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Uncertainty's Impact on Perceptions Toward Randomness

Ross Cook
Central Washington University, cookro@cwu.edu

UNCERTAINTY'S IMPACT ON PERCEPTIONS TOWARD RANDOMNESS

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Ross M. Cook

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We hereby approve the thesis of

Ross M. Cook

Candidate for the degree of Master of Science

APPROVED FOR THE GRADUATE FACULTY

_____	_____
	Dr. Kara Gabriel, Committee Chair
_____	_____
	Dr. Tonya Buchanan
_____	_____
	Dr. Richard Marsicano
_____	_____
	Dean of Graduate Studies

ABSTRACT

UNCERTAINTY'S IMPACT ON PERCEPTIONS

TOWARD RANDOMNESS

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The current study examined the effects that perceived uncertainty and success in a financial decision task had on participant's attitudes toward uncertainty. One hundred and fifty-three participants were randomly assigned to read one of three possible vignettes in which varying levels of uncertainty were depicted (i.e., high uncertainty, low uncertainty, and a control condition in which the degree of uncertainty was not mentioned). Participants were asked to make semi-informed decisions based on these vignettes and were, then, randomly assigned to a success or failure feedback condition in which they were told that they had either performed well or poorly. Afterward, attitudes toward uncertainty were measured with a combination of the Intolerance of Uncertainty Scale-12 (IUS-12) and the Economic Locus of Control Scales (ELOC). Analysis revealed non-significant effects of both the varying levels of uncertainty presented in the vignettes and the type of feedback on attitudes toward uncertainty. These results imply that the attitudes a person holds toward uncertainty are robust toward day-to-day chance occurrences and that these attitudes may require immense pressure to change.

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CHAPTER I

INTRODUCTION

A common saying is that hindsight in 20/20, meaning that when looking to the past it is relatively easy to parse out fact from fiction and to determine what courses of action should or should not have been undertaken. This can be seen in stark clarity when looking to the precursor to most major events, such as Pearl Harbor or the Great Depression. Specifically, as people look back at the chain of events that led up to an impending disaster the outcome seems truly inevitable, which can only be contrasted by how poorly people manage to predict their futures (Mlodinow, 2008). However, studies show that people rarely act as though this were truly the case and, instead, will tend to remember events such that the outcomes were already known, a phenomenon that has been dubbed hindsight bias (Werth, Strack, & Forster, 2002). Additionally, despite seeing the apparently obvious chain of circumstances that led to past events, all that knowledge proves of little use when attempting to determine future outcomes.

There are numerous studies that have demonstrated irrational or inconsistent human behavior when confronted with uncertainty. For example, participants and game-show contestants will invest more effort into situations that have greater rewards despite knowing that the outcome is randomly determined (Becker & van der Pligt, 2016) as well as Kahneman and Tversky's numerous studies that show that, on decision problems, asking the same question in a different way will yield vastly different results. However, comparatively little has been done to observe how people understand or interact with the uncertainty they experience in their lives, and whether or not these experiences can alter a person's attitudes towards uncertainty.

CHAPTER II

LITERATURE REVIEW

Uncertainty and Risk

At this point an important distinction needs to be made, and that is the distinction between the concepts of risk and uncertainty. Risk consists of known variables, predictable odds and, while the outcome may be unknown, the likelihood of various results can be ascertained. In contrast, uncertainty consists of unknown variables and unknown outcomes, with the accuracy of predictions impossible to determine definitively (Brooke, 2010). For example, risks can be seen as events of predictable chance, such as partaking in a lottery or drawing a royal flush from a deck of cards. Uncertainty, instead, refers to events of unpredictable chance, such as choosing the winning football team at the beginning of the year or determining if a movie will be successful before it is seen by the public.

The nature of whether uncertainty and risk are truly two separate concepts has been hotly contested in economic circles ever since the idea was originally conceived by Frank H. Knight in 1921 (Langlois & Cosgel, 1993). Much of this controversy stems from the idea that Knight's conception of risk is simply a lesser degree of uncertainty, that they are in fact the same construct but simply to varying degrees. However, more recent studies show that there is a notable difference in how people approach events with known as opposed to unknown probabilities (Camerer & Weber, 1992).

A study that explored these concepts, conducted by FeldmanHall, Glimcher, Baker, and Phelps (2016), sought to examine how participants would place bets in conditions of varying risk and ambiguity as well as how their emotional state would

affect their responses. Their participants, 45 people from New York University, were asked in various scenarios whether they would take a certain payout of $5 or whether they would gamble on a potentially higher payout which varied from $5 to $125. The gambling scenarios were presented to the participants in the form of a colored bar, one side red and the other blue, which visually depicted the chances of winning or losing by depicting it as the percentage of the bar that was a given color (e.g., 25% of the bar as blue would equal 25% of success when choosing to gamble). The gambles undertaken were either varying level of risk, which constituted a 25 to 75% chance of receiving nothing, or varying levels of ambiguity, which added an occluding grey bar over the colored representation which hid the precise level of risk. This occluding bar covered from 24 to 74% of the colored bar but always was centered in the middle so that the ends of both colors could be seen. Regardless of the size of the occluding bar, the chance of winning the gamble in the ambiguity scenario was always 50%.

FeldmanHall et al.'s (2016) results show that the participants became less willing to gamble as the levels of risk increased, especially when the chance of losing the gamble rose to 75%. They also found that, as ambiguity rose, participants were also less willing to take the gamble. Interestingly, in all conditions of ambiguity, participants were less willing to gamble away their $5 for a potential payout than participants who were 50% likely to win, an insignificant difference in the lowest ambiguity group (2%) but one that became increasingly greater as ambiguity rose (up to 18% for the 74% ambiguity group). This difference occurred despite the fact that the average chance of winning remained the same in every ambiguous condition and that would seem to imply that the participants were more averse to ambiguity than they were to risk. Participants' levels of emotional

arousal as determined by skin conductance response was negatively correlated with gambling in the high risk scenarios, but emotional arousal was positively associated with gambling in ambiguity-based scenarios. These findings indicate that emotional states play a role in decision-making in uncertain environments, and that known and unknown probabilities are mentally approached in different manners (FeldmanHall et al., 2016).

Decision-Making

A factor that initially stalled research into people's interaction with uncertainty was the idea that humans, as thinking and rational creatures, appraised potential gains and losses in a purely logical manner. This perspective is voiced in Keynes' rebuttal of Knight's theories, wherein Keynes postulates that while a person may be unaware of the true probabilities of a favorable outcome, that individual will simply choose the outcome that is most likely to end in a favorable result. Applying that to a situation in which a man is attempting to draw a colored ball from a sack where he does not know the frequency of occurrence, the man's perception of the frequency will continuously change as his experience with drawing the ball continues. Thus, each individual assumption is based on objective evidence and risk is never a factor in that persons's decision-making (Holton, 2004). In this manner of thinking, both risk and uncertainty lose a great deal of their meaning; an event has a chance to occur regardless of human perception and people simply use the information they have to make the best rational choice possible at every given moment.

The work of Tversky and Kahneman on the study of mental heuristics has greatly shifted thoughts on human decision-making from a purely reason based model. A heuristic is a method of problem solving that is neither perfect nor even optimal but

nevertheless is effective at quickly coming to a decision. Heuristics are eminently practical methods that emphasize speed and efficiency at the cost of potentially causing cognitive biases, which occur when natural methods of thought result in factually inaccurate beliefs. Through heuristics people can consider immensely complicated scenarios and make relatively sensible judgements without needing to know the entirety of the situation and minimizing the effort required.

Tversky and Kahneman (1973) describe the process of cognitive biases as being similar to how the human brain visually assesses the distance or size of various objects. By taking into account the clarity with which a distant object appears, a person can make an educated guess as to how close it is. For example, distant objects often appear blurry while close ones appear in sharp focus. However, this visual heuristic system is made difficult when visibility suffers which naturally makes objects appear indistinct and, thus, also makes them appear to be farther away than they actually are (Tversky & Kahneman, 1973). In this way, the heuristic that is accurate enough to give the human mind a workable method by which to make decisions can also produce the cognitive bias of mistaken distance.

To observe the effects of cognitive bias on decision-making Tversky and Kahneman used decision problems which are "defined by the acts or options among which one must choose, the possible outcomes or consequences of these acts, and the contingencies or conditional probabilities that relate outcomes to acts" (Tversky & Kahneman, 1981, pg. 453). These decision problems are often designed such that a single question can be asked in several different ways to create what Tversky and Kahneman call a decision frame which is "controlled partly by the formulation of the problem and

partly by the norms, habits, and personal characteristics of the decision maker" (Tversky & Kahneman, 1981, p. 453). Studies incorporating decision problems and frames have provided a wealth of knowledge about what information is deemed relevant when making decisions, as well as which factors weigh more heavily than others in selecting among options. Perhaps the most famous example of this is the Asian Flu problem that was conducted with students at Stanford University and the University of British Columbia (note that the brackets listed after the each program choice depict the percentage of participants which selected that choice):

> Problem Number 1 [N=152]: Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:
>
> If Program A is adopted, 200 people will be saved. [72 percent]
>
> If Program B is adopted, there is a 1/3 probability that 600 people will be saved, and a 2/3 probability that no people will be saved [28 percent]
>
> Which of the two programs would you favor?
>
> Problem Number 2 [N= 155]: Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

> If Program C is adopted 400 people will die. [22 percent]
>
> If Program D is adopted there is a 1/3 probability that nobody will die, and a 2/3 probability that 600 people will die [78 percent]
>
> Which of the two programs would you favor? (Tversky & Kahneman, 1981, p. 453)

While programs A and C and programs B and D are functionally equivalent, people in the first test overwhelmingly preferred to save two hundred people while those in the second test were reluctant to let four hundred die. The researchers later referred to this phenomenon as loss aversion which is the cognitive bias in which people place greater weight on potential losses than they do potential gains (Tversky & Kahneman, 1991). To be clear, there is no practical difference between the two scenarios, but how they were framed within the decision problem shifted participants' reactions immensely.

