustified importance to random, unwanted thoughts. Rachman's work focused on random negative thoughts, while Craig and Lafreniere's work focused on random positive thoughts. However, both of these concepts refer to a person's belief that their personal, random thoughts can influence external events in the environment.

Craig (2014) investigated the relationship of positive thought-action fusion to risk-taking behaviour and risk perception. The results supported a relationship between positive thought-action fusion and some forms of risk-taking behaviour, but there were no significant relations between this cognitive bias and risk perception. A limitation of this study was that risk perception was measured based only on how risky the participants believed the activities to be, using a five-point rating scale that ranged from "not at all risky" to "extremely risky"; however, past research (e.g., Sargeant et al., 2010; Slovic et al., 1979; Weinstein, 1982) has shown that personal and contextual factors are also involved in risk perception.

Relationships with Risk Perception

During a comprehensive review of the literature, Craig (2016) found very little consensus regarding the interrelationships between cognitive biases, risk perception, and risk-taking behaviours. The review included 191 studies that had investigated a relationship between cognitive biases and either risk behaviour or risk perception. After removing studies that only used risk perception in order to help define a cognitive bias (e.g., unrealistic optimism), Craig found that 77 of the remaining studies examined the relationship between cognitive bias and risk-taking behaviours, while 14 studies examined the relationship between cognitive bias and risk perceptions. Only five of the studies examined the relationship between all three variables (cognitive bias, risky behaviour, and risk perception); however, none of the five studies attempted to model the directionality of all possible interrelationships between these variables. One possible barrier to successful modelling of these relationships may be the need for a quantitative

measure of risk perception that is sensitive to the personal and contextual factors that can influence risk perception.

Fischhoff, and colleagues (1978) performed a study to investigate attitudes towards technological risks. During this study, the authors had participants evaluate 30 activities or technologies (e.g., food colouring, commercial aviation, nuclear power) in relation to the perceived benefit to society, the perceived risk, and the acceptability of its current level of risk. In addition, Fischhoff and his colleagues had participants evaluate the technologies on each of nine dimensions that had a predicted influence on risk perception. The nine dimensions were used to describe participants' attitudes towards the various technological risks. For example, food colouring was perceived to have effects that were not known to be fatal, but at the same time, it was rated as involuntary and uncontrollable, with delayed effects that were not well known to science or the people being exposed.

The study by Fischhoff and his colleagues (1978) was intended to provide policy makers with information about how people perceive the risks that accompany technological enterprises in society. In the process, the authors discovered that the nine risk dimensions that they studied proved to be effective predictors of the trade-offs participants made to choose between acceptable risk and perceived benefit. These risk dimensions, otherwise known as facets of risk perception, have been used in the creation of scales used to measure risk perception or risk attitude (e.g., Benthin, et al., 1993b; Hampson et al., 2001b). The current project posits that the influence of these risk dimensions on participants' risky decision making may share theoretical similarities with decisional balance theory.

Decisional Balance Theory

Decisional balance is a theory of behavioural change (Janis & Mann, 1977). In this theory, a person is only motivated to change their behaviour if the negative consequences from the current behaviour outweigh the benefits gained from that behaviour, and the benefits of a new behaviour outweigh the negative consequences of that behaviour. For example, if a person was considering decreasing their alcohol consumption, they would be motivated to change if their current alcohol consumption levels carried more negative consequences than benefits, and a reduction in their consumption would carry more benefits than consequences. Decisional balance measures have been used in interventions (e.g., Carey et al., 2006; Collins et al., 2009) wherein participants are asked to fill out an open-ended response measure with four fields (pros of current behaviour; cons of current behaviour; pros of new behaviour; cons of new behaviour), with the intended purpose of making the conflict between behaviours and goals more salient for individuals. In this way, these measures are used as a method for representing the benefits and negative consequences of different choices, with the hope that participants will acknowledge the problems associated with the behaviour, and become motivated to change their behaviour.

Prochaska and several of his colleagues (1994) performed research that supported the understanding that decisional balance can also be used as an indicator for participants' readiness to initiate a specific stage of change. Stages of change are defined in the Transtheoretical model as stages that individuals move through during behaviour change (Prochaska & DiClemente, 1982). The stages were first identified as contemplation, determination, action, maintenance and relapse (Prochaska &

DiClemente, 1982); however, at the time of the study by Prochaska and his colleagues (1994), the stages were identified as precontemplation, contemplation, preparation, action, and maintenance. When Prochaska and his colleagues applied Decisional Balance Theory to the Transtheoretical Model, they investigated the stages of change as a function of changes in decisional balance. The authors found a clear pattern of changes in decisional balance across participants' stages of change. Therefore, Decisional Balance Theory explains how individuals weigh the pros and cons of behaviours, and this can motivate a change in their current behaviour (Prochaska et al., 1994).

Decisional Balance for Risk Perception

Every day, the vast majority of people engage in risky behaviours. For example, over 3 million global deaths each year are attributable to harmful use of alcohol (World Health Organization, 2018); yet, alcohol consumption is still a common activity in most societies. The propensity for people to engage in risky activities is not necessarily a bad thing. Many risks are beneficial to both the person taking the risk and to society as a whole. For example, there is an innate risk to any individual who participates in human drug trials; however, the drug being tested may provide the individual with substantial health benefits, and the information gained from the drug trials may benefit the health of others in society. In fact, risk taking is encouraged and nurtured in some situations such as youth education, as it has been linked to creativity and self-esteem (e.g., Cooke et al.,2020; Neihart, 1999; Young, 1991).

The choice to label an activity or behaviour as a good risk or a bad risk is a personal decision that can vary greatly between individuals. The concept of risk inherently has two components: possible benefits and possible consequences. Whether or

not an individual chooses to engage in the risky activity is a decision that is largely based on personal and situational factors (e.g., Sargeant et al., 2010; Slovic et al, 1979; Weinstein, 1982), which may be conceived as facets of risk perception. A measure of risk perception that incorporated these risk-perception facets would provide a more holistic assessment of risk perception. Similar to the influence of decisional balance on behaviour change, the current project posits that these facets of risk are weighed by individuals when they are deciding whether a risk is a good risk or a bad risk, which may contribute to their decision to engage in the risky behaviour.

A limitation of the study by Fischhoff and his colleagues (1978) is that the study investigated nine possible facets of risk perception that had been derived from past literature (e.g., Otway, 1975). However, the authors did not empirically explore the possibility that there may be more risk dimensions than those that were under study. During a pilot study for the current project (Appendix A), participants were provided an opportunity to write open-ended responses to questions of risk perception. Several themes emerged from the data that could be considered facets of risk perception, such as enjoying thrill-seeking activities and a fear of sanctions. Nonetheless, there were several limitations to the pilot study, including using an online survey for the collection of exploratory qualitative data, the order of survey presentation, and limited space for participants' open-ended responses.

Using an online method of data collection to gather qualitative information proved to be a limitation for the pilot study. The qualitative data being sought were exploratory in nature. This information would have benefitted from face-to-face interaction between the researcher and each participant to facilitate the use of prompts

and follow-up questions, in order to elicit the information required for an exploratory research project. There were also order effects observed in the results from the pilot study; wherein, the cognitive bias that was measured early in the study (positive thought-action fusion) appeared to bias some of the participants' responses to the open-ended questions about risk perception. Specifically, some of the participants expressed their beliefs about whether or not they had a cognitive bias, rather than reporting their perception of the risk under study. Another limitation of the pilot study was the limited space that had been provided to participants for their open-ended responses regarding risk perception. Past research (e.g., Sargeant et al., 2010; Slovic et al., 1979; Weinstein, 1982) has provided evidence to support the concept of risk perception as a multifaceted construct. Participants would require a larger space (or a long period of time) to be able to fully explore the many facets of their risk perception.

To address the limitations of the pilot study, it was decided that collection of exploratory data on risk perception would benefit from the use of hour-long, face-to-face interviews. These interviews should be administered solely on the topic of risk perception, and independent from any other measures to yield a richer data set that could be used to explore the factors that may contribute to risk perception.

Existing Measures of Risk Perception / Attitude

Existing measures often use the term "risk perception" to refer to a participant's perception of the possible negative consequences that can result from a given activity. However, some of the measures described below acknowledge that people perceive more than just the possibility of negative consequences. Some of these scales (e.g., DOSPERT Scale; CARE Scale) include the perception of possible benefits as well as the perceived

consequences. Other scales (e.g., Benthin Risk Perception Measure; Hampson Risk Perception Scales) look at a variety of facets that are involved in risk perception. However, none of the existing scales contain all of the necessary features to provide a holistic view of risk perception, in a scale that can be used with a variety of research designs.

Domain-Specific Risk-Taking (DOSPERT) Scale

Created by Weber, Blais and Betz (2002), this 40-item scale assesses a variety of risk-taking activities in six domains: ethical, investment, gambling, health/safety, recreational, and social. Three different participant instructions are included in the scale, which allows the DOSPERT scale to assess risk perception, expected benefits, and expected engagement in each of the risk-taking activities. While developed mainly to be used to assess negative risk perception, risk attitude can also be assessed by regressing the risk perception scores and expected benefit scores on the expected engagement scores.

Each of the three scales (risk perception, expected benefits, and expected engagement) contain the same 40 items, which describe various risky activities, such as "betting a day's income at the horse races," or "engaging in unprotected sex." The only differences between the three scales are in the instructions and the response choices. To measure risk perception, Weber, and her colleagues provided the following instructions to participants:

> People often see some risk in situations that contain uncertainty about what the outcome or consequences will be and for which there is the possibility of 'bad' consequences. However, riskiness is a very personal and intuitive notion, and we

are interested in your gut level assessment of how risky each situation is. For each

of the following statements, please indicate how risky you perceive each situation.

(p. 289).

Item response scales for this risk perception scale range from "not at all risky" to

"extremely risky" on a five-point scale. As can be seen from the instructions, this risk

perception scale measures the participants' perceptions of the possible negative

consequences that may come from the risky activity.

Weber and her colleagues (2002) used a separate scale, expected benefits, to

assess the participants' perceptions of the possible benefits that may come from the risky

activity. To measure expected benefits, the instructions are provided to participants are

"For each of the following statements, please indicate the benefits you would obtain from

each situation." Item response scales for this expected benefits scale range from "no

benefits at all" to "great benefits" on a five-point scale.

The expected engagement scale provides participants with the instructions "For

each of the following statements, please indicate your likelihood of engaging in each

activity or behavior." Item response scales for this expected engagement scale range from

"very unlikely to "very likely" on a five-point scale (Weber et al., 2002).

The advantages of the DOSPERT Scale are twofold. The scale's primary benefit

is that it divides risk into various domains (e.g., gambling, social), as past research (e.g.,

Schoemaker, 1990) has shown that people do not perceive all risky situations equally.

Secondly, it acknowledges that people perceive the possible benefits associated with

risky activities in addition to the possible negative consequences; thereby allowing

researchers to measure risk attitude. However, this scale also has some disadvantages.

Firstly, the measure has 40 items for each of the risk perception, expected benefits, and expected engagement scales. All three scales must be given to participants in order to determine the participant's risk attitude. This process may produce fatigue in the participant due to the total number of items ($n = 120$), and the repetition of the same 40 items with three different instructions. Another disadvantage is that the DOSPERT Scale does not assess the meaning of participants' assessments of possible consequences versus possible benefits. For example, do the participants believe certain risky activities to be more controllable than others? A third disadvantage is that calculation of a risk attitude score involves the participants' expectation of engaging in the risk-taking behaviours. Therefore, risk attitude is not synonymous with risk perception.

Cognitive Appraisal of Risky Events Scale

Created by Fromme, Katz, and Rivet (1997), the Cognitive Appraisal of Risky Events Scale (CARE) is a 30-item measure that assesses both perceived risk and expected involvement in risky behaviours. Fromme and her colleagues were able to demonstrate construct, content, and criterion validity following development of the scale. Participants record their responses on a seven-point scale that ranges from "not at all likely" to "extremely likely." Fromme and her colleagues included an expected risk subscale and an expected benefits subscale, acknowledging the fact that a risky activity is something that could result in either a positive or negative consequence. However, the authors did not attempt to provide a scoring procedure that would combine the perceived consequences and perceived benefits scores. In addition to the Expected Risk Subscale and the Expected Benefit Subscale, Fromme and her colleagues included an Expected Involvement Subscale to measure risk-taking behaviour. The authors found that

participants' scores on the expected benefits subscale were positively and reliably associated with their involvement in risky activities. Each of these three scales is subdivided into risk domains (illicit drug use; aggressive and illegal behaviours; risky sexual activities; heavy drinking; high risk sports; academic/work behaviours), resulting in six Expected Risk subscales, six Expected Benefit subscales, and six Expected Involvement subscales.

The advantages and disadvantages of the CARE Scale are similar to those of the DOSPERT Scale, with three main differences. The first difference is that the CARE Scale uses the same response scales ("not at all likely" to "extremely likely") for all three subscales; whereas, the DOSPERT Scale uses different response scales for each of the subscales. The second difference is that the CARE Scale contains 30 items in each of the three subscales, for a total of 90 items requiring a response. This is compared to 40 items on each subscale, or 120 total items, for the DOSPERT Scale. The third, and most noteworthy difference is that Fromme and her colleagues conceptualized expected consequences and expected benefits as separate constructs, rather than envisioning their combined role in risk perception.

TRIRISK Scale

Ferrer, Klein, Persoskie, Avishai-Yitshak, and Sheeran (2016) developed the Tripartite Model of Risk Perception (TRIRISK) based on a scale that they developed to measure people's risk perception of disease. The TRIRISK Scale contains a total of 18 items, with six items in each of the three subscales to measure risk perception: Deliberative, Affective, and Experiential. The Deliberative Subscale contained items such as, "When I think carefully about my lifestyle, it does seem possible that I could get

[disease]," and "On a scale from 0 to 100 %, how would you rate the probability that you will develop cancer in the future?" (p. 657). The Affective Subscale contained items such as, "How fearful are you about developing [disease] in the future?", and "When you think about [disease] for a moment, to what extent do you feel anxious?" (p. 657). The Experiential Subscale included items such as, "I feel very vulnerable to [disease]," and "How easy is it for you to imagine yourself developing [disease] in the future?" (p. 657).

The TRIRISK Scale (Ferrer et al., 2016) provides a richer assessment of how people perceive their risk of getting a disease. Some of the items appear to assess the same facets of risk perception that were identified in the research by Fischhoff and his colleagues (1978). For example, Ferrer and her colleagues included the item "The way I look after my health means that my odds of getting [disease] in the future are: _____," which appears to assess the risk-perception facet of "controllability" that had been identified by Fischoff and his colleagues. However, there are a limited number of risk-perception facets assessed by the TRIRISK Scale. In addition, the TRIRISK Scale is very specific to the perceived risk of getting a disease, such as cancer. This restricts its use for research that involves other forms of risk.

Benthin Risk Perception Measure

This scale was developed by Benthin, Slovic, and Severson (1993b) to assess various factors involved in risk perception, such as controllability of the risk, possible benefits, and peers' participation in the risky activity. The scale was designed specifically for use with adolescents. When using this measure, researchers ask participants to rate fourteen distinct features of risk perception for each of a variety of risky behaviours. In the study by Benthin and her colleagues (1993a), participants used a 7-point rating scale

to rate 30 risky activities (e.g., smoking marijuana, taking diet pills, riding motorcycles) on fourteen dimensions, such as "to what extent are you influenced by your friends to do this activity," and "to what extent are the potential risks (dangers) associated with this activity frightening for people your age," (p. 158). In total, participants in the study were asked to make 420 ratings for the measures of risk perception.

Benthin and her colleagues (1993a) performed a factor analysis of the fourteen risk dimensions, resulting in two factors that the authors labelled "risk" and "admiration". They later plotted the 30 risk-taking activities into one of four quadrants (High Risk – High Admiration; High Risk – Low Admiration; Low Risk – High Admiration; Low Risk – Low Admiration), based on the mean participant ratings. Therefore, this scale was designed to provide an assessment of which activities were considered risky and/or admirable by adolescents.

While this scale has the potential to provide researchers with a fairly thorough assessment of participants' perceptions about risky activities, its size makes it difficult to use in studies that employ additional scales meant to assess risk perception in relation to other variables. In addition, this scale does not provide a score for risk perception; instead, this scale is intended to classify which activities are perceived as riskier than others.

Another potential weakness of this scale is that the 14 dimensions were not defined empirically, but rather chosen because of their suspected relevance to adolescent behaviour. Benthin and her colleagues (1993a) noted that some of the 14 dimensions came from past research by Slovic and colleagues (1979). The report by Slovic and his colleagues indicated that they hypothesized their nine dimensions may be relevant to risk-

taking behaviour. The authors were able to support the relationship between those nine dimensions and risk perception, but they did not provide empirical evidence to support the nine dimensions as being sufficient. Benthin and her colleagues chose to include 14 items in their scale, which suggests that they did not believe that the nine items utilized by Slovic et al. sufficiently represented all of the dimensions that can influence risk perception. However, similar to the original research (Slovic et al., 1979), Benthin and her colleagues used a theory-driven approach to produce the 14 dimensions used in the Benthin Risk Perception Measure. Therefore, it is possible that the scale may be missing some dimensions that are relevant to risk perception. This can be investigated using qualitative analyses and a data-driven method to investigate the full scope of dimensions.

Other Risk Perception Measures

Many of the other risk perception measures that have been found in the literature are specific to one type of risk, such as the Aviation Risk Perception Scale (Hunter, 2002, 2012), the Nuclear Risk Perception and Risk Attributes Measure (Prati & Zani, 2012), and the Risk Perception Scale for the Consumption of Raw Vegetable Salad in Full-Service Restaurants (Danelon & Salay, 2012).

There are also risk-perception scales that are very similar to the measures described previously. For example, the Risk Perception Scales created by Hampson and colleagues (2001b) are very similar to the Benthin Risk Perception Measure (Benthin et al., 1993b), and they involve similar limitations for their use. The main difference between the two measures is that the scales created by Hampson and her colleagues were designed to specifically measure facets of risk perception related to adolescent alcohol use. The Hampson Risk Perception Scales utilize 11 scales that each look at one facet of

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risk perception, such as "If someone your age did this activity, to what extent could he or she control the risks associated with it?" Hampson and her colleagues also included a twelfth scale to measure the participants' self-reported frequency of involvement over the past six months.

The Current Project

In order to assess the interrelationships between cognitive bias, risk perception, and risk behaviour, an appropriate risk perception scale is needed. The current project focused on developing a measure of risk perception that provides a holistic measure of risk perception, by including various facets of risk perception.

It is important that this scale is not confounded with cognitive bias, as its intended use is to measure the relationships between biases, risk perception, and risk behaviour. Consequently, care was taken to identify only those facets of risk perception that are common among participants who are high in cognitive bias and those low in cognitive bias. Additionally, the scale needs to be sensitive to individual differences in risk-seeking and risk-avoidance behaviours. Therefore, the identification of risk-perception facets utilized participants who reported high levels of risk-taking behaviour and those that reported low levels of risk-taking behaviour. It is also important that this scale is reasonable in size, in order to facilitate its ease of use in future research (Francis & Jackson, 2004). There are three main studies included in this dissertation, which aimed to use both qualitative and quantitative data to produce a reliable, valid, parsimonious scale that is capable of being used with a wide range of methodologies.

CHAPTER 2

Study 1

Facilitated in two parts, Study 1 identified differences in how participants

perceive risk. Rather than investigating whether participants perceive more or less risk in

a given situation, this study was meant to identify differences in the meaning that

participants assign to various risks in order to identify facets of risk perception. For

example, are some risks perceived as more controllable than other risks, making them

seem less risky? Do negative previous experiences with a risky activity mean that the

activity is perceived as being riskier from the participant's perspective?

Study 1 focused on identifying the facets of risk that collectively result in a

person's overall risk perception. The research questions that guided Study 1 were:

(1) Are there qualitative differences in risk perception between participants who

are high in cognitive bias and those who are low in cognitive bias?

(2) Are there qualitative differences in risk perception between participants who

frequently engage in risk-taking behaviour and those who do not?