Tversky and Kahneman have recorded many such cognitive biases and mental heuristics that people commonly incorporate into their decision-making, and decision problems like the Asian flu problem have proven very useful in understanding the way in which people approach a variety of situations. By carefully constructing a decision frame, researchers can attempt to discern what factors are being taken into account, even if those factors seem illogical or completely unconnected to the task.

Feedback in Uncertain Situations

Equally important to how people approach situations that involve risk or uncertainty is how they respond after the outcome has become known. In situations of risk or uncertainty, people credit the outcome to a combination of their own skills, the product on the environment, and random chance. Notably, those who succeed at an

uncertain task tend to overemphasize the effect of their own skill and a beneficial environment while undervaluing good fortune. This misattribution towards favoring personal effects over chance events could explain the persistent belief in hot streaks in sports, or a gambler's tendency to bet more after a series of wins (Mittal, Ross, & Tsiros, 2002).

Some choices made by people on whether to bet on a risk even seem paradoxical. When given the choice of $10 or an even chance at either $0 or $20, people will often avoid the risk and take the safe option. Additionally, when offered the chance to either win or lose $50 people will often avoid taking that risk. However, when gambling, if a person has just lost a bet then they are significantly more likely to take the next bet offered to them (Losecaat Vermeer & Sanfey, 2015). This shows that while people naturally avoid loses in situations of risk, this behavior can change depending on prior events. In other words, that is to say that decision-making in uncertain or risky situations is highly context dependent.

A study by Losecaat Vermeer and Sanfey (2015) examined the effect of feedback on risk taking behaviors using monetary, performance, and combined monetary/performance trials followed by an optional gamble with a sample of 72 students. The monetary trial involved participants either winning 1.2 Euros or losing 1.2 Euros based on randomly generated dice rolls. Two dice rolls were generated in each trial. Participants lost money if the roll was between two and six, and the participants won money if the roll was between seven and twelve. The performance trial involved participants attempting to press a button exactly one second after a visual cue. If the participant's response was within the allowed time interval, it was presented to the

participant as a success and, if it was outside the time interval, it was presented as a failure with feedback as too slow or too fast given to the participant. The combined trial was the same as the performance trial except that participants also won 1.2 Euros for successfully completing the time trial or lost 1.2 Euros for failing the time trial. Lastly, after each trial participants had the option to enter a 50/50 gamble to either win or lose 1, 1.2, or 1.4 Euros (randomly determined).

The researchers found that participants given negative feedback in both the monetary and monetary/performance trials were significantly more likely to take the optional post-trial risk as opposed to participants who received positive feedback. Post-trial risk-taking in the performance trials was not significantly affected by positive or negative feedback. Furthermore, while rates of success feedback between the monetary and monetary/performance trials were similar, when given negative feedback, participants were significantly more likely to take the post-trial risk in the purely monetary trials as opposed to the performance-dependent trials (Losecaat Vermeer & Sanfey, 2015).

The conclusions reached by Losecaat Vermeer and Sanfey from the information obtained by this experiment are twofold. First, that the prospect of losses is the primary motivating factor behind decisions that indulge risk. Second, that performance feedback alone, with no monetary or other outside context, is not enough to significantly influence participants' decision making in risk situations.

Locus of Control

The study of how feelings of personal control impact a person's life has been studied for quite a long time. While that time has produced an immense volume of

research, most every researcher of personal control in the past few decades can trace their influence back to Julian Rotter and his understanding of internal and external loci of control. Rotter describes the ideas of both external and internal control as:

> When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event in interpreted in this way by an individual, we have labeled this a belief in *external control*. If the person perceives that the event is a contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in *internal control.* (Rotter, 1966, p. 1)

To study locus of control, Rotter helped develop the Internal-External Locus of Control Scale which utilized a forced-choice questionnaire consisting of 29 items although six items were added as filler to obfuscate the purpose of the scale. Each item has two potential choices, reflecting internal versus external loci of control. For example, one choice is “Many of the unhappy things in people’s lives are partly due to bad luck” while the other is “People’s misfortunes result from the mistakes they make” (Rotter, 1966, p. 9-12).

A number of other locus of control scales have been created, often with specific focuses. Furnham notes that there have been locus of control scales made for such spheres as health, religious beliefs, educational settings, and political behavior (1986). While some of these scales have been used in studies of

participants' beliefs in their economic performance, a true economic locus of control scale had yet to be made (Furnham, 1986). To this end, Furnham created and validated a scale for determining a person's locus of control as it related to economic concerns, examining the demographic correlates of his scale in a sample of 254 subjects diverse in terms of age, education, political leanings, employment, and economic status (Furnham, 1986).

The structure of Furnham's Economic Locus of Control Scale (ELOC) consists of 40 items each answered on a 7-point Likert scale ranging from 1 (*strongly agree)* to 7 (*strongly disagree*). Furnham's factor analysis of the ELOC found four distinguishable factors: 1) *Internal,* which concerns personal control over positive factors of finance, such as one's own ability to become wealthy; 2) *Chance,* which concerns the impact that uncontrollable factors or luck have on a person's financial situation; 3) *External-Denial,* which is related to the denial that poverty exists as well as the negative outcomes that occur to others; and 4) *Powerful Others,* which concerns the power that other people hold in regards to one's own financial situation (Furnham, 1986, p. 37)

In his initial findings with the ELOC, Furnham noticed several trends that were consistent with prior locus of control findings. Furnham noted that "females more than males, older rather than younger people, and politically left-wing more than right-wing people tended to rate the power of chance as determinants of both wealth and poverty more highly" (Furnham, 1986, p. 39).

While the ELOC has been validated several times and been used in different populations, it has not been used to the extent that Rotter's original

Internal-External Locus of Control scale has. One study by Heaven (1990) confirmed the validity of the ELOC by replicating Furnham's initial study in a Protestant population. Additionally, Heaven found both an association between the *internal* and *denial* subscales of the ELOC in the work ethic of participants, as well as links in the *chance* and *powerful others* subscales to a desire for greater government spending towards the issue of unemployment. Heaven's findings were consistent with Furnham's initial analysis of the ELOC scale.

Sakalaki, Richardson, and Basaounis (2005) also used the ELOC in a Greek sample to test for differences in attitudes toward government and saving habits. The researchers found that an internal locus of control was correlated negatively with desire for governmental control as well as being correlated positively both with being politically well informed and greater tendencies toward saving money.

Intolerance of Uncertainty

While locus of control scales measures a person's attitudes toward how much control they have over their lives, measures of intolerance of uncertainty (IU) assess how a person responds to those elements that cannot be controlled. The original IU construct can be attributed to Freeston, Rheaume, Letarte, Dugas, and Ladouceur (1994) who defined it as the method with which people perceive uncertain information and how they react to that information cognitively, behaviorally, and emotionally. More recent definitions focus on the aspects associated with high levels of IU. IU can be described as a "dispositional characteristic that results from a set of negative beliefs about uncertainty and its

implications" (Sexton & Dugas, 2009, 176). The construct of IU has largely been associated with mental health, focusing primarily on its role in anxiety disorders, primarily generalized anxiety disorder. In addition to anxiety disorders, IU has been shown to be highly correlated with "worry, perfectionism, perceived level of control, dysfunctional attitudes, positive beliefs about worry, negative problem orientation, and cognitive avoidance" (reported by Sexton & Dugas, 2009, 176).

The most widely used scale for measuring IU is the 27-item Intolerance of Uncertainty Scale (IUS) developed originally in French (Freeston et al., 1994) before being later translated into English (Buhr & Dugas, 2002). Initial factor analysis of the IUS identified five potential factors that contributed to negative beliefs about uncertainty, including that uncertainty should be *avoided*, uncertainty is *frustrating*, uncertainty causes *stress*, uncertainty *promotes inaction*, and that being uncertain is seen as a *negative trait* (Freeston et al., 1994). However, in subsequent factor analysis of the English translation of the IUS, only four significant factors were discovered, including uncertainty *promoting inaction*, uncertainty is *stressful*, uncertainty *should be avoided*, and uncertainty is *unfair* (Buhr & Dugas, 2002). While several of the factors remained unchanged, the loss of the *frustrating* and *negative* factors of uncertainty as well as the addition of the *unfair* factor shows some troubling variability across the validations of the IUS.

The lack of consistent results when attempting to understand the underpinnings of this model has led others to create more refined models of IU. The twelve item IUS-12 model created by Carleton et al. (2007) measures two

factors of uncertainty. The first factor is prospective anxiety, which assesses a person's methods of approaching uncertainty, their desire for predictability, their preference for knowing about future events, and their willingness to seek out information to limit uncertainty. The other factor is inhibitory anxiety, which focuses on a person's desire to avoid uncertainty and their reluctance to make decisions whose outcomes are not known.

Later analysis by Hale et al. (2016) of the IUS-12 demonstrated that the variance in both prospective and inhibitory anxiety was highly explained by an underlying IU factor throughout the scale. When comparing several methods of analysis, Hale et al. found that a bifactor model all but removed the variation of both initial factors of the IUS-12 and that the underlying IU factor explained more than 80% of the combined variation ($w = .88$, $p < .001$). Because of this Hale et al. suggested that, while the IUS-12 scale still effectively measures IU, it should be used as a unidimensional model.

Manipulation of Traits

Originally, trait aspects have been considered as rigid and unchanging facets of a person's character. This belief has changed as researchers began to think of trait aspects as having their own degree of variation when recorded at different points in time. In a sample of 45 female college students, Natale (1978) found that temporary mood states, induced via reading self-referent statements designed to instill either euphoria or depression, significantly impacted the subjects' scores on Rotter's Internal/External Locus of Control Scale.

Specifically, induced euphoria resulted in increased scores of internality while induced depression resulted in increased externality.

Similar findings have been reported by Brecher and Denmark (1972). In their study, 88 female undergraduate students completed Rotter's Internal-External Locus of Control Scale just after having been given feedback from a recent test. Participants were given a test in one of their classes, and just prior to the experiment participants in one group were told by their professor that they had performed very poorly on the test. Afterword, the professor left and the participants were asked to complete the locus of control scale. Brecher and Denmark found that participants who had been given negative feedback prior to completing Rotter's scale scored significantly higher on measures of externality than those who were given no feedback at all.

A similar effect of trait variance has been seen in Intolerance of Uncertainty scales. Mosca, Lauriola, and Carleton (2016) conducted an experiment using 43 undergraduate students from the University of Rome. The participants were assigned to conditions intended to either increase or decrease IU and asked to complete the IUS-12. Afterword, participants were prompted to provide a negative life event that might occur in the future. Later that evening, the participants in the increasing IU condition were asked to repeat statements which reflected high levels of IU (e.g., "Concerning the negative event, it's difficult [to] not know what will happen") while participants in the decreasing IU condition were asked to repeat statements which reflected low levels of IU (e.g., "It doesn't bother me to not know what will happen to me") before once against taking the

IUS-12 (Mosca, Lauriola, & Carleton, 2016, p. 4). There was a significant difference between the two experimental groups, such that participants in the high IU group scored higher in the IUS-12 than those in the low IU group. The authors conclude that intolerance of uncertainty is sensitive to manipulation and appropriate as a process for experimental research.

The Current Study

The purpose of the current study is to examine the effects of success and failure in environments of differing uncertainty. Specifically, this experiment measured how success and failure influenced a person's feelings about the effect that randomness has in their lives. To investigate this relationship, the current study used Furnham's ELOC to assess attitudes of control and the IUS-12 to assess the subject's feelings toward uncertainty itself. There were two separate independent variables that were under the control of the researcher in this experiment: 1) the stated level of uncertainty in a decision task (i.e., low, high, and a control group), and 2) the reported success or failure of the participant in their attempts at completing the decision task (i.e., success, failure). As a result of the combination of independent variables in the present study there were two separate hypotheses under investigation.

The first hypothesis was that there would be an effect of the stated level of uncertainty in the decision task on participants' perception of uncertainty and on their degree of internality such that IU levels as measured by the IUS-12 would be higher in the high uncertainty task while scores of internality on the Economic Locus of Control Scale would be lower.

The second hypothesis was that there would be an effect of success or failure in the decision task on the participants' perception of uncertainty and on their degree of internality such that IU levels would be higher when participants think they have failed while scores of internality on the Economic Locus of Control Scale would be lower.

CHAPTER III

METHOD

Participants

One hundred and seventy-eight (124 Female, 53 Male, 1 Other) participants were gathered on a voluntary basis from students in psychology classes at Central Washington University via the departmental electronic participant recruitment system (i.e., SONA systems). The participants were mostly early college aged students (M = 21.04, SD = 4.37) and the most common major among the participants was psychology (33.33%) followed by undeclared (11.11%) with the rest the numbers consisting of all other majors. Participants in this study primarily identified as White/Caucasian (64.05%) with the rest identifying as Hispanic or Latino/a (16.99%), Multiracial (8.50%), Asian/Pacific Islander (3.27%), Black/African American (2.61%), Native American or Alaskan Native (2.61%), Other (1.31%), and some declined to comment (.07%). Participants in this study were reimbursed with class credit if applicable. No exclusionary criteria made a subject ineligible to take part in this experiment. The recruitment description was advertised as "Researching how people make choices in the stock market" and that participants would "Make the best economic choice by selecting several stocks from a small catalogue". Demographic information on participant age, gender, ethnicity, current major, and self-reported experience with the stock market were collected. Additionally information was collected on the participant's current interest in the stock market, and their feelings toward randomness in the stock market (see Appendix A for demographic questions).

Materials

The use of risk and uncertainty terminology. As mentioned earlier in the literature review, the technical definitions of risk and uncertainty differ. Risk implies known variables and potential outcomes, although the precise result of a given situation may be unknown. Uncertainty implies unknown variables which lead to unknown results. In colloquial use, risk and uncertainty are often deemed synonymous. For this reason, the terms risk and uncertainty were used in this colloquial manner during the instructions for the experiment, and thus regarded as synonymous, to best facilitate participant understanding of the tasks contained in this experiment.

Vignettes. This experiment made use of different instructions given to participants as the primary manipulation of participant perception of uncertainty. These vignettes had three levels: 1) low risk; 2) high risk; and 3) a control. The control vignette was depicted to the participants as follows:

> The following page has information about 10 different corporations and their corresponding stock values from the beginning of the 2016 fiscal year. Please select the 5 stocks that you believe would have made you the most profit if you had invested that year. You will be shown how much money your investments would have made after you make your selections.

The two other risk groups were presented with similar instructions except that in the low risk group a sentence was added after the first which specified: “These stocks were considered low risk investments by many economists at the time.” while the high

risk group stated “These stocks were considered high risk investments by many economists at the time.”

All participants were then presented with a small portfolio of real stock profiles with the instructions: “Of the 10 stocks listed on this page please choose 5 that you feel would grant you the highest returns.” Each stock profile had an average value of the stock as of the last 52-week period and a short description of the company itself. Stock information was taken from the financial forecasting website Kiplinger from their 2015 and 2016 stock forecasts (Glassman & Feinberg, 2015; Fonda, Kates, & Glassman, 2016). Information on current stock value, projected growth, as well as a brief description of the company was presented with the stocks. Additionally, a rating of the uncertainty of the stock’s value was given to each stock by the researcher. A list of all the stock profiles used in this experiment is shown in Appendix B.

Feedback on performance. The success or failure of each participant at this task was randomly determined at the initiation of the experiment. After completing the stock selection, finalizing their answer (“Are you sure these are the stocks you want?”), and waiting through a 5 second transition period meant to appear as a loading screen, participants were presented with either success or failure feedback. The fabricated loading screen was designed to give participants the impression that their choices were being accounted for and were used in the calculation of the outcome. In order to allow for random assignment to the success or failure feedback performance conditions, the initial stock choices made by the participants did not impact their reported success or failure.

After the short delay, participants in the succeed group were shown a screen indicating that they had exceeded the average market value by 29%. Those participants in

the fail group were told that they had performed 29% worse than average market value. All of the groups were also shown general information about the supposed average, minimum, and maximum possible returns (i.e., $1038, $897, and $1146, respectively). The purpose of this feedback was to provide participants with perspective on how great a difference 29% is compared to the overall trends as well as to imply to both cases that they could have done better and worse.

Intolerance of Uncertainty Scale-12 (IUS-12). The IUS-12 was used in this study to measure participant's feelings toward uncertainty and the method by which they would likely approach an uncertain situation. Khawaja and Yu (2010) examined the IUS-12 over a two-week time-frame with a sample of 50 clinical patients suffering from anxiety-related mental disorders and 56 non-clinical university students. The researchers reported acceptable correlation with the original IUS (r = .94), test-retest reliability (r = .77), and Cronbach's alpha (clinical = .87, non-clinical = .92) (Khawaja & Yu, 2010). In the current study, the Cronbach's alpha was .87 putting it at identical to the prior clinical use of this scale.