(3) Are there some facets of risk perception that are common to most participants,

regardless of cognitive bias or engagement in risky behaviours?

Methods: Study 1-A

Part A of Study 1 focused on the identification of possible confounds of risk

perception, including people who score high and low in cognitive bias, as well as those

who score high or low in risk-taking behaviours. Positive thought-action fusion and

illusion of control were the two cognitive biases chosen for this study. These two

cognitive biases were chosen for both logistical reasons (measures can be used for online studies) and their plausible relationships with risk perception.

Participants

Participants were recruited through the psychology participant pool at the University of Windsor. Students recruited through the participant pool received 0.5 bonus points for up to 30 minutes of participation. The original target sample of 300 participants resulted in a much lower proportion of males willing to be contacted for Study 1-B (27.6% of males), than females willing to be contacted for Study 1-B (57.6% of females). Therefore, the sample size was increased by recruiting additional male participants ($n = $ 100). Following removal of incomplete data, the final sample ($n = 384$) was fairly diverse in both age ($M = 20.76$; range = 17yrs. to 44yrs.) and ethnicity (White/European/ Caucasian = 70.3%, Middle Eastern = 10.2%, South Asian/Indian/Pakistani = 5.2%, East Asian/Chinese/Japanese = 4.4%, Black/African/Caribbean = 4.2%, Biracial/Multiracial = 3.1%, Latin/South American = 1.3%, Indigenous/First Nations/Metis = 0.5%, Other = 0.8%). There was also a fair representation of both females ($n = 241$) and males ($n = $ 138). In addition, there were responses from participants who identified as transgender ($n = 2$), nonbinary ($n = 2$), and gender fluid ($n = 1$).

Measures

The measures in this study were used to gather information regarding participants' demographic information, risk-taking behaviour and cognitive biases.

Demographic Questionnaire

This measure was used to collect information about the participants' gender, age, ethnicity, and year of study. Additionally, this questionnaire assessed if the participants

had any extraneous factors that might have influenced their risk-taking behaviours (e.g., religious beliefs that prohibit gambling). It also included a question asking participants if they were willing to be contacted for a follow-up interview (please see Appendix B).

Domain-Specific Risk-Taking (DOSPERT) Scale

This scale was created by Weber and colleagues (2002) to measure a variety of risk-taking activities in six domains: ethical, investment, gambling, health/safety, recreational, and social. The DOSPERT scale was created with three subscales. While the authors used all three subscales together in order to assess risk attitude, each of the three parts can also be used independently to assess risk behaviour, risk perception, and expected benefits (e.g., Blais & Weber, 2006; Harrison et al., 2005). The current study only used the Likelihood of Engaging in Risk subscale to assess risk behaviour. The DOSPERT Scale contains a total of 40 items, and participants are asked to rate them on a five-point scale that ranges from "very unlikely" to "very likely." Please see Appendix C. During the pilot study for this project, internal reliability for the DOSPERT Likelihood of Engaging in Risk subscales ranged from questionable (Health & Safety, $\alpha = .67$) and acceptable (Social, $\alpha = .70$; Ethical, $\alpha = .76$; Gambling, $\alpha = .79$) to good (Investment, $\alpha = .82$; Recreational, $\alpha = .83$).

Gamblers' Beliefs Questionnaire (GBQ)

The GBQ (Steenbergh et al., 2002b) assesses the gambling-related cognitive biases of illusion of control and overestimation of the likelihood of winning. It is a 21-item self-report measure that uses a Likert-type format for a 7-point scale ranging from "(1) strongly disagree" through "(4) neutral" to "(7) strongly agree." The current study used only the eight items that assess illusion of control as a cognitive bias. Steenbergh

and colleagues (2002a) found good internal reliability for the Illusion of Control subscale (α = .84). Please see Appendix D.

Positive Thought-Action Fusion Scale (P -TAF)

Developed by Craig and Lafreniere (2016), this 26-item scale measures the positive dimension of the thought-action fusion phenomenon on a seven-point scale that ranges from "(1) strongly disagree" to "(7) strongly agree." Please see Appendix E. An exploratory analysis (Craig & Lafreniere, 2016) provided evidence for a five-subscale structure that included Others (α = .91), Self (α = .84), Financial Gain (α = .86), Moral (α = .75), and Ethical / Global Concern (α = .76). This subscale structure was confirmed with a confirmatory factor analysis during the pilot study for this project. In addition, the pilot study was able to provide additional evidence of a relationship between P-TAF and risk. Please see Appendix A for further information regarding the pilot study.

Procedures

The results from the pilot study indicated that the P-TAF Scale might have influenced some of the participants' responses to questions about risk-taking behaviours. For example, when asked for views about buying scratch tickets, one participant wrote, "I don't think that thinking positively about winning is going to increase your chances of winning because it's something outside of your control." For this reason, the measures of cognitive bias were presented to participants after they had completed the other measures in this study.

The study took place online, using the Qualtrics online survey platform. The order of presentation to the participants was the consent form, followed by the demographic questionnaire, the Domain-Specific Risk-Taking Scale – Likelihood of Engaging in Risk

subscale, the Gambler's Beliefs Questionnaire, and the Positive Thought-Action Fusion

Scale. These measures were followed by a letter of explanation, which described the

study in greater detail than provided in the consent form.

Results: Study 1-A

The original data file ($n = 400$) was examined for data that was not missing at

random ($n = 16$). These data were further examined to ensure that there were no patterns

in the missing data that could be an indication of measurement error. All of these cases (n

$= 16$) were removed from the data file, as the examination revealed that they were

incomplete data, with no more than one portion of the survey (demographics) completed.

The remaining cases ($n = 384$) were used in data analyses.

The data were further investigated for any significant differences between

participants who agreed to be contacted for a follow-up interview ($n = 183$), and those

who did not agree to be contacted ($n = 201$). None of the participants that identified as

non-cisgendered ($n = 5$) indicated that they were willing to take part in Study 1-B. There

were no significant differences found in positive thought-action fusion or risk-taking

behaviour between the participants willing to be interviewed and those not willing to be

interviewed. A significant difference was found in scores on the Illusion of Control

Subscale (GBQ Scale; Steenbergh et al., 2002b), with participants who were not willing

to be contacted ($M = 24.10$, $SD = 9.45$) scoring higher in illusion of control than those

who were willing to be contacted for a follow-up interview ($M = 21.34$, $SD = 9.06$),

$t(382) = -2.49$, $p = .013$. However, this difference was nonsignificant when both male,

$t(136) = -0.22$, $p = .830$, and female, $t(239) = -1.49$, $p = .138$, participants were analysed

separately.

Cronbach's alpha was used to assess the reliability of all scales. The results provided evidence of good reliability ($\alpha = .84$) of the DOSPERT Scale (Weber et al., 2002) despite some lower reliability scores for some subscales. In assessing the reliability of cognitive bias measures, the Illusion of Control subscale from the Gambling Beliefs Questionnaire (Steenbergh et al., 2002b) was found to have good reliability ($\alpha = .84$), and the Positive Thought-Action Fusion Scale (Craig & Lafreniere, 2016) was found to have excellent reliability ($\alpha = .94$), with acceptable ($\alpha \geq .76$) subscale reliability values. Please see Table 1 for details from all reliability analyses for Study 1-A.

Table 1 *Scale and Subscale Reliabilities (Cronbach's alpha) for all measures* ($N = 384$)

Scale	Number of Scale Items	Mean	SD	Alpha
DOSPERT	40	2.42	0.41	.84
Social	8	3.38	0.58	.61
Recreational	8	2.56	0.80	.78
Gambling	4	1.29	0.51	.72
Health & Safety	8	2.53	0.64	.63
Ethical	8	1.72	0.56	.73
Investments	4	2.48	0.93	.82
GBQ; IoC subscale	8	22.97	9.33	.84
P-TAF Scale	26	64.48	23.95	.94
Other	9	21.37	9.84	.90
Self	6	19.87	7.51	.80
Financial Gain	4	8.19	4.22	.80
Moral	3	7.15	3.13	.76
Global/Ethical Concern	4	7.90	3.96	.77

Frequency distributions were used to identify participants who scored in the highest or lowest quartiles on measures of risk propensity and cognitive bias. Outliers were not removed from the data, as their data had been identified as particularly useful due to the purpose of Study 1-A, which was to identify participants who score extremely high or low on specific scales. Participants were chosen for the dimension of risk-taking behaviour with priority given to those participants who scored in the highest or lowest quartiles of the total DOSPERT Likelihood of Engaging in Risk subscale, with secondary priority given to those who scored in the highest or lowest quartiles of only select domains (ethical, investment, gambling, recreational). The DOSPERT domains of social risks and health risks were not considered for participant selection, due to the low internal reliability of these subscale domains. Similar procedures were used to identify participants who scored in the highest and lowest quartiles of cognitive bias, using the GBQ Illusion of Control Subscale and the P-TAF Scale with its associated subscales.

Methods: Study 1-B

Part B of Study 1 used qualitative methods to explore participants' perceptions of risk. Of particular interest were any facets of risk perception that are common among participants, regardless of whether they had scored high or low in cognitive bias and risk-taking behaviour during Study 1-A. In addition to facet identification, Study 1-B was used to help determine the relative importance of the various facets of risk in the participants' overall risk perception.

Participants

Participants whose responses from Study 1-A indicated a willingness to be contacted, and who had been identified as scoring high or low in risk-taking activities and

cognitive bias were contacted to schedule a follow-up interview for Study 1-B. Selection

of participants was based on gender and the participants' scores from Study 1-A with an

attempt to form four groups, with 10 participants (5 females; 5 males) in each group: (1)

high cognitive bias – high risk; (2) high cognitive bias – low risk; (3) low cognitive bias –

high risk; (4) low cognitive bias – low risk. Gender was balanced in each of these groups,

as past research has found gender differences in risk-taking behaviour and risk perception

(e.g., Byrnes et al., 1999; Harris et al., 2006). In addition, an attempt was made to balance

any participants who indicated extraneous factors (e.g., religious beliefs) across the four

groups. The intended purpose of this balancing was to prevent one group from being

confounded by an extraneous variable. For example, if all ten participants in the low risk-

taking group had identified as being devout followers of the Islamic religion, their

religious beliefs may have been their only reason for scoring low on the measure of

expected involvement in risky activities (e.g., gambling), which would result in a biased

representation of risk-avoidant participants for Study 1-B.

The final sample for this study ($N = 36$) consisted of four groups: High cognitive

bias – High risk (female $n = 5$; male $n = 4$); High cognitive bias – Low risk (female $n = 5$;

male $n = 3$); Low cognitive bias – High risk (female $n = 5$; male $n = 5$); Low cognitive

bias – Low risk (female $n = 5$; male $n = 4$), with one participant in each of the four groups

indicating that their religious beliefs prevented them from participating in gambling

activities.

The interview sample was sufficiently diverse in regard to both age ($M = 21.56$,

$SD = 4.40$, minimum = 18, maximum = 43), and ethnicity (White/European/Caucasian =

61.1%, Black/African/Caribbean = 11.1%, Middle Eastern = 8.3%, Biracial/Multiracial =

5.6%, South Asian/Indian/Pakistani = 5.6%, East Asian/Chinese/Japanese = 2.8%,

Latin/South American = 2.8%, Other = 2.8%). The participants were compensated with

$15.00 for up to one hour of participation in the interviews.

Materials

An unstructured interview guide was used for this study. The interviews included

items for participants, such as "Can you please describe how you feel about the prospect

of going skydiving?" A sample of some possible interview questions is provided in

Appendix F, with many of the follow-up items (probes) derived from a review of past

literature regarding risk perception and behaviour (e.g., Sargeant et al., 2010; Slovic et

al., 1979; Weinstein, 1982). Because the interviews were exploratory in nature, they

maintained a flexible administration that allowed the participants to fully express their

perceptions of risk.

Procedure

The interviews took place one-on-one in a quiet room on the University of

Windsor campus. The participants received a consent form (including consent for audio

recording), and were provided an opportunity to discuss the contents of the form with the

experimenter. After the participant consented to participate in the study, the experimenter

began the recording device prior to the interview. Following the interview, the participant

was thanked for their participation, and was provided with the compensation ($15.00).

Interviews were transcribed by a research assistant prior to analysis.

Results: Study 1-B

Preliminary Analyses

As stated previously, the original recruitment ($N = 300$) for Study 1-A had resulted in a much lower proportion of males ($n = 27.6\%$) than females ($n = 57.6\%$) willing to be contacted for follow-up interviews, which necessitated the recruitment of an additional 100 males for Study 1-A to provide a sufficient sampling frame for the current study (interviews). Due to the difficulty in recruitment, preliminary analyses were conducted to determine if the final interview sample was significantly different from the general population. The analyses involved comparisons between participants' scores from Study 1-A and normative data taken from psychometric evaluations of the relevant scales.

The authors of the DOSPERT (Weber et al., 2002) scale provided separate means and standard deviations for males and females. There were no significant differences in risk-taking scores between the DOSPERT normative data ($N = 244$, $M = 2.73$, $SD = 0.53$) and the current study's interview sample ($N = 16$, $M = 2.64$, $SD = 0.39$) for males, $t(258) = 0.67$, $p = 0.505$. There were also no significant differences in risk-taking scores between the DOSPERT normative data ($N = 301$, $M = 2.49$, $SD = 0.49$) and the current study's interview sample ($N = 20$, $M = 2.44$, $SD = 0.48$) for females, $t(319) = 0.44$, $p = 0.658$.

Both the P-TAF scale and GBQ scale combined genders when reporting their normative data. There were no significant differences in positive thought-action fusion scores between the normative data ($N = 262$, $M = 68.50$, $SD = 25.84$) and the current study's interview sample ($N = 36$, $M = 66.25$, $SD = 28.24$), $t(296) = 0.48$, $p = 0.629$.

Similarly, there were no significant differences found in Gamblers' Beliefs Questionnaire, Illusion of Control subscale scores between the normative data ($N = 403$, $M = 24.38$, $SD = 9.95$) and the current study's interview sample ($N = 36$, $M = 22.03$, $SD = 10.43$), $t(437) = 1.35$, $p = 0.177$.

Identification of Risk-Perception Facets

Interview transcripts were analysed using NVivo software in order to identify emergent themes. Many of the themes that emerged from the data corresponded to themes from past literature. For example, most participants discussed controllability as an important facet of their perception of risk involved in a situation. However, there were differences in what aspects of controllability were identified as being important, such as having control of whether positive or negative outcomes result from the activity versus having control of consequence severity. For this reason, there were also several subthemes that emerged from the data.

Analyses initially identified 24 main themes and an additional 26 subthemes (Table 2). Saturation was reached at 7 transcripts, with no new themes emerging after that point. A subsample of two participants from each group ($N = 8$) was chosen at random for reliability analyses. Transcripts from the subsample were analyzed by a second coder, after which analyses showed an inter-rater reliability rate of 85.5% (Cohen's Kappa = .69), reflective of substantial agreement (Landis & Koch, 1977). Inter-rater disagreement did not appear systematic for specific themes, suggesting random coding error.

Table 2: *Themes (Subthemes) Initially Identified in Study 1B*

Theme   (Subtheme)

1. Admiration of Activity
2. Interest
3. Sensory Appeal
4. Benefit Type
    a. (Adrenaline rush / Excitement)
    b. (Monetary Gain)
    c. (Social Benefit)
5. Proportion of Benefits versus Consequences
    a. (Severity of Consequences)
    b. (Significance of Benefit)
    c. (Benefits extend to Others)
6. Consequence Type
    a. (Addiction or Frequency of Risk Taking)
    b. (Disappoint Significant Others)
    c. (Loss of social ties)
    d. (Monetary Loss)
    e. (Physical harm or Injury)
    f. (Sanctions)
7. Control of Situation
    a. (Control of consequence severity)
    b. (Barriers to control)
    c. (Predictability)
    d. (Skills or Abilities)
8. Ease of Participation
    a. (Time or Effort)
    b. (Vulnerable or Unsafe Conditions)
9. Ethical considerations
    a. (Guilty Conscience)
    b. (Moral Values)
10. Habit or Internalized behaviour
11. Immediacy of Effect
12. Knowledge about activity
    a. (Gain experience or Info)
13. Luck or Optimism
14. Necessity
    a. (Avoidable)
15. Participation by Others
16. Past experience
17. Probability
18. Relative to Current Position
    a. (Nothing to Lose)
    b. (Too much to lose)
19. Apathy
20. Religion
21. Reputation or Role Model
22. Social Influence or Support
23. Unexplainable fear / phobia
24. Who is harmed
    a. (Risk to Others)
    b. (Risk to Self)

Themes were compared within and between each of the four groups (Group 1: high cognitive bias – high risk; Group 2: high cognitive bias – low risk; Group 3: low cognitive bias – high risk; Group 4: low cognitive bias – low risk). The themes of particular interest were those that emerged at fairly consistent rates across all four groups; however, themes that emerged at slightly different rates between high risk and low risk groups were also considered, because small differences in participants' risk behaviour is not thought to be a confound for the study of risk perception.

There were several qualitative differences noted between participants who scored high on the risk behaviour scale and those who scored low on the same scale from Study 1A. For example, when discussing the activity of driving in an automobile a low-risk participant made the statement, "I'm like, *You don't understand. I can't handle this. I will start crying if I can't get this seat belt on my body right now!*", while a high-risk participant made the statement, "I am a better driver now, I don't think about my safety. I don't think about *I need to put my seatbelt on*."

There were also several qualitative differences noted between participants who scored high on the cognitive bias scales and those who scored low on the same scales from Study 1A. For example, when discussing skydiving, a participant who scored high on illusion of control made the statement, "The risks aren't overly bad, because I did the tandem jump. I don't have a license or anything. There's not too many fatalities or injuries so I went for it", while a participant who scored low on illusion of control made the statement, "You're attached to someone who has control over what's going to happen to you—whether you fall flat—I think I would panic midair and it would not go well."

While there were qualitative differences in how participants perceived many of the various facets of risk perception, the themes occurred at similar rates across the four groups. Even though participants from each group endorsed the vast majority of themes at similar rates, there were distinct differences between facets of risk perception in regard to the number of participants across all groups who endorsed each theme or subtheme. For example, some facets were endorsed by nearly all participants (e.g., severity of consequences, control of situation); whereas, other facets were endorsed by approximately half of the participants from each group (e.g., ease of participation). There were also some facets that were only mentioned by a small minority of participants in each group (e.g., benefits others over self). These variations in participant endorsement of risk-perception facets were noted as indications of the relative importance of facets of risk perception. Numerical values were assigned based on the number of participants that identified that specific risk-perception facet, as well as the emphasis that the participants expressed for certain facets of risk perception. With regard to emphasis, the original numerical value that represented the number of participants who identified the risk was increased by one value if a participant mentioned the same facets of risk perception more than three times throughout the interview, or if two or more participants specifically emphasized the importance of a theme. For example, "NO [extended pronunciation]! So many things can go wrong in that situation. You never really know" was coded as placing emphasis on the theme (lack of) predictability. If another participant had also indicated emphasis of that theme, the numerical value would have been increased by one unit. The final assigned numerical weighting values were retained for analyses in Study 2A.

Several themes were also identified that did not include any data that was unique only to that theme. For example, all statements that had been coded into the theme of Benefit Type, had also been coded into one of the benefit-type subthemes. Similarly, all statements that had been coded into the theme of Consequence Type, had also been coded into one of the consequence-type subthemes. The theme Relative to Current Position also contained all statements that had been coded into the subthemes of Nothing to Lose and Too Much to Lose, leaving the subthemes with no unique contributions. Therefore, Benefit Type, Consequence Type, Nothing to Lose, and Too Much to Lose were removed due to lack of unique contributions, leaving a total of 46 themes for further analyses.

The next iteration of thematic analysis revealed that despite having a small number of unique contributions, some of the subthemes reflected constructs that were very closely related to other themes, which may have accounted for the coding errors. For example, some data from Social Influence or Support included statements that fit very well, such as "It depends who is around and how much fun I am having. I probably wouldn't do it if they weren't around. It depends on the context." A second comment that seemed to reflect this theme well was "It depends. If I am at a party with my friends, it's not a big thing. But if I went to a Frat party then there is a big pressure to drink. Everyone is like *Have a drink…loosen up*." A third comment coded as Social Influence or Support was "Sometimes it's easier to fit in than to be by yourself. I'd be more tempted because everyone else is doing it." While these comments did reflect social influence or support, they also reflected other themes (e.g., Social Benefit and Participation by Others).