The IUS-12 was initially designed to measure two different factors: prospective anxiety assessed through seven questions, and inhibitory anxiety assessed through five questions. Each of the questions used in the IUS-12 is measured on a 5-point Likert scale that ranges from 1 (*Not at all characteristic of me*) to 5 (*Entirely characteristic of me*). Higher scores denote greater degrees of uncertainty intolerance, while lower scores denote a greater acceptance of uncertainty (Hale et al., 2016). However, as stated previously, recent analysis of the IUS-12 conducted by Hale et al. (2016) demonstrates a significant underlying IU factor that accounts for the variation in both the prospective and

inhibitory anxiety factors. Due to this, Hale et al. suggest that future research using the subscales of the IUS-12 be done using the model as a unidimensional instrument. As such, this study used the IUS-12 as a unidimensional model to measure IU where all questions were summed together to create a measure of IU for each participant. The IUS-12 is presented in its entirety in Appendix C.

Economic Locus of Control Scale (ELOC). The ELOC was used to measure the participant's locus of control in regard to economic factors in their lives and was chosen due to its refined focus on financial situations.

The ELOC consists of 40 items that measure four different subscales. The *internal* subscale assesses personal control over positive factors of finance, such as one's own ability to become wealthy (e.g., "Saving and careful investing is a key factor in becoming rich"). The *chance* subscale assesses the impact that uncontrollable factors or luck have on a person's financial situation (e.g., "Becoming rich has nothing to do with luck"). The *external/denial* subscale assesses the denial that poverty exists as well as the negative outcomes that occur to others (e.g., "People's poverty results from their own idleness"). Lastly, the *powerful others* subscale assesses the power that other people hold in regards to one's own financial situation (e.g., "Although I might have the ability, I will not become better off without appealing to those in positions of power"; Furnham, 1986).

Each item is answered on a 7-point Likert scale ranging from 1 (*strongly agree)* to 7 (*strongly disagree*) and the subscales are calculated by summing up the values given to each question that they contain. Higher scores in the *internal* subscale represent greater degrees of locus of control internality. Conversely,

higher scores in the *chance*, *external/denial*, and *powerful others* subscales represent greater degrees of locus of control externality.

Furnham's (1986) reported psychometric qualities for the ELOC were sufficient to validate its use. In a sample of 254 subjects, Furnham reported Cronbach's alpha for the overall scale (α= 0.78) as well as the *internal* (α= 0.72), *chance* (α= 0.63), *external/denial* (α= 0.66), and *powerful others* (α= 0.65) subscales that were within acceptable limits. After a one-week interval, the 254 participants took the ELOC again. From this, Furnham reported a test-retest reliability coefficient of 0.86. Lastly, 96 of the total participants also completed Rotter's Internal-External Locus of Control Scale. Here it was found that internality, as reported by Rotter's scale, positively correlated with the *internality* subscale of the ELOC (r = .33).

This study is focused on the use of the *internal* subscale of the ELOC. This subscale focuses on the degree of influence one places on one's self as opposed to one's environment in determining economic outcomes. As belief that an outcome is within one's control as opposed to being out of one's control is central to this study it was determined that this subscale was especially pertinent. In addition, many of the other subscales have disappointing Cronbach's alpha levels, especially the *chance* subscale, while the *internal* subscale did not have this problem. In the current study, the Cronbach's alpha for the overall ELOC was .72 while the Cronbach's alpha for the *internal* subscale was .68. This put both ELOC alpha levels at slightly lower than prior studies.

However the ELOC has only been tested and validated when using the entire scale. As such the entire ELOC has been included in this study in its original form to ensure that it will retain the validity found in earlier testing. The ELOC is presented in its entirety in Appendix D.

Manipulation of Trait Variables. As previously mentioned, research has shown that individual trait variables vary despite maintaining relative stability over time. While individuals may maintain general levels of various traits or behavior there also exists a degree of fluctuation in each individual where those traits will vary. This fluctuation itself can be considered an individual difference variable and thus can be predicted given sufficiently effective manipulations. These changes are unlikely to persist for a long period but for the purposes of this study, it was hypothesized that trait of locus of control could be manipulated in a controlled way and could be used as a dependent variable. It is with this past research in mind that locus of control and intolerance of uncertainty were used as dependent variables.

General Skill Assessment. Two questions were included with the intent to determine participant attitudes toward skill. The first involved asking participants two questions: 1) “How much impact does a person’s skill and decision making have in their ability to find profitable stocks in the real world as opposed to their luck?”; and 2) “How much impact did skill or decision making have in your ability to find profitable stocks in this scenario as opposed to your luck?” These questions were expressed as a Likert scale that ranged from 1 (*Their results are purely due to luck/My results are purely due to luck*) to 7 (*Their results are purely due to their skill/decision making abilities/My results are purely due to my skill/decision making abilities*). These were studied in relation to the

demographic questions relating toward skill in stock selection to verify that the experiment has made a significant difference in state based attitudes.

Attention Checks. Two attention checks were included to confirm participant response accuracy. One was placed at the end of the IUS-12, appearing as a question, while the second was placed at the end of the ELOC, again appearing as a question. These attention checks were as follows: “On this question make sure to select the number 4” and “On this question make sure to select the number 2”.

Manipulation Check. A manipulation check was included at the conclusion of the study. This involved asking participants to respond with the degree of risk presented to them in the vignette. The presentation of this question was as follows: “What amount of risk did economists attribute to the stocks you saw?” (High Risk, Low Risk, Risk was not mentioned).

Procedure

This experiment follows a 3 (Informed Risk: Low, High, Control) x 2 (Feedback: Success, Failure) factorial design. Participants who wished to enter this experiment accessed it through the SONA and QUALTRICS systems independent of any direct researcher supervision. As such, participants read through the experiment using screen-based text and selected their responses electronically with a computer mouse or other such instrument. Because of this, there were no physical materials used throughout this experiment.

Upon entry into the online experiment participants were randomly assigned to an informed risk and a feedback condition and were presented with the demographic questionnaire. Next, the participants were presented with their informed risk version of

the scenario prior to being presented with the 10 stocks. As previously noted, a message at the top of the screen prompted the participants to "Please choose the 5 stocks from these options which you feel would grant the highest returns." With the low risk qualifying low risk and the high risk group qualifying high risk. After selecting their stock options, participants were brought to a 5-second video meant to replicate a loading screen which automatically continued with the experiment and, then, showed each participant that they either succeeded or failed depending on which experimental group they had been randomly assigned to.

Participants then completed the IUS-12 and the ELOC, completed the attention check questions as they finished each scale, and ended their participation the skill assessment and manipulation check questions. The IUS-12 was chosen to occur first due to its focus on attitudes toward uncertainty, its freedom from being burdened by additional subscales like the ELOC, and its shorter size making it less likely to have an overwhelming effect on the ELOC as opposed to the reverse.

Once the manipulation check was completed, participants were informed of the true nature of the test and that the results they were shown did not reflect their performance in the previous decision task or their potential ability to differentiate profitable from non-profitable stocks in the real-world marketplace. Additionally, participants were informed that the purpose of the experiment was to understand their feelings about randomness in situations of both varying uncertainty and whether or not those feelings were changed depending on the results that they achieved in these situations. The participants were guided to contact the researcher if they had any

questions or concerns following the experiment. Lastly, the participants were thanked for their time.

Statistical Analysis

The data collected from each person participating in this experiment were: 1) demographic information, including age, gender, ethnicity, current major, experience with the stock, current interest in the stock market, and feelings toward randomness in the stock market; 2) responses to the skill assessment and manipulation check questions "How much impact does a person's skill and decision making have in their ability to find profitable stocks in the real world as opposed to their luck?", "How much impact did skill or decision making have in your ability to find profitable stocks in this scenario as opposed to your luck?", and "What amount of risk did economists attribute to the stocks you saw?"; 3) ELOC scores for the *internal*, *chance*, *external/denial*, and *powerful others* subscales; and 4) a IUS-12 score measuring overall intolerance of uncertainty.

Once these data were collected, the ELOC and IUS-12 were analyzed via a factorial multivariate analysis of variance in order to minimize the error that can accumulate when performing multiple consecutive statistical tests. The covariates used are the questions: *"How familiar are you with stock trading and the stock market"*, *"How would you rate your level of interest in stock trading and the stock market"*, and "*How much skill do you think there is necessary to be financially successful when investing in stocks*?"

In summary, the independent variables were the informed risk (Informed Risk: Low, High, and Control) and performance feedback (Feedback: success at stock task,

failure at stock task). The dependent variables were the reported scores for the ELOC and the IUS-12. All statistical analyses were performed using the open source software R.

CHAPTER IV

RESULTS

Participant Exclusions

Two attention tests were placed within the experiment (i.e., “For this question please respond with the number 2”) that called on participants to answer with a specific response Twenty-two participants failed either the first or second attention check and their data were consequently removed from the statistical analysis. This resulted in a total of 153 participants ultimately included in the statistical analysis.

General Skill Assessment

General skill assessment involved two questions regarding the skill associated with choosing stocks. One question was asked before the vignettes were shown to the participants (i.e., “How much skill do you think there is necessary to be financially successful when investing in stocks?”) and the second question was asked at the conclusion of the study (i.e., “How much impact does a person’s skill and decision making have in their ability to find profitable stocks in the real world as opposed to their luck?”).

A Welch Two Sample *t*-test analyzing participant responses regarding the skill associated with stocks, both before the experiment (M = 5.04, SD = 1.21) and after the experiment (M = 4.90, SD = 1.19) was found to be non-significant, $t(303.91) = 1.05$, p = 0.295. An ANOVA was used to analyze the effect of manipulated risk and success in a decision task had on participants’ attitudes toward the effectiveness of their own skill at the decision task (M = 4.05, SD = 1.64). The ANOVA did not yield significance, $F(1, 149) = .47$, p = .496. An ANOVA was also used to analyze the effect of manipulated risk

and success in a decision task had on participants' attitudes toward the effectiveness of their own skill in general in selecting stocks (M = 4.9, SD = 1.19). The ANOVA did not yield significance, $F(1, 149) = .79$, $p = .376$.

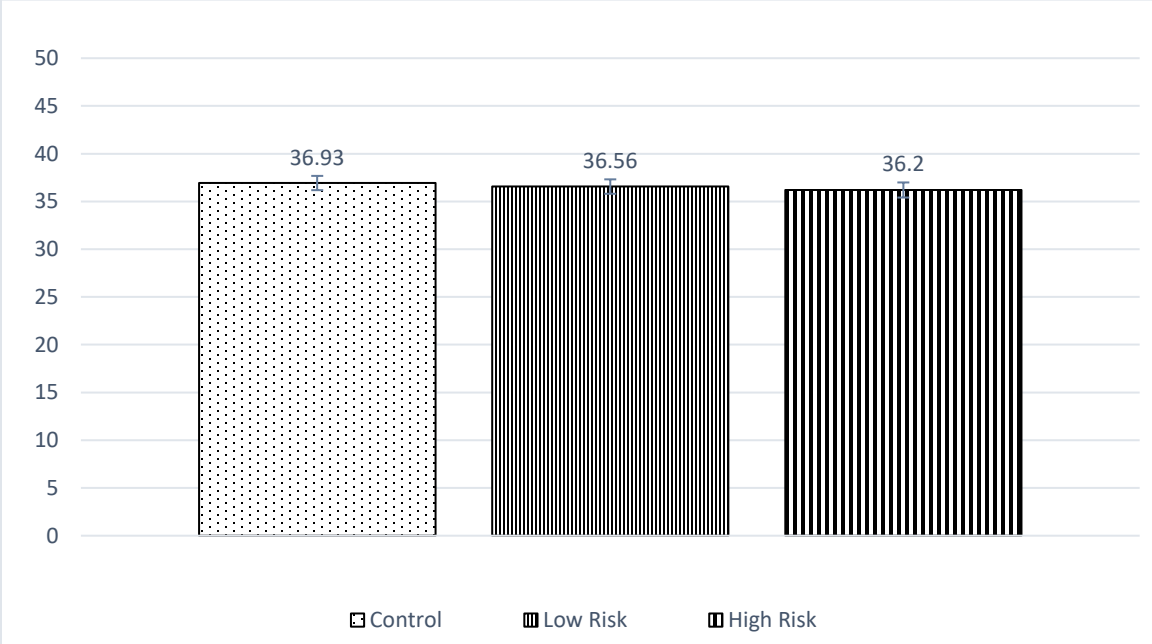
Assumption Testing

Royston's H test was used to determine multivariate normality due to there being two dependent variables. Participants' IUS-12 (Min = 12, Max = 59, M = 33.66, SD = 8.7) scores as well as ELOC-Internal (Min = 15, Max = 49, M = 36.57, SD = 5.43) scores passed tests of multivariate normality ($p = .460$). Homogeneity of variance for participants' scores on the IUS-12 and ELOC-Internal were tested using Barlett's test of homogeneity of variance. The assumption of homogeneity of variance was passed ($p = .798$).

Levene's test was used to determine whether the covariates of stated stock experience (Min = 1, Max = 7, M = 1.78, SD = 1.22), stock interest (Min = 1, Max = 7, M = 2.88, SD = 1.69), and skill associated with choosing stocks (Min = 1, Max = 7, M = 5.04, SD = 1.21) all passed the assumption of homogeneity of variance, $F(5,147) = 1.07$, $p = .377$. Box's M test was also utilized to assess multivariate homogeneity of variance of stated stock experience, stock interest, and skill associated with stocks between the grouping variables of risk level and success/failure. This test also found that the data passed the assumption of homogeneity of variance, $X^2(18, N = 153) = 23.13$, $p = 0.186$.

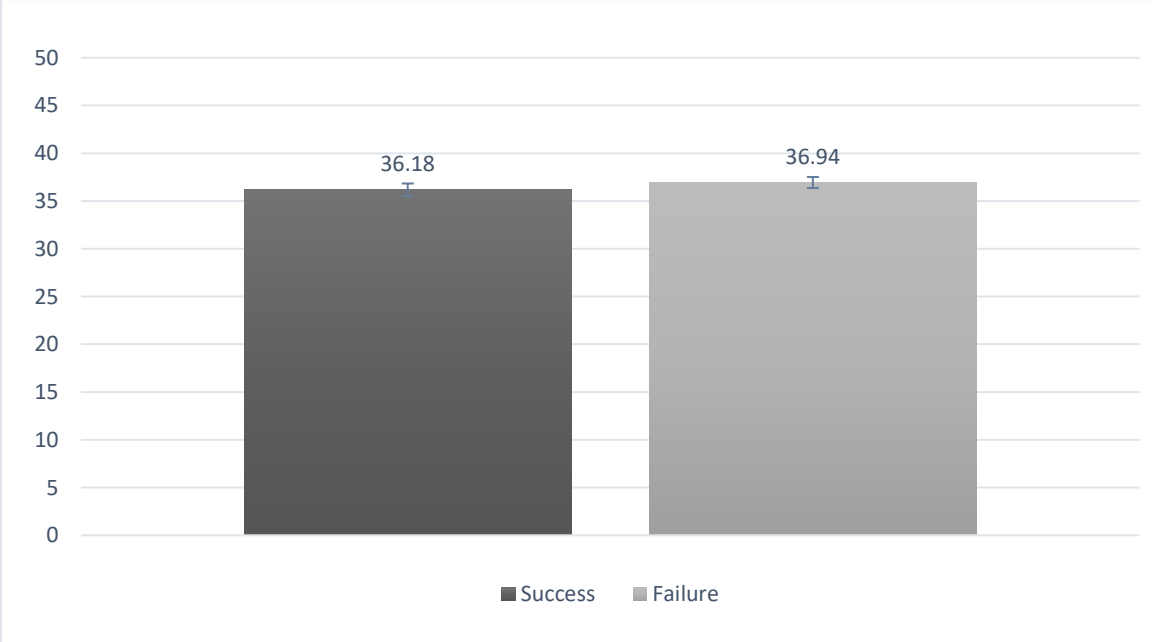
Figures 1 and 2 depict participants' IUS-12 scores and ELOC-Internal scores differentiated by the manipulated factors of risk level (i.e., Figure 1A and Figure 2A) and success/failure (i.e., Figure 1B and 2B).

Figure 1A:



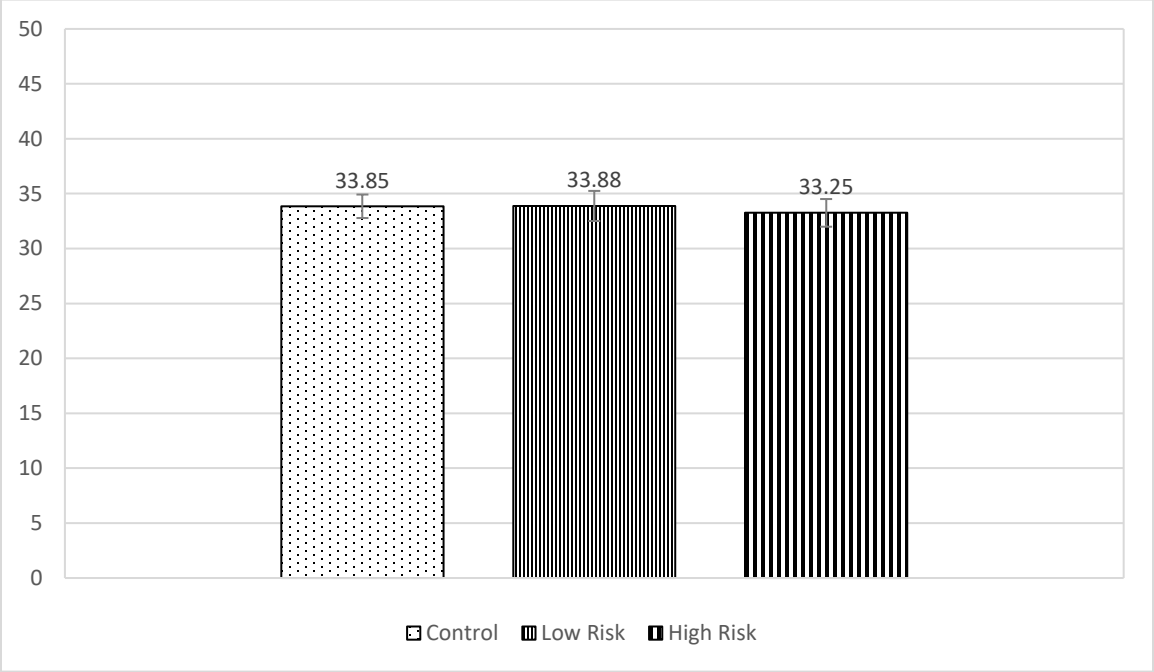
ELOC-Internal Scores and Standard Error by Manipulated Risk