Several other themes were also identified that were closely related to other themes. For example, there was considerable overlap between "Sensory appeal of risk

activity" and "Adrenaline rush." There was also a great deal of overlap between "Ethical or moral considerations", "Guilty conscience", and "Moral values". In total, 20 (sub)themes were identified as superfluous, leaving 26 themes for further analyses. All data that had been originally coded into the omitted 20 themes were able to be recoded into one of the remaining 26 themes. Please see Appendix G for examples of data that contributed to the 26 themes retained at the end of the current study.

Many of the final 26 themes still exhibited strong relationships to other themes. For example, comments made during the interviews that referred to the number of possible benefits as compared to the number of possible consequences were coded into the theme "Benefits versus Consequences". There were also two additional themes that were closely related; specifically, the themes "Significance of Benefit" and "Severity of Consequence" were closely related to "Benefits versus Consequences". The decision was made to retain these themes (and other groups of themes that were similarly related) as being unique, due to the differences in importance that participants had expressed during the interviews. Participants clearly expressed that the severity of any possible consequences was more important in their perception of risk than the significance of any possible benefits. At the same time, participants considered both the severity of consequences and significance of benefits as being more important than the number of benefits as compared to the number of consequences. Therefore, it was considered important to retain all of these as separate themes, rather than combining them into a higher order theme.

The next iteration of thematic analysis delineated each theme (facet of risk perception) into a collection of question items that reflected each meaning. It is important

to note that risk facets do not represent different factors or subscales. Rather, they represent the various matters that people consider when evaluating the riskiness of an activity. Most of the facets reflected constructs that could be represented with a variety of different questions. For example, the facet Admiration for Risk Activity could be represented by the question item "It is an admirable activity" or "Most people see it as an admirable activity" or "I think it is an activity that my friends would admire." Main question items were chosen to best represent each specific facet. The number of main question items chosen reflected the relative importance that participants had expressed for the facet. For example, Ethical or Moral Considerations was a facet emphasized as being extremely important in the participants evaluation of a risk; therefore, four main questions items were chosen to represent Ethical or Moral Considerations. In comparison, having previous knowledge about the activity was not emphasized as being important, so only one question item was chosen as a main item for the facet of Knowledge About Activity. The reason that some facets were assigned more items than other facets (reflecting their relative importance) was for the purpose of weighting the scale. In this way, facets that were considered to be more important in risk perception, would receive a heavier weighting in the final scale than facets that were considered less important.

Despite qualitative analyses suggesting that the main items alone were both necessary and sufficient to represent their respective facets, the decision was made to retain additional question items for analyses in the next study. Some of these added items were identical in meaning to their respective main item, but with alternative phrasing. These items were retained for analyses in the next study to ensure that if any of the main items were misinterpreted by participants or caused confusion, there would be alternative

item options that could be substituted in place of the main item. Additionally, there were

some items retained for the next study that had a slightly nuanced meaning in comparison

to the main item. The main reason for retaining these nuanced items was to assess

whether there were alternative items that would better represent their relative facet than

the items that had been chosen as main items. This decision to retain extra items for

quantitative analyses resulted in a total of 172 items for the next study, which can be

found in Appendix H.

Discussion

The main goal of Studies 1A and 1B were to identify facets of risk perception,

which are variables that contribute to a person's identification of a risk as being a good

risk or a bad risk. Study 1A assessed participants' past risk-taking behaviours, as well as

the extent to which they held cognitive biases that were relevant to risk perception. The

specific purpose of Study 1A was to identify potential participants for Study 1B who

scored in the top or bottom quartiles on measures of cognitive bias and risk-taking

behaviour.

Despite some difficulties in recruitment, a sufficient number of eligible

participants agreed to take part in Study 1B, which involved one-on-one interviews. The

participants who agreed to be contacted for a follow-up interview did not differ

significantly on scores for risky behaviour or cognitive biases from participants who did

not agree to be contacted. The final interview sample was also found to accurately reflect

the general population in relation to their scores on measures of risky behaviour and

cognitive biases, when compared to normative data.

The first research question inquired if there were possible qualitative differences in risk perception between participants who are high in cognitive bias and those who are low in cognitive bias. Analyses of the interview data found only minimal qualitative differences in how the facets of risk perception were perceived by participants who had scored high in cognitive bias and those who scored low in cognitive bias. For example, both high-bias and low-bias groups identified controllability as being an important facet of risk perception; however, participants who had scored high in illusion of control occasionally expressed that they had more control in some situations, when compared to participants who had scored low in illusion of control.

Qualitative differences between low-bias and high-bias groups were expected, and necessary for the scale to be sensitive to differences between groups. On the other hand, quantitative differences in the facets of risk perception would have been an indication that that the new risk perception scale would be confounded with cognitive bias. Consequently, only those facets of risk perception that were common among participants who scored high in cognitive bias and those low in cognitive bias were of interest for the new scale. All facets of risk perception that were identified in Study 1 occurred at relatively similar rates between both high-bias and low-bias groups, providing support for the construct validity of the risk perception facets identified in this study.

The second research question inquired if there were qualitative differences in risk perception between participants who frequently engage in risk-taking behaviour and those who do not. These analyses found that while both high- and low-risk-taking groups identified the same facets of risk perception, there appeared to be some differences between high and low risk-taking groups in whether participants appraised facets of risk

perception as positive or negative. For example, an adrenaline rush was perceived as a positive experience by most participants in the high-risk group, but as a scary, negative experience by many participants in the low-risk groups.

The third research question inquired if there were some facets of risk perception that are common to most participants, regardless of cognitive bias or engagement in risky behaviours. Thematic analyses found that the vast majority of identified risk-perception facets were common among participants from all four groups. Nonetheless, there were distinct differences between facets of risk perception in regard to the number of participants from each group who endorsed each specific facet. For example, some facets, such as Past Experience were endorsed by nearly all participants; whereas, other facets, such as Ease of Participation were endorsed by approximately half of the participants from each group. There were also some facets that were only mentioned by a small minority of participants in each group. These differences in participant endorsements may indicate that there are some facets of risk perception that are not important to all perceivers of risky situations. Alternatively, the differences may indicate that some facets of risk perception were simply not salient to the participants at the time of their interviews.

Many of the risk-perception facets that were identified in the current study were similar to those identified in past research. For example, the risk-perception facet of Admiration for Risk Activity identified in the current study was conceptually similar to the risk-perception facet Admiration from the Benthin Risk Perception Measure (Benthin et al.,1993), and also similar to the Peer Admiration risk-perception facet from the Scales created by Hampson and colleagues (2001). Similarly, the risk-perception facet of

Severity of Consequences identified in the current study was conceptually similar to the risk-perception facet Seriousness of Effects from the Benthin Risk Perception Measure, as well as being similar to the Severity of Consequences risk-perception facet reported by Fischhoff and colleagues (1978). Please see Appendix I for further detail.

There were eight facets of risk perception identified in the current study that appeared to be conceptually unique to risk-perception facets from past literature, and 18 facets of risk perception that exhibited conceptual similarities with risk-perception facets from past research. However, as noted previously, some facets of risk perception may not be considered important by all risk perceivers, and some risk facets just may not be salient to perceivers for some types of risk. It was hoped that quantitative analysis could be used in the next study to better facilitate demarcation between the importance and salience of various risk-perception facets to aid in the facet weighting. Nonetheless, this study was successful in identifying the 26 unique facets of risk perception, and determining tentative weighting of their importance based on qualitative data.

Table 3: *Description of Risk-Perception Facets Retained*

Risk-Perception Facet	Weight Value	Description
Admiration of Activity	3	The risky activity holds a place of esteem, such as something that would equate to an act of bravery. Perceiver values the idea of telling others they accomplished the activity
Interest	2	The risky activity draws the attention and/or curiosity of the perceiver
Adrenaline rush/ Sensory Appeal	3	Perceiver anticipates a possible thrill or stimulation that is entertaining or attractive to the senses
Social Benefit	1	Perceiver anticipates the strengthening of existing social bonds, or the creation of new social relationships to result from engaging in the specific risky activity
Benefits versus Consequences	1	Perceives an imbalance in the possible benefits and consequences of the specific risky activity
Severity of Consequences	3	The possible consequence(s) could be overwhelming or catastrophic
Significance of Benefit	2	The benefit is meaningful or significant enough to influence the decision independent of the possible consequences
Disappoint Significant Others	2	Participation in the risky activity would likely receive disapproval of family or friends. Perceiver fears not meeting the expectations of people who are significant in their life.
Control of Situation	2	Control of the situation or the severity of any possible consequences
Predictability	1	Situation is unpredictable making it difficult to assume probabilities of success
Skills or Abilities	3	Perceives having a skill set that maximizes receiving the benefits from an activity and/or lowers the possibility of negative consequences. Successfully using that skill set provides a sense of power or accomplishment.
Ease of Participation	1	Activity requires commitment of resources (preparation) or involves barriers that make participation in the risky activity more difficult
Unsafe Conditions	1	The risk associated with the activity is intensified by contextual factors (e.g., environment)
Ethical or Moral considerations	4	Activity is judged as being right or wrong, rather than just considered for benefits and consequences, and participation in the activity has the propensity to create a guilty conscience for the participant
Immediacy of Effect	2	Perceiver weights benefits or consequences that will be received in the near future more heavily than those expected in the distant future

Risk-Perception Facet	Weight Value	Description
Knowledge about activity	1	Perceiver does not believe they have sufficient information to participate in the activity
Gain experience or Info	3	Participation in the activity provides an opportunity to gain knowledge or experience, or acts as a bridge to opportunities
Necessity	2	Participation in the activity would satisfy a need (e.g., hunger, shelter), and the situation or context makes it unlikely that participation in the risky activity can be avoided
Common	1	Perceiver views the activity as something that others commonly participate in
Past experience	1	Past experience (good or bad) in the activity by the participant or a close acquaintance acts as a deterrent or instigator to engagement in activity
Probability	2	Likelihood of receiving benefits over consequences. decision made is similar to a mathematical calculation
Relative to Current Position	2	Willingness to take the risk is dependent on the perceiver's current position (financial, occupational, etc.)
Apathy	1	Perceives that Risk is unescapable in life, so just go with it.
Religion	1	Perceives the activity as being against their religion or their religious values
Fear / phobia	1	Perceiver has difficulty even considering the activity due to an extreme fear or phobia that prevents rational thought
Risk to Others	1	Participation may lead to consequences for others not involved in the activity

CHAPTER 3

STUDY 2

The purpose of Study 2 was to use the results from Study 1 to develop the Holistic

Assessment of Risk Perception (HARP) Scale, by providing quantitative data that could

be used in combination with the qualitative data from Study 1-B to confirm the scoring

procedure (weighting of facets) for the new scale. A second purpose of Study 2 was to

use quantitative data to assess if the main items chosen for the scale (47 items) in Study

1-B, best represented the facets of risk perception.

Due to the wide range of risky activities (e.g., health risks, financial risks, moral

risks), not all facets of risk perception will be applicable to every type of risk. The 172

items that were brought forward from Study 1-B were based on interviews, in which

participants had discussed a very broad range of risky activities. However, due to the

large number of items under study, it was not feasible to include every type of risk in the

current study. Therefore, an attempt was made to choose risky activities for Study 2 that

had potential to elicit a fairly large number of facets of risk perception. The specific risk

activities that were chosen were (1) investing in the stock market, and (2) slightly

cheating on taxes, such as exaggerating expenses. Investing in the stock market was

chosen because it is a socially acceptable form of gambling and was mentioned several

times in interviews as an activity that students were actively engaged in, or were

considering. The risk of slightly cheating on taxes was chosen because it reflects a moral

or legal risk and is therefore less socially acceptable. While some of the participants may

have limited experience with the stock market or taxes, the current study was interested

in the participants' perception of the activity as a good risk or a bad risk, which did not require actual involvement with the activity.

Despite these risks having the potential to elicit a fairly large number of facets of risk perception, they were utilized with the knowledge that they did not represent all forms of risk-taking, and therefore it was likely that they would be unable to elicit all facets involved in risk perception. For example, the facets of risk perception that a person may consider when thinking about participating in a health risk or an extreme sport would not necessarily be the same facets of risk perception that they would consider when thinking about stock markets or tax preparation. Since the interviews performed in Study 1B had included a much broader range of risk types, the current study was performed under the predetermination that data analyses would not only need to include information from the qualitative analyses of interviews performed in Study 1B but would also need to weight the information from the comprehensive interviews more heavily in decisions regarding the removal of any items and scoring procedures.

There were no hypotheses associated with Study 2 due to its exploratory nature. The guiding research questions for this study were: (1) Are the main 47 items developed in Study 1-B the best question items for use in the new scale? (2) Does quantitative data from the current study support the weighting of facets that had been determined with qualitative data in Study 1-B?

Methods

The current study was designed to provide quantitative data that could be used with the qualitative data from the previous study (Study 1-B) to perform data analyses

using mixed methods to confirm the relative weighting of the risk-perception facets and support the use of the main 47 question items for the scale.

Participants

A sample of 100 participants was recruited through the psychology participant pool. There were no inclusion criteria for this study. Exclusionary criteria included any persons who participated in Study 1-B. Students recruited through the participant pool received 1 bonus point for up to 60 minutes of participation. One participant withdrew his data following the study. Data from an additional 10 participants were removed due to non-serious reporting. The remaining sample ($N = 89$) had a large proportion of female participants (77.5%), and consisted mainly of young adults, with an average age of approximately 23 years ($M = 22.85$, $SD = 6.66$). The ethnicity of the participant sample was fairly diverse (66.3% White/European/Caucasian; 9% Middle Eastern; 6.7% Black/African/Caribbean; 5.6% South Asian/Indian/Pakistani; 2.2% Indigenous/ First Nations/Metis; 2.2% East Asian/Chinese/Japanese; 5.6% Multiple ethnicities; 2.2% Other).

Measures

Tentative HARP Risk Perception Items

Participants were presented with a list of 172 items (Appendix H) developed from the 26 themes that had emerged from Study 1B. Participants were asked to indicate the extent that they agreed with each of the 172 items on a 7-point scale that ranged from (1) Strongly Disagree to (7) Strongly Agree. The list of risk perception items was presented twice to all participants. Due to the extensive length of the survey, the following instructions were provided to participants before beginning the first administration of the

risk perception items, and again prior to the second administration of the risk perception

items:

> Truthful responses are extremely important for accurate scale development. We
>
> are aware that this is a lengthy scale, but please take your time and respond as
>
> accurately as possible. If you need to take a break while completing this survey,
>
> you can exit your browser and when ready, click on the link you were provided
>
> and begin where you left off.

For the first administration of the items, participants were asked to think about the

situation *Investing in the stock market*, and for the second administration, participants

were asked to think about the situation *Slightly cheating on taxes (e.g., exaggerating*

expenses).

Demographic Questionnaire

This measure was used to collect information about the participants' gender, age,

ethnicity, and year of study, for the purpose of describing the sample. Please see

Appendix B.

Added Items to Approximate Risk-Perception

This study utilized ten questions to estimate participants' overall assessment of

the risky activities being investigated (investing in the stock market and cheating on

taxes). Specifically, for each of the risky activities, participants were asked to respond to

five questions (please see Appendix J). These five questions evaluated the extent that

participants perceived the activity as risky, as well as the expected likelihood of receiving

positive benefits or negative consequences from the activity. Participants were also asked

to indicate whether they believed the activity to be worth the risk, and whether they

would consider taking part in the activity within the next six months, if they were given the opportunity to do so. These items were used to produce a para-risk-perception score (a rough estimate of risk perception) for analyses. The term *para-risk-perception items* will be used to refer to these items collectively.

Procedure

The study took place online, using the Qualtrics online survey platform. Participants were first presented with the consent form. If the participant consented to participate in the study, they were asked to respond to the tentative HARP risk perception items, which were presented in randomized order. Next, participants were presented with the demographic questionnaire, followed by the para-risk-perception items. These measures were then followed by a letter of information to explain the purpose of the study in greater detail, and provided an opportunity for participants to withdraw their data from the study. The placement of the demographic questionnaire between the HARP risk perception items for the new measure and the para-risk-perception items was intended to provide a distraction, so that participants' responses to the HARP risk perception items were less likely to influence their responses on the para-risk perception items.

<div align="center">

Results

</div>

The data file was examined for missing data patterns. Participants whose data was not missing at random, or whose data was identified as non-serious reporting were removed from the analyses. Non-serious reporting was identified through both short completion times and response sets. Outliers were not removed, as none were identified as influential outliers that had a significant impact on the data. Individual question items

were reverse scored as applicable, in an attempt to have all question items assessing the extent that participants perceived the activity as a negative or "bad" risk.

Following data cleaning, a score of benefit/consequence balance was computed as the result of subtracting scores from the item, "Please indicate how likely you would be to receive benefits if you took part in the following activities" from the item "Please indicate how likely you would be to receive negative effects if you took part in the following activities". Positive benefit/consequence balance scores represented participants who considered that particular risk as having more expected consequences than benefits; whereas, negative scores represented participants who considered that particular risk as having more perceived benefits than consequences. These benefit/consequence balance scores had a possible range of 12 (-6.0 to 6.0) and were computed for both the risk activity of investing in the stock market (M = -0.31, Mdn = 0.00, SD = 2.35), as well as for the risk activity of slightly cheating on taxes (M = 3.09, Mdn = 4.00, SD = 2.69).

Spearman's correlation coefficients were used for item-level analyses as they are more appropriate for ordinal level data (Field, 2018). The benefit/consequence balance scores were negatively correlated with the item "Please indicate the extent to which you, personally, consider the following activities as being worth the risk" for the activity of investing in the stock market (r_s(88) = -.61, p < .001) and for the activity of slightly cheating on taxes (r_s(88) = -.53, p < .001). The benefit/consequence balance scores were positively correlated with the item "Please indicate your overall assessment of the riskiness of each of the following activities" for the activity of investing in the stock

market ($r_s(86) = .64$, $p < .001$) and for the activity of slightly cheating on taxes ($r_s(87) =$

.36, $p = .001$).

      A para-risk perception score was created for analyses, by summing the

benefit/consequence balance score with the score from the "overall assessment of

riskiness" item and subtracting the "worth the risk" item score for each of the risky

behaviours. The para-risk-perception scores had a possible range of 24 (-12 to 12),

providing greater variability for analyses. Participants perceived cheating on taxes ($M =$

7.19, $SD = 4.29$) to be more of a negative, or "bad" risk than investing in stocks ($M = -$

.29, $SD = 4.72$), $t(86) = 11.00$, $p < .001$.

Table 4: *Items used in Calculation of Para-Risk-Perception Scores*

Question Items
1. Please indicate how likely you would be to receive negative effects if you took part in the following activities
2. Please indicate how likely you would be to receive benefits if you took part in the following activities
3. Please indicate your overall assessment of the riskiness of each of the following activities
4. Please indicate the extent to which you, personally, consider the following activities as being worth the risk

Note:
Benefit/Consequence Balance Score = Item 1 – Item 2
Para-Risk-Perception Score = (Item 1 – Item 2) + Item 3 – Item 4

      The current study was interested in risk perception, not risk-taking behaviour.

However, significant negative correlations were found between the para-risk-perception

scores and the item "If given the opportunity, how likely is it that you would consider

taking part in the following activities within the next 6 months?" for the activity of investing in the stock market ($r_s(86) = -.57$, $p < .001$) and for the activity of slightly cheating on taxes ($r_s(86) = -.49$, $p < .001$).

Each of the risk-perception facets that had been identified in Study 1B were represented by multiple items for the scale that was administered to participants in the current study. These facets were represented with a minimum of two items, and a maximum of 14 items ($M = 6.62$, $SD = 3.19$; $Mdn = 5.50$). The mean was computed for individual question items from each facet to create a score for each facet in the data set. This computation resulted in two scores for each facet, with one score reflecting the participants' responses in relation to investing in the stock market, and the other score reflecting the participants' responses in relation to cheating on taxes.