Figure 1B:



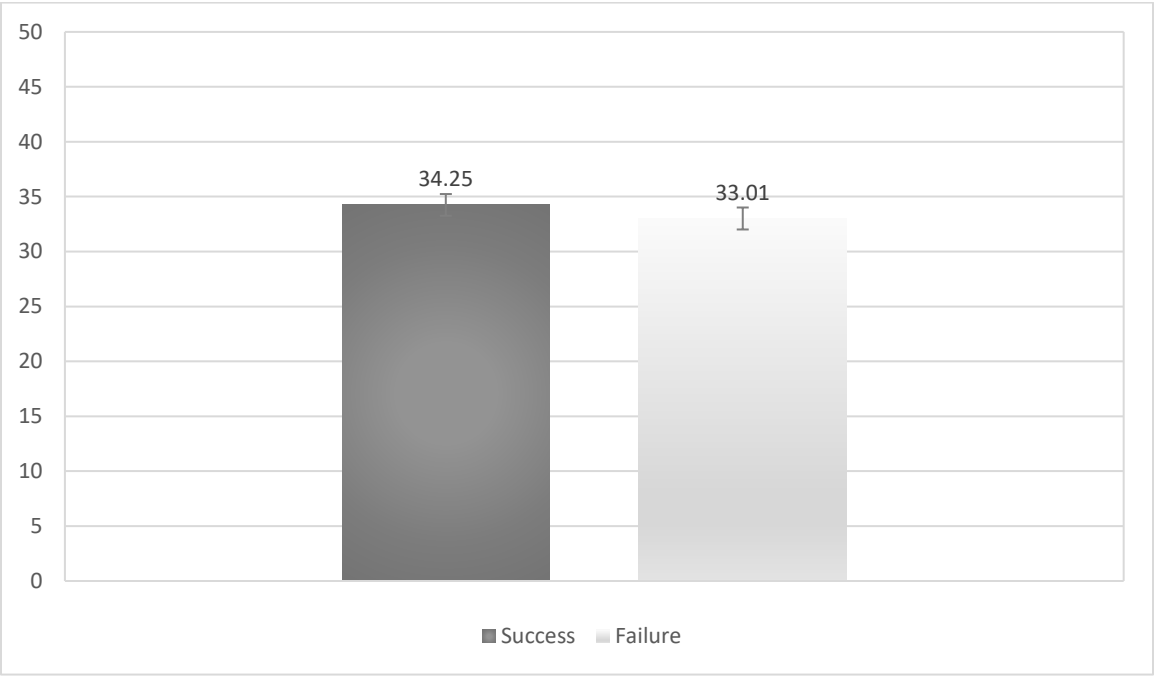
ELOC-Internal Scores and Standard Error by Feedback in a Decision Task

Figure 2A:



IUS-12 Scores and Standard Error by Manipulated Risk

Figure 2B:



IUS-12 Scores and Standard Error by Feedback in a Decision Task

MANCOVA Analysis

A MANCOVA was used to determine the effects of manipulated risk (i.e., High, Low, and Control) as well as feedback after the decision task (i.e., Success, Failure) on participants' attitudes toward uncertainty as reported by the IUS-12 (M = 33.66, SD = 8.70) and on the effect of locus of control as reported by the ELOC-Internal subscale (M = 36.57, SD = 5.43). Additionally, the three self-reports of participants' stock experience (M = 1.78, SD = 1.22), stock interest (M = 2.88, SD = 1.69), and skill associated with choosing stocks (M = 5.04, SD = 1.21) as recorded on seven-point Likert scales were used as covariates.

The overall MANCOVA, Wilks Lambda = .989, $F(6, 146) = 0.845$, $p = .432$, did not yield significant effects of the independent variables or the covariates of stock experience ($p = .662$) and skill associated with choosing stocks ($p = .223$) on IUS-12 or ELOC-Internal scores. The covariate of stock interest did have a significant effect on IUS-12 and ELOC-Internal scores, Wilks = .909, $F(2, 145) = 7.28$, $p = .001$.

This analysis was also performed while excluding all participants who failed the manipulation check with similar results. As the manipulation check did not appear to meaningfully impact the results of the analysis the removed participants were once again added to increase the statistical power.

MANOVA and ANOVA Analyses

Given the lack of effect of the overall model, several additional statistical analyses were conducted in order to fully investigate the relationships among variables. A follow-up MANOVA was used to confirm the lack of effects of manipulated risk (i.e., High, Low, and Control) and feedback after the decision task (i.e., Success, Failure) on

the IUS-12 and ELOC-Internal subscale. The MANOVA did not yield significance, Wilks = .992, $F(2, 148) = .544$, $p = .582$. The effect of participant-reported interest associated with choosing stocks was analyzed using a follow-up MANOVA. The MANOVA did not yield significance, Wilks = .928, $F(2, 150) = 1.787$, $p = .171$.

Individual ANOVAs were attempted to determine if an effect would be observed separately for IUS-12 and ELOC-Internal scores. There were no main effects or interactions of manipulated risk and feedback after the decision task on IUS-12 scores or ELOC-Internal subscales.

Exploratory Analysis of Perceived vs. Actual Risk Levels

As previously noted, at the conclusion of the study, a manipulation question was presented to the participants prompting them to recall which risk level they had been presented with earlier in the study (i.e., “High Risk”, “Low Risk”, or “Risk was Not Mentioned”). Table 1 represents the risk levels recalled by the participants differentiated by the actual manipulated risk levels used in the study. An exploratory analysis of the discrepancy between actual risk levels and participant recalled risk levels was undertaken to better understand what factors might influence participant recall of risk.

A binary logistic regression was used to examine the effects that manipulated risk level (i.e., High Risk, Low Risk, and Control), feedback on the decision task (i.e., Success, Failure), and participant responses on the IUS-12 scale had on the discrepancy between actual risk levels presented and participant recollection of risk. Due to logistic regression’s strict requirements of one predictor for every fifty observations, only three predictors could be used for this analysis. Manipulated risk and feedback on the decision task were chosen due to their status as the main manipulations of this study while IUS-12

Table 1

Manipulated Risk	Participant Recalled Risk			
	High Risk	Low Risk	Risk Not Mentioned	Totals
High Risk	43	1	7	51
Low Risk	3	39	6	48
Control	12	14	28	54
Totals	58	54	41	153

Participant Recalled Risk by Manipulated Risk Group

scores were chosen based on the idea that a participant's attitudes toward uncertainty may alter how much risk the participant recalls in prior events. To calculate the discrepancy between manipulated and recalled risk, a new variable was created called discrepancy which consisted of two levels, one for participants who correctly recalled the risk level presented in the vignette (coded as 1) and one for participants who incorrectly recalled the risk level presented in the vignette (coded as 0). Multicollinearity was assessed to ensure that the variables used (i.e., manipulated risk, success on the decision task, IUS-12 scores, and discrepancy) were not too highly correlated with one another. A test of the full model against a constant-only model was statistically significant, indicating that the predictors reliably distinguished between participants correctly or incorrectly

recalling the risk levels presented to them, $X(4, N = 153) = 17.3$, $p = .002$; however, Nagelkerke's R-squared reported a value of .141 showing a very weak relationship between predictors and prediction.

Of the variables investigated, manipulated risk showed significant predictive potential in both the high ($p =< .001$) and low ($p = .002$) risk levels. Participants in either category were more likely to correctly recall the risk level presented to them in the vignettes and thus had lower average discrepancy scores. Consequently, participants in the control group (i.e., "Risk was not mentioned") were less accurate in their recollections of the risk level presented to them in the vignettes and, thus, had higher average discrepancy scores. Participant scores on the IUS-12 also significantly predicted risk discrepancy ($p = .045$). Higher scores on the IUS-12 were associated with less participant accuracy in recalling risk levels presented. Feedback on the decision task was not a predictor if participant discrepancy ($p = .589$).

Investigation of IUS-12 Effects on Skill Assessment

The predictive effects of IUS-12 scores on participant's ability to accurately recall their presented risk levels prompted further investigation. It was hypothesized that IUS-12 scores would predict participants' responses to the skill assessment question associated with personal skill (i.e., "How much impact did skill or decision making have in your ability to find profitable stocks in this scenario as opposed to your luck?") while IUS-12 scores would not predict participants responses to the skill assessment question associated with general skill (i.e., "How much impact does a person's skill and decision making have in their ability to find profitable stocks in the real world as opposed to their luck?").

To examine this hypothesis two correlation tests were performed using participants' IUS-12 scores. Participant ratings of the skill required by people, in general, to find profitable stocks in the real world was not associated with IUS-12 scores, $r(1, 151) = -0.126$, $p = .118$. In contrast, participant ratings of the skill that they needed to find profitable stocks in this study was significantly associated with IUS-12 scores, $r(1, 151) = -.182$, $p = .024$. These results confirm that IUS-12 scores were associated with their attitudes toward the effectiveness of their own skill.