Item Refinement

As noted in Study 1B, main items had been identified that best represented each of their respective facets, but additional items had been included to ensure that the phrasing of items captured the facet meaning in its entirety, and that no items were misinterpreted by participants. Therefore, most facets were represented by very similar (redundant) items in the current study. Hierarchical regression was used, with the main items being analyzed in the first block, and the similar (mainly redundant) items being placed in the second block to assess any relative contribution they made above the main items. All main items that had been developed in Study 1B made significant quantitative contributions to their respective facet scores. Therefore, none of the items that were identical in meaning to the main items were of interest, since replacement of main items was not required. To ensure that all relevant nuanced meanings of the facets had been

captured, the results were then analyzed with the goal of identifying any items that (1) made a significant quantitative contribution to the item's respective facet score when used to measure both of the risky activities assessed in the current study, and (2) were qualitatively (conceptually) different from the original item(s) chosen to represent that facet.

There were several instances of the added items meeting one criterion listed above, but not both criteria. Specifically, many of the items that were identical in meaning did make a significant contribution to the scale, but they did not add value to the scale because their conceptual meaning was redundant (asking the participant the same question twice). For example, the facet of "Admiration for activity" when used to consider the risky activity of investing in the stock market, had one item that made a significant contribution beyond the main items, "It would be great to be able to tell my friends about it," $\beta = .339$, $t = 2.263$, $p = .027$. However, this item was conceptually redundant and highly correlated with the main item, "It is one of those experiences that you can't wait to tell your friends about," $rs = .57$, $p < .001$. For the same facet of "Admiration for activity" when used to consider the risky activity of cheating on taxes, the same item (It would be great to be able to tell my friends about it) made a significant contribution beyond the main items, $\beta = .325$, $t = 2.059$, $p = .043$. Again, this item was conceptually redundant and highly correlated with the main item, "It is one of those experiences that you can't wait to tell your friends about," $rs = .69$, $p < .001$.

The results supported the use of the original main items, as none of the additional items made both a qualitative and significant quantitative contribution to the facet subscale scores. The retained items ($N = 47$) represented each of the facets with the

number of items (minimum of one item, maximum of four items) that had been determined as appropriate weighting during qualitative analysis in Study 1B. These items were brought forward into the next set of analyses, which was intended to examine whether quantitative data could support the decisions that had been made regarding the relative weighting of the facets.

Weighting of Risk-Perception Facets

Investing in the Stock Market

New facet scores were calculated as the average score of the main question items for each of the facets that they represented, respectively. Regression analyses were used to examine the relative contribution of the average risk-perception facet scores to the para-risk-perception score. Examination of the probability plots (standardized residual vs standardized predicted) indicated that the assumptions of linearity and homoscedasticity were not violated. The P-P plot indicated a possible violation of the assumption of normality of errors, with a slight S-shaped curve that is associated with skew; however, the histogram confirmed that residual values were only slightly skewed. The Durbin-Watson value (Durbin-Watson = 1.737) was within the required range, indicating independence of errors. Both tolerance and VIF indicated the absence of multicollinearity and singularity (tolerance $\geq$ .2; VIF < 10). No outliers were found to be influential observations (COOKS <1; DFFIT <2); therefore, no observations were removed prior to analysis. The model was significant, R^2 = .71, $F(26,56)$ = 5.24, $p < .001$, but the only facets shown to significantly predict para-risk-perception scores were Severity of Consequences (b = 1.139, p = .032), Significance of Benefit (b = 0.899, p = .041), and Apathy (b = -0.853, p = .035). Please see Table 5 for item-level details.

Table 5: *Regression Analysis Summary for Facets of Risk Perception (Investing in Stocks) Predictors of Para-Risk Perception Score*

	B	SE B	β	t	p
Admiration	-.316	.642	-.072	.491	.625
Interested	.513	.545	.158	.941	.351
Sensory / Adrenaline	.615	.589	.171	1.043	.301
Social Benefit	-.401	.369	-.110	1.087	.282
Benefit vs Consequences	.078	.517	.018	.150	.881
Severity of Consequences	1.139	.518	.257	2.199	.032
Significance of Benefit	.899	.430	.238	2.090	.041
Disappoint Others	-.423	.362	-.119	1.167	.248
Control of Situation	-.630	.537	-.154	1.173	.246
Unpredictability	.049	.342	.014	.144	.886
Skills or Abilities	-.223	.630	-.057	.354	.724
Ease of Participation	.316	.311	.083	1.016	.314
Vulnerable / Unsafe Conditions	.597	.441	.184	1.355	.181
Ethical or Moral Considerations	.212	.633	.049	.336	.738
Immediacy of Effect	.312	.561	.062	.556	.580
Knowledge about Activity	.178	.329	.053	.539	.592
Gain Experience or Information	.912	.620	.217	1.470	.147
Necessity	-.105	.488	-.019	.214	.831
Participation by Others	.370	.303	.113	1.219	.228
Past Experience	-.317	.312	-.096	1.016	.314
Probability	1.146	.660	.271	1.736	.088
Relative to Current Position	-.212	.556	-.049	.382	.704
Apathy	-.853	.394	-.268	2.163	.035
Religion	.026	.355	.009	.072	.943
Fear or Phobia	.465	.336	.169	1.383	.172
Risk to Others	-.017	.311	-.005	.053	.958

Slightly Cheating on Taxes

New facet scores were calculated as the average score of the main question items for each of the facets that they represented, respectively. Regression analyses were used to examine the relative contribution of the average risk-perception facet scores to the para-risk-perception score. Examination of the probability plots (standardized residual vs standardized predicted) indicated that the assumptions of linearity and homoscedasticity were not violated. Similar to the regression analysis for Stocks, the P-P plot indicated a possible violation of the assumption of normality of errors, with a slight S-shaped curve that is associated with skew; however, the histogram confirmed that residual values were only slightly skewed. The Durbin-Watson value (Durbin-Watson = 1.873) was within the required range, indicating independence of errors. Both tolerance and VIF indicated the absence of multicollinearity and singularity (tolerance $\geq$ .2; VIF < 10). No outliers were found to be influential observations (COOKS <1; DFFIT <2); therefore, no observations were removed prior to analysis. The model was significant, R^2 = .67, $F(26,59)$ = 4.52, $p <$ .001.

The facets shown to significantly predict para-risk-perception scores were Sensory/Adrenaline (b = 1.432, p = .050), Significance of Benefit (b = 0.901, p = .030), Unpredictability (b = 0.628, p = .007), Skills or Abilities (b = 1.370, p = .035), and Fear or Phobia (b = 1.033, p = .003). Therefore, the only facet that had significantly predicted para-risk-perception scores for both risky activities was Significance of Benefit. Please see Table 6 for item-level details for the activity of cheating on taxes.

Table 6: *Regression Analysis Summary for Facets of Risk Perception (Cheating on Taxes) Predictors of Para-Risk Perception Score*

	B	SE B	β	t	p
Admiration	-.659	1.042	-.101	.633	.529
Interested	.726	.564	.149	1.286	.203
Sensory / Adrenaline	1.432	.716	.291	2.000	.050
Social Benefit	.520	.668	.096	.779	.439
Benefit vs Consequences	.480	.396	.139	1.214	.230
Severity of Consequences	-.018	.582	-.004	.032	.975
Significance of Benefit	.901	.405	.283	2.226	.030
Disappoint Others	-.547	.502	-.158	1.089	.280
Control of Situation	.153	.366	.042	.418	.678
Unpredictability	-.628	.227	-.251	2.773	.007
Skills or Abilities	-1.370	.635	-.320	2.157	.035
Ease of Participation	-.249	.227	-.101	1.099	.276
Vulnerable / Unsafe Conditions	.621	.440	.178	1.414	.163
Ethical or Moral Considerations	-.273	.705	-.061	.387	.700
Immediacy of Effect	.208	.364	.062	.573	.569
Knowledge about Activity	.123	.347	.038	.353	.725
Gain Experience or Information	-.404	.688	-.100	.587	.559
Necessity	.297	.507	.066	.585	.561
Participation by Others	.403	.260	.150	1.554	.126
Past Experience	.067	.199	.029	.337	.737
Probability	.532	.533	.126	.998	.322
Relative to Current Position	.182	.424	.048	.429	.669
Apathy	.232	.536	.053	.432	.667
Religion	-.011	.229	-.005	.049	.961
Fear or Phobia	1.033	.334	.388	3.093	.003
Risk to Others	.117	.324	.046	.360	.720

Internal Reliability

Cronbach's alpha was used to examine the internal reliability of the scale score, as represented by facet scores (average score of the 1 - 4 items used to represent each facet). When the scale was used to assess the activity of investing in the stock market, the internal reliability was excellent (α = .92). Data suggested that the reliability could be increased slightly (α = .94) by the removal of the facet "religious beliefs." The data also produced an excellent internal reliability value (α = .93) when it was used to assess the activity of cheating on taxes. Again, the data suggested that the reliability could be increased slightly (α = .94) by the removal of the facet "religious beliefs."

Exploratory Factor Analysis

The assumptions for factor analysis are an adequate sample size, absence of influential data points, normality, and absence of multicollinearity or singularity. Normality of the data for investing in the stock market was first assessed using the Kolmogorov – Smirnov test, which produced a significant statistic for all but one of the items, indicating non-normality. As suggested by Field (2018), normality was also assessed using a combination of Q – Q plots and skew and kurtosis values. The Q – Q plots displayed S-shaped curves, suggested that the data was skewed. According to Coolican (2009, as cited in Mayers,2013) skew and kurtosis values should be less than two times greater than their standard error. In the current study, seven of the items produced skew values outside of the acceptable range, and four of the items produced kurtosis values outside of the acceptable range. To assess for influential data points, standardized z-scores were saved into the data file. None of the z-scores exceeded Tabachnick and Fidell's (2007) suggested cut-off z-score of 3.29. As suggested by Field

(2018) multicollinearity and singularity were assessed using bivariate correlations (<.80) and the correlation matrix determinant (>.00001), which supported the absence of multicollinearity or singularity in the current study. The sample size for this study ($N =$ 84) did not meet Nunnally's (1978) estimated requirement of ten cases per variable, and also fell below Comrey and Lee's (1992) sample size requirements, which states that a good sample size for exploratory factor analysis requires a minimum of 300 participants. Examination of the SCREE plot suggested the retention of two factors. The Kaiser Guttman rule (eigenvalue >1) suggested the retention of six factors. The cumulative percentage of variance accounted for increased from two factors (42.61%) to three factors (47.96%), and then slowed, only reaching 56.91% at six factors.

Normality of the data for the risky activity of slightly cheating on taxes was also assessed using the Kolmogorov – Smirnov test, which produced a significant statistic for all of the items, indicating non-normality. Normality was also assessed using a combination of Q – Q plots and skew and kurtosis values, as suggested by Field (2018). The Q – Q plots displayed S-shaped curves, suggested that the data was skewed. Additionally, 15 of the items produced skew values outside of the acceptable range, and eight of the items produced kurtosis values outside of the acceptable range (Coolican, 2009, as cited in Mayers, 2013). To assess for influential data points, standardized z-scores were saved into the data file. None of the z-scores exceeded Tabachnick and Fidell's (2007) suggested cut-off z-score of 3.29. As suggested by Field (2018) multicollinearity and singularity were assessed using bivariate correlations (<.80) and the correlation matrix determinant (>.00001), which supported the absence of multicollinearity or singularity in the current study. As with the data described above

(activity of investing in the stock market), the sample size for this study ($N = 84$) did not meet Nunnally's (1978) estimated requirement of ten cases per variable, and also fell below Comrey and Lee's (1992) sample size requirements (minimum of 300 participants). Examination of the SCREE plot suggested the retention of one factor. The Kaiser Guttman rule (eigenvalue >1) suggested the retention of eight factors. The cumulative percentage of variance accounted for increased from one factor (33.02%) to two factors (41.19%), and continued in small incremental increases, only reaching 62.98% at eight factors.

The decision was made not to proceed with exploratory factor analyses in the current study, due to the violations in assumptions for data from both risky activities under study (investing in the stock market and slightly cheating on taxes).

Study 2 Discussion

One of the goals of the current study was to confirm that the main scale items developed in Study 1-B best represented their relative facets. These main items had been developed in Study 1-B to represent the facets of risk perception, and the number of main question items for each facet reflected the relative importance that participants had assigned to each of the risk facets in their overall risk perception. However, the phrasing of the main questions had been determined subjectively. Therefore, the current study was used to examine if any additional question items would better represent their respective facet of risk perception. Analyses supported the use of the 47 main question items that had been developed in Study 1-B, as there was insufficient evidence that any of the added items contributed both quantitatively and conceptually to the facets of risk perception.

A second goal of the current study was to examine whether these quantitative data would provide support for the weighting of facets that had been determined with qualitative data in Study 1-B. The data from the current study was unsuccessful in supporting the findings from Study 1-B. Specifically, when using regression analysis, the vast majority of risk-perception facets did not appear to make a significant contribution to the para-risk perception score for either of the risky activities, even though they had all been identified as important facets of risk perception during scale development in Study 1B, and many of them had also been identified as important facets of risk perception in past literature (e.g., Benthin et al., 1993b; Hampson et al.,2001b). Additionally, there were large differences in the relative contributions of stock facet scores on the stock para-risk-perception score, as compared to the contributions of tax facet scores on the tax para-risk-perception score. In other words, participants identified many of the risk-perception facets as relatively important for one type of risk, but not for the other. For example, the risk-perception facet of severity of consequences appeared to make a significant contribution to the para-risk perception score when used to assess the risky activity of investing in the stock market ($b = 1.139$, $t = 2.199$, $p = .032$), but not when used to assess the risky activity of slightly cheating on taxes, such as exaggerating expenses ($b = -.018$, $t = .032$, $p = .975$).

It was anticipated that the current data would have to be used in combination with the qualitative data from Study 1-B, since the two forms of risky activities chosen for this study (investing in stocks and cheating on taxes) were not able to represent all forms of activities that involve risk (e.g., health risks, social risks, recreational risks, etc.). Therefore, the two risky activities chosen for this study had been used with the

understanding that they would be unable to fully elicit all facets involved in risk perception. Since the interviews performed in Study 1-B had included a much broader range of risk types, the current study was performed with acknowledgement that data analyses would need to include information from the qualitative analyses of interviews performed in Study 1B, and that the information from the comprehensive interviews in Study 1B would need to be weighted more heavily in decisions regarding the removal of any items and scoring procedures. The requirement to weight qualitative information more heavily was amplified by limitations to the current study.

The main limitations of the current study were that the final sample ($N = 89$) was extremely small and data may have suffered from participant fatigue effects due to the length of the questionnaire. However, the extent of fatigue effects was difficult to determine, since participant responses were expected to differ when completing the HARP scale for the risky activity of investing in the stock market, as compared to when it was completed for the risky activity of slightly cheating on taxes. The decision was made not to extend data collection, as the data were not able to meet expectations of contributing to facet weighting.

Due to the limitations of the current study, the results from Study 1-B were given full value in determining the weighting of risk-perception facets for the HARP Scale. Nonetheless, the averaged facet scores produced excellent internal reliability scores for the scale, indicating that they were all measuring the same construct. The only facet that lowered the internal reliability of the scale was the risk-perception facet that assessed religious beliefs. While this facet did lower the internal reliability of the scale for both of the risky activities under study, the reliability was lowered a negligible amount (.01 -

.02), and the internal reliability remained in the excellent range (> .90), even with inclusion of the Religion facet. The decision was made to retain this facet of risk perception, since data from Study 1-B indicated that this facet has much more influence on risk perception for some perceivers when other forms of risky activities are being considered, such as gambling. Therefore, the scale that proceeded for psychometric evaluation consisted of 26 risk-perception facets, represented by 47 main question items, with each risk-perception facet having 1 - 4 items, based on the relative importance of the facet's importance that had been determined in Study 1-B.

While not a goal of the study, attempts were made to perform exploratory factor analyses on the data. These attempts were unsuccessful, possibly due to violations of the assumptions associated with these analyses. Nonetheless, these attempts provided some useful information. For example, examination of the diagnostic information supported the absence of multicollinearity or singularity. Additionally, the eigenvalues and scree plots suggested a different number of factors dependent on the risk type (risk domain) under study. This suggests that any future attempts to identify subscales may require multiple analyses, examining a variety of different risk domains.

CHAPTER 4

Study 3

Study 3 was designed as a psychometric evaluation of the Holistic Appraisal of Risk Perception (HARP) Scale, and assessed the internal reliability, convergent validity, discriminant validity, and concurrent validity.

The hypotheses tested in Study 3 were:

H_1: The Holistic Assessment of Risk Perception scale will demonstrate convergent validity with moderate correlations to conceptually similar phenomena (risk perception/risk attitude scales).

H_2: The Holistic Assessment of Risk Perception scale will demonstrate discriminant validity with less than 20% shared variance with sensation seeking.

H_3: The Holistic Assessment of Risk Perception scale will demonstrate concurrent validity with moderate correlations to measures of risk behaviour.

H_4: The Holistic Assessment of Risk Perception scale will demonstrate internal reliability with high Cronbach alpha values ($\alpha \geq .80$).

Methods

Study 3 was a psychometric evaluation of the reliability and validity of the new Holistic Assessment of Risk Perception (HARP) Scale, using non-experimental (correlational) methods. The conventions put forward by Cohen (1988) were used for interpretation of correlational relationships; wherein, a correlation coefficient of .10 is thought to represent a weak or small association;.30 is considered a moderate correlation; and.50 or larger is thought to represent a strong or large correlation.

Participants

A sample of 421 participants was recruited through the psychology participant pool ($n = 192$), Facebook social media ($n = 111$), Qualtrics recruitment panel ($n = 107$) and RSearch recruitment panel ($n = 11$), with no inclusion criteria. The Qualtrics recruitment panel is a third-party service that recruits participant panels from other recruitment services. Researchers pay Qualtrics for the service, and Qualtrics compensates the participants. The RSearch recruitment panel is similar in nature to the participant pool, in that researchers are responsible to compensate participants directly; however, the pool of potential participants is drawn from a more diverse population than undergraduate students. The RSearch service is a platform created by a Canadian university that is intended to help connect researchers and potential participants.

Students recruited through the Psychology Participant Pool received 0.5 bonus points for up to 30 minutes of participation. Participants recruited through social media or RSearch were entered into a draw, with the chance of winning a fifty-dollar ($50) gift card. Participants recruited through RSearch were also eligible to earn points through the RSearch recruitment system. Participants recruited through Qualtrics were compensated directly by the Qualtrics service for their participation. The amount of compensation was based on the individual agreements that participants had entered into with their independent crowdsourcing platforms (see Footnote 1). Regardless of the recruitment source, the exclusionary criteria for all participants included any persons who participated in Study 1-B or Study 2.

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[1]The RSearch recruitment and the Qualtrics Panel recruitment strategies were completed as part of a pilot study funded by the University of Windsor Office of Research & Innovation Services, in an attempt to examine existing recruitment options for researchers.

All data obtained through the RSearch recruitment panels ($n = 11$) were found to have no indications of non-serious reporting or missing data. Therefore, all data from the RSearch recruitment panels were retained for analyses. The data obtained through the psychology participant pool ($n = 192$) included five cases of withdrawn data, one incomplete case, and 19 cases that were identified as non-serious reporting (identified by response sets and unreasonably short completion times). The data that were obtained through Facebook social media ($n = 111$) included 15 incomplete cases and two cases that were identified as non-serious reporting. There was a much higher proportion of non-serious reporting cases (64.5%) identified in the data from the Qualtrics recruitment panels. All invalid data were removed prior to analyses of the final sample ($N = 310$). All final scale scores were compared using one-way ANOVA of group means, with groups defined as recruitment sources. Post-hoc Games-Howell comparisons did not reveal any patterns of significant differences between groups.

The final sample was mostly female (77%, $n = 239$), but fairly diverse in other characteristics, such as age ($M = 30.87$, $SD = 15.42$) and ethnicity (72.6% White/European/Caucasian; 6.5% Black/African/Caribbean; 5.8% Middle Eastern; 4.2% East Asian/Chinese/Japanese; 2.3% Latin/South American; 1.9% South Asian/Indian/Pakistani; 1% Indigenous/ First Nations/Metis; 3.5% Multiple ethnicities; 1.9% Other).

Measures

Demographic Questionnaire

This questionnaire was used to collect information about the participants' gender, age, and ethnicity, for the purpose of describing the sample. It also contained questions to

assess if the participant had any extraneous factors that might influence their risk-taking

behaviours (e.g., religious beliefs or legal restrictions such as age that prohibit gambling).

Please see Appendix B.

Holistic Assessment of Risk Perception (HARP) Scale

The HARP Scale is the measure under psychometric evaluation during this study.

The HARP Scale contains 47 items that assess 26 different facets of risk perception, such

as the participants' perceptions of the control they have to influence the outcome of the

risky activity. Please see Appendix K. The HARP Scale is intended to be used with any

type of risk, wherein participants are provided with a risky activity that they are to

consider while rating their risk perception. For the current study, participants were

provided with two risky situations: (1) Skydiving; (2) Buying a $50 lottery ticket from a

charity organization. While these two risk-taking situations do not fully represent risky

situations that would elicit the full spectrum of risk-perception facets, the were believed

to be sufficiently diverse to elicit a fair number of facets.

Domain-Specific Risk-Taking (DOSPERT) Scale

Weber and colleagues (2002) created this scale to assess a variety of risk-taking

activities in six domains. Only the risk domains of gambling and recreational risks were

used in this study. All three of the DOSPERT subscales were used to assess risk

perception, expected benefits, and the likelihood of engaging in each of the risk-taking

activities. The DOSPERT items being used for this study included a total of 12 items (8

recreational risk; 4 gambling), which were rated on a five-point scale for each of the Risk

Perception, Expected Benefits, and Likelihood of Involvement subscales. An additional

six items were added to the gambling subscale to assess a broader range of gambling

activities. For example, in addition to items such as "Gambling a week's income at a casino," items such as "Buying a $10 scratch ticket" and "Playing poker online for money" were added to represent lower-stake gambling activities. Please see Appendix C.

Cognitive Appraisal of Risky Events (CARE) Scale

Similar to the DOSPERT Scale, Fromme and colleagues (1997) created the Cognitive Appraisal of Risky Events Scale (CARE) to assess a variety of risk-taking activities in six domains. Only the risk domain of high-risk sports was used in this study. All three of the CARE subscales were used to measure expected risk, expected benefits, and expected involvement. The high-risk sports domain of the CARE scale includes a total of four items, which are rated on a seven-point scale for each of the Expected Risk, Expected Benefit, and Expected Involvement subscales. Please see Appendix L.

Gambling Behaviour Survey

This survey was created for use in a past study (Craig, 2014), and contains questions to assess participants' likelihood of engaging in gambling behaviours. The survey contains 15 items that are rated on a seven-point scale that ranges from "no chance" to "definitely." Some of the items for this survey were taken from the Canadian Adolescent Gambling Inventory (CAGI; Trembay et al., 2010), with adjustments made to reflect gambling behaviours found in young adult populations. Craig reported good internal consistency, as measured by Cronbach's alpha ($\alpha = .89$). The gambling behaviours of interest for this study included scratch tickets, lottery tickets, casino games, and internet gambling (Please see Appendix M).

Brief Sensation Seeking Scale (BSSS)

Created by Hoyle and colleagues (2002), this scale was created based on items from Form V of the Sensation Seeking Scale (SSS-V; Zuckerman et al., 1978). The BSSS contains eight items that are scored on a five-point Likert-type scale ranging from "strongly disagree" to "strongly agree". The scale is divided into four subscales: (1) Experience Seeking, (2) Boredom Susceptibility, (3) Thrill and Adventure seeking, and (4) Disinhibition. The authors were able to provide evidence in support of the reliability and validity of this scale, using samples totaling more than 7,000 participants over two studies. Please see Appendix N.

Procedure

The study took place online, using the Qualtrics online survey platform. Participants were first presented with the consent form. Those who consented to participate in the study were asked to complete the HARP Scale for the activity of skydiving, followed by the CARE subscales for the high-risk sport domain, and the DOSPERT subscales for the recreational-risks domain. Participants were then asked to complete the HARP a second time for the activity of buying a $50 scratch ticket from a charitable organization. This was followed by the DOSPERT subscales for the gambling domain, the Gambling Behaviour Survey, the Brief Sensation Seeking Scale, and the demographic questionnaire. These measures were then followed by a letter of information to explain the purpose of the study in greater detail, and allowed participants to withdraw their data if they felt that they had not provided honest, thoughtful answers.

Results

Pattern analyses was used to examine missing data. All missing data was found to be missing at random. Necessary items from the new HARP scale were reverse scored with the result of all higher scores representing participants' perception of the activity as a negative risk. Reverse scoring was completed for necessary items from all other tests in accordance with test instructions, prior to calculation of the scale and subscale scores. However, scoring procedures for the DOSPERT Scale were not followed, as these would have produced risk attitude scores, rather than risk perception scores. Instead, the DOSPERT Expected Benefits subscale was subtracted from the DOSPERT Risk Perception subscale to create risk balance scores. Positive balance scores represent participants who consider that particular risk unfavourably (more expected negative consequences than benefits); whereas, negative scores represent participants who consider that particular risk favourably (more perceived benefits than negative consequences). This procedure was followed for both the gambling and recreational-risk domains of the DOSPERT Scale. Similarly, the CARE scoring procedure was altered, so that the Expected Benefit subscale scores were subtracted from the Expected Risk subscale scores, producing risk balance scores to represent the risk as favorable (negative balance scores) or unfavorable (negative balance scores). It should also be noted that the risk balance scores produced from the DOSPERT and CARE scales exhibited standard deviation scores that were higher in value than the mean score for each respective scale, which indicates poor reliability.

The HARP Scale was examined for inter-item correlations. Similar to the previous study, Spearman's correlation coefficients were used for item-level analyses as

they are more appropriate for ordinal level data (Field, 2018). Results found that many of the items were highly correlated. However, the highest inter-item correlational values when the scale was used to assess the activity of skydiving was between the item "It would be really exciting/pleasurable" and the item "I would find it entertaining", $r_s(305)$ = .77, $p < .001$. These same two items had a much lower correlational value when used to assess the activity of buying a lottery ticket, $r_s(303)$ = .55. Similarly, the highest correlational value when the scale was used to assess the activity of buying a lottery ticket was the item "People I care about might be ashamed of me if I did this" and the item "I would be embarrassed if people knew I did this", $r_s(306)$ = .72, $p <.001$. These same two items had a much lower correlational value when the scale was used to assess the activity of skydiving, $r_s(307)$ = .55. These results did not suggest any issues with singularity or multicollinearity, as no values were above the threshold ($> .80$) indicated by Field (2018). Additionally, the items that were highly correlated when examining one type of risk were correlated to a lesser extent when examining another type of risk.

Cronbach's alpha was used to assess the internal reliability of each scale and subscale used in the current study. The new HARP scale exhibited excellent internal reliability ($> .90$), as did the Gambling Behaviour Survey (GBS). Most of the other subscales exhibited good internal reliability scores ($>.80$ alpha $<.90$), with a few exceptions; however, none of the subscales exhibited internal reliability scores below the acceptable range ($>.70$ alpha $<.80$). Please see Table 7 for internal reliability scores and descriptive information from all scales and subscales used in the current study.

Table 7: *Scale and Subscale Reliabilities (Cronbach's alpha) for all measures* ($N = 310$)

Scale	Number of Scale Items	Mean	SD	Alpha
HARP: Skydiving	47	174.16	37.65	.93
HARP: Lottery Play	47	163.69	30.76	.90
DOSPERT Recreational Risk				
Expected Benefits	8	21.17	6.06	.82
Risk Perception	8	29.36	4.37	.71
Risk Balance	-	8.19	8.67	-
Likelihood of Involvement	8	18.03	6.75	.80
DOSPERT Gambling Risk				
Expected Benefits	10	21.88	7.78	.93
Risk Perception	10	31.99	6.27	.83
Risk Balance	-	10.11	11.54	-
Likelihood of Involvement	10	19.05	6.77	.83
CARE High-Risk Sports Domain				
Expected Benefits	4	21.34	4.17	.85
Expected Risk	4	15.03	4.77	.78
Risk Balance	-	-6.31	6.70	-
Expected Involvement	4	16.04	6.79	.81
Gambling Behaviour Survey	15	44.48	17.71	.93
Brief Sensation Seeking Scale	8	24.29	6.28	.79

Convergent Validity

Convergent validity was assessed by examining the relationship between the HARP Scale and the risk-perception balance scale scores that had been produced from the DOSPERT and CARE scales. First, the HARP scale (risk activity of skydiving) was examined with the CARE risk-balance score from the domain of high-risk sports, $r(308)$ = .29, $p < .001$, and the DOSPERT risk-balance score from the domain of recreational risks, $r(308)$ = .43, $p < .001$. Next, the HARP scale (risk activity of buying a $50 lottery ticket) was examined with the DOSPERT risk-balance score from the domain of gambling risks, $r(308) = .30$, $p < .001$. These low to moderate correlational relationships between the HARP Scale and conceptually similar phenomena provide some evidence in support of convergent validity.

Discriminant Validity

Discriminant validity was assessed by examining the relationship between the HARP Scale and the Brief Sensation-Seeking Scale (BSSS). Relationships between the BSSS and HARP were examined separately for the risk activity of skydiving, $r(308)$ = -.54, $p < .001$, and the risk activity of buying a $50 lottery ticket from a charity organization, $r(308) = -.09$, $p = .109$. The shared variance between the HARP Scale and sensation-seeking when examining a recreational risk ($R^2 = .29$) was very dissimilar from the shared variance between the HARP Scale and sensation-seeking when examining a financial risk ($R^2 = .01$); providing evidence to partially support discriminant validity, in that the two scales (HARP and BSSS) are not measuring the same construct.

Concurrent Validity

Concurrent validity was assessed by the relationship between the HARP Scale and measures of risk-taking behaviour, including the DOSPERT Likelihood of Involvement subscale (in the domains of gambling and recreational risks), the CARE Expected Involvement subscale (in the domain of high-risk sports), and the Gambling Behaviour Survey. First, the HARP scale for the risk activity of skydiving was examined with the DOSPERT Likelihood of Involvement subscale in the domain of recreational risks, $r(308) = -.50$, $p < .001$, and the CARE Expected Involvement subscale in the domain of high-risk sports, $r(308) = -.34$, $p < .001$. Next, the HARP scale for the risk activity of gambling (buying a $50 lottery ticket) was examined with the DOSPERT Likelihood of Involvement subscale in the domain of gambling, $r(308) = -.31$, $p < .001$, and the Gambling Behaviour Survey, $r(308) = -.33$, $p < .001$. These moderate to high correlational values between participants' scores on the HARP Scale and their reported conceptually-similar behaviours provide evidence in support of concurrent validity.

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Discussion

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The ability for the DOSPERT and CARE scales to assess both perceived benefits and perceived consequences in various risk domains made these scales amenable to alternative scoring methods to produce risk-balance scores. These risk-balance scores were used to assess the convergent validity, because even though they did not incorporate assessment of individual facets of risk perception, they did represent both perceived benefits and perceived consequences of risk domains that resembled the risks under study (skydiving and lottery). It was hypothesized that the Holistic Assessment of Risk Perception scale would demonstrate convergent validity with moderate correlational

relationships to conceptually similar phenomena (i.e., risk-balance scores from the DOSPERT and CARE scales). This hypothesis was supported, with most correlational values indicating moderate relationships.

To assess the discriminant validity of the HARP scale, it was hypothesized that the HARP would not share more than 20% of its variance with the Brief Sensation-Seeking Scale (BSSS). This hypothesis was only partially supported, as the HARP scale only shared 1% of its variance with the BSSS when used to assess the risk activity of buying a lottery ticket, but it shared 29.16% of its variance with the BSSS when used to assess the risk activity of skydiving. Past research (e.g., Zuckerman, 2007) has identified a strong relationship between sensation seeking and risky behaviour; however, sensation seeking is only one of the many facets of risk perception assessed by the HARP Scale. It is possible that consideration of an activity like skydiving created a halo effect for those high in sensation-seeking, such as the halo effect discussed by Weber and colleagues (2002), in which greater expected benefits (e.g., thrill sensation) were associated with smaller perceived risk consequences. Nonetheless, the results support discriminant validity in that if the scales were measuring the same construct, the shared variance between the HARP Scale and the BSSS would be similar, regardless of the type of risk measured. Therefore, the disparate measures of shared variance when the scales are used to examine different types of risk provide evidence in support of discriminant validity.

To assess concurrent validity, moderate relationships were hypothesized between risk perception, as measured by the HARP Scale, and risk-taking behaviour. In the current study, risk-taking behaviour was measured using the Likelihood of Involvement subscale from the DOSPERT (recreation risks domain and gambling domains), as well as

the Expected Involvement subscale from the CARE (high-risk sports domain), and the

Gambling Behaviour Survey (GBS). Concurrent validity was fully supported with

moderate to high relationships between the HARP Scale and all above measures of risky

behaviour.

To examine reliability, it was hypothesized that the Holistic Assessment of Risk

Perception scale would demonstrate internal reliability with high Cronbach alpha values

($\alpha \geq .80$). This hypothesis was supported with Cronbach alpha values in the excellent

range ($\alpha > .90$) when the HARP scale was used to examine both the recreational risk of

skydiving ($\alpha = .93$) and the financial risk of lottery play ($\alpha = .90$). Internal reliability was

the only form of reliability measured in the current project since the HARP scale is

intended to assess a person's current perception of risky activities, not the stability of

their risk perception over time; thus, making test-retest reliability inappropriate for this

study.

CHAPTER **5**

GENERAL DISCUSSION

The first pair of studies in the current project provided qualitative data that was used to identify facets of risk perception and determine their relative importance in people's determinations of activities as being good risks or bad risks. The procedures used in these studies were designed to minimize the possibility of introducing the confounds of risk-taking behaviour and cognitive bias during scale development. Specifically, Study 1A was used to assess the extent of cognitive biases and risk-taking behaviour of potential participants for Study 1B. Participants who were willing to participate in Study 1B were assigned to groups based on the dimensions of high-or-low bias and high-or-low-risk. The interviews from Study 1B provided rich data that represented participants' perceptions of a very broad range of risky activities. These risky activities spanned across multiple risk domains, including among others, financial, physical/health, social, recreational, ethical, and legal risks. The unstructured interviews provided participants the opportunity to fully explore their thoughts and perceptions of these activities. Therefore, these interview data made it possible to identify a wide breadth of risk facets that are involved in a person's perception of activities as being good risks or bad risks.

Participants also made several explicit statements during the interviews regarding the relative importance of various risk facets in their overall consideration of risky activities. For example, even if a risky activity was appealing to the participant in regard to many risk facets (e.g., admiration of activity, social benefits), they would still perceive it as a bad risk if they considered the activity ethically "wrong" or if the possible

consequences had potential to be very severe (i.e., participation in an activity possibly resulting in a long-term disability or incarceration). For this reason, the risk-perception facets that were identified by participants as being more important in risk perception were weighted more heavily in scale construction. Scale items were constructed to best represent each of their respective facets of risk perception. The facets that were weighted more heavily in participants' risk perception were represented by a greater number of scale items that reflected the relative importance that participants placed on that specific risk-perception facet.

The second study in this project was intended to provide quantitative data to support weighting of the facets within the scale. Study 2 was unsuccessful, due to the extreme variability in facet endorsement that was based on the type of risk (e.g., social risk, financial risk) being perceived. Therefore, the decision was made to weight information from the previous qualitative study (Study 1-B) much more heavily in decisions regarding scale refinement.

The same limitation that restricted mixed-methods analyses in Study 2, also introduced a limitation when using the HARP scale to assess risk perception across different risk domains. A goal of the current project was to expand on the findings from past research (Benthin et al., 1993a; Fischhoff et al., 1978; Hampson et al., 2001a), which had each identified between 9 and 14 risk facets that were used to assess risk perception of relatively specific types of risk. The current project identified 26 risk perception facets for the HARP scale, with the goal of being able to use the scale to assess perception of a variety of risky activities across all risk domains, such as recreational risks, health risks, academic risks, financial risks, and others. However, the results from these studies show

that some facets of risk perception may not be salient to participants at the time of risk perception. Additionally, some facets of risk perception may not even be applicable to some forms of risky activities. For example, the risk-perception facet of ethical considerations may not have clear application to some forms of risky behaviour, such as investing in a new house. In some other situations, such as choosing to take harder courses, ethical considerations would likely not be salient to students when they are considering the activity as a good risk or a bad risk, even though course options may have ethical implications in the future by better preparing student to fulfill their duties in their chosen occupations. For some other forms of risky activities, the risk-perception facet of ethical considerations would be very salient and applicable, such as in the perception of legal risks like shoplifting or illicit drug use.

These findings are consistent with past research (e.g., Schoemaker, 1990, Slovic et al., 1986; Weber et al., 2002) that found risk perception to be specific to the domain, or type of risk under study. For this reason, all facets of risk perception were retained, but a "non-applicable (n/a)" response option was added to the HARP scale to increase the scale's suitability for assessing perception across broad range of risky activities. As stated by Parker and colleagues (2011), it is necessary to investigate the possibility of multidimensionality in complex constructs in order to move research forward. While the HARP Scale is thought to be a unidimensional construct, future research could be used to examine the scale's structure. This may be able to negate the necessity for a "non-applicable" response option by performing multiple studies, with each study only assessing risky activities from one risk domain. Factor analyses could then be used to identify any subscales that are not applicable to specific risk domains.

Despite the inability to use mixed methods in Study 2 for scale refinement, the results from qualitative analyses in Study 1-B proved to be sufficient in refining the HARP scale prior to the evaluation of reliability and validity in the final study. The psychometric evaluation (Study 3) was successful in providing evidence to support both the reliability and validity of the HARP scale. Internal consistency was the only form of reliability assessed in the current project due to logistical considerations. However, future studies may find relationships between risk perception and more stable constructs, such as personality or global risk aversion. If these types of shared relationships are found in future studies, it may be beneficial to examine the test-retest reliability of the HARP scale. Nonetheless, evidence from the current study supported the concurrent, convergent, and discriminant validity of the HARP scale. Additionally, the conceptual similarity between risk facets utilized in past measures (Benthin et al., 1993a; Fischhoff et al., 1978; Hampson et al., 2001a) and 18 of the risk-perception facets from the HARP scale, provides supportive evidence of face validity.

Previous work by Fischhoff and colleagues (1978) had identified nine dimensions that had been predicted to influence risk perception. All of these dimensions shared conceptual similarities with risk perception facets identified in the current project. Similarly, all 14 of the risk facets identified by Benthin and colleagues (1993a) and all ten risk facets identified by Hampson and colleagues (2001a) shared conceptual similarities with risk perception facets identified in the current project (see Appendix I). While the remaining eight HARP risk perception facets did not appear as risk facets in previous risk-perception measures, many do share similarities to aspects mentioned in

other risk literature (e.g., Cruwys et al., 2021; Lauriola et al., 2014; Nicholson et al., 2005; Vlek & Stallen, 1980; Zuckerman & Kuhlman, 2000).

The concept of risk perception shares conceptual similarities with several other constructs, including among others, risk acceptance, risk choice, and risk preference. Distinctions between many of these constructs varies by discipline and theoretical foundation. For example, the risk-value (R–V) models (e.g., Bell & Fishburn, 2001; Jia et al., 1999; Sarin & Weber, 1993) state that risky choice is a compromise between risk and value, in that a person can judge the riskiness of an activity accurately, yet still prefer a higher-risk option over a lower risk option. Sokolowska (2006) discussed how these models depend on risk judgement and risk preferences being two distinct processes. Her research provided evidence that aspirations influence risk preferences, but not risk judgement, which supports the R–V models.

While there are conceptual similarities between the concept of risk preference presented in the R–V models and the concept of risk perception presented in the current project, there is also a conceptual difference between these constructs. Specifically, risk preference, as detailed in the R–V theory, refers to the participant's preference of one activity over another; whereas, risk perception as evaluated by the HARP scale refers to the participant's perception of a risky activity being a good risk or a bad risk, independent of any other risky activity.