CHAPTER V

DISCUSSION

Uncertainty Testing

The purpose of the current study was to examine the effects that manipulated risk level and feedback in a decision task would have on participants' feelings toward uncertainty as measured by the IUS-12 and ELOC-Internal subscale. Of note, the collected data on these measures differed somewhat from the results of similar studies. IUS-12 scores averaged higher (M = 33.7, SD = 8.7) as compared to Carleton, Norton, and Asmundson's initial sample in 2007 (M = 25.85, SD = 9.45) although the differences stayed within a single standard deviation. ELOC-Internal scores also averaged noticeably higher (M = 36.57, SD = 5.43) than seen in the prior research by Sakalaki, Richardson, and Bastounis in 2005 (M = 27.6, SD = 10.8). The higher average of both IUS-12 and ELOC-Internal scores imply that the current study's sampled participants had greater aversive attitudes toward uncertain situations while also having more belief in their ability to affect their own financial futures. The impact of participants' interest in stocks, their experience with stocks, and the skill levels they associated with selecting high-value stocks were also assessed. Both levels of manipulated risk and feedback in the decision task had no effect on either participant's reported IUS-12 or ELOC-Internal scores. In addition, greater intolerance to uncertainty (i.e., less tolerance for uncertainty) was inversely predictive of participant's ability to accurately identify their manipulated risk level as well as participant ratings of the skill that they needed to find profitable stocks in this study.

One possible explanation for the current findings is that the trait-based measures of Intolerance of Uncertainty and Internality are both robust to the effects of circumstantial uncertainty or performance outcome across situations. People engage in situations of varying uncertainty throughout day-to-day activities and minor successes and failings will likely occur quite frequently. Thus, while this study hypothesized that each individual event would cause fluctuations in attitudes toward uncertainty, it appears that attitudes toward uncertainty are a stable personality characteristic that influence how an individual approaches uncertain situations. Alternatively, fluctuations in intolerance to uncertainty may occur in response to situational factors but the methods utilized in this study were insufficient to cause or detect such changes. In this study, participants were asked to act as though they were making an important financial decision (i.e., choosing to invest money in various stocks). Unfortunately, there was no real financial cost or tangible burden upon the participant. Thus, the study's methodology may have been insufficient at providing a necessary impetus to alter intolerance to uncertainty.

Discrepancy Testing

As previously noted, a manipulation check question was included in this study. This manipulation check involved the participant's ability to correctly recall the risk level they had been presented with in the vignettes. Importantly, the ability to correctly recall the presented risk level was not only influenced by the actual level of risk presented but also by the participant's own IUS-12 scores. In regards to manipulated risk, the control group was associated with lower rates of accuracy in recalling the presented risk level as compared to both the high risk and low risk groups. Higher intolerance to uncertainty as measured by IUS-12 scores was associated with lower rates of accurately recalling the

presented risk level. In contrast, the type of performance feedback was not associated with recall for the presented risk level.

With regard to the former finding, it appears likely that the effect of manipulated risk level on participant accuracy in recalling that risk level is primarily due to the presence of the control group. More specifically, the control group was defined by the absence of any mention of risk. This procedure may have created a potential confounding variable, where in two conditions (i.e., high and low) participants are recollecting the risk level presented but, in the control condition, participants were forced to recollect whether or not risk was actually present in the first place. As such, it is possible that participants were less accurate in their recall of the risk level in the control scenario because there was no specific mention of risk level.

The effect of IUS-12 score on participants' ability to accurately recall the previously presented risk level is an unusual finding. Higher IUS-12 scores were associated with lower accuracy in recalling the risk group, which suggests that more negative feelings toward uncertainty were associated with poorer memory for information. This suggests that poor memory is causally linked to high intolerance of uncertainty and may create feedback loops in which people with poorer memories more often cause or feel as though situations are more uncertain. This increased exposure to uncertain events may embitter those with poor memory to those uncertain events, especially as they may feel that they should be able to act with certainty but are unable to. Alternately, greater intolerance to uncertainty could be seen as a protective or adaptive mindset in that those with poor memories may take greater preventive measures to avoid uncertainty due to their greater intolerance to uncertainty.

Finally, higher intolerance of uncertainty was negatively associated with participant belief that skill helped them properly choose stocks. Thus, participants with more negative attitudes toward uncertainty felt that their skill mattered less than those with more positive attitudes toward uncertainty. Additionally, intolerance of uncertainty was not associated with participant attitudes toward the general skill required to correctly select stocks, indicating that intolerance of uncertainty had a greater impact on one's attitudes of how skill effects personal outcomes as opposed to how skill effects the outcomes of others. There are several possible explanations for this finding. One such example is that higher intolerance of uncertainty is associated with lower confidence in one's own abilities. This could explain why intolerance of uncertainty affects attitudes towards the effectiveness of one's own skill but not the skill of others. Another possibility is that a higher intolerance toward uncertainty is associated with greater focus on negative personal outcomes. This could cause people high in intolerance toward uncertainty to set conservative expectations for the future as they are always conscious of what could go wrong in a given situation.

Study Limitations

A notable limitation of the current study is that the stimulus provided through the use of vignettes and a decision task appears to have been insufficient to invoke changes in the participants' attitudes toward uncertainty. Past research on uncertainty reveals several examples that used a combination of real financial stakes as well as in-person interaction. FeldmanHall, Flimcher, Baker, and Phelps (2016) had participants gamble with real money as a core part of their study while Losecaat, Vermeer, and Sanfey (2015) had financial risks in the form of gambled and performance dependent

monetary gain/loss. Tversky and Kahneman have observed uncertainty changes using procedures without real financial stakes in decision tasks focused on manipulating risk or uncertainty (e.g., Tversky & Kahneman, 2005). However, it appears that real-life financial impacts are more powerful in invoking changes in participants. Thus, real financial gains and losses dependent upon participant actions may be an important component for future studies.

A second limitation comes from the sample's demographic characteristics, including more female than male participants (i.e., men only 28.1% of the 153 participants) and the young average age (i.e., the average age was 21 and only nine participants were over 30 years of age). Given that younger adults may be less familiar with or interested in the stock market, the stock manipulation used in the current study may also have been less impactful than it would have been in an older sample.

Conclusions

The current study found that intolerance to uncertainty and economic internality were not influenced by the level of manipulated risk or performance outcome in a financial situation. However, accuracy in recalling the previously stated risk of the situation and participant attitudes toward the effectiveness of their personal skill both decreased as intolerance to uncertainty increased. This effect indicates that intolerance of uncertainty is associated with less accurate and less confident decision-making. Uncertainty, both as it affects people and as those people move forward to make decisions with unknown outcomes, is not yet fully understood. While the current study was unsuccessful at creating reliable stimuli affecting attitudes toward uncertainty, future

research may succeed through utilizing a more direct approach of financial risk and thus begin to create a framework to understand people's responses to uncertainty.

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Appendix A

Demographic Questionnaire

To help with this study please respond below with information regarding your:

1. Age: Participants will be presented a blank box with which they can enter any three digit number, may choose to not report.
2. Gender: Male, Female, Other (Will be prompted to specify with text), Decline to Answer
3. Ethnic/Racial Background: White / Caucasian (Non-Hispanic), Hispanic or Latino, Black or African American, Asian / Pacific Islander, Middle Eastern, Native American or Alaskan Native, Multiracial (specify with text), Other (specify with text), Decline to Answer
4. Department of Current Major/Academic Program: Drop down box with all departments at CWU

This study will be looking at stocks and investing, with that in mind please respond below regarding:

5. How experienced are you with the stock market / investing in stocks: Rated on 1-7 Likert scale (*No experience / Very Experienced)*
6. How much interest do you have in the stock market / investing in stocks: Rated on 1-7 Likert scale (*No interest / Considerable Interest)*
7. How much skill do you think there is necessary to be financially successful when investing in stocks? Rated on a 1-7 Likert scale (*There is no skill involved - It is pure luck / It is completely dependent on skill- Luck has nothing to do with it)*

Appendix B

List of 2015 Stocks Used

1

Name: Novo Nordisk (NVO)

Stock Value: $41.71

Projected 2015 Earnings Growth: 14%

Overall Risk Level: ------

Description: Novo Nordisk is a Danish firm that specialized in diabetes care and hormone replacement therapy, is among the holdings of mutual fund Wasatch World Innovators (WAGTX) and a favorite of the columnist James Glassman. It's a big firm, with a market cap of $119 billion (more than one-third the gross domestic product of the country where it's based) and an impressive growth record that should continue.

2

Name: Restoration Hardware (RH)

Stock Value: $74.56

Projected 2015 Earnings Growth: 27%

Overall Risk Level: ------

Description: Restoration Hardware is an upscale home-furnishings chain with 87 stores and a strong catalog and Internet business, is the top holding of T. Rowe Price New Horizons (PRNHX) which has been picking hot growth stocks since 1960. In the quarter that ended August 2, sales rose 14% over the same period the year before. More important, as the housing market recovers, Restoration Hardware should benefit from strong pent-up demand for new couches, dining room tables and the like.