The HARP Scale was developed using a different conceptualization of risk perception than has been set forth in previous research. In this project, risk perception is investigated as a holistic construct that acknowledges all risk-taking activities as having both positive and negative components, or facets. While a person's decision to engage in

risky behaviour may be influenced by his or her perception of the activity as a good risk, a person may consider an activity to be a good risk, but not have motivation to actually engage in the activity. Therefore, it is important to note that the HARP scale is intended to assess perception independently from risk propensity or risk-taking behaviour.

Grounded in Decisional Balance Theory (Janis & Mann, 1977), this project provides evidence to support the proposition that people weigh several perceived facets of risk, which culminate in their overall perception of the activity as a good risk or a bad risk. However, some findings were inconsistent with Decisional Balance Theory. Specifically, participants' perceptions of activities being a good risk or a bad risk were not the result of a simple balancing of number of benefits to number of consequences, because some benefits and consequences were weighted more heavily in participants' judgements of the activity being a good risk or a bad risk. In fact, the proportion of benefits to consequences was only one of the 26 risk-perception facets identified by participants, and only received the basic weighting (1 of 47) in creation of the HARP scale. Nonetheless, the Decisional Balance Theory did contribute the foundational structure for the current study, in that people weigh the importance of the possible positive and negative outcomes of an activity, and form a decision as to whether that specific activity is a good risk or a bad risk.

The HARP Scale contributes to the study of risk by providing a measure that can be used to study relationships between risk perception and a variety of constructs including both cognitive biases and risk-taking behaviour. Care was taken in the development of this scale to ensure that this measure of risk perception was not conflated with cognitive bias or risk-taking behaviour. This should aid in future research projects;

particularly, in those examining relationships between bias, behaviour, and perception. This scale also produces a single score for risk perception, which contributes to its flexibility and ease of use. This is an important consideration, as one of the intended implications of this research is to stimulate further research in the area of risk perception. It should also be noted that all data for this project was collected prior to the global pandemic that began in 2020. Future research may wish to examine any possible changes in risk perception that may have been influenced by the pandemic.

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APPENDICES

Appendix A: *Pilot Study*

Positive thought-action fusion is a cognitive bias that has only recently been identified as an independent construct (Craig & Lafreniere, 2016). As a result, there is very little evidence to substantiate the subscale structure of the P-TAF Scale. Craig and Lafreniere (2016) hypothesized that the subscale structure of the P-TAF Scale would be similar to the subscale structure of the TAF-R (Shafran, et al., 1996), because the TAF-R had been used as a theoretical model during the construction of the P-TAF Scale. However, an exploratory factor analysis provided evidence that the P-TAF subscale structure differed from the structure that had been hypothesized (Craig & Lafreniere, 2016).

In addition, past work by Craig (2014) provided evidence of a relationship between positive thought-action fusion and some forms of risk-taking behaviour. However, the specific nature of this relationship has yet to be determined. It is also unclear why this cognitive bias may be implicated in some types of risk-taking behaviour, but not in others. The purpose of this pilot study was to provide additional evidence that can be used to help delineate the relationship between positive thought-action fusion and risky behaviour. Additionally, a large sample was collected for this study so that a confirmatory factor analysis could be used to provide additional evidence of the subscale structure of the P-TAF Scale.

The hypotheses of the pilot study were:

H_1: Participants who score high on the P-TAF Scale will report higher levels of risk propensity.

H_2: There is a difference in the quality or type of risk perceptions between participants who score high on the P-TAF scale and those who do not.

H_3: A confirmatory factor analysis will support the P-TAF subscale structure found in previous work by Craig and Lafreniere (2016).

Method

Participants

A sample of 310 participants was obtained through the University of Windsor's Psychology participant pool. Due to the exploratory nature of a pilot study, there were no exclusionary criteria for participation. Students received 0.5 bonus points for 30 minutes of participation. The resulting sample was a diverse representation of the student population for both age (range = 18 to 32; $M = 20.86$) and ethnicity (White / European = 69%, Black / African / Caribbean = 5.5%, Latin / South American = 1%, East Asian / Chinese / Japanese = 6.8%, South Asian / Indian / Pakistan = 4.5%, Middle Eastern = 7.4%, Multiracial = 4.8%, No Response = 1%). There was an overrepresentation of female students in the sample (Female = 80%, Male = 18.7%, Non-Binary = 0.3%, No Response = 1%), which is common with samples drawn from the participant pool.

Measures

Positive Thought-Action Fusion Scale (P -TAF). Developed by Craig and Lafreniere (2016), this 26-item scale measures the positive dimension of the thought-action fusion phenomenon on a seven-point scale that ranges from "strongly disagree" to "strongly agree." An exploratory analysis (Craig & Lafreniere, 2016) provided evidence for a five-subscale structure that included Others ($\alpha = .91$), Self ($\alpha = .84$), Financial Gain ($\alpha = .86$), Moral ($\alpha = .75$), and Ethical / Global Concern ($\alpha = .76$).

Domain-Specific Risk-Taking (DOSPERT) Scale (Weber et al., 2002). This scale measures a variety of risk-taking activities with the use of six subscales: Ethical, Investment, Gambling, Health/Safety, Recreational, and Social. The DOSPERT Scale contains a total of 40 items, and participants are asked to rate them on a five-point scale that ranges from "very unlikely" to "very likely." While the DOSPERT scale can be used to assess risk perception and/or expected benefits, the current study only assessed the participants' likelihood of engaging in each of the activities as a measure of risk-taking behaviour.

Qualitative Assessment of Risky Activities. This measure was created for the current study in order to gather information about the participants' perceptions of risky activities. Participants were asked to provide a detailed account of their thoughts and feelings regarding three different risky activities: (1) Buying lottery and scratch tickets, (2) Chasing a hurricane or tornado by car to take dramatic photos, and (3) Not wearing a passenger seatbelt in a car.

Demographic Survey. This survey asked a variety of demographic questions (age, gender, ethnicity, major area of study) for the purpose of describing the sample.

Procedure

This study was performed online using FluidSurvey for data collection. The participants were first provided a consent form with details about the study. If they agreed to participate, they received the Domain-Specific Risk-Taking (DOSPERT) Scale (Weber et al., 2002), and the Positive Thought-Action Fusion Scale (P-TAF; Craig & Lafreniere, 2016). Participants were then asked to provide open-ended responses to the three questions in the qualitative assessment of risky activities. These were followed by

the demographic survey. Participants also completed additional measures that were not included in the current study. Participants were then provided a letter of information describing the study in more detail, and then all participants were redirected to a separate landing page in the survey database to submit their name for remuneration purposes.

Results

All survey responses that were terminated before completion were removed from the data file. Analyses confirmed that all missing observations were missing at random; therefore, a multiple imputation method was used to fill in missing data prior to analyses. The internal reliability was examined for all scales and subscales, resulting in Cronbach's alpha values that ranged from adequate (α >.70) to excellent (α >.90). Please see Table 1a for details.

Table 1a *Descriptive Information for Scales used in Pilot Study*

	Items	*M*	*SD*	*α*
P-TAF Scale	26	67.63	29.36	.95
Others Subscale	9	22.60	12.30	.93
Self Subscale	6	20.90	8.50	.86
Financial Gain Subscale	4	8.50	5.01	.85
Moral Subscale	3	7.61	4.06	.79
Global / Ethical Concern Subscale	4	8.30	4.68	.81
DOSPERT Scale	40	93.62	18.29	.87
Ethical Subscale	8	13.51	4.61	.76
Investment Subscale	4	13.85	3.72	.82
Gambling Subscale	4	5.25	2.24	.79
Health/Safety Subscale	8	19.34	5.41	.67
Recreational Subscale	8	19.53	6.92	.83
Social Subscale	8	26.26	4.95	.70

Analysis of the relationship between the P-TAF scale and risk-taking behaviours supported relationships between positive thought-action fusion and social risk taking, $r_{(310)} = -.156$, $p = .006$, investment risk taking, $r_{(310)} = .166$, $p = .003$, and gambling $r_{(310)} = .266$, $p < .001$. However, the results did not support relationships between positive thought-action fusion and ethical risks, recreational risks, or health and safety risks. Correlational relationships between the various forms of risk are detailed in Table 2a.

Table 2a *Correlations Between Various Forms of Risk-Taking Behaviour*

	Social Risk	Ethical Risk	Investment Risk	Gambling Risk	Health & Safety Risk	Recreational Risk
Social Risk	--					
Ethical Risk	.249**	--				
Investment Risk	.148**	.203**	--			
Gambling Risk	.003	.295**	.216**	--		
Health & Safety Risk	.368**	.542**	.083	.182**	--	
Recreational Risk	.334**	.322**	.188**	.211**	.475**	--

** Significant at $p = .01$

For Hypothesis 2, there were three qualitative responses included in the survey that asked participants for a detailed account of their thoughts and feelings regarding three different risky activities. Qualitative responses were analyzed using thematic analysis. The themes that emerged from responses to the first risky activity (buying lottery and scratch tickets) were labelled *belief in luck*, *an aspect of control*, and

perception of a benefit other than monetary gain. The themes that emerged from the

second risky activity (chasing a hurricane or tornado by car to take dramatic photos),

included *enthusiastic about the thrill of chasing storms*, and *enjoying thrill-seeking, but

not to that extent*. The themes that emerged from the third risky activity (not wearing a

passenger seatbelt in a car) included *a belief that seatbelts are not necessary*, and *a fear

of sanctions if not wearing a seatbelt*. Qualitative responses from the survey were coded,

and participants received a nominal score for each of the themes that emerged from the

data. For example, participants who commented on an aspect of luck received a score of

1, while those who did not comment on luck received a score of zero for that specific

variable. Scores from the P-TAF scale were divided by determining cut points for three

equal groups, and then recoding the variable with the highest and lowest groups receiving

nominal values.

Chi square analyses were performed using two-by-two cross-tabulated designs,

with the nominal P-TAF values as one variable and the nominal theme scores as the other

variable. Results from all chi-square analyses were non-significant, with the exception a

relationship between positive thought-action fusion and a fear of sanctions for not

wearing a passenger seatbelt, X^2 (1, $N = 210$) = 4.79, $p = .029$, with a higher number of

participants with high P-TAF scores reporting a fear of sanctions ($n = 23$) then expected

($n = 17.2$) for not wearing seatbelts.

For Hypothesis 3, a confirmatory factor analysis (CFA) was performed using

Amos software. Multivariate outliers were removed ($n = 29$) after being identified with

Mahalanobis distance. There was still a sufficient sample size ($n = 281$) after removing

the outliers. The CFA compared the theoretical structure first hypothesized by Craig and

Lafreniere (2016) and the factor structure that the authors later revealed with an exploratory factor analysis. Results of the current study confirmed that the factor structure that had been revealed by the exploratory factor analysis (Model 2) was a better fit than the original hypothesized structure (Model 1). Please see Table 3a for details.

Table 3a *Fit Indices for Possible Substructure of the P-TAF Scale*

					RMSEA C.I.			
Model	χ^2	*df*	χ^2/df	RMSEA	LO	HI	CFI	TLI
1	1261.38	289	4.37	.11	.10	.12	.83	.81
2	745.97	289	2.58	.08	.07	.08	.92	.91

Model 1 = Theoretically hypothesized structure (Craig & Lafreniere, 2016)
Model 2 = Structure revealed through EFA (Craig & Lafreniere, 2016)

Discussion

The analyses for Hypothesis 1 were consistent with past research by Craig and Lafreniere (2016), which had found evidence to support relationships between positive thought-action fusion and some forms of risk-taking behaviour, while simultaneously finding no evidence to support relationships between positive thought-action fusion and other forms of risk-taking behaviours. The reasoning for these different relationships is not supported by correlations between the risk variables. For example, there was no significant correlation between social risks and gambling risks ($r = .003$, $p = .957$), yet both of these forms of risk-taking behaviour were related to positive thought-action fusion. Similarly, there was a significant relationship between health and safety risks and social risks ($r = .368$, $p < .001$), yet social risks were related to positive thought-action

fusion, while health and safety risks were not. These findings suggest that there may be another variable of interest that is mediating the relationships between positive thought-action fusion and various forms of risk-taking behaviour.

The results for Hypothesis 2 were unanticipated, as the only statistically significant result was in the opposite direction than would be expected. Positive thought-action fusion was significantly related to the participants' fear of getting a ticket for not wearing their seatbelt. However, the P-TAF scale contains items such as "If I think about getting away with cheating, this increases the chance that I will get away with cheating" (Craig & Lafreniere, 2016). Therefore, it would be expected that those with high scores on the P-TAF scale would have less fear of retribution. It is possible that the brief, open-ended responses on an online questionnaire did not provide enough detail from the participants for qualitative analysis.

The results from Hypothesis 3 were able to provide evidence in support of the P-TAF subscale structure that had been revealed by Craig and Lafreniere (2016) during exploratory factor analysis. The confirmatory factor analysis performed in the current study was the final step in psychometric evaluation of the P-TAF scale, which validates its subscale structure for use in future research.
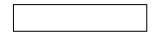
Appendix B: *Demographic Questionnaire*

Gender

○ male

○ female

○ transgender

○ other (please specify) _____

Age at last birthday

To what racial or ethnic group do you belong?
If you belong to more than one group, please check all that apply.

☐ White/ European

☐ Black/ African/ Caribbean

☐ Latin/ South American

☐ East Asian / Chinese / Japanese

☐ South Asian / Indian / Pakistani

☐ Indigenous / Metis / First Nations

☐ Middle Eastern

☐ Bi/ Multiracial (please specify) _____

☐ Other (please specify) _____

Is there anything, such as your age or religious beliefs, that prevents you from taking part in gambling activities (e.g., slot machines, bingo, lottery tickets)?

☐ Yes (please specify) _____

☐ No

Item added for Study 1A:
If selected, would you be willing to consider taking part in a follow-up interview?

Appendix C: *Domain Specific Risk Attitude (DOSPERT) Scale* (Weber, Blais & Betz, 2002)

Likelihood of Engagement Scale Instructions:
For each of the following statements, please indicate your likelihood of engaging in each activity or behavior.
Provide a rating from 1 to 5, using the following scale:
1= Very unlikely; 2= Unlikely; 3= Not sure; 4= Likely; 5= Very likely

Risk Perception Scale Instructions:
People often see some risk in situations that contain uncertainty about what the outcome or consequences
will be and for which there is the possibility of 'bad' consequences. However, riskiness is a very personal and
intuitive notion, and we are interested in your gut level assessment of how risky each situation is.
For each of the following statements, please indicate how risky you perceive each situation. Provide a rating from 1 to 5, using the following scale:
1=Not at all risky-------- 2----------- 3=Moderately risky-----------4------------5=Extremely risky

Expected Benefits Scale Instructions:
For each of the following statements, please indicate the benefits you would obtain from each situation.
Provide a rating from 1 to 5, using the following scale:
1=No benefits at all--------2-----------3=Moderate benefits-----------4-------------5=Great benefits

Risk Activities by Domain

Social Risks
1.   Admitting that your tastes are different from those of your friends.
10. Disagreeing with your father on a major issue.
16. Arguing with a friend about an issue on which he or she has a very different opinion.
19. Approaching your boss to ask for a raise.
23. Telling a friend if his or her significant other has made a pass at you.
26. Wearing provocative or unconventional clothes on occasion.
34. Taking a job that you enjoy over one that is prestigious but less enjoyable.
35. Defending an unpopular issue that you believe in at a social occasion.

Recreational Risks
2. Going camping in the wilderness, beyond the civilization of a campground.
6. Chasing a tornado or hurricane by car to take dramatic photos.
15. Going on a vacation in a third-world country without prearranged travel and hotel accommodations.
17. Going down a ski run that is beyond your ability or closed.
21. Going whitewater rafting during rapid water flows in the spring.
31. Periodically engaging in a dangerous sport (e.g. mountain climbing or sky diving).
37. Trying out bungee jumping at least once.
38. Piloting your own small plane, if you could.

Gambling
3. Betting a day's income at the horse races.
11. Betting a day's income at a high stake poker game.
22. Betting a day's income on the outcome of a sporting event (e.g. baseball, soccer, or football).
33. Gambling a week's income at a casino.
Gambling subscale items added for Study 2B:
- Buying a $10 scratch ticket
- Playing poker online for money
- Betting $20 on slot machines at the casino
- Playing black jack with friends for money
- Buying lottery tickets when the jackpot is large
- Playing the same numbers on lottery tickets each week

Health and Safety Risks
4. Buying an illegal drug for your own use.
8. Consuming five or more servings of alcohol in a single evening.
27. Engaging in unprotected sex.
29. Not wearing a seatbelt when being a passenger in the front seat.
32. Not wearing a helmet when riding a motorcycle.
36. Exposing yourself to the sun without using sunscreen.
39. Walking home alone at night in a somewhat unsafe area of town.
40. Regularly eating high cholesterol foods.

Ethical Risks
5. Cheating on an exam.
9. Cheating by a significant amount on your income tax return.
12. Having an affair with a married man or woman.
13. Forging somebody's signature.
14. Passing off somebody else's work as your own.
20. Illegally copying a piece of software.
25. Shoplifting a small item (e.g. a lipstick or a pen).
28. Stealing an additional TV cable connection off the one you pay for.

Investment Risks
7. Investing 10% of your annual income in a moderate growth mutual fund.
18. Investing 5% of your annual income in a very speculative stock.
24. Investing 5% of your annual income in a conservative stock.
30. Investing 10% of your annual income in government bonds (treasury bills).

Appendix D: *Gamblers' Beliefs Questionnaire (GBQ) – Illusion of Control Subscale*

(Steenbergh, Meyers, May, & Whelan, 2002b)

Participant Instructions:

Please read each of the following statements carefully. Rate to what extent you agree or disagree with each statement. Each item was rated on a Likert-type scale that ranged from 1 (*strongly agree*) to 7 (*strongly disagree*).

Rating Scale:

1 = Strongly Disagree
2 = Disagree
3 = Somewhat Disagree
4 = Neutral
5 = Somewhat Agree
6 = Agree
7 = Strongly Agree

Question Items:

1. I think of gambling as a challenge.
2. My knowledge and skill in gambling contribute to the likelihood that I will make money.
3. My choices or actions affect the game on which I am betting.
4. I should keep track of previous winning bets so that I can figure out how I should bet in the future.
5. Gambling is more than just luck.
6. My gambling wins are evidence that I have skill and knowledge related to gambling.
7. I have a "lucky" technique that I use when I gamble.
8. I have more skills and knowledge related to gambling than most people who gamble.

Appendix E: *Positive Thought-Action Fusion (P-TAF) Scale* (Craig & Lafreniere, 2016)

Participant Instructions:
Please indicate the extent that you agree with the following statements.

Response Scale:
1 = Strongly Disagree; 2 = Disagree; 3 = Somewhat Disagree; 4 = Neither Agree nor
Disagree; 5 = Somewhat Agree; 6 = Agree; 7 = Strongly Agree

Question Items:

Factor 1: TAF Others

1. If I think of a relative/friend finding a new job, this increases the chance that they will get a new job.
2. If I think of a sick relative/friend getting better, this increases the chance that they will get well.
3. If I think of my friend/relative winning an award, it increases the chance that they will win an award.
4. Thinking of someone else being successful increases the chance that they will be successful.
5. If I think of a friend/relative avoiding a car accident, this decreases the chance that they will have a car accident
6. If I think of a friend/relative getting home safely, this increases the likelihood that they will get home safely.
7. If I think about my pet staying healthy, it increases the chance that they will stay healthy.
8. If I think of my car running well, it decreases the chance that my car will break down.
9. If I think about animals being friendly, it decreases the chance that I will be attacked by an animal

Factor 2: TAF Self

10. If I think of myself winning a competition, it increases the chance that I will win.
11. If I think about being attractive, it will make my desired partner more attracted to me
12. If I think of myself in a higher position at work, it increases the chance that I will get a promotion.
13. When I am sick, if I think about getting better, it increases the chance that I will get better.
14. If I think of myself as being popular, it will make me have more friends.
15. If I think about winning, it decreases the chance of me losing

Factor 3: TAF Financial Gain

16. If I think of myself winning while scratching lottery tickets, it will increase the chance of winning
17. If I think of a friend/relative winning the lottery, this increases the chance that they will win the lottery.
18. If I think of myself winning the lottery, this increases my chance of winning the lottery.
19. If I think of being a millionaire, there is a better chance that I will get a million dollars

Factor 4: TAF Moral

20. Having an honourable thought is almost as good as doing an honourable deed.
21. Thinking about helping someone else is almost the same as actually helping someone.
22. When I have a kind thought about someone else, it is almost as good as paying them a compliment.

Factor 5: TAF Ethical / Global Concern

23. If I think of myself getting away with cheating, this increases the chance that I will get away with cheating
24. When I hear news reports of peace talks, I know that it is because I thought about world peace.
25. If I think about the end of global warming, it will increase the chance that global warming will end.
26. If I think that I won't get caught speeding, it increases the chance that I will get away with speeding.

Appendix F: *Interview Guide for Study 1-B*

<u>**Preamble:**</u>
The definition of a risky activity is any activity that has the potential for positive benefits or negative consequences. Most activities in life have some amount of risk involved. For example, if you purchase a lottery ticket you risk financial loss. Or, if you disagree with your friends you risk social consequences. And if you go skydiving, you are risking injury. The purpose of our discussion today is for you to think carefully about what kinds of things you think about when you are deciding whether or not to participate in an activity. I am interested in hearing about everything you consider when making your decision.

<u>**Sample questions:**</u>

1. Can you please list a few risky activities that you have considered participating in recently?

2. Can you please describe what you were thinking the last time you participated in [risk-taking activity 1]?

3. Can you please describe what you were thinking the last time you participated in [risk-taking activity 2]?

4. Can you please describe how you feel about the prospect of going skydiving?

5. What did you think about the last time that you were the passenger in a vehicle, and you were deciding whether or not to wear a seatbelt?

6. Have you ever bought a scratch ticket?
    a. Can you tell me why you decided (not) to purchase a ticket?

<u>**Prompts**</u> (may be used to explore initial responses to any of the above questions):

   i.   What are your thoughts about the possible benefits from [activity]?

  ii.   What are your thoughts about the possible consequences from [activity]?

 iii.   Do you consider your participation in [activity] to be something voluntary, or is it pretty much unavoidable?

  iv.   How familiar are you with [activity]? Is it something you take part in frequently?

   v.   Do you know a lot about [activity], and any possible benefits or consequences that may come from it?

  vi.   Do you know many people that take part in [activity]?

 vii.   Do you feel that you have a degree of control over the outcome of [activity]?

Appendix G: *Sample of Qualitative data used to Identify Themes and Subthemes*

Theme (Subtheme)	Sample Quotes from Data
Admiration of Activity	P3: *Yeah, I would have bragging rights saying, "I actually did this" and I would be a part of myself would be proud for taking that step…* P15: *My mark wasn't very good in the class, but I did it and I am very proud. I decided to take that risk because I think it's cool to say I did it. I feel very proud of the difficult courses I have taken.* P24: *I've always wanted to. I've always thought it was really cool. I love flying. And jumping out of a perfectly good airplane sounded like a good plan.* P11: *It would be one of those life time experiences. To be able to say I've done it and to see the world in a different view.* P2: *I don't think anyone would say anything, but I don't think it would be looked on well.* P15: *I think it's cool when people do things like that.* P20: *I find it admirable to be able to accept the randomness of life and its experiences.*
Interest	P28: *I think, in the beginning, coming out of high school, I was really excited to only be studying the things I want to study. And then, I realized that there is still a lot of stuff that isn't that interesting to me.* P34: *I don't think it would ever be something I would consider. Even if I had that money, I don't think that would be something I would do.* P34: *I know some of my friends do the stock market thing. It has never meant anything to me.* P9: *I think I would avoid anything I don't feel comfortable with. It's something that doesn't interest me anyways.* P2: *…it was one thing I had always wanted to do.*
Adrenaline rush / Sensory Appeal	P1: *Drinking and gambling can give you a rush, like a quick rush. Maybe it's the increase of dopamine, I don't know, but it's something that you don't have to work hard for.* P10: *…[because of] my love and need for speed and going fast, like motorcycles.* P12: *The benefit of that is it makes me feel good. It is a sense of escape for me.* P17: *It's very exhilarating to carve the cores and go through hills and rivers, and not stopping no matter what you see.* P21: *I enjoy the feeling of being on a motorcycle and the adrenaline.* P27: *A lot of it being the adrenaline rush. I used to like going on roller coasters, but then I got bored of them. I want to go to the next level.* P31: *I just love the feeling. I'll relate to roller coasters. I love the feeling of having my hands out just when the drop is coming. That weightless factor.*

Social Benefit	P2: *I think it's, like, partially the positive component holds a social aspect.* P17: *You get to bond with your friends.* P32: *I do it with my grandma. I find it as an interaction and it's fun for us.* P4: *Bringing us closer in the relationship. I mean, that definitely helps build bonds and stuff that way.* P4: *Definitely, not part taking would be something that would hinder those relationships just because there's conversations that you can't participate in and bonding the moments that you can't be a part of.*
Proportion of Benefits versus Consequences	P3: *So, it is kind of like, considering the risks and the benefits involved, they're kind of equal. I guess it depends on how you execute your plan in order to cheat your way out of this midterm or final.* P10: *Is it worth the fight? Is it worth telling them and it is going to end up in a fight? Is it worth the drama I don't need or want?* P12: *What are the pros and cons of everything? And, sort of weighing out long-term risks that could happen.* P13: *I would take the consequence of them finding out and getting mad or grounding me. The benefits are worth it.* P16: *I feel like the negative outcomes outweigh the positives because the positive is only to have a good time.* P19: *Doesn't seem worth it. You're going to go to jail for a chocolate bar? Come on, do big or go home.*
Severity of Consequences	P1: *There were teachers who you heard horror stories about from previous programs and people. And I just remember thinking "Oh my God, I don't want to take it" and I am crying and "oh blah blah blah". And flash forward to today, I have the mentality of don't cry. Don't worry because you either get the credit or you don't!* P2: *I think about like cheating on something, I'd say, I would rather completely fail an exam. I would rather get a 20% on it rather than getting a zero and getting kicked out of university.* P11: *If I sprang my ankle, that's one thing. But if I hurt my back and need to sit in a wheelchair, then that's the rest of my life.* P22: *If I tell the truth, I know I am telling the truth. If I am telling a lie and she finds out, there is a bigger punishment for that. I know that, so I don't do that usually.* P34: *Trying your hardest and still failing. That's defeating. I think I would rather take a course that is not super interesting but I know I will do well as long as I am trying. Whereas, something you are trying and trying and trying, but you don't make it. It'll make me not love it.*

Significance of Benefit	P11: *This professor is crazy hard. Everyone says "you're not going to get a good mark", but I know this professor teaches really well. And I think the subject material will really benefit me in the long run* P20: *It would be hard, but the idea of "I am doing this for something greater" would really help me to push through that.* P22: *If it is really important to me, I don't care about the risks. If it's important than I have to do it. I would take the risk.* P22: *If I had money right now, I would invest in small businesses. I would invest. I wouldn't invest in bonds because there isn't much gain.* P26: *I would cheat for a scholarship, and willing to push my luck for it. If it was to cheat just for a good grade, I would do it once and then not try to do it anymore.*
Disappoint Significant Others	P1: *Like I would never want my parents to be ashamed of me. Or, you know, my friends would just think "What happened? Like, why would you do something like that?"* P23: *They wouldn't get mad, mad. I just don't want to disappoint them.* P33: *It's difficult because it's people I love, and they trust me. If I lie to them, I feel like I am piercing a dagger in their chest because, I am not only hurting myself, but them.* P4: *I come from a family that is very against drugs, so there would definitely be my parents feeling like they have failed and their disappointment.*
Control of Situation	P1: *You don't know what's going to happen. You never know what's going to happen on the road but you're safe when you put your seatbelt on.* P12: *The first thing is if there's another way to take it without that professor...Gain some control to take it in the summer or the winter or the fall. Maybe the professor will be different.* P12: *In my family and where I am at for my age, 21, there's still a lot of "you don't know how to make your choices yet. We still have to guide your specific path and tell you what works and what doesn't." My main thing is even when I want to control that situation, I know I can't.* P14: *If I felt like I had control then, I might be more apt to do it.* P15: *But I like being in control of my own thing and you're attached to someone who has control over what's going to happen to you— whether you fall flat—I think I would panic midair and it would not go well.* P17: *There is things you can do before, like having a SAT phone or being in a big group or educating yourself or knowing what to do if you encounter a dangerous animal.* P21: *If I was going to gamble, I would do it as a poker game because I feel like I have more control, rather than the machines.*

Predictability	P1: *Even though, I focus so much on it and I appreciate it so much that there's still a potential that it will not work out…. The only thing that can tell is time*
	P12: *The immediate fear is where am I landing? Is it the ocean, land, a person's house? Where are we going?*
	P13: *Doing drugs is a lot more risky. You never know what you are getting.*
	P15: *I think it was a very risky move because I tend to live at home and in my comfy little nest. So, [student exchange] is going out of my comfort zone which is a risk.*
	P17: *If I am in a safe place, then 6 or 7 shots, I will be fine—I will just stay there. But if I am in a public place, I wouldn't do it. I don't know what other people will do. I don't know what will happen.*
	P19: *I think you can sum it up as, "risk is the unknown and people are afraid of that unknown". That's why they are risk averse.*
	P24: *I would definitely invest in real estates before investing in bonds or the stock market because nobody knows when the stock market goes up or down.*
Skills or Abilities	P1: *I am a better driver now, I don't think about my safety. I don't think about "I need to put my seatbelt on".*
	P14: *I am not good at poker, blackjack, and stuff like that. If I were good, then maybe*
	P20: *When I make the decision to drive, I know I can operate a machine at that moment. I know myself pretty well in my toxicity level and what I can do.*
	P25: *I play video games a lot and they are decently competitive. Would I put money on some of those, maybe if I had a chance of winning. It's more skill oriented than random chances in those. The more skill I have, the more control I have in the situation.*
	P28: *I have been training up to the meet, for example. It's something I feel comfortable with.*
	P3: *If I were to pick up a skate board, at first, I would try to go in stages. I would never try to go from a kick flip right off the bat because I've hardly done any skating in my life time.*
Ease of Participation	P3: *Let's say if I was trying to steal a chocolate bar instead of a flat screen tv. Besides the size, I feel like it would be easier for you to go for the chocolate bar.*
	P11: *I'd be more willing to steal a chocolate bar at a small store with small security than a chocolate bar from a store with high security.*
	P18: *I had to write a test outside of my class with my phone in my pocket and the teacher never checked on me. I could've cheated.*
	P19: *You going to twist the neck to see his paper? Might as well study. It's easier than cheating.*
	P27: *I want to do stuff that doesn't require me to have a lot of background information and knowledge.*

Vulnerable or Unsafe Conditions	P1: *When I was first driving, I was driving a very unsafe vehicle. Like, it was a car probably from the 80s. And I'm not sure that there were many safety standards at all, let alone the ones we have today…* P12: *What I was most worried about was the coral in the reef because if you touched it, it could paralyze you…That was what kept me from fully enjoying the sharks because I was concentrating on the coral.* P15: *I applied to France and there have been recent terrorist attacks so that also scared me.* P31: *If I was at a party…like a sketchy party, I would not drink that much because I wouldn't want to let my guard down.* P36: *…the idea that I am exposing myself and putting myself in a vulnerable space being intoxicated like that is not appealing.*
Ethical or Moral considerations	P2: *It's not about being caught or not, it's living with that money that you stole. It makes me feel sick. I don't think I am satisfied with who I am right now. I don't want to have money unless I made it.* P10: *It's probably tempting if I am hungry. It's still wrong. I wouldn't do it.* P11: *It's wrong and it's very, very wrong. Not just kinda wrong.* P12: *It was that guilt and shame that I would lie to my parents and I wasn't brought up like that.* P12: *My mom always says, "your work ethics means more than your grades on your transcript". And I've grown to fully believe that.* P13: *I would think "you can't do that. It is wrong"* P17: *Even if it is only the rich 1%, it's still not mine and I don't have the right to take that.*
Immediacy of Effect	P10: *Cancer? Then that's not good. Sometimes I think about it if I am laying out in the sun too long… Sometimes I do think about it but not as much as the burn.* P11: *I'd go for the $1, $3, or $4 [scratch tickets]. Buy something that would give me immediate gratification.* P15: *It would be the immediate changes to my health that would worry me. Long term, that could be horrible and detrimental to your health. But the immediate knowing that I would gain weight…I think that would be the immediate thoughts of needing to change my diet.* P22: *Heart disease and stuff, yeah, they are there, but I don't think about them because I like food. My age is such that I don't care about heart diseases and stuff.* P27: *If I was closer to my retirement, I would be less interested in the stock market. But, because I am young, and I can wait for that rebound, I am less concerned about that.* P33: *With bonds, it's a slow process. I'd forget about it*

Knowledge about activity	P13: *I don't know how to do it.* P15: *I personally wouldn't do it because I don't know how. I've never played Poker.* P11: *[In Kinesiology], we've talked a lot of physical stuff, like injuries. I think my perspective would be different if I majored in something else* P23: *People who are in stock market know which ones go up and which ones don't. They have more knowledge. For me, I don't really know.* P27: *I've never played any card games at the Casino because I find them really intimidating. I don't want to walk up to a table and not know what I am doing.* P35: *I don't think we have expertise in robbery to pull something like that. We have to get it planned.*
Gain experience or Info	P6: *In a way, it could open up an opportunity. Say the government sees that you can do this, they can hire this guy to prevent other people from doing what he is doing.* P11: *I am willing to take the risk to gain the experience.* P20: *If the [tough] course is interesting to me I would still do it just for the pursuit of education.*
Necessity	P13: *I think there's a lot of other options before that point. I don't think I would ever let myself do that.* P15: *If it wasn't a necessity, I wouldn't steal. If I had the money, I would pay for it.* P17: *I would think of other alternatives before I resorted to [cheating].* P22: *I would do it for sure. Survival and risk taking, if it is a question of survival, survival wins.* P25: *I absolutely need to defend myself. If I am being pushed into a fight that means to do me harm, then by all means I have to fight.* P27: *How badly I would need it too. If I really need it for Grad school and this is my last year and my last class and it's weighted heavily and I wasn't able to study at all.* P6: *I feel like if you really need it, you need to do what's best for you at the time.* P33: *It comes to desperation. We all have that part in our minds for our survival—needs to get that scholarship, "You NEED it. YOU BETTER CHEAT BOI."*

Participation by Others	P23: *The more common it is, the more likely I am going to do it. The less common, the less likely I am to do it.* P24: *I feel like it happens quite a bit. There is always a few kids that are cheating during every exam.* P26: *I am usually in the background and let them try first. If they are ok, I should be ok.* P28: *If I knew other people had [test bank answers], then going in, I would have too. Other people are going into the test with that advantage, I want that advantage too.* P31: *If it's more common—because you can see the chance. I am very probable. If they got out of it without any harm, then, "Awww what the heck"* P33: *I am not going to do it just because everybody else is doing it.* P35: *Sometimes it's easier to fit in than to be by yourself. I'd be more tempted because everyone else is doing it.*
Past experience	P11: *No matter what, safety first because I have so many past experiences. I have seen people getting hit and seeing the medical side of things by seeing people come out and having to go through rehab because they weren't wearing a seatbelt. Seeing people losing their extremities, like a leg, in a car. And it was because they weren't wearing a seatbelt.* P1: *I lost a friend to an accident where they were not wearing their seatbelt. And for a while, I, you know, I was consciously aware of "put your seatbelt on, put your seatbelt on"* P12: *[I hide my sexuality because] I came out to my parents during my first year of university in my letter, and it didn't go as well as I hoped. They swept it under the rug and "it's a phase". They sent me to therapy and all that stuff.*
Probability	P11: *If I knew there was a higher chance of being caught, I'd be against it…a lower chance, then I would be more for it.* P17: *The odds of it paying out is too minuscule for me to want to spend money.* P28: *I'd probably buy a scratch ticket before a lottery ticket. I think a lottery ticket is more unlikely for multimillions. If I were to play a scratch ticket for a thousand bucks, it's almost like more of a chance.* P31: *If you are playing roulette and you put down your money on red, then there is 40% you will win. But then the 60% chance of you losing money is more. It's a flip of a coin at that point. It's not worth it.* P7: *Immediately, I'm thinking can I get away with it… "How possible is it?" you're weighing whether it's feasible…* P9: *The probability is really low so I don't play the lottery.*

Relative to Current Position	P1: *Like only if I had 5 days to live, sure, why not, right?* P2: *I wouldn't want to ruin, like, everything that I've worked for so far in my life, knowing that, like, all of those years and years of school or whatever just to have a future that's a dead end.* P9: *I am already in a good environment; I would think about the consequence. What if I take this [new] job and it won't last long? I am not going to have a job.* P10: *Too much to lose…not worth it.* P14: *Maybe if I didn't have a place to live, like literally nothing to lose…I could see getting caught up in that kind of thing…maybe getting away with it.* P17: *If you get caught [cheating], you could get kicked out of university. So, all these years that you've done will mean nothing.* P27: *I do not think I would take that risk. I don't think I would want to give up my future and my goals. It's a lot. Short term risks to that is huge. I am at a good spot in life.* P29: *Too young to die. I have too much to lose.*
Apathy	P1: *But I also think, "Well, I could get out of my car and a car could hit me and I could die."* P10: *I have heard of people getting injured, but that's with everything. Maybe I'd try.* P12: *There's risk with everything in life… walking out the door.* P19: *Thinking from health aspect, I really don't care. I am French so health means nothing to me. Everybody smokes there.* P24: *It's something that I worry about less because I live in Windsor and it has the highest cancer rates. If I figure I will get it anyways.*
Religion	P11: *I am not worried about letting down my friends nor my parents being ashamed of their kid making a stupid decision. But I am ashamed of letting down God.* P17: *Stealing from a bank and all of the people, it violates the 10 commandments.* P23: *I don't drink at all. That has nothing to do with drinking. It's because I can't drink because of my religion. I don't drink at all. Not one. Not ten. It won't make a difference at all.* P3: *If you're religious, at all too, I mean, stealing is considered to be a sin so it would just be bad…* P35: *It's more a fear of disappointing God. I know I will be forgiven. It's more the sin. God is watching me and is shaking his head right now.*

Fear / phobia	P13: *I'd be too scared and anxious [to cheat].* P22: *If someone pushes me [out of the plane], it would be better. I don't think that I would be able to go on my own. I won't do that, but I want to.* P4: *People are like, "Oh, it's fine. I'm a good driver." And I'm like, "You don't understand. I can't handle this. I will start crying if I can't get this seat belt on my body right now!"* P9: *I am very terrified of heights. I think for me that even if someone said "I'll give you a billion dollars" I still wouldn't*
Risk to Others	P33: *I am bi-sexual, and my family is super religious. If I were to tell them I have a slight thing for guys, they would be shocked and disappointed. It comes down to I rather not have them feel that pain. I'd rather hold that in myself and let them live in the world of, "My son is a straight person who we can trust."* P33: *I think this ties into consequences, but mostly it's how it affects others besides me.* P4: *I have some family members that do have academic reputations, not at this university, but at different universities. I would probably be concerned with how that affects them if I was plagiarizing. Would that ruin their reputations in some way?* P14: *If you are in a car accident and you are not strapped in, you could injure other people in the car because you become projectile.* P28: *If I can reason with myself that this is not going to affect their life that much, I am ok.*

Appendix H: *Risk perception Scale Statements used in Study 2 with primary, representative question items bolded*

1. It is an admirable activity.
2. Most people see it as an admirable activity.
3. **I think it is an activity my friends would admire.**
4. It requires a personal characteristic (e.g., bravery, kindness) that I find admirable.
5. I would feel embarrassed if people I know found out that I had done it
6. I find it interesting.
7. It is not the type of activity that I find interesting.
8. I just don't see the point in doing it
9. **It just doesn't appeal to me.**
10. I can think of much better ways to use my time or resources.
11. It is just not worth my effort
12. I would enjoy the sensation that I could get from it
13. I am driven to do it because of the feeling it could give me.
14. It would give me a pleasurable feeling.
15. It would allow me to cut loose and enjoy myself.
16. **I would get a feeling of satisfaction from it**
17. It would provide an adrenaline rush.
18. There would be a sense of exhilaration from it
19. It is an activity that could give me a thrill.
20. **It would be really exciting / pleasurable.**
21. **It is one of those experiences that you can't wait to tell your friends about.**
22. It would be great to be able to tell my friends about it
23. Taking part in it gives you a good story to share with friends.
24. **I would enjoy the feeling of being able to say that I have done that.**
25. I feel there is a benefit to being able to say that I have done this.
26. I feel that I can experience personal growth from it
27. Taking part in this would make me a better person.
28. It would allow me to express a different aspect of myself.
29. Doing it would make it easier to have similar experiences in the future.
30. **Taking part in it can create other opportunities for me.**
31. **I would find it entertaining.**
32. It would be an escape for me.
33. It could be relaxing
34. It would help in coping with everyday life.
35. It would be fun to do
36. It would be a good way to pass some time
37. **Being able to do it would make me feel powerful.**
38. I would feel powerful when I do it
39. **I would feel a sense of accomplishment for doing this.**
40. Facing it head on is an accomplishment in itself.
41. **I see it as a challenge that I want to overcome.**
42. Doing it would be quality time spent with people I care about.
43. **This is an activity I can share with people I enjoy spending time with.**
44. It can bring me closer to the people I care about.