3

Name: AbbVie Inc. (ABBV)

Stock Value: $58.23

Projected 2015 Earnings Growth: 16.8%

Overall Risk Level: ------

Description: Volatility is unnerving, but investors able to keep their heads can use it to their advantage. There's sure to be a lot of heated political rhetoric about limiting drug costs, for example. That could be a cue to shop for bargains among top-notch pharmaceutical firms such as AbbVie Inc. The company's key product is Humira, a drug used to treat rheumatoid arthritis and similar conditions. Big pharmaceutical companies with global reach will benefit long-term from a coming surge in health care spending in emerging markets.

4

Name: Abbott Laboratories (ABT)

Stock Value: $65.42

Projected 2015 Earnings Growth: 0.4%

Overall Risk Level: ------

Description: Drug and medical-device maker Abbott Laboratories is focusing on high-growth areas. Last July, the firm said it would sell part of its overseas generic-drug business to Mylan for $5.3 billion. The deal, slated to close in 2015, will allow Abbott to focus on emerging markets, where sales in the third quarter of 2014 rose by double-digit percentages from the same period in 2013 and helped boost overall profits by 13%.

"Abbott will have a higher growth profile," says Mark Freeman, co-manager of the Westwood Income Opportunity Fund (WWIAX).

5

Name: Gilead Sciences (GILD)

Stock Value: $90.17

Projected 2015 Earnings Growth: 25%

Overall Risk Level: ------

Description: The case for large biotech companies has never been so compelling, says Matt Peron head of global stock investing at Northern Trust. Although the industry is churning out many new drugs with long patent lives, some of the stocks remain attractively priced. Gilead Sciences is a leading example. Gilead won approval from U.S. regulators in October to sell Harvoni, which could become a blockbuster hepatitis C drug. Gilead also has treatments for HIV. Analysts say profits could increase by 25% in 2015, yet the stock trades for just 11 times estimated earnings.

6

Name: Precision Castparts (PCP)

Stock Value: $245.09

Projected 2015 Earnings Growth: 15%

Overall Risk Level: ------

Description: A boom in the aerospace industry is boosting Precision Castparts. The firm makes complex molds and other components used to build jet engines. For three of the past four quarters (most recently the July-September period), the company has fallen short of earnings forecasts as clients used up inventory. As a result, the stock has dropped

13% over the past year. But Stephen Levenson, an analyst at investment bank Stifel, says the de-stocking should end in early 2015. Meanwhile, production of the high-tech Airbus A350 XWB and Boeing 787 Dreamliner will boost profits.

7

Name: Charles Schwab (SCHW)

Stock Value: $27.18

Projected 2015 Earnings Growth: 20%

Overall Risk Level: ------

Description: Low interest rates have pressured profits at Charles Schwab, which is waiving fees to prevent clients from suffering losses in money market funds. But the broker is making up for it with volume. According to a report by the William Blair firm, Schwab was on track to pull in more than $100 billion in net new assets for the third straight year in 2014. “Schwab is an asset-gathering machine,” says Pin Oak Equity Fund (POGSX) manager Mark Oelschlager. Schwab plans to jump on the “robo-adviser” bandwagon in 2015, offering automated portfolios to clients with low balances.

8

Name: Stanley Black & Decker (SWK)

Stock Value: $85.78

Projected 2015 Earnings Growth: 11%

Overall Risk Level: ------

Description: Power-tool maker Stanley Black & Decker is benefiting from a housing rebound. In the third quarter, sales in the Stanley’s do-it-yourself segment rose 9%. Weak performance at a European subsidiary has hurt overall results, but Ron Sloan, senior

manager of the Invesco Charter Fund (CHTRX), says Stanley is taking steps to right the business,. That will help the company's profit margins, which Sloan says could climb by as much as three percentage points in 2015. "Companies already operating at high margins won't have that opportunity," he says.

9

Name: Citigroup (C)

Stock Value: $50.23

Projected 2015 Earnings Growth: 60%

Overall Risk Level: ------

Description: Citigroup is the only major U.S. bank that trades at a discount to tangible book value (assets, excluding intangible assets, minus liabilities), says SNL Financial, and the reason seems clear. Investors are terrified of Citi Holdings, the entity set up in 2009 to hold toxic loans the bank couldn't unload. But now that most of the loans are gone, the unit accounts for only 5% of the bank's assets. But that still amounts to $100 billion and remains a legitimate concern, given that Citi has a market value of $162 billion. Citi Holdings will be gone someday, and when it is, the stock is likely to be much higher. Analyst Mike Mayo, of CLSA, a Hong Kong-based brokerage, thinks Citi will reach $107 in four years.

10

Name: MeadWestvaco (MWV)

Stock Value: $78.71

Projected 2015 Earnings Growth: 20%

Overall Risk Level: ------

Description: MeadWestvaco owns raw land and packaging and specialty chemical assets that are worth 50% more than the stock's market value of $8 billion. Spinning off the specialty-chemicals business alone could fetch $3.5 billion, says Jeff Smith, head of Starboard Value, a hedge fund that owns 5.6% of MeadWestvaco. To Smith, this is a classic case of entrenched management not doing enough for shareholders. MeadWestvaco is already a good business, but jettisoning one or two of its units would make it a much more valuable one.

All stock information obtained from the financial forecasting website Kiplinger (Glassman & Feinberg, 2015, 2016)

Appendix C

Intolerance of Uncertainty Scale-12

Please select the number that best corresponds to how much you agree with each item.

1 = Not at all characteristic of me
2 = A little characteristic of me
3 = Somewhat characteristic of me
4 = Very characteristic of me
5 = Entirely characteristic of me

1. Unforeseen events upset me.
2. It frustrates me not having all the information I need.
3. Uncertainty keeps me from living a full life.
4. One should always look ahead so as to avoid surprise.
5. A small unforeseen event can spoil everything, even with the best planning.
6. When it is time to act, uncertainty paralyzes me.
7. When I am uncertain I can't function very well.
8. I always want to know what the future has in store for me.
9. I can't stand being taken by surprise.
10. The smallest doubt can stop me from acting.
11. I should be able to organize everything in advance.
12. I must get away from all uncertain situations.

Prospective: 1, 2, 4, 5, 8, 9, 11

Inhibitory: 3, 6, 7, 10, 12

Appendix D

Economic Locus of Control Scales

For each of the following statements, indicate the extent to which you agree or disagree by selecting the appropriate number.

1 = Strongly Disagree
2 = Moderately Disagree
3 = Slightly Disagree
4 = Undecided
5 = Slightly Agree
6 = Moderately Agree
7 = Strongly Agree

1. Becoming rich has little or nothing to do with chance

2. Saving and careful investing is a key factor in becoming rich.

3. Whether or not I become wealthy depends mostly on my ability.

4. Accountants can rarely do very much for people who are poor.

5. Anyone can learn a few basic economic principles that can go a long way in preventing poverty.

6. To a great extent my life is controlled by accidental happenings.

7. People's poverty results from their own idleness.

8. Social workers relieve or cure only a few of the financial problems their clients have.

9. I feel that my finances are mostly determined by powerful people.

10. There is little one can do to prevent poverty.

11. No matter what anyone does, there will always be poverty.

12. When I make plans I am almost certain to make them work.

13. Whether or not people get rich is often a matter of chance.

14. People who never become poor are just plain lucky.

15. There is no chance of protecting my savings from bad luck happenings.

16. The seriousness of poverty is overstated.

17. When it comes to wealth, there is no such thing as ‘bad luck’.

18. When I get what I want, it is usually because I am lucky.

19. In the long run, people who take care of their finances stay wealthy.

20. Relief from poverty requires good hard work more than anything else.

21. Although I might have the ability, I will not become better off without appealing to those in positions of power.

22. In the Western world there is no such thing as poverty.

23. Becoming rich has nothing to do with luck.

24. How many friends I have depends on how generous I am.

25. Most people are helped a great deal when they go to an accountant.

26. There are a lot of financial problems that can be very serious indeed.

27. People like myself have little chance in protecting our personal interests when they are in conflict with those of strong pressure groups.

28. Regarding money, there isn’t much you can do for yourself when you are poor.

29. Politicians can do very little to prevent poverty.

30. It’s not always wise for me to save because many things turn out to be a matter of good fortune or bad fortune.

31. If I become poor, it is usually my own fault.

32. Financial security is largely a matter of good fortune.

33. Getting what I want financially requires pleasing those people above me.

34. Whether or not I get to be well-off depends on whether I am lucky enough to be in the right place at the right time.

35. I can pretty much determine what will happen to me financially.

36. I am usually able to protect my personal interests.

37. When I get what I want, it is usually because I worked hard for it.

38. My life is determined by my own actions.

39. It is chiefly a matter of fate whether I become rich or poor.

40. Only those who inherit or win money can possibly become rich.

Internal: 2, 3, 19, 31, 36, 37, 38

Chance: 10, 23, 28, 30, 39, 40

External/Denial: 7, 16, 18, 22, 29

Powerful Others: 9, 21, 27, 33