45. **There are more possible benefits than consequences**
46. There are more possible consequences than benefits
47. **The possible consequence is extremely severe**
48. If this goes bad, then it would go really bad (devastating)
49. **Even if it did not go well for me, the consequence would not be too bad**
50. If this goes bad, the consequences would affect the rest of my life
51. The consequences could turn out bad, but it isn't the worst thing I could do
52. If this goes well, the benefit would be life changing
53. **The possible benefit(s) would be extremely valuable**
54. This could lead to great benefit
55. **The possible benefit is just not meaningful to me**
56. Even though there may be a cost to me, this would benefit others
57. This is worth any possible consequences, because it would benefit others
58. I worry that if I did it once, I might want to keep doing it
59. This isn't something that people should do often
60. The possible consequences would be really annoying
61. **People I care about might be ashamed of me if I did this**
62. If I did this, I could disappoint people close to me
63. **I feel like I would be letting people down if I did this**
64. Other people may be angry at me for doing this
65. I may make others upset with me if I do this
66. If this goes bad, I could lose something I really need
67. At least if this goes bad, I wouldn't lose anything meaningful
68. **This activity is just not safe**
69. This would put my personal safety at risk
70. I could get in trouble with the law for doing this
71. I might get in trouble from a person in authority
72. **I would feel defeated if this did not work out for me**
73. I would feel disappointed in myself if I was not successful at this
74. **I have some personal control in how this turns out**
75. There are things I can do to make sure this turns out in my favour
76. Other people are in control of the outcome
77. **Taking part in this activity would make me feel vulnerable**
78. The outcome is just a result of random chance that I can't control
79. I can control the severity of any possible negative outcomes
80. The consequence wouldn't be too bad as long as I take precautions
81. There is a period of time where I could back out without consequences
82. Even if things don't work out to my benefit, I know I can handle the consequences
83. Even with preparation, there are a lot of things that could go wrong
84. No matter how much I try to control the outcome, there are just some things in this situation that are beyond my control
85. It requires too much effort to try and control the outcome
86. There are ways to control the outcome severity, but those precautions just are not right for me
87. I don't have the resources that would be necessary for this to work in my favour
88. **The possible outcomes are unpredictable**
89. There are so many things that *might* happen that it is impossible to foresee what *will* happen
90. **I have skills that would help this work out positively**
91. I do not have any personal ability with this activity
92. I feel comfortable with it, because I have skills in this activity
93. **It takes a lot of preparation to do this**
94. There are no barriers to taking part in this

95. It does not require much effort to do this
96. I see this as a new challenge to overcome
97. You have to try it to get experience
98. I can trust the people and environment involved
99. I feel comfortable with the situation
100. It goes against my ethics
101. Participating in it is ethically wrong
102. This would make me feel good about my personal character
103. I would feel guilty for doing this
104. I would have a hard time living with my conscience after doing this
105. It goes against my morals
106. I would have a hard time forgiving myself for doing this
107. There is nothing wrong with doing this
108. This is just something I would do without thinking about it
109. It is something I see as a normal thing to do
110. Any possible consequences wouldn't happen until far in the future
111. I might suffer consequences in the future
112. This would benefit me right away
113. I would not see any benefit until some time in the future
114. I do not know much about it
115. I am confident that I have sufficient knowledge about this activity
116. I have some prior knowledge in this area
117. I trust that I have enough information to make an informed decision
118. The only way to learn about it is from doing it
119. This would provide me with an opportunity to gain life experience
120. I could gain some knowledge and experience from it
121. I am optimistic that it would end in my favour
122. I am a very lucky person, so everything would be fine
123. I am a very unlucky person
124. Things like this do not usually work out well for me
125. I am not concerned about how it would turn out
126. I just don't really care how it turns out
127. Taking part in this means a lot to me
128. This is something very important to me
129. This is an activity that I value
130. I am not in a position where I feel that it is necessary to do this
131. This is the only viable option for me
132. There could be worse consequences if I didn't do it.
133. There are better ways for me to achieve a similar benefit
134. I would do whatever was necessary to avoid this activity
135. Most of my peers do this
136. This is a very common activity that a lot of people do
137. This has worked out favourable for me in the past
138. This has turned out well for someone close to me
139. I know from experience (personal/people close to me) that this could turn out bad for me
140. The odds are not in my favour
141. The probability of this working out well for me is very high
142. There is a very high chance that this would benefit me
143. It is likely that this will not turn out well
144. I am at a point in my life where this just feels right
145. I am not in a situation where this would be a good decision right now

146. I have nothing to lose
147. I feel that all I can do is to improve on my current position
148. **Even if it didn't work well, I would not be much worse off**
149. I have too much to lose
150. **I am content with my current situation, and this could negatively affect it**
151. My life is great, so why would I bother doing this?
152. **Risk is everywhere is life, so why not?**
153. I could get hit by a bus tomorrow, so why not try this?
154. Bad stuff happens in life, whether I do this or not
155. I have strong religious beliefs that prevent me from taking part
156. **This does not align with my spiritual beliefs**
157. Doing this could damage my reputation
158. This could set a bad example for people who look up to me
159. People might look down on me for doing this
160. Respectable people wouldn't do this
161. **I would be embarrassed if people knew I did this**
162. I just don't think anything bad would happen
163. People that I care about would be with me
164. I would be doing this by myself
165. **Just the thought of this terrifies me**
166. I feel extreme fear at the thought of doing this
167. Any possible harm would only happen to people who deserve it
168. The people being affected are in a position that it wouldn't really hurt them anyway
169. Bad things could happen to other people
170. **This could result in harming innocent people**
171. No one else would be affected except me
172. This could have negative effects for me, not just other people

	Fischhoff et al. (1978)	Benthin et al. (1993a)	Hampson et al. (2001a)
Admiration		Admiration	Peer admiration
Interested			
Sensory / Adrenaline			
Social Benefit		Peer influence	Peer pressure
Benefit vs Consequences		Benefits vs. risks	
Severity of Consequences	Severity of consequences	Seriousness of effects	
Significance of Benefit			Benefits
Disappoint Others			Parental approval
Control of Situation	Control over risk	Personal control	controllability
Unpredictability		Need for regulation	
Skills or Abilities			
Ease of Participation			Ease of doing
Vulnerable / Unsafe Conditions	Chronic - catastrophic	Personal risk	Personal risk
Ethical or Moral Considerations			
Immediacy of Effect	Immediacy of effect		
Knowledge about Activity	Knowledge 1.Personal 2.Scientific	Knowledge	
Gain Experience or Information		Informational value	
Necessity	Voluntariness	Avoidability	Avoidability
Participation by Others		Perceived participation	Perceived participation
Past Experience	Newness	Old or new risk	Newness
Probability			
Relative to Current Position			
Apathy			
Religion			
Fear or Phobia	Common - Dread	Fear	
Risk to Others		Risk to peers	Risk to others

Appendix J: *Para-Risk Perception Items used in Study 2*

People often see some risk in situations that contain uncertainty about what the outcome or consequences will be and for which there is the possibility of 'bad' consequences. However, riskiness is a very personal and intuitive notion that can change depending on personal circumstances, and we are interested in your gut level assessment of how risky each situation is for you personally.

1. Please indicate your overall assessment of the riskiness of each of the following activities

   Rated on a 7-point scale from "not at all risky" to "extremely risky"
   Activities:
   - Investing in the stock market
   - Slightly cheating on taxes (e.g., exaggerating expenses)

2. Please indicate the extent to which you, personally, consider the following activities as being worth the risk

   Rated on a 7-point scale from "definitely not worth it" to "definitely worth it"
   Activities:
   - Investing in the stock market
   - Slightly cheating on taxes (e.g., exaggerating expenses)

3. Please indicate how likely you would be to receive negative effects if you took part in the following activities

   Rated on a 7-point scale from "extremely unlikely" to "extremely likely"
   Activities:
   - Investing in the stock market
   - Slightly cheating on taxes (e.g., exaggerating expenses)

4. Please indicate how likely you would be to receive benefits if you took part in the following activities.

   Rated on a 7-point scale from "extremely unlikely" to "extremely likely"
   Activities:
   - Investing in the stock market
   - Slightly cheating on taxes (e.g., exaggerating expenses)

5. If given the opportunity, how likely is it that you would consider taking part in the following activities within the next 6 months?

   Rated on a 7-point scale from "extremely unlikely" to "extremely likely"
   Activities:
   - Investing in the stock market
   - Slightly cheating on taxes (e.g., exaggerating expenses)

Appendix K: *Study 3 Tentative Holistic Appraisal of Risk Perception (HARP) Scale*

Instructions:

Please indicate the extent that you agree with the following items when you think about the situation:

_____ (first administration is "Skydiving"; second administration is "Buying a $50 lottery ticket from a charity organization")

Rating Scale: 7-point Likert-type

1 = strongly disagree; 2 = disagree; 3 = somewhat disagree; 4 = neither agree nor disagree; 5 = somewhat agree; 6 = agree; 7 = strongly agree

1. I think it is an activity my friends would admire.
2. This is an activity that I value
3. It is one of those experiences that you can't wait to tell your friends about.
4. It just doesn't appeal to me.
5. I would enjoy the feeling of being able to say that I have done that.
6. It would be really exciting/pleasurable
7. I would find it entertaining.
8. I would get a feeling of satisfaction from it
9. This is an activity I can share with people I enjoy spending time with.
10. There are more possible benefits than consequences
11. The possible consequence is extremely severe
12. I would feel defeated if this did not work out for me
13. Even if it did not go well for me, the consequence would not be too bad
14. The possible benefit(s) would be extremely valuable
15. The possible benefit is just not meaningful to me
16. People I care about might be ashamed of me if I did this
17. I feel like I would be letting people down if I did this
18. Taking part in this activity would make me feel vulnerable
19. I have some personal control in how this turns out
20. The possible outcomes are unpredictable
21. I have skills that would help this work out positively
22. Being able to do it would make me feel powerful.
23. I would feel a sense of accomplishment for doing this.
24. It takes a lot of preparation to do this
25. This activity is just not safe

26. Participating in it is ethically wrong
27. I would have a hard time living with my conscience after doing this
28. It goes against my morals
29. I would be embarrassed if people knew I did this
30. Any possible consequences wouldn't happen until far in the future
31. This would benefit me right away
32. I am confident that I have sufficient knowledge about this activity
33. I see it as a challenge that I want to overcome.
34. Taking part in it can create other opportunities for me.
35. I could gain some knowledge and experience from it
36. There could be worse consequences if I didn't do it.
37. There are better ways for me to achieve a similar benefit
38. This is a very common activity that a lot of people do
39. I know from experience (personal/people close to me) that this could turn out bad for me
40. The odds are not in my favour
41. There is a very high chance that this would benefit me
42. Even if it didn't work well, I would not be much worse off
43. I am content with my current situation, and this could negatively affect it
44. Risk is everywhere is life, so why not?
45. This does not align with my spiritual beliefs
46. Just the thought of this terrifies me
47. This could result in harming innocent people

Appendix L: *Cognitive Appraisal of Risky Events (CARE) Scale* (Fromme, Katz & Rivet, 1997)

Expected Risk Subscale Instructions:
Please rate the likelihood that a negative consequence would occur from each of the following activities. A negative consequence is defined as one in which you might become sick, injured, embarrassed,
lose money, suffer legal consequences, fail a class, or feel bad about yourself.

Expected Benefit Subscale Instructions:
Please rate the likelihood that a positive benefit would occur from each of the following activities. A positive benefit is defined as one in which you would experience pleasure, win money, feel good about yourself, etc.

Expected Involvement Subscale Instructions:
Please rate the likelihood that, given the opportunity, you would engage in this activity in the next 6 months.

Rating Scale:
1 = Not at all likely; 2 = Unlikely; 3 = Somewhat unlikely; 4 = Neutral; 5 = Somewhat Likely;
6 = Likely; 7 = Extremely Likely

Items:

Risky Sexual Activities
4. Leaving a social event with someone I have just met
12. Sex without protection against pregnancy
16. Sex without protection against sexually transmitted diseases
27. Involvement in sexual activities without my consent
23. Sex with multiple partners
29. Sex with someone I have just met or don't know well

Illicit drug use
1. Trying/using drugs other than alcohol or marijuana
22. Smoking marijuana
25. Mixing drugs and alcohol

Aggressive and illegal behaviours
3. Grabbing, pushing, or shoving someone
5. Driving after drinking alcohol
6. Making a scene in public
10. Disturbing the peace
11. Damaging/destroying public property
14. Hitting someone with a weapon or object
19. Slapping someone
21. Punching or hitting someone with fist
16. Getting into a fight or argument

Heavy Drinking
9. Drinking alcohol too quickly
7. Drinking more than 5 alcoholic beverages
28. Playing drinking games

High Risk Sports
15. Rock or mountain climbing
17. Playing non-contact team sports
24. Snow or water skiing
30. Playing individual sports

Academic / Work Behaviours
2. Missing class or work
8. Not studying for exam or quiz
13. Leaving tasks or assignments for the last minute
18. Failing to do assignments
20. Not studying or working hard enough

Appendix M: *Gambling Behaviour Scale* (Craig, 2014)

<u>**Participant Instructions:**</u>

If given the opportunity, how likely is it that you would engage in this activity?

<u>**Rating Scale:**</u>

1 = No Chance   2 = Very unlikely   3 = Unlikely   4 = Not sure   5 = Likely   6 = Very Likely   7 = Definitely

<u>**Items:**</u>

1. Casino slot machines
2. Casino card games (poker, black jack, etc.)
3. Other casino games
4. Internet slot machines
5. Internet card games (poker, black jack, etc.)
6. Other internet gambling
7. Lottery tickets (6/49, Super 7, etc.)
8. Instant-win or scratch tickets (pull-tab, Nevada strips, etc.)
9. Raffle tickets
10. Cards with friends for money (poker, black jack, etc.)
11. Board or dice (for money)
12. Sport Select (Pro Line, Over/Under, Point Spread)
13. Sports pools or games (football, hockey, basketball, etc.)
14. Bingo
15. Horse race (live at track and/or off-track)

Appendix N: *Brief Sensation Seeking Scale (BSSS)*

(Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002)

Participant Instructions:

Please indicate the extent that you agree with the following items.

Rating Scale:

1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; 5 = strongly

agree

Experience seeking Subscale Items:

1. I would like to explore strange places.
2. I would like to take off on a trip with no pre-planned routes or timetables.

Boredom susceptibility Subscale Items:

3. I get restless when I spend too much time at home.
4. I prefer friends who are excitingly unpredictable.

Thrill and adventure seeking Subscale Items:

5. I like to do frightening things.
6. I would like to try bungee jumping.

Disinhibition Subscale Items:

7. I like wild parties.
8. I would love to have new and exciting experiences, even if they are illegal.

Appendix 0: *Holistic Appraisal of Risk Perception (HARP) Scale*

Participant Instructions:

Please indicate the extent that you agree with the following items when you think about the situation: _____

Rating Scale: 8-point Likert-type

0 = non-applicable (n/a); 1 = strongly disagree; 2 = disagree; 3 = somewhat disagree; 4 = neither agree nor disagree; 5 = somewhat agree; 6 = agree; 7 = strongly agree

1. I think it is an activity my friends would admire (R)
2. This is an activity that I value (R)
3. It is one of those experiences that you can't wait to tell your friends about (R)
4. It just doesn't appeal to me.
5. I would enjoy the feeling of being able to say that I have done that. (R)
6. It would be really exciting/pleasurable (R)
7. I would find it entertaining. (R)
8. I would get a feeling of satisfaction from it (R)
9. This is an activity I can share with people I enjoy spending time with. (R)
10. There are more possible benefits than consequences (R)
11. The possible consequence is extremely severe
12. I would feel defeated if this did not work out for me
13. Even if it did not go well for me, the consequence would not be too bad (R)
14. The possible benefit(s) would be extremely valuable (R)
15. The possible benefit is just not meaningful to me
16. People I care about might be ashamed of me if I did this
17. I feel like I would be letting people down if I did this
18. Taking part in this activity would make me feel vulnerable
19. I have some personal control in how this turns out (R)
20. The possible outcomes are unpredictable
21. I have skills that would help this work out positively (R)
22. Being able to do it would make me feel powerful. (R)
23. I would feel a sense of accomplishment for doing this (R)
24. It takes a lot of preparation to do this
25. This activity is just not safe
26. Participating in it is ethically wrong
27. I would have a hard time living with my conscience after doing this
28. It goes against my morals
29. I would be embarrassed if people knew I did this
30. Any possible consequences wouldn't happen until far in the future (R)
31. This would benefit me right away (R)
32. I am confident that I have sufficient knowledge about this activity (R)
33. I see it as a challenge that I want to overcome. (R)
34. Taking part in it can create other opportunities for me. (R)

35. I could gain some knowledge and experience from it (R)
36. There could be worse consequences if I didn't do it. (R)
37. There are better ways for me to achieve a similar benefit
38. This is a very common activity that a lot of people do (R)
39. I know from experience (personal/people close to me) that this could turn out bad for me
40. The odds are not in my favour
41. There is a very high chance that this would benefit me (R)
42. Even if it didn't work well, I would not be much worse off R)
43. I am content with my current situation, and this could negatively affect it
44. Risk is everywhere is life, so why not? (R)
45. This does not align with my spiritual beliefs
46. Just the thought of this terrifies me
47. This could result in harming innocent people

Scoring Instructions:

Reverse score (R) items (perceives as a bad risk). Sum all items for total scale score. While this scale is not intended to examine individual facets, identification of facets is as follows:

Admiration (sum items 1, 2, 3)
Interest (sum items 4, 5)
Sensory/Adrenaline (sum items 6, 7, 8)
Social Benefit (item 9)
Benefits vs Consequences (item 10)
Severity of Consequences (sum items 11, 12, 13)
Significance of Benefit (sum items14, 15)
Disappoint others (sum items 16, 17)
Control (sum items 18, 19)
Predictability (item 20)
Skills or Abilities (sum items 21, 22, 23)
Ease of participation (item 24)
Unsafe (item 25)
Ethical Considerations (sum items 26, 27, 28, 29)
Immediacy of Effect (sum items 30, 31)
Knowledge about activity (item 32)
Gain experience/opportunity (sum items 33, 34, 35)
Necessity (sum items 36, 37)
Commonality (item 38)
Past experience (item 39)
Probability (sum items 40, 41)
Relative to current position (sum items 42, 43)
Apathy (item 44)
Religion (item 45)
Fear/Phobia (item 46)
Risk to others (item 47)

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